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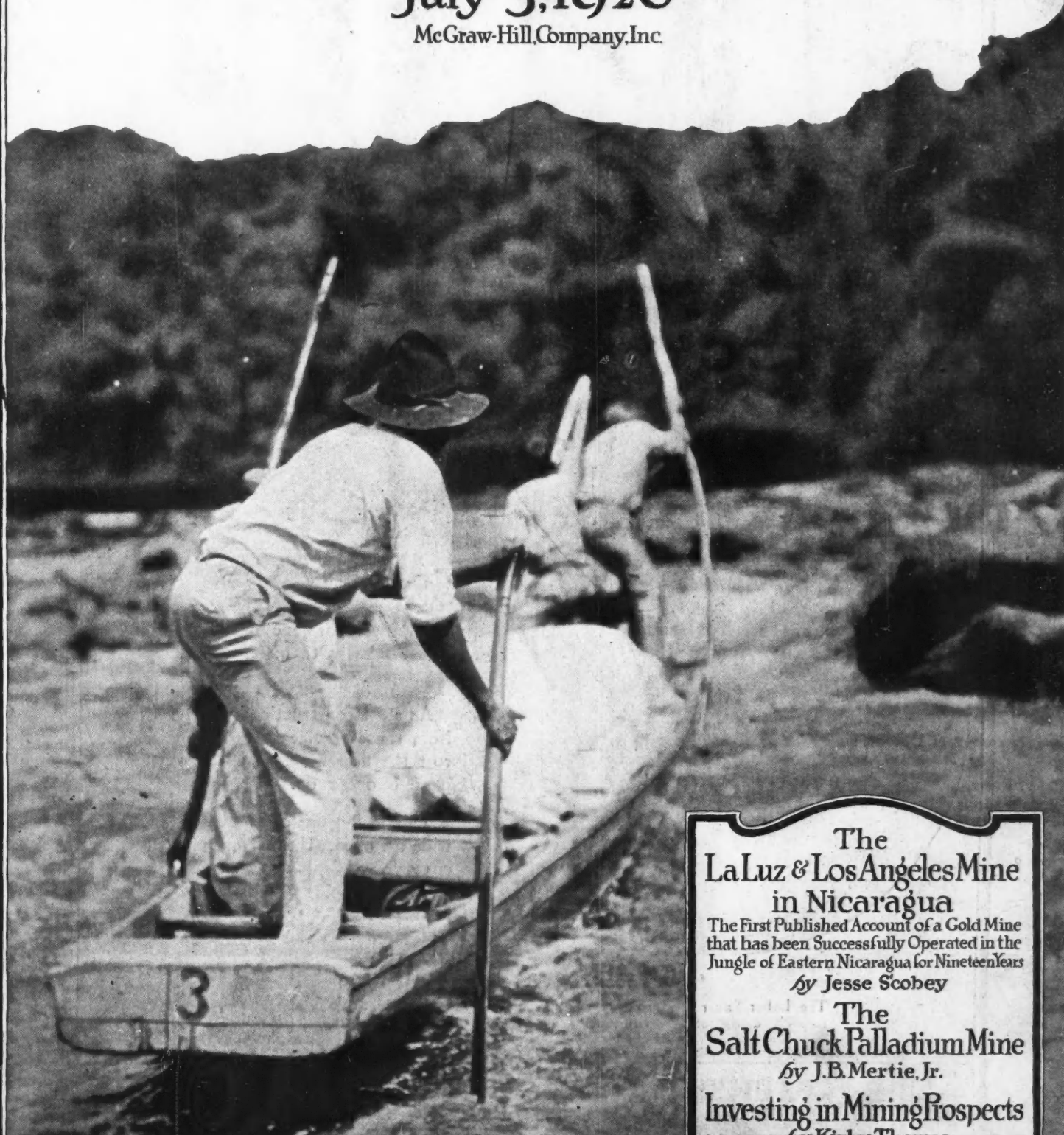
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July 3, 1920

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Jungle of Eastern Nicaragua for Nineteen Years
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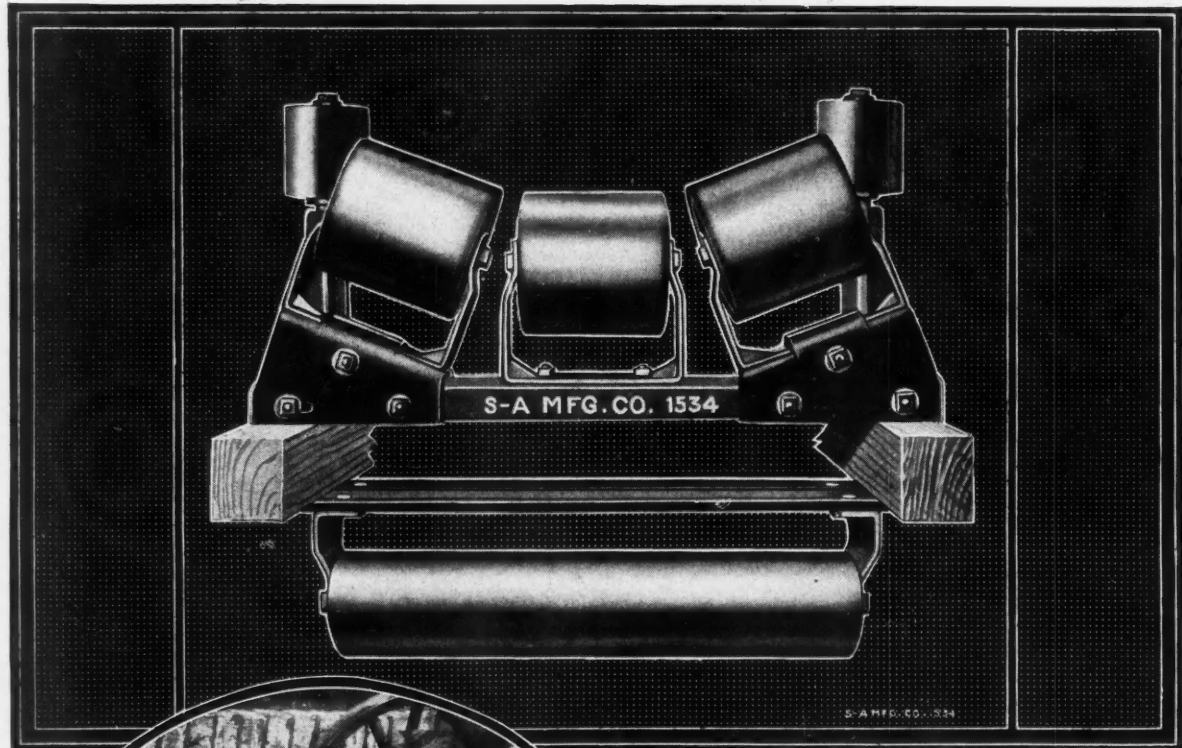
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A Weekly Journal of the Mining and Mineral Industries

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NON-METALS

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Volume 110

New York, July 3, 1920

Number 1

Finding Fault With the Pittman Act

THE metropolitan newspapers, and we refer particularly to the *New York Tribune* and the *New York Evening Post*, attack the Pittman Silver Act, the former asking that it be repealed at the next session of Congress. Says the *Tribune* editorially: "The Pittman law contained a curious 'joker.' This required the Treasury to purchase for every dollar melted up an equivalent amount of bullion at the fixed price of \$1 an ounce. The Treasury has begun to make such purchases, with the result that American-produced bullion now commands 99½c. an ounce, while foreign bullion is selling for only 91½. The Pittman law is thus operating as the Bland-Allison and Sherman acts operated, to put a fictitious value on silver bullion—if mined in the United States. The error made in 1878 and 1890 is being repeated. Silver is not needed as a basis for currency, especially when purchased at more than market value. The 'joker' in the Pittman measure should be eliminated at the next session of Congress."

The inference which the ordinary reader would gain from the editorial mentioned is that the naughty silver producers, by a piece of sharp legislation fathered by the Senator from Nevada, are now mulcting the people, as represented by the Government, of 8c. an ounce on all silver produced. Should this price differential be maintained until the entire 207,000,000 ounces is purchased, the total amount would be close to \$17,000,000.

However, as most of our readers know, the Government is not losing one cent on the transaction. The price of silver began to skyrocket in 1918. India, a producer of wheat, jute, and other articles necessary for the prosecution of the war, demanded that she be paid in this metal, a large amount of which was lying dead in the Treasury vaults. By the Pittman Act, which was passed by the Senate on April 18, 1918, 207,000,000 ounces of silver was sent to the Far East to settle trade balances, for which the Government received an equivalent to \$1 per ounce. This increase in the supply acted as a stabilizing influence on the market, and without doubt prevented silver producers from reaping as great profits as would have been the case otherwise. Now, with the rapid decline in the price of this metal, the act again exerts a stabilizing influence, the silver producers now being protected from incurring possible losses, just as they were checked in taking inordinate profits from a rapid rise, two years ago. The Government buys back at the same price at which it sold.

To say that the bill contained a "joker" is unfair. This so-called "joker" was introduced by Senator Fall, of New Mexico, and its probable effect fully pointed out in the Senate discussion. The fixed \$1 price was forecast by Senator Owen, chairman of the Committee on Banking and Currency, who said, "When the Government fixes a definite price for silver the miners can

make their plans accordingly, and, seeing for several years ahead a fixed market at \$1 an ounce, it will stimulate the production of silver in this country and replace the idle silver which is now in the Treasury merely in storage."

Senator Lodge, whose opposition to price-fixing is well known, studied the bill very carefully and said, "The bill is safe as framed," later voting for it. In fact, the bill was passed without the formality of a roll-call, so insignificant was the opposition. It is interesting to note that one of the opponents of the act was Senator Thomas, of Colorado, one of the big silver producing states.

The Pittman Act has apparently been confused by the press with various price-fixing legislative enactments, which have been generally condemned. Any one with a knowledge of the bill will understand that it is radically different in principle. It also has nothing to do with the schemes for free coinage with which it has been unjustly linked.

This country will need all the stabilizing influences which it can muster in the next few years, to prevent disastrous panics. The silver producers have made their plans, which include extensive and expensive mining development, predicated on a price of \$1 for silver for several years to come. To repeal the act would be unjust, the Government profiting at the expense of legitimate industry. One dollar an ounce is not an exorbitant price for silver. The yearly average has never fallen below 50c., and the present quotation is much less than the advances over 1914 prices in many other commodities. Since the Civil War, the price of silver has averaged over \$1 per ounce during twenty-two years, but of recent years has been under that figure.

We believe that when the conditions are understood, the movement for the repeal of the Pittman Act will disappear. American mining interests must, however, not be caught asleep and must see that the fullest publicity is secured, in order to protect their rights.

Cornwall's Tin Troubles

THE vagaries of the metal markets and the unusual economic conditions existing in the world today have severely chastised many mining industries. The most conspicuous recipient of this punishment is the gold-mining industry, owing to the unvarying price of gold; but almost every one of the metals has suffered from its unsettled future prospects—as the pronounced fluctuations in the metal markets testify. The latest addition to the list of affected mining industries is tin mining in England.

The recent pronounced drop in tin prices has seriously affected the old and stable tin-mining district in Cornwall, and has placed many of the producing properties in a precarious position as regards present and future

operating possibilities. Tin is a metal that admits of wide speculation. Last February the London price was around £420 per ton, whereas early June quotations have dropped to around £225, chiefly the result of frenzied finance.

Considering the present cost of production, the latest quotations are too low for profitable operation of these mines. Normally, a price of £200 per ton would have represented a fair return to the mining companies, but with today's high cost of labor and materials a price of £350 per ton would be none too adequate.

In commenting upon this situation, which has disturbed one of the world's historically interesting mining centers, and an important tin-producing area, the *Financial Times* states that "if the government temporarily held out a hand to the most deserving mines to tide them over the present crisis they would doubtless be able to carry on by themselves, once trade conditions all over the world have become stabilized."

The help referred to, financial assistance, would enable the mines to undertake further exploration, development, and experimental work to improve their properties, something which was not sufficiently attended to during the stress of the war. This is a logical method of attack to such a problem. Instead of speculating as to when the price of tin will become normal, an adjustment to the existing conditions through an attempt to lower production costs is not only more philosophical and sensible but more likely to achieve quicker results.

The McFadden Gold Bill

THE failure of Congress to pass the McFadden Act leaves the question of gold production where it was—in the hands of chance. The gold miners are the chief "goats," who must expiate the economic sins of a world that has found out how to live on credit instead of cash. The plan of the bill had certain defects, but it appeared the best that could be devised. Although it was generally supported, cold water was thrown on it by Frank A. Vanderlip, just before his departure for Japan. He told its supporters that the possession of more gold in this country would only be an excuse for more inflation. No remark could be more thoughtless and untrue; but from a financier of Vanderlip's standing it doubtless had a deterrent effect upon the great majority who shrink at innovations in any case.

The current financial happenings, the fluctuations of exchange dependent upon the transfer of gold from one country to another, show beyond doubt that the basis for the world's currency is metal, and the more substantial the basis the less the relative inflation. National financial systems that have been obliged to expand their paper currency have done so despite an insufficient gold reserve, as in the case of Europe. Experience has shown that when a nation—even the United States—must have a certain amount of money, it goes ahead and prints it, and considers the metal basis later. Increase of gold production would hasten deflation by meeting it part way.

We hope the matter will not be allowed to rest. The people who buy gold jewelry in this country so recklessly will only enjoy paying a little more for it, as a tax to partially compensate the gold miner so that it will pay him to keep on digging; and the general condition of the country will unquestionably be made healthier thereby.

Miami Copper and Minerals Separation

WHETHER the Miami Copper Co. is now infringing Minerals Separation patents is still an open question. The motion for the reopening of the old case to admit additional testimony was denied by the U. S. Circuit Court of Appeals at Philadelphia on June 17. However, the court stated that the denial was made without any expression of opinion which would preclude the use of such of the newly found matter as may prove to be pertinent in questions arising in the accounting now going on. The case was sent to the master for accounting without any determination as to whether the present operations of the Miami company are of an infringing nature, so it would appear that this new evidence may now be presented in the accounting proceedings at Wilmington.

We can hardly blame the court for "passing the buck," as with a Philadelphia summer coming on, even lawyers are sufficiently human to wish to avoid going through with the intricacies of this case once more. We sympathize with the "master," and do not envy him his job.

The Contract System in Mining

OUR news columns recently announced that a plan of having underground work performed by contract had been placed in effect in the Bingham, Utah, district with good success. Contract systems are by no means new, for the practice dates back to the earliest days of mining and includes practically all of the features embodied in the mine contract of today. Briefly, the contract system as applied to underground mining covers the principle that a certain price per foot or per car is paid for the work. The price may, or may not, include the cost of supplies. The establishment of a rate or price per foot, per car, or whatever unit is decided upon, is usually based on actual company account performance for a period of time which is sufficient to determine a compensation that will be fair and equitable. Different heights of stope, varying conditions of ground, length of tram, accessibility of working place, and other considerations are also determining factors in the rating of the contract.

Advantages that may be claimed for the contract system are: The efficient men are enabled to make a wage in proportion to their ability—in other words, a premium is paid for efficiency; the difficulty of adequate supervision of the work covering a large area in underground operations is obviated, as the men are placed on their own initiative; if a charge is made for supplies, which are paid for at a nominal rate by the contractor, there is a tendency on the part of the men to be more conservative in their use, the actual production costs are lowered, and the men who are good workers and have a thorough knowledge of the work receive the benefit. A further consideration, and one which will particularly appeal to the younger men, who naturally seek up-to-date methods for the performance of their tasks, is the fact that the contract plan enables the worker to apply his originality and ingenuity to his own advantage.

Among the reasons given for shortages of labor in underground operations is the fact that many young men formerly available for mining operations are turning to other pursuits. By the adoption of an equitable contract system not only is the opportunity offered for the full development of the miner's earning capacity,

but methods which conform to modern business practices and are applicable in all lines of endeavor are introduced. The result is that there is less tendency on the part of men primarily inclined toward mining to enter other fields.

Combining Business With Vacation Pleasures

TWO of the national engineering societies are adopting a sensible course in combining the maximum amount of pleasure with their general meetings this summer. The A. I. M. E. will enjoy a boat trip on the Great Lakes and a visit to one of the most attractive mining districts in the world. The Chemical Engineers will go north into Canada, visiting many interesting plants in Ontario and Quebec, and taking such attractive side trips as the one up the Saguenay River to Chicoutimi. These trips will take the place of vacations for many of those who are going, and, as planned, should prove more enjoyable than the average holiday intended for pleasure only.

The principal reason for the ordinary kind of annual meetings is that they provide an opportunity to become acquainted with our fellows, and to exchange ideas which, for one reason or another, we do not care to make public in the *Transactions*. How much better we can do this under the conditions which will prevail on the trips already mentioned!

The Divining Rod

BELIEF in the divining rod dies hard. The frequency with which requests are made for information regarding this and similar devices for detecting the presence of minerals underground is astonishing. We had supposed that these devices were fast going the way of the gold brick, used in the past for separating the foolish from their money. We were coming to think that all were so well versed in the tricks of swindlers and fakers, thanks to the liberal course afforded in the J. Rufus Wallingford stories, that comparatively few could be victimized or deceived except by something new. The foolish, of course, would still be with us to the end, but none so simple as to try to divine the presence of minerals by other than legitimate prospecting methods based on principles of geology.

The magnetic needle will detect the presence of iron, of which all are well aware, and this is the only device of which we know that can be used successfully for such purposes. Columbus sought a shortcut to India, and all of us would like to find the quick road to wealth. So it is not strange that some means of disclosing earth's hidden treasure without cost or effort should dance in the imagination along with the fairies of one's childhood. One rub of the lamp placed all things at Aladdin's disposal. But lamps are old-fashioned now, and science reigns.

Traditions linger, and it is half-baked education, in our opinion, that is largely responsible for the seemingly widespread belief concerning divining rods. A short course in physics and courses in perhaps a dozen other subjects have their place in the curriculum of every high school throughout the country, and here in the metropolitan district have invaded even that of some of the grammar schools. These may be well enough as stepping stones to something higher, but, if study end with them, the student is in the proverbial dangerous position of the possessor of a little knowl-

edge. Dangerous it is, he will agree, after spending his money for the latest thing in divining rods and failing to get results.

The man with money that is burning a hole in his pocket and who desires to lay bare the mineral secrets of the district in which he lives can better invest his capital in the good old-fashioned way of grub-staking a prospector or by putting it into an exploration or a development company.

The airplane, radio, and a dozen other inventions invite the optimistic to believe that all things are possible, and thus it is that swindlers having new devices are treated with greater tolerance than they deserve. The U. S. Geological Survey, in *Water-Supply Paper 416*, issued in 1917, has already undertaken to educate the uninformed as to the foolishness of attempting to discover oil or other mineral deposits by waving, as it were, a magician's wand. This paper, entitled "The Divining Rod," by Arthur J. Ellis, may be had for the asking, unless by chance it be out of print. In an introductory note, by O. E. Meinzer, it is said: "It is difficult to see how, for practical purposes, the entire matter could be more thoroughly discredited." But, nevertheless, the superstition persists.

Sign on the Dotted Line

WE HAVE before us a ballot from the Harvard Engineering Society, to vote for officers. There is to be elected a president, a first and second vice-president, a secretary, a treasurer, and five governors. In the case of all but the governors, we are instructed to "vote for one." There is in each instance only one to vote for. In voting for the board of governors we are instructed to "vote for five." Only five candidates are given. We can go through the formality of voting the excellent ticket, which has been carefully selected by someone for us, or of throwing the documents in the wastebasket. In the interests of efficiency we shall do the latter.

According to the way of looking at it, this sending out of ballots, with no choice of candidates, to free and independent Americans, to ascertain their choice, is a meaningless courtesy of the Spanish type, a piece of stupidity, or an impertinence. What a waste of costly paper, perfectly good stamps, and clerical work there is here!

Engineers should stand for efficiency. If they get a Department of Public Works they are going to show the folks what efficiency is. Also, they should stand for honesty. Cut out, then, such meaningless ballots. If the form of your society (we are speaking to all engineers) is oligarchic—if a small group selects the officers and decides what the society shall do—simply advise those of us who are too busy to indulge in false motions who the officers are to be, and do not insult our intelligence as engineers and Yankees by asking which is our choice of one.

We do not intend to criticize the oligarchic system as practiced by preference by engineers and scientists—although we should like each society some day to experiment with democracy. We are speaking now only from the standpoint of conservation of energy, and of efficiency. In the organizations in which we hold membership, we hereby appoint the secretary of each society which follows this system to cast our vote by proxy for all the candidates who will be appointed (elected) anyhow; and this proxy is permanent.

WHAT OTHERS THINK

Why Hoover Was Not Nominated

Now that the Republican convention is over, and Mr. Hoover was not nominated, his friends have been explaining what was the matter. One or two of the engineering magazines have said that the trouble lay in the stupidity of the politicians and the rabble that they represent; that the intellectuals or prematurely bald young men who amateurishly advocated Mr. Hoover underestimated the power of political machinery and "the bosses." The *New York World*, which was one of the strongest supporters of Mr. Hoover, suggests that he made a mistake in entering the primaries in California, and that, just when he was beginning to worry the "Old Guard," he injured his own chances by committing himself where he had not time for a real test of strength.

My own opinion is that possibly Mr. Hoover was a bit too gloomy and heavy in his speeches. He is a serious-looking man, anyway, and after the strain of war people prefer not to be depressed too much. Mr. Hoover realizes the tremendous questions facing the nation and understands how to solve them as probably no one else does; but perhaps he was a little too lugubrious in his attitude. For instance, I recently talked with an engineer who said that he was enthusiastic for Hoover until he came to New York for the dinner of the Institute at which Mr. Hoover made an address. Although this engineer is not lacking in nerve, he said that he was somewhat alarmed by the gloom in the new president's expressions.

However, one of the chief considerations for Mr. Hoover's lack of strength at Chicago was undoubtedly his disinclination to wage a bitter fight for the nomination and resort to all the tricks of the self-seeking politician. He chooses to give his efforts to the nation as they are asked for, and to retain his own sincerity and decency, rather than flare up and campaign eagerly for office.

P. B. McDONALD.

New York City.

The Troubles of a Cyanider

In your issue of May 29 Mr. Carpenter misinterprets my statements in a former issue of the *Engineering and Mining Journal*, in an effort on my part to help the, to me unknown, unfortunate cyanider, who set forth his woes in the issue of March 20. Therefore, I desire to further elaborate my statements.

First, let me refer the interested reader to my article entitled "Effect of Air in Cyanidation," printed in the issue of *Engineering and Mining Journal* dated March 22, 1919. That shows two of the absolutely essential conditions of the art, namely, that air (meaning its oxygen constituent) must be present in the cyanide-solvent for efficient dissolution of the gold and silver contents of the ore so treated, and that it must be absent from the pregnant solvent for efficient precipitation by means of zinc, in the form of either shavings or dust.

The troubled cyanider notes conditions under which the zinc shavings had ceased to act as a precipitant, and the inflowing solution was re-dissolving the precipitated gold, so that the outflowing solution had more gold per unit. That is to say, the tailings assayed higher per unit than did the feed. The additions of cyanide, alkali, and of lead acetate failed to remedy the bad conditions beyond a short time, and after that complicated the perplexing problems.

The fact that gold was being re-dissolved shows that it could all be re-dissolved by a cyanide-solvent, and thus separated from the coated zinc. Because it is not practicable to continue to run pregnant solution through the precipitation vat for that purpose, I advised that the metallic contents of the vat be removed to a proper receptacle for treatment with a newly prepared non-pregnant, aerified cyanide solution to remove completely the gold from the zinc. Obviously, the zinc may be restored to commercial form if such restoration be profitable. The slur about running the solution from this treatment is sufficiently answered as follows: The aerified solvent might as well be run through the freshly supplied zinc precipitation vat with the, also more or less, aerified mill solution, "to meet again the conditions complained of," as I stated.

The troubled cyanider removed the coated zinc shavings from numbers 1 and 2 of the compartments of the precipitation vat, the contents of the other compartments were moved up toward the head, and compartments 4 and 5 were filled with new lead-coated shavings. There was a temporary improvement in precipitation, probably due to this addition, and then precipitation ceased. He did not say what he did with the inactive shavings, though they undoubtedly had gold on them.

The usual treatment is to wash them thoroughly and return the "longs" to the vat. The "shorts" are variously treated to separate the zinc from the gold, either by acids, by smelting, or by both. Mr. Carpenter advises the use of hydrochloric acid to clean the "longs," and to dissolve the zinc from the "shorts." Troubled cyaniders know the amount of labor, time, space, expense, and loss of zinc, gold, silver, acids, and other chemicals that are chargeable to such manipulation. I do not here calculate the money value of the losses, but they are serious.

The detached gold and undissolved loosened coatings have to be washed from the zinc as effectively as may be, and the washings filtered to secure the precious metals for smelting, but these are not all recovered in this way from the "longs," which are returned to the vat. If the acid be not thoroughly washed away, or neutralized by an alkaline wash, they should not be returned. In any event, this treatment is ineffective for securing untarnished zinc shavings, owing to oxidation resulting from exposure to corrosive liquids and air. Certainly they are not as effective as are freshly cut zinc shavings.

Mr. Carpenter's remarks as to possible pre-conditions and their remedies are useful as far as they go, and if they can be put in practice.

For bag-filtration, a sufficient number of doubled bags of proper size, each unit consisting of a bag of light, twilled muslin, inclosed in an outer one of heavier and stronger canvas, are securely connected to the main pipe carrying a de-aëriated pregnant solution, into which is fed, continuously, the zinc dust in requisite quantity, while forced under, say, ten pounds pressure into the bags. The bags are hung from the main pipe in close order, above one or more launders which conduct the filtrate back to the mill stock-solution tank. The precipitates and the surplus of zinc dust are caught by the inner bags.

The double bags are removed when enough precipitate has been collected, one at a time, after closing a cock in the branch pipe connecting the bag with the main pipe. They are allowed to drain and then the double bag is removed and another empty couple are substituted. Or the bag may be moved, without draining in place, to a position above another launder having a like discharge to the stock-solution tank. The bags are allowed to drain until their contents assume a consistency which permits the removal of the inner bag. Then a new inner bag is fitted within the outer, thus made ready to take its place in the routine of operations.

The contents of an inner bag are not directly removed, but bag and all are submitted to acid for removal of surplus zinc, if the latter be necessary, or directly dried, calcined (which removes the bag material by combustion), then mixed with fluxes, and melted to obtain the bullion. The cost of the inner bags is only a fraction of what would otherwise be expended if attempts were made to clean the bags of adhering precipitates, so that they might be used again.

The method of precipitating gold and silver from pregnant cyanide solutions which consists in de-aëriating the solutions and precipitating the values by zinc dust as they pass to the filters, either press or bag, saves more than one-half of the zinc, cyanide, other chemicals, labor, and wastes, which are incident to precipitation by zinc shavings. The cost of suitable vacuum and solution pumps and of accessory apparatus is small when the advantages of the above-outlined methods are considered.

Theft can be the more easily prevented by isolation of the housing of the precipitation department, locks, and safe.

N. S. KEITH.

Philadelphia, Pa.

Foreign Oil Fields Closed to Americans

Under this caption, in the *Engineering and Mining Journal* of May 29, 1920, appears what is reported to be a comprehensive summary, from the *New York Times*, of the Presidential message regarding the restrictions imposed by foreign countries in connection with the acquisition of oil lands. In this article, referring to Canada, the following paragraph occurs:

In Canada, by Order of the Council of Jan. 29, 1920, any company acquiring a lease for oil development must be registered or licensed in the dominion and have its principal place of business there. Under leases on crown lands companies acquiring oil and gas rights must be British, and if a company ceases to be British its lease is subject to cancellation.

This is not a correct interpretation of the Order in Council referred to and leaves a wrong impression on the public mind. To remove this impression and the

stigma cast upon Canada, allow me to quote *verbatim et literatim* a portion of the Order in Council referred to, a part of it which evidently has not been carefully read by the compiler:

Thursday, the 29th day of January, 1920.

And whereas by Order in Council dated the 19th of January, 1914, the regulations for the disposal of petroleum and natural gas rights then in force were rescinded, and new regulations substituted therefor, Section 40 of which regulations contains the following provision:

"Any company acquiring by assignment or otherwise a lease under the provisions of these regulations, shall at all times be and remain a British company, registered in Great Britain or Canada and having its principal place of business within His Majesty's Dominions, and the chairman of the said company and a majority of the directors shall at all times be British subjects, and the company shall not at any time be or become, directly or indirectly controlled by foreigners or by a foreign corporation.

"Any alteration in the memorandum of articles of association, or in the constitution of the company, or in the bylaws of the company, shall be reported to the Minister, provided that two months' previous notice of the intention to make any alteration which might conceivably affect the British character of the company shall be given in writing to the Minister, and if, in the opinion of the Minister, the said alteration shall be contrary to the cardinal principle that the lessee company shall be and remain a British company under British control, the Minister may refuse his consent to such alteration.

"If the company which may acquire a location under these regulations shall at any time cease to be a British company, or shall become a corporation under foreign control, or shall assign any of the rights acquired under the lease without the consent in writing of the Minister being first had and obtained, the lease shall be subject to immediate cancellation in the discretion of the Minister."

And whereas the Minister of the Interior reports that it is now apparent that the insertion in the regulations of the above restriction does not give to the government of Canada any more effective control over the oil which may be produced from locations acquired under these regulations than if the provision had not been so inserted, and as there would appear to be no doubt that this restriction has had the effect of discouraging the introduction of foreign capital so essential to the exploration and testing of vacant Dominion lands thought to contain oil,

Therefore His Excellency the Governor General in Council, on the recommendation of the Minister of the Interior, is further pleased to order that Section 40 of the petroleum and natural gas regulations, as above quoted, approved by Order in Council dated the 19th of January, 1914, be and the same is hereby rescinded, and the following is substituted therefor, viz:

"Any company acquiring by assignment, or otherwise, a lease under the provisions of these regulations shall be a company registered or licensed in Canada and having its principal place of business within His Majesty's Dominion."

The above is self-explanatory, and further comment is unnecessary. I might add, however, for the benefit of those whose education regarding Canada has been somewhat neglected, that any Order in Council of the dominion government, referring to mineral rights, affects only the newer provinces and territories. The original, or confederation, provinces control their own mineral resources and make their own laws and regulations regarding them.

W. F. JENNISON.

Truro, Nova Scotia.



PANORAMIC VIEW OF LA LUZ AND LOS ANGELES PROPERTY IN NICARAGUA. AT THE LEFT IS THE OPEN-

The La Luz and Los Angeles Mine, in Nicaragua

Ore, Which Occurs in One Body, Mined From Surface Benches—Present Milling Includes Stamps, Ball Mills, and Classifier, Amalgamation and Cyanidation Having Been Found the Best Practice—Flotation Not Suitable

BY JESSE SCOBAY

Written for *Engineering and Mining Journal*

RELATIVELY little definite working data have been printed on the few established properties of the east coast of Nicaragua. No large-scale operations claim particular outside attention, but a mine that is merging into the second generation becomes interesting. After twenty-three years of continuous production, the La Luz and Los Angeles ownership is permitting, for the first time, the publication of its experience, in the belief that this may be of help to other pioneers, and may benefit a new and promising country.

With the discovery of gold at grass roots, one 3½-ft. Huntington mill was started at the La Luz and Los Angeles mine in July, 1897, by local Spanish prospectors. It was provided with inside amalgamation, and the usual outside plates, to treat the hillside dirt, which was found to pan free gold in paying quantity. There was no outstanding ledge and no defined vein or quartz cropping, with the normal trappings of hanging and foot wall on which to measure the strike and dip, so essential to well-trained mines. According to the technique of the profession, it was not even a prospect, except that gold was there in the tangled jungle.

By December, 1898, about 4,800 tons of material had been shoveled through the one Huntington, producing \$38,400. To December, 1900, the dirt was worked with one arrastre and one Huntington mill at the rate of twenty-two tons per day. Through 1901 to October, 1904, two Huntingtons were used, and from October, 1904, to February, 1905, three Huntingtons were running on ore of about \$10 per ton.

A party of Pittsburgh men, headed by the late

Thomas B. Riter, purchased the property in July, 1905, from the Nicaraguan owners, of whom the chief stockholder was the late Senor José Aramburu, of Bluefields, Nicaragua. The latter, a discoverer, had incorporated the Compañía Minera La Luz y Los Angeles in 1896, under the laws of the Republic of Nicaragua. The present La Luz & Los Angeles Mining Co. was incorporated Feb. 8, 1916, under the laws of the State of Delaware, by the same original holders of stock, with J. Gilmore Fletcher, of New York City, as the company's president.

RECORD JUSTIFIES EARLY ESTIMATES

When purchased in 1905, the valuation was made by engineers, and was based on their judgment of a prospect. No positive, possible, or probable ore was in sight, except as might be interpreted from a fairly comprehensive plan of surface trenches and pits. It was then estimated that the pay-orebody would be 750 ft. long by 400 ft. wide, and could reasonably be anticipated to extend to a depth of 100 ft., and would approximate a grade of \$10 per ton. The record of the property sustains the early prospectus fairly well. The ore mined over the nineteen-year period from 1901 to 1920 amounts to 540,145 tons broken, of an average grade of \$8.15 per ton, amounting to total gross value of \$4,399,334.

It is unusual to be able to report the record of a mine with continuous mint certificates, month by month, over a period of nineteen years on bullion from mine workings in one body wholly on the surface and at no point over 60 ft. in depth. An open quarry is now



CUT WORKING OF THE MINE AND AT THE RIGHT CAN BE SEEN THE MILL ON THE SHORE OF THE LAKE

exposed about 1,000 ft. long, with a maximum width of 300 ft., with the floor all in ore.

TABLE I. MINT BULLION RETURNS BY YEARS.

Year	Oz. Bullion	Average Value per Oz.	Mint Returns
1901	716.10	\$17.12	\$12,283.39
1902	2,159.50	17.10	36,944.60
1903	2,796.97	16.85	47,015.93
1904	3,813.40	16.90	64,466.22
1905	4,136.61	17.35	71,657.18
1906	6,584.62	17.48	114,125.55
1907	6,304.91	16.90	106,292.44
1908	6,351.54	17.12	108,942.86
1909	8,929.67	16.10	143,614.37
1910	11,323.84	17.15	194,425.41
1911	15,926.25	17.50	278,572.78
1912	15,888.07	17.60	278,886.60
1913	15,178.75	17.60	267,022.32
1914	10,360.08	17.61	182,732.01
1915	11,845.43	16.95	200,834.47
1916	7,578.27	17.30	131,132.17
1917	6,364.17	17.55	111,703.39
1918	13,782.35	17.45	240,233.65

In the process of milling, the grinding units graduated from Huntington mills to stamps and tube mills, due to the change of material treated, from soft surface dirt to hard, unoxidized rock. In this transition period a considerable part of mine-dump rock was sorted out as being too hard for the Huntingtons, and this, with the normal mine waste of low grade, amounts to about 25 per cent of the total ore broken.

The mill-head value is determined by adding the average tailing assay to the monthly bullion return. The average grade of ore sent to the mill over a period of nineteen years is \$9.20 per ton, of which, by amalgamation, the average extraction has been about 66 per cent. A total of 440,145 tons of ore has been milled, from which precious metals to the value of \$6.07 per ton have been extracted, a total of \$2,671,259.29.

TABLE II. SUMMARY OF ELEVEN YEARS, MILL REPORTS, AMALGAMATION.

Year	Tons of Ore Treated	Assay per Ton	Extraction	
1909	26,423	\$7.92	68.6	Five Huntington mills.
1910	34,312	8.13	69.8	Five Huntington mills.
1911	38,742	9.68	74.5	Six Huntington mills.
1912	44,518	8.12	77.2	Six Huntington mills.
1913	43,223	9.09	68.0	Six Huntington mills.
1914	49,933	5.80	63.0	Six Huntingtons and five stamps.
1915	35,131	9.25	62.0	Ten stamps and old Huntingtons.
1916	26,459	7.90	61.5	Ten stamps and one 8-ft. Hardinge. (Reconstruction)
1917	32,957	5.65	60.0	Ten stamps, one ball mill, one pebble.
1918	57,947	6.90	60.6	Ten stamps, one ball mill, two pebble.
1919	11,235	10.33	69.0	Ten stamps only (no power) (Hard ore).

The average of ore milled for the last eleven years has been \$7.11 per ton.

No attempt was made to keep detailed mill records previous to 1909; or, if so, they were lost. The work then outlined was to carry the mill-level tramway into the hill, following the surface excavations and thereby providing mill holes from which the "manta" (covering) could be drawn off in cars. Prospect pits were dug in front of the trend of the most highly mineralized area, but in the main the operations were directed by the foreman in charge panning his dirt daily, and guiding his laborers into anything assaying more than \$5, and away from anything less. In the strict sense of the word, miners were not employed nor needed. All ore to the mill was from open surface benches, from which the dirt was barred down and shoveled into cars to the mill holes. At times 25 per cent dynamite was used in 1½-in. holes churned to 10- or 12-ft. depths to break up the benches.

HIGH COST OF POWER VS. LOW LABOR COSTS

The pay dirt made up by the oxidation of the surface rock to a depth of about 20 ft. was easily broken in Huntington mills. The greatest difficulty was experienced in attempting to pass the always wet dirt or mud through grizzlies, to eliminate any hard oversize not suitable to the Huntingtons. Labor was cheap, and there was a merited aversion to mechanical equipment, particularly because of limited and expensive power. Furthermore, it was recognized that an entirely different mill would be required for the harder unoxidized ore, and plans were under way for a modern plant of stamps and tube mills. Accordingly, there was little attempt at refinements or betterments. The additions made were all for the purpose of testing the comparative merits of stamps and ball mills, and trying out pebble mills under different conditions.

The extraction secured by amalgamation has doubtless been uniform throughout the period of operations. The results reported in Table II are complicated by the difficulty of obtaining consistent assays, and by the variable personal factor of four different superintendents. Taken day by day, the tailing assay will vary

by 100 per cent, but by the end of the month the average will settle down to normal. On oxidized surface ores the extraction ranges from 60 to 70 per cent, and in 1920, on hard unaltered ore—and similarly for the whole of 1919—the average extraction is taken at 70 per cent.

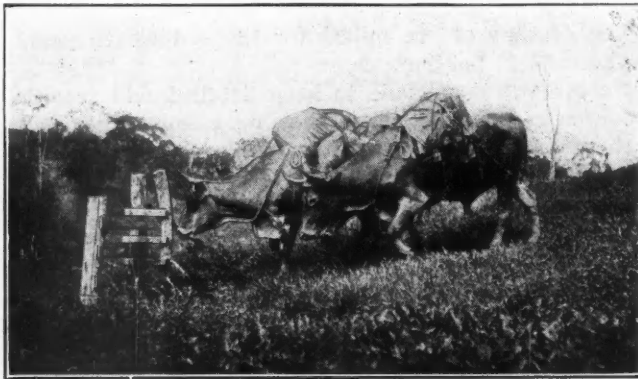
A serious effort was made in 1914 and 1915 to reach a satisfactory determination of extraction, with the following result, the "apparent" extraction being calculated from head and tailing assays, and the "actual" extraction made up from tailings assay and bullion returns:

TABLE III. TABULATION OF MILL EXTRACTION BY AMALGAMATION

1914	Extraction		1915	Extraction	
	Apparent	Actual		Apparent	Actual
Jan.....	69.70	65.38	Jan.....	63.54	64.43
Feb.....	62.20	65.50	Feb.....	54.54	57.63
Mar.....	63.67	68.27	Mar.....	66.66	60.00
Apr.....	68.13	63.80	Apr.....	51.75	57.55
May.....	51.02	57.96	May.....	68.03	63.98
June.....	63.01	64.42	June.....	40.12	62.28
July.....	54.54	58.73	July.....	66.02	66.58
Aug.....	51.78	54.69	Aug.....	55.55	59.04
Sept.....	60.71	60.00	Sept.....	46.55	54.78
Oct.....	58.93	57.64	Oct.....	63.97	62.82
Nov.....	55.55	61.91	Nov.....	63.29	57.54
Dec.....	72.97	67.06	Dec.....	46.80	62.20
Average for year, 63 per cent.			Average for year, 62 per cent		

In 1912, a serious attempt was made thoroughly to groove the exposed open cut and to sample regularly over 5-ft. sections. So much has been said and written about sampling gold mines, and of the propriety of resampling when erratic neighboring assays are returned, that Table IV is submitted as interesting. The management is convinced that a resampling and reassaying of the same territory would not check any one particular 5-ft. section, and that there would be individual variations of over 100 per cent, but that, in the final averaging of five hundred assays, the results might check satisfactorily.

Actual mill tests with ten stamps over a period of thirty days' running have been found to be the only reliable method of ascertaining mass valuations. Of the complex results reported in Table IV, the average of exposed ore assayed was \$6.50 per ton. Taking the final result of eleven years' milling throughout this same territory, and adding the tailing assays to the mint returns, the feed to the mill shows a value of \$7.11 per ton, which is an apparent variation in favor of actual results, over those obtained by mine sampling, of 10 per cent.



TRANSPORTATION METHODS AT LA LUZ AND LOS ANGELES ARE PRIMITIVE ALTHOUGH EFFECTIVE

All that can be said of the results indicated, and of the value of deductions from monthly returns, is that the record is a remarkable demonstration of the law of averages, and that over a period of time the figure will be approximately 60 per cent. The average of all data over nineteen years is 66 per cent. It has been impossible to obtain evidence that the oxidized ore yielded a higher extraction than does the unoxidized part.

The deduction is drawn that the gold is metallic, and that surface oxidation only alters the mass rock, without affecting the gold.

To determine a satisfactory mill-head assay, or a basis for the valuation of the ore in place, has been difficult. With metallic gold erratically distributed in any single cubic yard, it has never been possible to make the final subdivisions sufficiently accurate to check assays, even on the same general sample.

PYRITES FREE FROM GOLD

The ore occurs in a highly fractured contact-metamorphic limestone with intrusions of basic porphyry and monzonite porphyry, the mass highly altered and having been subjected to repeated crushing. It is unusually low in sulphides. The most highly iron-stained gossan at one edge of the open cut contains no pay gold, and pyrite in the ore mass is not welcomed, as it indicates absence of valuable minerals.

TABLE IV. TABULATION OF GROOVE SAMPLING OPEN-CUT IN 1912

(Each sample over five feet)
Assays in Dollars per Ton

Block 1		Average
Groove No.		
1	\$0.80-tr.-1.60-2.40	\$1.20
2	\$1.60-1.20-20.40-2.00-0.40-2.00	4.60
3	Tr.-2.40-4.00-5.20-6.00-4.80-4.00-5.20-6.80-9.20	4.76
4	\$2.80-4.80-3.20-2.00-0.80-8.80-4.00-12.80	4.90
5	\$1.20-4.40-8.40-6.00-12.00-7.20-4.80-5.60-2.80	5.82
6	\$3.40-6.40-4.00-7.60-8.00-2.00-0.40-4.00	4.50
7	\$8.40-2.40-1.20-5.20-2.00-7.20-5.60-6.00-4.60-3.20-2.00-6.40-7.20-4.00	4.67
8	\$4.80-2.80-18.00-38.40-13.60-2.40-2.00-2.40-3.20-14.40-6.80-5.60	9.53
9	\$2.40-10.40-2.40-2.40-5.60-5.26-4.40-3.20-1.60-6.00-5.60-0.40	4.14
Block 2		
Groove No.		
1	\$3.20-0.80-0.80-2.00	\$1.36
2	\$1.20-3.60-5.60-4.80-2.80	3.60
3	\$0.80-3.20-0.40-0.40-3.60	1.68
4	\$0.40-18.40-0.40-0.40-tr	3.92
5	\$0.40-0.80-2.00-0.40	.90
6	\$2.40-2.00-4.00	2.80
Block 3		
Groove No.		
1	\$8.80-4.00-2.40	\$5.06
2	\$16.00-7.20-8.80	10.66
3	\$2.80-4.00	3.40
Block 4		
Groove No.		
1	\$5.20-5.60-4.80-4.80-3.20-0.80-2.40	\$3.83
2	\$6.40-13.60-tr.-1.60-8.00-4.00-2.00-4.00	4.95
3	\$2.40-0.80-14.40-3.20-1.60-2.80-3.20	3.95
4	\$2.40-1.60-8.40-8.80-2.00-3.20-3.60-1.20	3.65
5	\$1.60-2.80-3.60-6.40-0.80-6.40-3.20-1.60-5.20	3.51
6	\$0.80-1.60-2.00-6.00-5.60-12.00-0.40	4.06
7	\$4.80-1.60-3.60-5.20-3.20-2.40-3.20	3.43
8	\$10.80-3.20-16.00	10.00
9	\$4.00-2.80	3.40
10	\$4.00-2.80	3.40
11	\$2.00	2.00

Block 5	
Groove No.	
1	\$5.20-4.00-12.00-20.00..... \$10.30
2	\$3.60-4.40-12.00-tr-6.00..... 5.20
3	\$8.00-8.00-6.00-12.80-14.00..... 9.76
4	\$4.40-6.00-1.60-11.60-4.00-10.40-13.20-10.00-2.40-16.40-3.20-5.60-7.20-3.20-3.60-2.00-2.40-2.40..... 6.10
5	\$4.40-8.00-17.60-6.40-8.80-17.60-7.20-5.60-3.20-6.40-7.20..... 8.44
6	\$0.80-14.40-6.80-6.40-9.20-8.00-5.60-12.00-22.80-3.20-6.80-4.00-2.80-1.60-0.80..... 7.01
7	Tr.-18.80-12.00-2.40-4.40-3.20-4.80-2.00-0.80..... 5.38
8	Tr.-10.40-8.00-14.80-7.20-0.80-4.80-1.60-0.80..... 5.38
9	\$8.80-11.20-7.60-2.80-19.20-13.60-6.80-4.00-3.60-1.60..... 7.92
10	\$4.80-21.60-14.00-2.40-2.80-9.60-4.00-1.60..... 7.60
11	\$9.60-9.60-24.00-26.00-10.40-7.20-3.60-0.80..... 11.40
12	\$0.40-0.80-12.00-13.60-12.40-11.20-2.00-20.00-48.00..... 13.38
13	\$20.00-4.00-1.60-2.00-2.40-11.60-2.40..... 6.28
14	\$12.00-24.80-5.20-4.00-2.40-5.20-1.20-3.20-0.40..... 6.50
15	\$12.80-26.80-16.00-32.00-6.40-4.80-3.60-8.80-28.00..... 15.47
16	\$8.00-4.00-13.60-15.20-34.80-9.20-8.00-18.40..... 13.90
17	\$8.00-1.60-5.60-7.60-10.00-41.20-15.60-38.40-14.40..... 15.82

Block 6	
Groove No.	
1	\$0.20-1.60-1.20-16.00-2.00-18.00-4.00-4.00-12.40-4.40-4.80-12.40..... \$6.75
2	\$8.00-8.80-5.60-6.40-20.80-6.40-5.60-1.20-6.00-1.60-0.80-2.00-6.40-6.00-1.60-10.00-3.20-1.60-4.00-5.60..... 5.38
3	\$7.60-3.20-4.80-4.40-2.40-3.20-4.00-4.80-5.60-5.20-3.60-6.40-2.00-0.80-3.60-4.00-3.60-4.80-1.20-14.40..... 4.26
4	\$4.80-12.00-10.40-2.40-2.00-tr-10.40-2.80-3.20-3.20-1.60-9.60-0.40-8.00-3.60-5.20-4.80-9.20..... 4.92

Block 7	
Groove No.	
1	\$20.00-3.60-4.00-3.20-8.00-4.00-2.40-2.80..... \$6.00
2	\$6.80-4.00-3.60-4.00-2.60-11.20-6.80-3.20-12.00-7.20..... 6.24
3	\$3.20-1.60-2.40-1.60-tr-3.20-8.00-2.80-11.20-8.80-8.40..... 4.66
4	\$3.40-6.00-2.40-2.00..... 3.45
5	\$2.00-1.20-2.00-1.60..... 1.70
6	\$4.40-4.00-1.60..... 3.32
7	\$3.60-1.20..... 2.40
8	\$4.40-2.40-0.80-3.20..... 2.70
9	\$1.20-2.40-3.20..... 2.27
10	\$4.00-9.60-1.20-2.40-2.00-4.40..... 3.93
11	\$8.00-0.40-tr-1.20-1.60-4.80..... 2.67
12	\$1.60-6.00-tr-3.20-1.60..... 2.48

Block 8	
Groove No.	
1	\$4.80-2.40-3.20-6.40..... \$4.20
2	\$12.80-0.40-tr..... 4.40
3	\$0.20-2.40-18.00..... 6.86
4	\$6.60-2.80..... 4.40
5	\$6.00-6.60..... 6.30
6	\$2.40-3.20-2.00..... 2.53
7	\$2.40..... 2.40
8	\$6.20-2.00..... 4.10
9	\$3.60-8.00-5.40..... 5.66
10	\$5.60-4.20-3.60-8.80..... 5.50
11	\$4.40-4.00-5.60-8.80..... 5.50
12	\$4.20-5.20-10.60-9.60-5.80-4.00..... 6.56
13	\$0.40-4.00-2.20-2.00-4.40-8.40..... 3.55
14	\$8.00-4.40-2.20-3.40-2.00-8.40-9.60-3.00-5.00..... 5.10
15	\$0.80-3.60-8.00-6.60-6.40-6.60-2.20-2.00-2.00..... 4.77
16	\$0.20-2.00-3.20-3.40-2.80-1.20-2.00-8.20..... 2.88

Block 9	
Groove No.	
1	\$2.00-3.20-16.80-5.60-15.20..... \$8.56
2	\$2.00-17.60-15.60-6.80-4.00-12.80-1.20-32.00..... 11.56
3	\$60.00-5.20-2.40-3.20-11.20..... 15.00
4	\$6.40-4.00-10.80-6.80-7.60-8.00..... 9.45
5	\$19.20-32.80-9.60-7.20-2.80..... 14.32
6	\$6.40-10.40-19.60-7.20-8.00-6.40..... 9.57
7	\$24.80-16.80-8.00-6.00-2.80..... 9.75
8	\$4.80-7.20-12.00-2.00-0.80..... 5.36
9	\$6.40-8.40-28.80-8.00-4.00-1.20..... 9.47
10	\$1.20-4.00-4.00-13.20-25.60..... 9.60
11	\$16.80-8.80-8.00-6.00..... 9.90
12	\$66.00-2.40-0.40..... 22.93

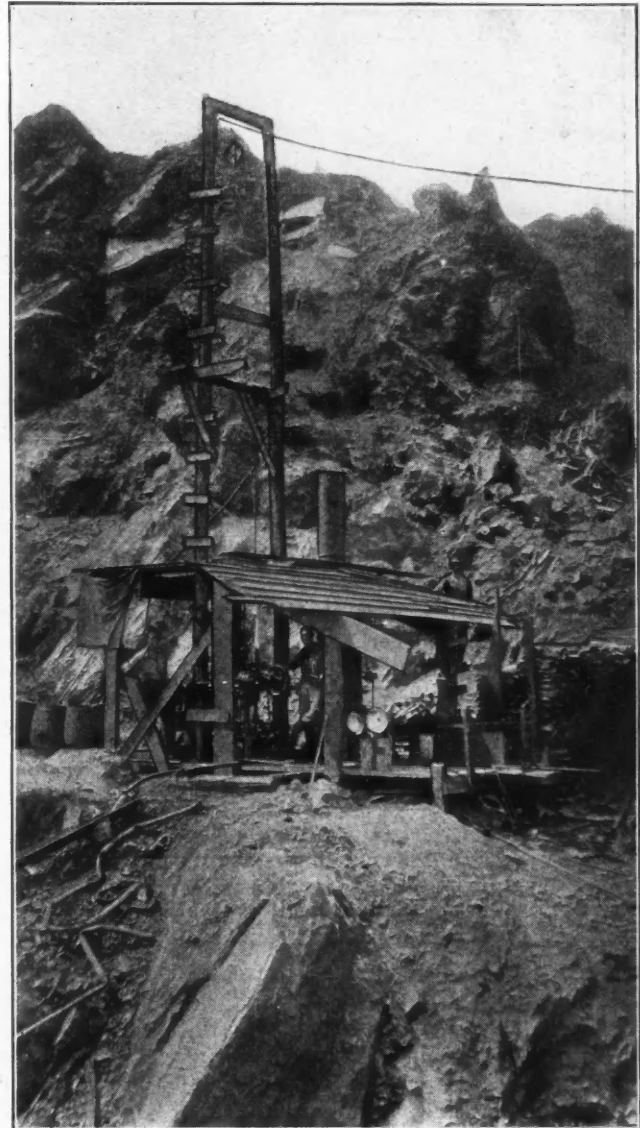
Final average of 592 assays—\$6.50 per ton.

In the early operations little thought was given to developing ore in depth. The mine was extending in area, by natural growth, with a satisfactory monthly output. It was recognized in 1913 that a horizontal limit would soon be reached, and although some new tunnels have since been opened, the deposit is now practically defined in length and breadth. Three shafts were planned at 200-ft. intervals, and two were completed, but the third encountered more water than could be handled economically by windlass. This work established the impossibility of drifting at 100-ft. depth, or of sinking deeper without power for hoists, pumps, and air compressors.

The cost of steam and gasoline engines was prohibitive, as demonstrated by experience, and a proposed hydro-electric plant could not be built without a heavy investment. There seemed to be no alternative for determining ore in depth except to prospect with diamond drills. A No. 12 American hand drill was tried, and one vertical hole of 350-ft. depth proved the ter-

ritory to be fair drilling rock, but with high diamond cost and slow progress. The information gained, however, was used as a basis for soliciting a contract to sink ten holes of 500 ft. each, and a bid was accepted at \$3.50 per foot, the company paying the expenses of transportation and board of the men while at the mine.

The work was begun in February, 1916, and concluded in August, 1916, with about 6,000 ft. of drilling. The information gained settled many points, and demonstrated no change in the formation and a continuity of average grade of ore to the depth explored. The



PROSPECTING DRILL AT LA LUZ AND LOS ANGELES MINE

results cannot, of course, be considered conclusive, but when studied without bias they are all that could be desired.

SHATTERED GROUND SHOWS HIGHER MINERALIZATION

The maximum drilling progress for twenty-four hours was 88 ft. A fair average shift's work of ten hours was 20 ft. advance. In any one hole the best recovery of core amounted to 33 per cent, with the average considerably lower. The sludge samples were found to be consistently richer than the core, and in final summation were about 47 per cent higher. The



ALONG THE WATER TRAIL TO LA LUZ MINE

final cost to the company amounted to \$5.26 per foot for all holes.

It is characteristic of the deposit to exhibit better gold values in the more shattered ground, and with a low percentage of core for assay in broken ground the core samples could not be free from doubt as being representative of the section. They will be accepted as a guide and justification for sinking the final working shaft.

HUNTINGTON MILLS GIVE GOOD SERVICE

Early milling operations on the decomposed surface rock were with six Huntington mills with 24-mesh screens, using approximately five horsepower each and treating, over monthly periods, an average of twenty tons per twenty-four hours. They were entirely satisfactory and well understood by native labor. On the La Luz and Los Angeles type of gold ore they are excellent inside amalgamators, and are the best possible prospecting machines for that country. When the machines became old, after service of three or four years, the repairs and renewals amounted to 16.8c. per ton, exclusive of labor and lost time.

The average of several years shows that, of the total amalgam collected, 64.8 per cent was taken from the mill wells and 35.2 per cent from the plates. Over a period of five years, the quicksilver loss has amounted to 0.0097 lb. per ton of ore milled. With Hardinge mills and plates the mercury loss has been 0.01187 lb. per ton of ore. The summation of quicksilver loss over eight and one-half years has been 0.01025 lb. per ton of ore, which amounts to 0.03324 lb. per ounce of bullion recovered.

Flotation tests are not encouraging, and flotation treatment cannot be applied to a metallic gold ore of this character. A representative sample of the unaltered sulphide ore was sent to the General Engineering

Co., and it may be conclusive to give a digest of that company's report:

Test No. 1:

Ore crushed in ball mill to 100 mesh. Treated on Callow pneumatic flotation machine with an oil mixture of G.E. No. 1, 40 per cent; No. 2, 40 per cent; No. 8, 20 per cent (1½ lb. per ton).

	Weight, per Cent	Au	Ag	Iron, per Cent	"Insol.," per Cent
Crude ore assay.....		0.286	0.3	6.0	44.6
Flotation concentrates... 1.35		6.56	6.6	15.0	23.6
Recovery.....		31%	29.6%		

Test No. 2:

Ore crushed in ball mill to 120 mesh. Treated on Callow pneumatic flotation machine with an oil mixture of G.E. No. 2, 50 per cent; No. 25, 50 per cent. (1 lb. per ton)

	Weight, per Cent	Au	Ag	Iron, per Cent	"Insol.," per Cent
Crude ore assay.....		0.286	0.3	6.0	44.6
Flotation concentrates... 1.33		6.88	5.2	15.1	23.6
Recovery.....		32%	23.1%		

Test No. 3—Amalgamation and Flotation:

Ore crushed to 40 mesh, treated direct to plates.

	Weight, per Cent	Au	Recovery, per Cent
Crude ore assay.....	100	0.283	
Amalgamation tailings.....	100	0.063	
Amalgamation extraction.....		0.22	77.76
Amalgamation tails crushed to 120 mesh in ball mill, treated in Callow pneumatic flotation machine, with oil G.E. No. 2, 50 per cent; No. 24, 50 per cent (1½ lb. per ton).			
Flotation concentrates.....	2.28	1.26	10.15
Total recovery.....			87.91

(N.B.—Concentrate is not a shipping value.)

Test No. 4—Flotation and Concentration.

Ore crushed in ball mill to 80 mesh, treated in Callow pneumatic flotation machine, using sodium sulphide (2 lb. per ton), with an oil mixture of G.E. No. 1, 40 per cent; No. 2, 40 per cent; No. 8, 20 per cent. (1½ lb. per ton).

	Weight, per Cent	Au	Ag	Iron, per Cent	"Insol.," per Cent
Crude ore assay.....		0.286	0.3	6.0	44.6
Flotation concentrates..... 3.59		2.24	4.4	14.6	28.6
Recovery.....		36.7%	45.1%		
Flotation tailings sent to table concentration					
Table concentrates..... 2.56		4.61	3.9	16.4	38.4
Recovery (table).....		53.8	28.5		
Combined concentrates..... 6.15		3.2	4.2	15.3	32.6
Total recovery.....		90.5%	73.6%		

(N.B.—Concentration 16 to 1; product not a shipping value)

Test No. 5—Amalgamation, Flotation and Concentration:

Ore crushed to 80 mesh, treated direct to plates.

	Weight, per Cent	Au	Ag	Recovery, Au, per Cent
Crude ore assay	100	0.286	0.32	
Amalgamation tailings		0.137	0.16	
Amalgamation extraction		0.148		51.77
Amalgamation tailings emulsified with No. 2 Na ₂ CO ₃ and No. 2 Na ₂ S and oil mixture of G.E. No. 8, 50 per cent; No. 132, 33 per cent; and G.E. No. 2, 17 per cent (1½ lb. per ton); treated in Callow pneumatic flotation machine.				
Flotation concentrate	5.86	1.19	1.9	24.38
Flotation tailings sent to Wilfley table				
Table concentrates	1.30	3.82	3.4	17.36
Total recovery				93.51%

(N.B.—Combined concentration 13.96 to 1; and product is not a shipping value)

The concentration and flotation tests are valuable only by elimination. Other mines near La Luz and Los Angeles would not necessarily have similar experience, but the record is published as a guide against anticipating merit in flotation on similar neighboring ores.

Cyanidation tests have been made and checked. In 1912 the Henry E. Wood Ore Testing Co. made a careful examination of ore and tailings sent to them, with the following conclusion:

- (a) Treatment of actual mill tailings after amalgamation, which had passed Huntingtons with 24-mesh screens: As received, the tailings were separated into "sands" and "slime," and each subjected to normal percolation or air agitation, with a final combined recovery of 83.6 per cent.
- (b) The same material reground in tube mill to pass mechanical classification, and treated in Pachuca tank with air agitation, gave (tailing assay, trace gold) plus 98 per cent recovery.

More modern tests were made in 1916 on true sulphide ores as then uncovered, with the result shown on the chart.

The ideal treatment for this ore is amalgamation and cyanidation, but considering the simplicity of direct cyaniding, and the greater security of the recovered metal, the decantation treatment in weak cyanide solution will probably be installed at the La Luz and Los Angeles mine.

When in 1916 it became necessary to break into the harder ore below the surface "manta," the original Huntington mills were found to be inadequate. The vibration, wear, and tear were so excessive that all Huntingtons were finally abandoned.

Production was never stopped, and the present half unit of a new milling plant was erected over the old mill. Five 1,050-lb. stamps on concrete foundation were first put in, crushing to 4 mesh and delivering to several Huntingtons, but the latter could not be adapted to the ore.

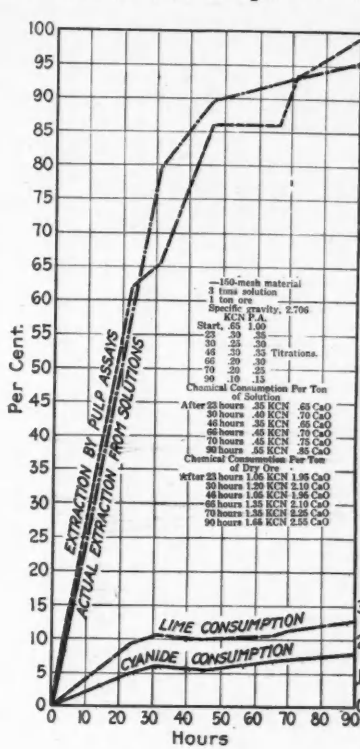
STAMPS RETAINED, BECAUSE OF LACK OF COMPARATIVE DATA

The stamps were increased from five to ten for fine crushing to minus No. 421 ton-cap screens, direct to plates. Inside mortar amalgamation was attempted, but was discontinued. With a larger milling plant in view, it was desirable to test the ore under working conditions with a Hardinge 6-ft. ball mill in competition with the ten stamps. Several factors could not be isolated to decide definitely the respective merits, and without substantiating figures it was decided to retain stamps. During the war period, a good supply of balls was not to be obtained, and the mill could not be operated with a fair full charge of metal. On a soft

ore the Hardinge ball mill would take all the tonnage that could be delivered through a 6-in. feed scoop; but with no adjustment would it deliver a finished output under the conditions stated.

Using the ball mill in a closed circuit with an Akins classifier was tried, but with soft feed and sand return the ore charge did not offer sufficient resistance to the balls, with the result that the liner wear was excessive and renewals were abnormal. During a period when balls were not at hand, an attempt was made to use scrap iron of discarded Huntington mill roller heads, or pieces of 4-in. shafting, cut to 6-in. lengths, or the necks of stamp-mill shoes. With hard ore this material was not satisfactory, and there was a noticeable decline in the capacity of the mill when anything but round steel balls was used.

In this period one 8-ft. Hardinge pebble mill was installed to take the product of stamp mills at 4 mesh,



TESTS ON LA LUZ SULPHIDE ORES

together with the output of the ball mill in its office of a coarse crusher, using an Akins classifier ahead of the pebble mill. The 8-ft. Hardinge pebble mill delivered a finished product, without further classification, direct to the plates. Although not orthodox, the practice seemed to show the best results in this particular instance. Some slight oversize would show on the plates, but inasmuch as it was of low tailing assay, the mill could be crowded to a higher tonnage output per horsepower than could have been done in a closed circuit.

The situation was complicated by power costing \$750 per horsepower-year, with, moreover, not sufficient engine capacity to run a second 8-ft. Hardinge pebble mill to test a closed circuit. With ten 1,050-lb. stamps at 100 drops per minute, and one 6-ft. ball mill at 27 r.p.m., and two 8-ft. pebble mills at 26 r.p.m., the plant could not be run to speed with 200 hp. The driving pulleys on the two pebble mills were increased to reduce their speed to 20 r.p.m. each, and the advantage was at once apparent in reducing the power to less than 200 hp., and within easy limit of the engine capacity, with no apparent lessening of the mill tonnage. In net result the plant attained a maximum output of 250 tons per day, and an average, for thirty days, of 210 tons. The net mint production was raised from 1,200 oz. per month to an average of 1,500 oz., with a maximum thirty days' run of 1,700 oz. bullion output.

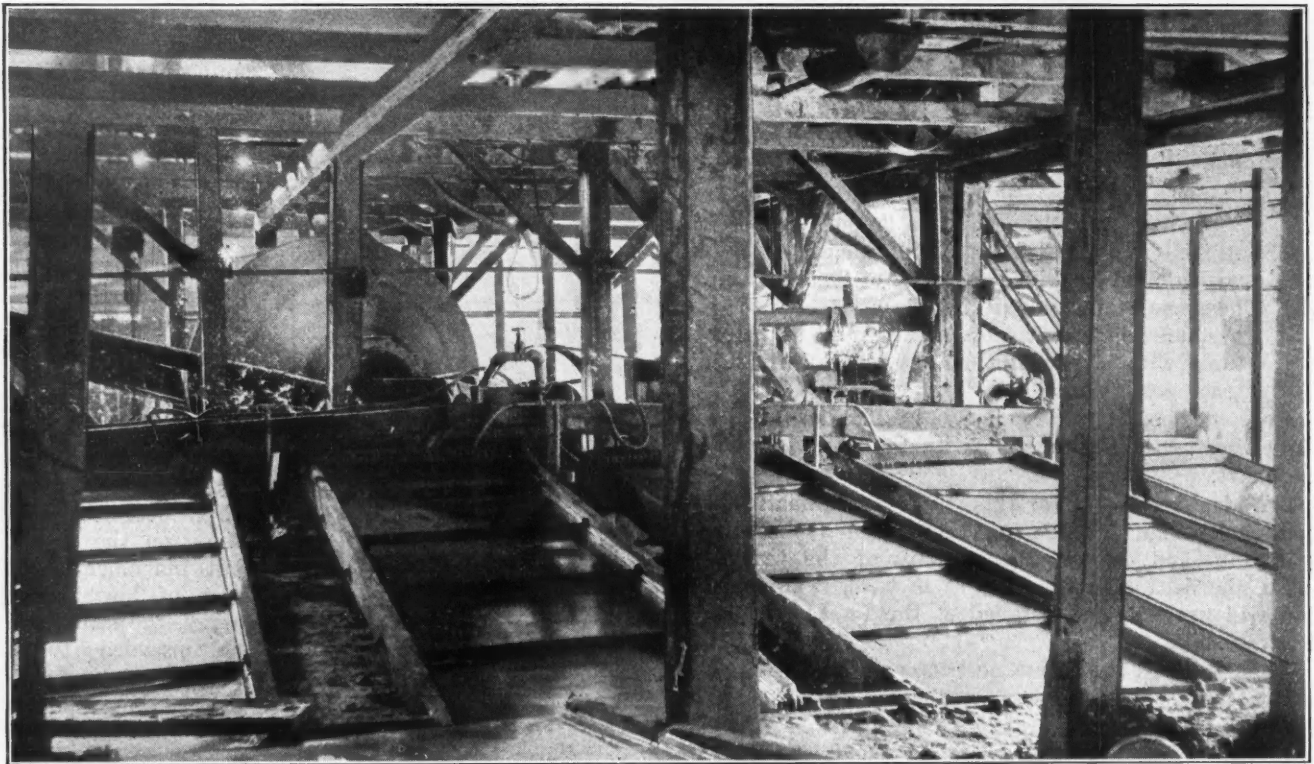
The 8-ft. x 36-in. pebble mills used mine rock in place of imported pebbles. In the mine are small patches of hard, close-grained flint or chert, which, when

sorted out, generally gave an assay of \$3 to \$4.50 per ton. This material was shot down and selected in blocky pieces of five to six inches, delivered to a special mill bin, and was charged out on the reports as ore. It was thrown into each pebble mill by hand from a car on a track above the mill. A rough four-side iron chute of $\frac{1}{2}$ -in. plate iron as a gooseneck was so secured as to project the stones directly into the pulp-discharge end of the Hardinge, and did not interfere with the free discharge of the finished pulp. It was the work of one man per shift to feed two mills, cobbing the irregular stones to size to enter the mill. Of the total mill tonnage the rock used to form pebbles amounted to 4.3 per cent, or 86 lb. of rock to the ton of ore treated.

With the pebble mill running in open circuit, delivering a finished product, the practice developed of

row of growing trees, starting from the original poles. Naturally, this wood is worthless as fuel or timber. In the older growth are scattered trees of superb hard wood and sufficient soft wood, as cedar and mahogany, for normal building purposes, but no new mine prospect can depend on wood fuel in quantity to maintain a boiler plant of over 25 hp. Also, for mining work, the hard grades cannot be excelled for underground timbering, for shafts or drifts, but it would be unwise to count on square-set stoping timbers, except as they might be brought in from the lower coast savanna pines.

Naturally, hydro-electric power is the only solution for mining work, and it can be developed for all the districts if capital is invested. No development in depth can be obtained to show mining stability without considerable power for hoisting, pumps, and compressors.



INTERIOR OF PRESENT MILL AT LA LUZ

making a very wet discharge direct to the plates. An excess of water permitted a classification in the mill that held back the oversize.

The second 8-ft. Hardinge mill was installed in 1918 for either open or closed circuit. This unit takes 4-mesh product from the ten stamps, and, operating in closed circuit with a 48-in. Akins classifier, the work is done at about eighty to ninety tons per twenty-four hours on hard ore. At this point the stamps are operating about to capacity, unless the ore can be crushed finer than 2-in. to 2 $\frac{1}{2}$ -in. size; and the Akins classifier return to the Hardinge is about the limit of the classifier blades. Any greater tonnage would necessitate doubling the classifiers, and doubtless require the use of steel pebbles in the Hardinge, with, of course, more power consumption.

The mining districts of the east coast of Nicaragua are all in tropical jungle. Growth is phenomenal. A telephone line, built a few years ago, is now a continuous

A vicious circle is established, in that no company can be fully warranted in building an expensive first-cost power installation until the mines are developed to show stability.

With a receding wood supply at the La Luz and Los Angeles mine, a 25-hp. gasoline engine was first installed, which gave satisfaction but with high fuel costs. Gasoline was imported from New Orleans at a freight cost of 50c. a gallon. To combat the rising cost of gasoline, a 50-hp. Diesel engine for crude oil was tried out in 1915. The experience over a period of twelve months was costly. From day to day practically every casting in this engine was broken, until a decision was reached to meet the local conditions with an engine that the labor could understand. In 1917 a 150-hp. vertical three-cylinder engine, built to burn distillate, was successfully installed, and by using the light distillate fuel in the Diesel engine no further running trouble was experienced.

With the swollen prices and freight rates during the war period, and to date, even these engines are impracticable except as expedients to develop the mines to a point where they will warrant hydro-electric plants. The table indicates the power source and the cost per horsepower-year:

POWER IN 1913.		
	Per Cent Used	Cost per Hp. Year
Gasoline.....	22.99	\$606.48
Steam.....	17.36	581.13
Water (Pelton wheel).....	59.65	141.06

Wood, five cords per 25 hp. day—\$5.20 per cord.
Gasoline, 50 gal. per 21 hp. day at \$0.75

POWER COSTS IN 1918

Using a 150-hp. Fairbanks Morse engine and a 50-hp. Diesel engine (distillate), to secure an average of 200 hp. per day, the combined consumption was 350 bbl. of distillate per month, at \$0.74 per gallon. The cost per horsepower-year was \$777. With the distillate engines the cost per ton of ore milled was \$2.16, a most abnormal charge.

With a rainfall of about 120 in. per year concentrated in six months of the season, the trails and roads are bad. The mine freight is carried by river in pitpans for 175 miles, to within five miles of the mine. Mule-back haulage is used to some extent, but the more accepted method is by pack oxen, which, unshod, are better able to navigate the swampy roads. Loads were formerly limited to 150 lb., but with the development of mud sleds the largest piece yet handled was an engine base weighing 5,000 lb. Any necessary part of reasonable weight can be transported. Freightage may be variously estimated as follows:

	Per Ton Mile	Limit
Women carriers.....	\$2.00	80 pounds.
Pack oxen.....	4.00	150 pounds.
River pitpans.....	0.25	5,000 pounds.
Coast schooners.....	0.07	5 tons.

Government control is excellent, and the officials are courteous and efficient. There is no record with this company of the oppression or graft so commonly charged against many of the struggling Central American republics. Strikes are unknown, and theft is rare. Revolutions have occurred in Nicaragua, but the La Luz and Los Angeles mines have not been molested or threatened.

There is a nominal tax of \$0.40 gold per year per hectare mining claim. On timber and grazing land the tax is \$0.16 gold per hectare. A separate and additional tax of \$5 gold per \$1,000 invested capital is collected on all property, stores, supplies, and accounts. Bullion exported is taxed at \$17 per kilogram of pure gold, the assessment being made subject to final mint returns. On the La Luz and Los Angeles bullion, running about 830 fineness, the export duty amounts to approximately 3.12 per cent, or \$0.53 per ounce of bullion.

Wild Tales From the Hills

Possibly the premier assay ever reported came from the old Black Warrior mine, in the Bradshaw Mountains of Arizona, back in the days when silver was worth just a bit above a dollar an ounce. It reported a silver value of \$30,000 a ton, or a little more than the solid metal would have then been worth. On a par with this is the tale of the California pioneer who boasted that when he was express agent in one of the early camps he often shouldered and dumped into the daily stage a sack that contained \$100,000 worth of gold dust—a load that a pack mule could not carry.

Hand vs. Machine Development

By G. L. SCHMUTZ

Written for *Engineering and Mining Journal*

THE data here given in the tables covering comparisons between hand and machine development were obtained from one of the largest mines in the Southwest. The total amount of footage used in computing averages applies respectively to the years 1917 and 1918. The rock encountered in the development was principally latite, andesite, and monzonite. The average wage of labor per day was \$2.

TABLE I. AVERAGE DEVELOPMENT COSTS PER FOOT OF ADVANCE

Year	Drives		Saving Hand Over Machine	Winzes		Saving Hand Over Machine
	Hand	Machine		Hand	Machine	
1917	6.93	9.71	2.78	8.31	11.22	2.91
1918	7.38	8.89	1.51	8.33	10.88	2.55

Year	Raises		Saving Hand Over Machine
	Hand	Mach.	
1917	6.96	7.55	0.59
1918	6.83	7.42	0.59

Estimated Saving for All Hand-Driven Development

Year	Footage of Machine Drives	Hand vs. Machine Saving	Savings in Drifts	Footage of Machine Winzes	Hand vs. Machine Saving
1918	11,332.50	1.51	17,112.07	165.5	2.55

Year	Saving in Winzes	Footage of Machine Raises	Hand vs. Machine Saving	Saving in Raises
1918	432.22	10,206.0	.59	6,021.54

TABLE II. PERCENTAGE DISTRIBUTION OF FACTORS ENTERING INTO DEVELOPMENT COST

	Drives		Winzes		Raises	
	Hand, Per Cent	Machine, Per Cent	Hand, Per Cent	Machine, Per Cent	Hand, Per Cent	Machine, Per Cent
Labor.....	67	49	72	45	71	52
Explosives.....	27	38	24	40	24	35
Forge and drills.....	6	13	4	15	5	13
Totals.....	100	100	100	100	100	100

The figures given in Table I indicate that, at this mine, hand is considerably cheaper than machine development. However, there are instances wherein this difference in cost must be sacrificed for speed. Some of the advantages accruing from the practice of running development by hand rather than by machine are as follows: A smaller cost per ton of ore extracted chargeable to exploration and development; employment can be given to more men; less water is required for machines; less power is required for compressors; there is less dust.

[Cost comparisons of hand and machine drill work are not numerous, as, under the wages which have ruled in the Western states, there has been little inducement to employ all hand labor. Each increase in output per unit of labor has been won at additional expenses for power, lubricants, and overhead where mechanical equipment is employed. There is a point where the increased costs, when superimposed on a given labor wage, increase the unit cost of the work. Increased wage rate makes it possible to add such increased charges in greater proportion without increasing unit costs as compared with hand work. Mr. Schmutz's labor cost of \$2 per day, and his comparative unit costs for development work, indicate that with labor at this wage, unit costs are increased by machine drilling. With labor at \$4 per day, the unit costs would be lower in the case of machine mining than with hand labor with the same wage.—EDITOR.]

Investing in Mining Prospects

Chances for Success Are Gaged Largely by the Business Ability of the Personnel, Sufficient Finances, the Manner in Which the Property Is Operated, and the Presence of Ore in Paying Quantities

BY KIRBY THOMAS

Written for *Engineering and Mining Journal*

THE risks of investing in any business enterprise at its inception, or in its first stages, are greater than in the later stages, when the undertaking is established and perhaps earning a profit. This is true with mining ventures to a greater degree than with most other commercial or industrial undertakings. There are, too, certain features in connection with all mining investments, increasing this risk, often not duly considered by the prospective investor, who, at the time of investing, is likely to be under the spell of the mine vender or the stock salesman and self-blinded by the promise of a large gain in the transaction.

It is seldom that mineral deposits are found which can be determined without much expensive labor to be of sufficient commercial value to justify a mining operation. A mineral deposit the extent and value of which are unproved is termed a "prospect"—an obvious designation. The value of a prospect is difficult to measure, and its profit possibilities, if there be any, are latent. It is in this prospect stage that much money is lost in mining, not only by investors but by skilled and experienced miners and engineers.

THE RISK OF INVESTING IN A MINE PROSPECT

A prospect mining venture is essentially and inherently hazardous. The mining engineer and the mining man will not deny this; in fact, they recognize it by offering to the investor a large interest at a low figure, or by associating with others in the cost of the development, so as to divide the risk. This great risk is evidenced, also, in the low price of the shares in prospecting and developing companies. There is a chance either of a failure and total loss, or of a success which may mean a many-fold gain for all.

If the investor goes into prospect mining with his eyes open to the risks, which risks he takes for the chance of the great gain expected, no blame should be attached to anyone if a loss ensue. However, because of the great physical risks in a mining prospect, proper business precautions should be taken.

SECURING A CLEAR TITLE ESSENTIAL

The first consideration is the title. It should hardly be necessary to mention such an elementary matter, but the fact is that mining-stock investors often have no knowledge of and make no inquiry as to the title under which the company holds the property. Mining property in the Western United States and in Mexico may be held under "location" or "denouncement"—that is, the title is in process. Companies frequently offer stock when the title to their properties is in this stage. Ordinarily, this is reasonably safe, but there is a chance of the full title failing to issue on a technicality or an irregularity. Therefore, it is best for the investor to insist upon the protection of full fee title to the property, or upon a guarantee, or to hold a "string" on

his money until the title is perfected—ordinarily a matter of a few months.

Many stocks are sold by companies which hold their properties under a form of contract, customary in the mining business, known as a "lease and bond." The owner gives to the company, or to the promoter, a lease with the right to develop and operate the property for a given period, usually one or two years, and an option to purchase for a stipulated price and terms during the period of the lease. The purpose of this negotiation is self-evident. The purchaser of the property has opportunity to prove to his satisfaction that it is worth the price.

Ordinarily, it is stipulated that development and exploration shall be done. This form of contract is sound, and is usually resorted to by experienced men in negotiations for undeveloped and unimproved properties. On the other hand, the mining investor is often unfamiliar with the business risks involved in a lease and bond proposition. The investor often does not know that the property, encouraging reports of which may be before him, does not belong to the company offering him its stock, and this fact is sometimes not impressed upon him unduly. He does not know that should the expensive work that is necessary, part of which he is to pay for, prove the property to be of value, the company must then pay many thousands, or a million or more, for the property; and he does not consider that if the prospect should prove to be very valuable, his associates in the transaction may not be financially able to complete the deal, or the conditions of the negotiation may be such that the money to purchase the property cannot be raised.

The investor who goes into a company which owns only a contract or a lease on a mine should recognize that, aside from taking the usual physical risks of mining, he is taking, also, great business risks in respect to the ability of his company, or of its backers, to carry out the terms of the contract and acquire the property for the company.

In the purchase of a stock interest in a property held under lease and bond it should, however, be borne in mind that if the company can raise enough money to prove up the property, and to give it a measurable value greater than the contract price, the transaction is reasonably safe within itself, for even though the first investors may not be able to raise the purchase price, there is always a market for developed and proved mining properties.

Usually, in a prospect mining proposition the owner takes a part of the stock of the company in exchange for his property, the remaining stock going mostly into the treasury of the company, to be sold for development purposes, and thus make all the stock valuable. The prospective investor should inquire as to the proportion of the issued stock which the owner receives, and

also what part certain intermediaries, called promoters or stock agents, acquire as their profit. There is no set rule or guide as to how much stock should be issued for the property, but the amount and all conditions should always be critically considered.

Other primary points in a prospect mining investment relate to capitalization of the company and the amount of stock in the treasury. If an investor purchases mining stock which is not from the treasury of the company, he is simply making a trade. If he purchases stock from the company's treasury, his money goes to his company and is, or should be, used in making his property more valuable. Consequently, other things being equal, it is more advantageous to buy treasury stock than individual stock, a matter often overlooked. The number of shares in the treasury is vitally important, for if there is only a small amount of treasury stock the company may have difficulty in raising the money needed for the development and purchase of the property, and to borrow on company notes or bonds is ordinarily, for evident business reasons, not practicable in the development or management of prospect companies.

AVOIDING THE "HIGH COMMISSION" STOCK

Extravagant impositions in the form and guise of commissions to the stock salesman, brokers, and intermediaries for raising the funds often accompany mining flotations, and this point should be scrutinized carefully. Often the investor considers the stock on its own merits, without inquiring as to what part of the dollar which he pays is to go into his property. In some notorious instances the cost of raising money for mining enterprises has been from 50 to 90 per cent of the sum obtained—a condition obviously and glaringly wrong from a business standpoint, and a forerunner of failure of the enterprise saddled with such incompetency or dishonesty.

In financing a prospect mining company it is customary to pool the owner's and the promoter's stock. The stock investor should usually insist on such an arrangement, and should know of the details of the pool agreement. If the owner and the promoter cannot sell any of their stock until the mine is profitable, they are likely to have a lively and continued interest in the success of the undertaking, and such a plan makes them carry the full risk along with the man who furnishes the money. The pooled stock, too, is taken off the market, and thus the financing is easier and surer.

CARRYING A "PADDED" DIRECTORS' LIST

The mining-stock investor is often influenced by the eminent respectability and high financial standing of the board of directors, but he should bear in mind that sometimes bankers, lawyers, and others lend their names to mining corporations without first having thorough knowledge of the undertaking, and that they sometimes do not give the attention to the business which is morally, at least, incumbent upon company officers. Not infrequently fine-feathered directors have been given their stock free for the use of their names.

A mining-stock offering should always be accompanied by a report from a disinterested mining engineer or other competent expert. Statements by the owner or the agents should be designated as "venders' reports," as is the British practice. Mining reports are not infallible, either as to competency or integrity. The

reputation and experience of the man making the report is always a wise and proper subject for inquiry. Most reports on prospects are opinions only, and should be taken as such. The prospective stock buyer should study the reports and weigh the facts and conclusions in all their bearings, for manipulation of reports by overzealous venders is one of the tricks of the business. If the technical parts of the report are beyond the knowledge or experience of the investor, he should consult some one with mining experience, or, better, seek directly the advice of a mining engineer in good standing, as he would consult a lawyer in any other business transaction.

UNSCRUPULOUS PROMOTERS PRONE TO EXAGGERATION

Outward evidences generally indicate unsound companies to a wise and wary investor. Promises of immediate dividends from a prospect, extravagant claims and incomplete or misleading statements about the property, announcement of arbitrary stock advances, suggestions of philanthropy in the promotion, failure to present essential points, evidence of lax business methods or of financial incompetence, claims of the discovery of wonder-working ore processes, positive valuations of the undeveloped, and hence unknown, orebodies—these and other equally axiomatic indications of incompetency or dishonesty should automatically protect the public; but unfortunately they do not.

The purchase of stock in a mining prospect company is not an investment in the sense that the transaction may be expected to result in early regular dividends, but it may be, nevertheless, a good business speculation, and may become a source of profit. There is the chance for profits during the development period from the enhanced price of the stock as the prospect development progresses, and, of course, always the expectation that sooner or later the prospect will be a mine, and then the stock will have an intrinsic value many times greater than the price paid. Mining stocks are often bought solely on the chance that the price will rise or be raised, and that the holders can unload at a profit. This is a speculation, and is in the same class as speculation in stocks or with the markets.

CAUSES OF FAILURE OF MINING INVESTMENTS

The chief cause of loss of investments in mining prospects is the failure to find valuable ore in commercial quantities. Not one in a hundred of the discoveries of outcrops or mineral indications which attract the prospector finally develops into a mine. Generally, the limited work of the prospector or of the owner determines this, and the "discoveries" die a-borning. Often a little work will give hope and encouragement and some definite facts as to the mineral conditions. The prospector comes to have faith in his property, the mining man thinks that it will make good, and the engineer makes a favorable report on it as a prospect. At this stage the proposition is likely to be offered to the investor, either in the form of an interest or as stock in a company, as usually much more money is needed than the owner has or can afford to risk.

Provision of sufficient funds for the company at this stage will not, however, insure success. The business must have honest and competent management, and probably, also, technical engineering guidance. The company must be financially able to carry out the necessary explorations and developments. These essential factors

for success being all favorable, there is reason to expect a profitable investment, barring, of course, the inherent physical risk of there not being enough valuable ore in the property to make a paying mine.

MINING SHOULD BE REGARDED AS A SPECIALIZED BUSINESS

It should hardly be necessary to caution a business man as to the wisdom and necessity of skilled, competent management. Yet many mining companies, particularly those engaged in making mines from prospects, are woefully mismanaged, chiefly for the reason that many persons do not recognize the fact that mining in nearly all its phases is an intricate, specialized form of business activity, requiring special experience and technical training, as well as a high order of business ability and energy.

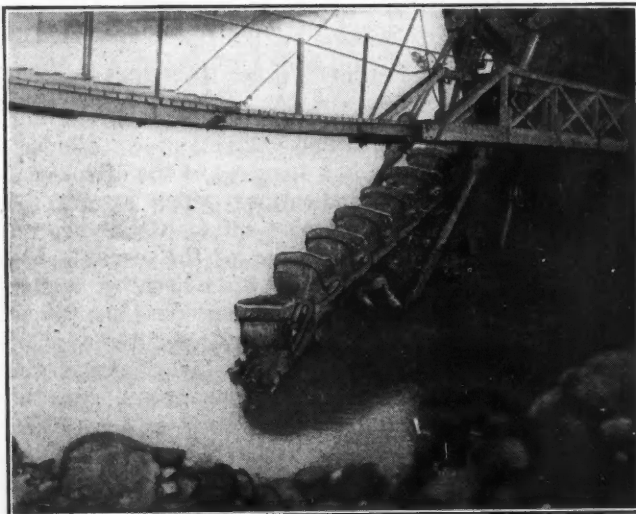
Most prospects require much more money to prove than the sanguine owner or promoter expects, or the stock buyer is led to believe. Lack of sufficient capital is the cause of many failures, for rarely can enough ore be taken from a prospect to pay for its development.

All of the rich mines now operating were once prospects, in most cases not many years ago, and each year many prospects are developed into mines, making many individuals and the community wealthy. Those who are prepared to take the money risks involved, who will use hard common sense and good business judgment, and who will study the business, will find as much interest and profit in investing in mining prospects as in most other business activities—especially if they are persistent.

Bucket-Line Troubles

Written for *Engineering and Mining Journal*

A not infrequent accident in dredge operation is for the bucket line to run off the lower tumbler. When the buckets ride up on the flange of the tumbler, the lower part of the bucket line slides out of its normal position on the rollers, and if operation is continued the buckets



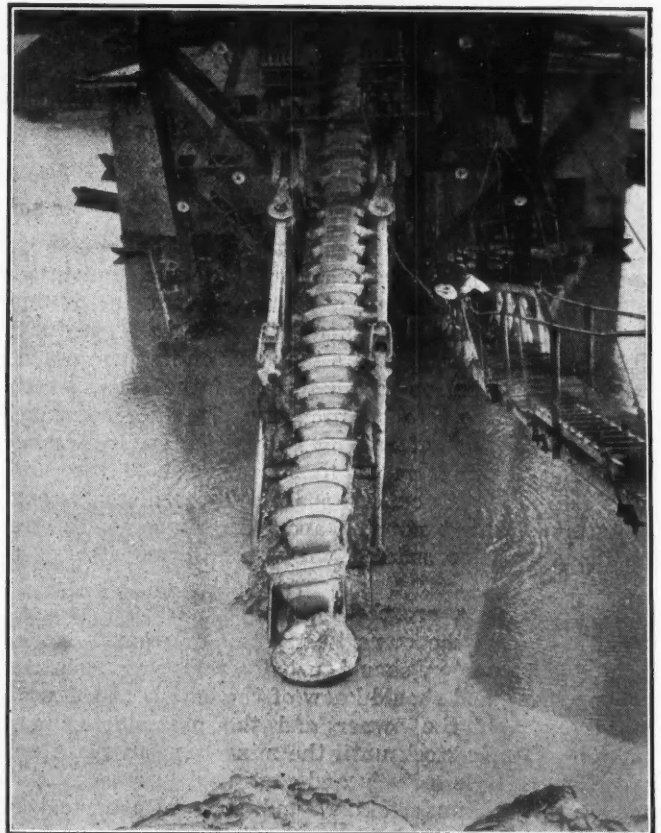
BUCKET LINE BEING SPRAGGED OVER

will ride off the lower tumbler completely. Usually the bucket line is stopped before this takes place. The ladder is raised, and the condition of the tumbler and buckets determined.

To get the bucket line back into position short sprags

are inserted between the bow gantry post and the bucket line, and the buckets are started in the reverse or down direction. Sometimes spragging at the gantry will shove the bucket line over enough to get it back into the tumbler, but if the line is quite tight, spragging at the lower tumbler by placing a sprag reaching from the corner formed by the bottom of the tumbler flange and the tread up to the inside corner of the bucket bottom is an effective method of readjustment. In most cases several sprags of different length must be used before the bucket line reaches its position and the line of buckets is operated up or down, as conditions warrant.

In the illustration in this column the two lower buckets are riding the edge of the flange of the tumbler. The dredge-master is shown placing a steel bar, sprag, in the lowest position, as shown in the first illustration,



BUCKET LINE RIDING ON FLANGE OF LOWER TUMBLER

preparatory to finally throwing the buckets onto the tumbler. The sprag is secured to a rope which is made fast by the man on the bridge. Success attended this last maneuver, for, on the bucket line being slowly worked down, the buckets snapped into place with a great jar which shook the whole structure of the dredge.

The photos shown were taken of one of the dredges of the Yuba Consolidated Goldfields Co. at Hammonton, and were obtained through the courtesy of M. L. Summers, superintendent of the company.

Exportations of Iron Ore from Lorraine to Germany during 1919 amounted to 1,147,947 tons, according to *Commerce Reports*. The imports of coke into Lorraine from Germany amounted to 1,382,845 tons, and of coal 342,498 tons. These figures do not include the deliveries of coal and coke made in accordance with the application of the peace treaty.

The Salt Chuck Palladium-Copper Mine

A Unique Alaskan Copper Property Yielding Copper Concentrates Carrying Over 3 Per Cent Of Palladium per Ton—Unusual Local Geology Disclosed by Examination—
Ore Concentrated by Flotation and Shipped

BY J. B. MERTIE, JR.*

Written for *Engineering and Mining Journal*

THE Salt Chuck mine, formerly known as the Goodro, is about half a mile northeast of Lake Ellen and at an equal distance from the source of the Salt Chuck, at the head of Kasaan Bay, Prince of Wales Island, Alaska. Mining was begun originally on what was considered to be a low-grade copper deposit, but subsequently it was discovered that the ore was of more value for its content of platinum metals than for its copper, so that this mine is now more properly described at a palladium¹-copper mine. It has been operated continuously since 1917, and in 1919 it employed about sixteen men.

The lode crops out at an elevation of 400 ft., upon a little knoll rising from one of the rounded ridges characteristic of this glaciated area. A few other surface outcrops have been found near by, but the general surficial configuration of the mineralized zone has not been determined, owing in part to the timber and dense vegetation of the surrounding area, but particularly to the irregular distribution of the mineralization, which gives no clew as a guide in prospecting. The ore zone however, or the zone within which the discovery of oreshoots may be expected, is believed to be at least 250 ft. wide and is thought to extend in a direction about N. 75 deg. W.

UNUSUAL LOCAL GEOLOGY DISCLOSED

This deposit, unlike most of the other commercial ore deposits of Kasaan Peninsula, occurs in an area of coarse-grained intrusive rock, which has been mapped by Wright² under the general designation granitic intrusives. Such intrusive rocks invade the Paleozoic sedimentary rocks of Kasaan Peninsula at many localities, occurring as small and large bodies of varying petrographic character. The normal type of these rocks is a diorite, low in quartz and orthoclase, but numerous other facies have been evolved by magmatic differentiation. In the acidic differentiates, low potassium and high soda content expresses itself through the formation of sodic granite and syenite, the chief feldspar of which is albite, in place of orthoclase, the normal type in such rocks.

Much diversification is apparent among the basic types of differentiated rocks, although few of these have been described in any detail. This differentiation is well illustrated at the Salt Chuck mine, where the country rock is in general a pyroxenite, with gabbroic and gabbro-pegmatic phases. Wright referred to the country rock at the Salt Chuck mine as a gabbro, but in his petrographic description he showed clearly that the plagioclase feldspar constitutes only from 5 to 10 per cent of the rock. It seems better, therefore, to designate

the intrusive rock at the mine as pyroxenite, remembering, however, the gradual transition to the true gabbroic intrusives in this vicinity.

The chief rock-forming mineral is augite, and the subordinate constituents are biotite, iron oxides, plagioclase, apatite, and titanite, though not all of these are invariably present in any one specimen. Biotite in particular is variable in distribution, and much of it occurs as large splendid crystals. The pyroxene and plagioclase are in places much altered, the alteration resulting in the development of rocks rich in epidote and in chloritic and sericitic material.

PALLADIUM AND PLATINUM FOUND

The ore minerals consist of copper sulphides, distributed in grains and small patches as oreshoots in the pyroxenite. Bornite is the chief copper mineral, but a small proportion of chalcopyrite also occurs locally. Chalcocite and covellite are both present, as alteration products of the bornite and also of the chalcopyrite. Finely disseminated chalcocite and native copper have been reported by Knopf³ as occurring in some drifts about half-way between the upper and lower tunnels, leading from a connecting winze. Practically no gangue minerals are found with the ore. In addition to copper, gold, silver, palladium, and platinum are recovered.

The metallic content of the Salt Chuck ores was shown in a table of analyses by Campbell⁴, and this table, with the addition of three determinations of concentrates, is given herewith.

METALLIC CONTENT OF SALT CHUCK ORES

(Copper in per cent; other metals in ounces to the ton)

	Copper	Gold	Silver	Platinum	Group Palladium	
Glory hole.....	1.92	0.07	0.17	.....	0.41
150-ft. level.....	1.08	0.07	0.24	.....	0.18
Bottom of winze.....	1.28	0.05	0.24	.....	0.17
Average of ore analyses.....	1.427	0.063	0.217	.....	0.253
Gabbro.....	0.06	0.01	0.10	.....	0.01
Chalcopyrite.....	27.66	0.11	2.08	.....	1.01
Concentrates.....	43.81	1.17	4.60	.....	3.54
Concentrates (<i>Eng. and Min.</i> <i>Jour.</i> , Sept. 27, 1919).....	36.96	1.27	6.10	0.10	2.93
Concentrates.....	0.04	2.56
Concentrates.....	39.41	1.20	5.18	0.04	3.38
Average of concentrates.....	40.06	1.213	5.293	3.147	..

PLATINUM OCCURRENCE RATIO IS ESTIMATED

From these data it is possible to estimate the percentage recovery of the precious metals in the concentrates. If the concentrates average 40.06 per cent of copper, each ton of concentrate will contain 801.2 lb. of copper. Then, as the average copper content of the ore is 1.427 per cent, each ton of ore contains 28.54 lb. of copper; and the number of tons of ore used to produce 1 ton of concentrates, on the assumption of a copper recovery of 100 per cent, would be $801.2 \div 28.54 = 28.07$ tons. The recovery of gold, silver, and platinum metals in ounces per ton is obtained by dividing their

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¹An alloy of palladium and gold is used as a platinum substitute, for chemical ware and for jewelry. An alloy of palladium and silver is used for contact and spark devices for internal combustion engines.

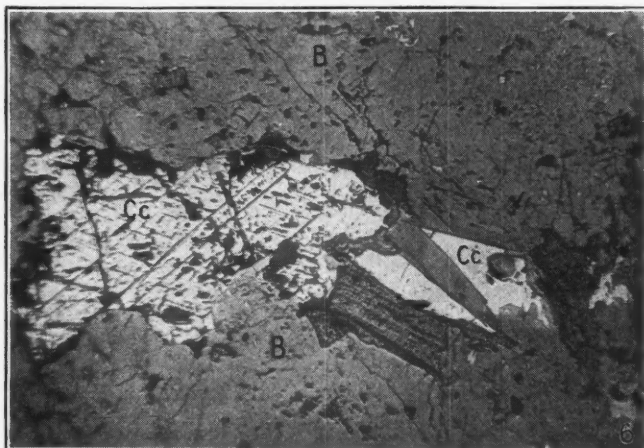
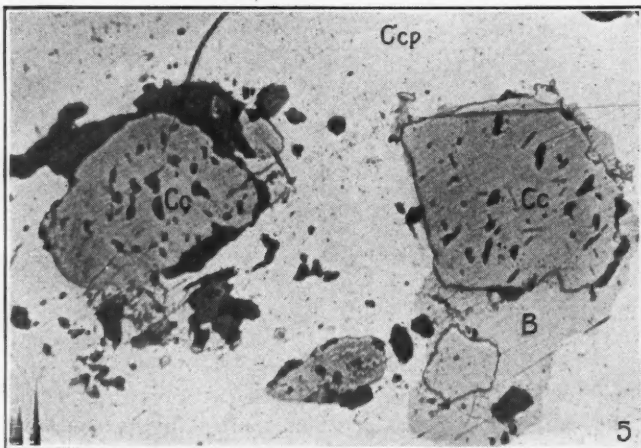
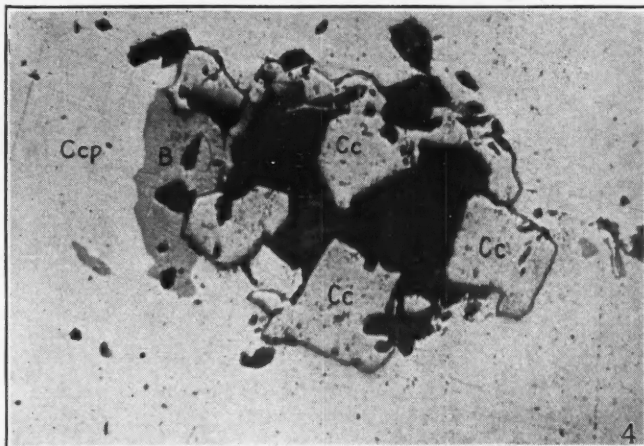
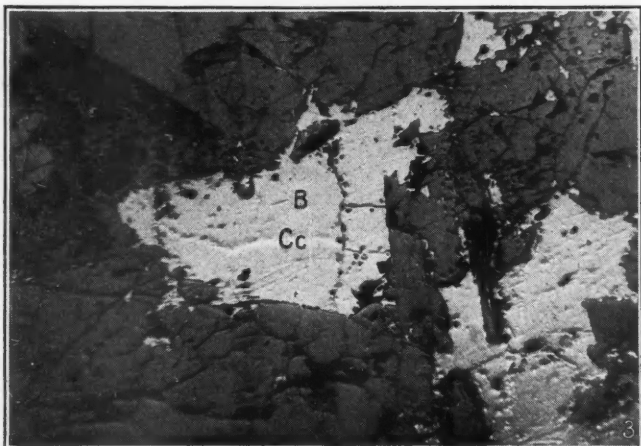
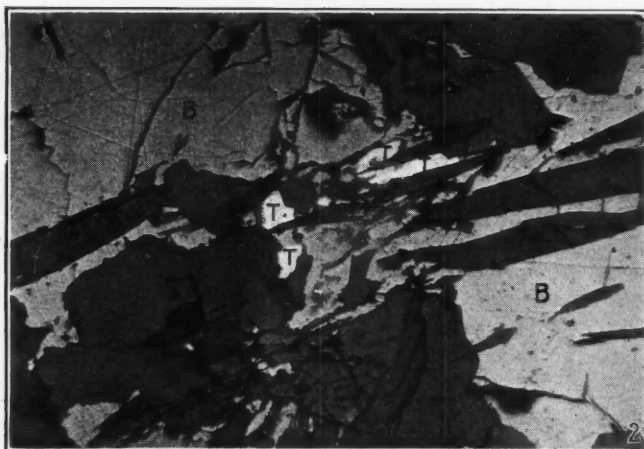
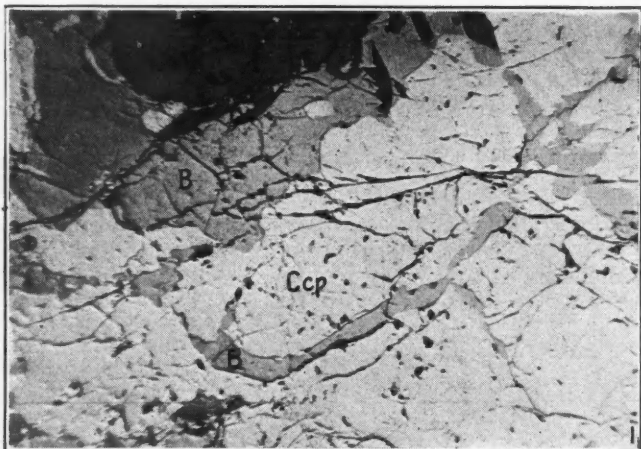
²Wright, C. W.: "Geology and Ore Deposits of Copper Mountain and Kasaan Peninsula, Alaska"; U. S. Geological Survey, Prof. Paper 87, p. 73, 1915.

³Knopf, Adolph: "Mining in Southeastern Alaska," 1910; U. S. Geological Survey Bull. 430, p. 101, 1911.

⁴Campbell, D. G.: "Palladium in Alaska Lode Deposits"; *Min. and Sci. Press*, Vol. 119, pp. 520-522, 1919.

respective figures in the "average of concentrates" by 28.07; and the ratio of the resulting quantities to the corresponding quantities given in the "average of ore analyses" furnishes the percentage of recovery for the precious metals in terms of the assumed 100 per cent recovery of copper—that is, gold, 68 per cent; silver,

precious metals, it appears that the ratio of the copper to the gold, silver, and platinum metals is 6,607, 1,918, and 1,645 to 1, respectively, and that the ratio of the gold to the silver and platinum metals is roughly 1 to 3 and 4, respectively. Of course, an average of three assays affords no basis for exact deductions, but,



POLISHED SECTIONS OF SALT CHUCK ORES

Fig. 1—Typical intergrowth of chalcopyrite and bornite (Magnified 30 times). Fig. 2—Argentiferous tetrahedrite (?) (Magnified 125 times). Fig. 3—Bornite cut by indistinct veinlet of chalcocite (Magnified 30 times). Fig. 4—Chalcocite (with crystalline outlines) replacing chalcopyrite and bornite (Magnified 125 times). Fig. 5—Chalcocite replacing chalcopyrite and bornite (Magnified 125 times). Fig. 6—Chalcocite replacing bornite (Magnified 30 times).

87 per cent, and platinum metals, 44 per cent. The exact percentages of precious metals recovered are obtained by multiplying these computed percentages by the true recovery of copper.

On reducing the copper percentage to troy ounces per ton, and comparing the result with the figures for the

nevertheless, these figures are useful in giving a general idea of the occurrence of these metals.

A little free gold may be seen in some of the ore, but the disparity between the recovery of gold and the recovery of platinum metals leads to the belief that a considerable part of the gold is chemically combined or

mechanically held with sulphides. The high content of silver relative to gold suggests an additional source of silver besides that alloyed with gold; and the high silver recovery indicates that the silver is present as a silver or copper-silver mineral, probably a sulphide or sulpho-salt, which is highly adapted to the flotation process. Possibly it occurs in both these forms. The high content but low recovery of platinum metals, when considered in the light of the known relationship between copper and platinum metals in these ores, indicates that the larger part of the platinum metals is held mechanically by the copper minerals and liberated in the ball mill. The ratio of palladium to platinum appears to vary considerably, but is believed to average about 50 to 1.

HIGHER GOLD - SILVER - PLATINUM RATIO IN CHALCOPYRITE

The analysis of the chalcopryite is also of interest. Gold, silver, and platinum metals are found in the chalcopryite, and although this fact does not permit inferences as to the state of existence of the precious metals, it serves partly to corroborate those already drawn. The ratio of gold to silver to platinum metals in the chalcopryite is about 1 to 19 to 9, whereas in the average of ore analyses it is 1 to 3 to 4. The higher ratio of silver to gold in the chalcopryite analysis is probably attributable in part to the lower content of gold in the chalcopryite than in average ores, owing to the presence of a certain percentage of free gold in the country rock; but probably it is due more largely to the higher content of silver in the chalcopryite as a result of the presence of intergrown silver or copper-silver sulphides.

The higher ratio of platinum metals to gold in the chalcopryite analysis is interpreted as evidence that more of the platinum metals are associated with the copper minerals than occur free in the country rock, thus corroborating the relationship that appears to exist between the copper and platinum metals in the mine. The analyses above given show from 0.13 to 0.21 oz. of platinum metals to the ton for each 1 per cent of copper; the lower figure is more probably representative of the average.

The mode of formation of this deposit and the distribution of the ore present some puzzling features. The country rock, though mainly pyroxenite, shows gabbroic and gabbro-pegmatitic phases, and at the west end of the glory hole a basic dike 4 ft. thick cuts the pyroxenite. Considerable epidote also occurs, in part replacing the minerals of the country rock and in part as traversing veinlets. The ore is evidently later than the dike, for a bornite-chalcopryite oreshoot cuts directly across the dike. The country rock is much fractured, but there is no particular system to the fractures, and there are no large displacements. The general trend of the zone of the fractured and faulted rock, however, is believed to be about N. 75 deg. W.

A cursory inspection would indicate that the bornite and chalcopryite may be regarded as ores segregated from the gabbro mass. The copper minerals do not appear to follow the larger fracture planes to the extent that might be expected in an ore deposited from circulating waters. The ore occurs in shoots, which appear independent of the rock fractures, and the bornite is found as disseminated particles within these shoots, some of it in massive country rock at some distance from any apparent openings. Also, free gold was ob-

served which had been drawn out and elongated by faulting subsequent to its deposition, showing that at least some of the fracturing movements occurred after the deposition of the ore.

On the other hand, some of the copper ore, particularly the chalcopryite, lies along the fractures in such a manner as clearly to show that it entered the rocks and was deposited subsequent to the fracturing. Moreover, where the bornite occurs in massive unfractured pyroxenite, the rock-forming minerals of the pyroxenite are noticeably altered, chiefly to epidote with less chloritic material; and the degree of this alteration appears to be a function of the amount of ore present. Finally, the texture of the ore as seen under the microscope belies the appearance of primary character which is seen in hand specimens.

The country rock contains many minute cracks, adequate for circulating ore solutions, and the ore itself shows that it has entered the rock in this manner and replaced the rock minerals. Hence, though all the details of the ore deposition cannot be explained, it seems certain that this is at least an epigenetic deposit—that is, it was formed later than the containing country rock.

UNUSUAL EXAMPLE OF ENRICHMENT

The presence of chalcocite, covellite, and native copper points unmistakably to enrichment due to the action of meteoric waters working downward from the surface. The chalcocite and native copper observed by Knopf⁵ were at a depth of about 200 ft. below the surface, and show that enrichment has occurred at least to this depth. This is rather remarkable for southeastern Alaska, for it has generally been believed that in that region the recent glaciation had removed the zone of oxidation and practically all of the secondary sulphide zone. It would be of interest to know whether this supergene enrichment is a remnant representing a pre-glacial secondary sulphide zone, or whether it has occurred in post-glacial time. In either case the theoretical conclusion is that the ore will be found to become leaner with depth, but it is doubtful if this feature will prove of much economic importance, as the percentage of secondary sulphides appears to be relatively small.

POLISHED SECTIONS AS EVIDENCE OF GENESIS

A number of polished sections of the Salt Chuck ores were made and examined, primarily to discover the source of the high silver content of the ore. Other interesting features, however, were noted.

Fig. 1 shows the relationship between bornite and chalcopryite, when these two minerals occur together. There is nothing in the photograph to indicate the formation of one of these minerals prior to the other. On the other hand, they appear to be primary hypogene intergrowths. Fig. 2 shows another occurrence of the same mineral. Fig. 3 illustrates a peculiar form of alteration from bornite to chalcocite. The chalcocite is present as a shadowy indistinct veinlet, cutting the bornite. Much chalcocite alteration of this type is seen in the ores.

Figs. 4 and 5 show other types of replacement of bornite and chalcopryite by chalcocite. Fig. 6 also shows chalcocite replacing bornite, and it illustrates the well-known cleavage of the chalcocite.

⁵Knopf, Adolph: "Mining in Southeastern Alaska, 1910"; U. S. Geological Survey Bull. 480, p. 101, 1911.

One specimen of chalcopyrite ore from the Salt Chuck mine was observed to contain a large percentage of pyrrhotite, and some pyrite, but no photographs of this specimen were made.

MINE DEVELOPMENT SHOWS INDEFINITE MINERALIZED ZONE

The Salt Chuck ore deposit has been developed at the surface by a small glory hole and an open cut almost adjoining it on the east, and underground by a tunnel 300 ft. long, which at its face opens upward through a stope into the glory hole. Near the face of this tunnel a winze has been sunk 200 ft., connecting with a new lower tunnel, and the winze has been continued upward as a raise for 90 ft. A tram 2,200 ft. long has heretofore been used to transport ore from the mine to the mill. The new lower tunnel, 1,225 ft. long, has now been completed and will be used as the main oreway.

Ore is now being taken from the stope that connects the upper tunnel with the glory hole. One of the difficulties of mining operations at this property is the irregular distribution of ore stopes. Practically no data are available on which to base prospecting, for there is no vein or well-defined shear zone, and the stopes occur seemingly at random. There is a limit to the mineralized zone, which probably coincides with the limit of the faulted and fractured area of peridotite, but this is neither sufficiently definite nor sufficiently circumscribed to be of value in laying out the mine. That such a limit exists is shown in the new lower tunnel, which is 1,225 ft. long and in which no ore was seen until the tunnel had been driven 990 ft. The horizontal sequence in this tunnel from the portal inward is as follows:

SEQUENCE IN LOWER TUNNEL AT SALT CHUCK MINE

	Feet
Barren country rock.....	990
Zone of disseminated bornite.....	15
Barren country rock.....	15
Zone of disseminated bornite.....	30
Barren country rock.....	170
Zone of disseminated ore, chiefly chalcopyrite, subordinately bornite.....	5

It is not known in what manner the ore zones shown are cut by the tunnel, and the thicknesses given therefore may or may not represent true cross-sections of the shoots.

ORE TREATMENT CONSISTS OF CONCENTRATION BY TABLES AND FLOTATION

The ore is reduced in a concentration and flotation plant on the property. Power for the mill and mine is generated partly by water and partly by means of a 75-hp. Fairbanks-Morse semi-Diesel engine. Water is taken from a 31-acre lake and delivered to the wheels in a 10-in. stream, under a head of 179 ft.; and when the supply is adequate, 220 hp. is generated by this means. The supply of water, however, is usually inadequate, and the engine has to be run much of the time. This constitutes one serious handicap to economical mining.

Ore is delivered at the mill into a 175-ton storage bin, from which it goes through two sets of jaw crushers and is reduced to about 2-in. size. This material is then dumped into a seventy-five-ton bin, whence it is fed automatically to a Worthington ball mill, with a rated capacity of sixty tons in twenty-four hours. Fine grinding is at present accomplished by this operation, but the ball mill is overtaxed, and it is planned

to introduce rolls between the crushers and the ball mill, reducing the product to 1½-in. size before delivery to the mill. This will be a great improvement. The pulp from the ball mill goes to a classifier, from which the oversize is conveyed back by a scraper belt to a trommel, and the fines flow off and are raised by a bucket-elevator belt to the flotation cells. The oversize from the trommel goes back to the ball mill, and the undersize to a Diester-Overstrom concentrating table.

The flotation plant consists of five cells, in which are used mixtures of oil of pine, pine tar, creosote, and coal tar. About 90 per cent of the ore is caught in the first two cells. From these the concentrate goes to Callow cones, where it is largely dewatered. Final drying is accomplished in filter presses, and a shipping product containing only 10 per cent of moisture is said to be produced.

Three Nickel Companies Operating in New Caledonia

The New Caledonian nickel industry is having somewhat of a boom at present, according to *Chemical Engineer and Mining Review*. Three companies are operating. The Nickel Co. is the oldest, and for that reason is better situated than the others in regard to its leases. Its smelting plant is at Thio. This company has recently taken over the electric furnaces installed by the Haut Furneaux Co. at Noumea, and will, it is stated, soon begin the production of ferro-nickel. Ballande & Son, which is the trading name of a Roman Catholic order of priests, also operate a furnace at Noumea. The most recent entrants into the field are the Japanese, who are erecting a smelting plant at Noumea to be equipped with up-to-date appliances for handling the ore at all stages. This is known as the Point Chaleix smelters. Nickel is found all over the island, and is almost invariably mined by open cut. It is hand picked so as to average the furnace charge at 5.5 per cent.

The entrance of Japanese capital is a new factor in the nickel industry. It is unlikely, however, that the Caledonian supply could ever make Japan independent of the British-owned deposits.

Results of Testing a Silver-Lead-Zinc Ore By Differential Flotation

The Simon Silver-Lead Mines Co., Mineral County, Nev., recently sent a sample of the sulphide orebodies that have been developed between the fourth and sixth levels of their mine, to the Minerals Separation North America Corporation, for testing. The ore is a complex lead-zinc sulphide, and the results secured may be of interest, even though made under laboratory conditions. The differential flotation process which was used has not been made public.

	Ag, Oz.	Pb	Zn	Per Cent	
				Fe	"Insoluble"
Feed.....	6.46	9.1	9.2	6.5	...
Lead conc.....	39.0	67.6	9.6	2.8	2.0
Zinc conc.....	8.2	3.2	46.8	9.0	2.6
Tailings.....	0.54	trace	1.6	5.7	...
Total recovery.....	93.9@	97.3	71.3	...	...

The silver-lead concentrate contained 76.1 per cent of the silver in the ore treated, the zinc concentrate containing the remainder, 17.8 per cent. This is equivalent to 81 per cent of the recovered silver appearing in the lead concentrate.

Mining Engineers of Note

Bartlett L. Thane

JUST along about the time that the last century was getting out of the arena of activity, a football team was licked into shape on the Berkeley campus in California. It was a perfect machine. Every player acted and every play was "pulled off" with clock-like precision. No flock of birds ever moved more in unison than did this aggregation of clean-limbed, speedy players. Well—it "mopped up" the Stanford team with a conclusiveness and a dispatch that left the adherents of that university speechless and in consternation. The young quarterback of the winning eleven was a student in the mining department of the University of California. The same generalship which marked his management of that celebrated football game has been shown in his own affairs, for Bartlett L. Thane, while yet in college, made very definite plans for his future career as a mining engineer. When a senior student he wrote a short article on "Stoping With Machine Drills," which was subsequently published in the "Transactions" of the American Institute of Mining and Metallurgical Engineers. In the article, Mr. Thane called attention to the need for machine drills in stoping. Strange as it may appear to mining engineers now, it is a fact that at the time Thane wrote his paper only three mines in California were using stoping drills in their operations. As Thane obtained his first mining experience at the "chuck" of a "baby Ingersoll," he was in a better position than many older engineers of that day to appreciate the many advantages of light, readily portable drills in stoping work. His paper played an important part in helping the idea along.

Thane was first laborer, later miner, then shift boss, foreman, assistant superintendent, and, finally, engineer for the Sumdum and Bald Eagle mines, at Sumdum, Alaska. Evidently the individuals who controlled the destinies of the two mines decided to try him out in every imaginable position. In 1903-05, Thane was superintendent of the Wyndham Bay and Ebner gold mines. He next became superintendent of the Eagle River mine, where he stayed from 1905 to 1910. Next, he assumed charge of the Kensington gold mine, Eagle

River mine, Perseverance, and then became manager for the Alaska Gastineau Mining Co., remaining in this position until 1919, when he became managing director.

For the last five years Thane has directed the affairs of the "B. L. Thane Exploration," a company organized for exploration work in connection with the development of raw-mineral products in the Pacific Coast states. He has retained certain operating positions at the same time. These have served to divide his interest between engineering and promotion. Probably one of the most successful enterprises which he succeeded in bringing to a vital position in the mining industry of the country was the Northwest Magnesite Co. Acting in the capacity of consulting engineer, Thane brought this company into the position where it became an active competitor with the Eastern refractories companies. He has proved his abilities along lines apart from engineering by his advocacy of tariff legislation for the protection of domestic magnesite, appearing before Congressional committees and holding his own as an expert witness in behalf of the domestic producers. Mr. Thane's interests have broadly covered the field of mining. Gold, silver, copper, lead, magnesite, and oil comprise the range of his work, and if an iron and steel industry ever becomes solidly established on the Pacific Slope, it will be due largely to his vision.

Compared with his other enterprises, this is the biggest job he has tackled. He organized a working staff and painstakingly investigated iron-ore deposits, refractories, fuel and metallurgical methods pertaining to an iron and steel industry on the Pacific. In a clever way he drew all the lines together and welded his scheme into a reality as far as preliminary work could go. Only the business conditions incident to the war interfered with the consummation of the plan.

Like many another mining engineer, Thane has traveled extensively, having visited practically all of Alaska and the United States, Northern Mexico, England, Central Europe, and Western Canada. He is a member of the American Institute of Mining and Metallurgical Engineers, Mining and Metallurgical Society of America, and Alaska Engineering Society.



BARTLETT L. THANE

BY THE WAY

A Douglas Memorial

The children of Dr. James Douglas have arranged for the erection in the plaza at Nacozari, in memory of their father, of a replica of Blondat's fountain at Dijon, France. The bronze figures are being cast, and after their arrival at Douglas, Ariz., a sculptor, Leslie Cauldwell, will come from Paris and fashion the fountain out of local tufa and erect it. It is planned that it shall face the main entrance of the library building.

A movement has also been launched at Bisbee by Hoval A. Smith to erect a monument in the Warren district to Dr. Douglas. Referring to this, the *Tucson Citizen* says:

Bisbee is one of the most interesting mining cities in the country and is itself a great monument to Dr. Douglas. No shaft of granite is needed there to spread his fame among Arizonans of the present day, but it is fitting that some appropriate memorial should perpetuate his fame and what he did in establishing this great district. Nor was his work confined to the Warren district alone. Nacozari, Morenci, Tyrone, Dawson, the El Paso & Southwestern, and finally Douglas, the city which bears his name, are all his monuments.

Dr. Douglas made his one of the great names of the Southwest and it will endure long after a monument of stone has ceased to be significant. Monuments and memorials more often perpetuate the sculptor's fame than that of those to whom they are erected.

Overheard Today

1. The Amateur Geologist: "Do you know Dr. Ransmith of the United States Geological Survey? He wrote a monolith on the Divipah Mining District." The more we think this over the more hidden meanings we see in it.

2. The Amateur Optimist: "I ain't with the majority that is always tryin' to pull down what the other feller puts up: I'm with the majority that says, 'Sure, he made a poor job of it, but chances are ten to one the other feller would have done a damsite worse.'" A cheery faith in human nature will cure all evils.

A Losing Victor

Zinc operators of Baxter, Kan., are enjoying a little hard luck that recently befell Victor Rakowsky, when he wagered 10 to 1 that the Chanute Spelter Co. could not make 450 tons of concentrates in one week at its new mine on the Hartley land, just west of Baxter. He lost because the mine turned out about 475 tons for the week ended June 12. The wager is understood to have been \$1,000 to \$100, and the "easiness" of Rakowsky is explained by the fact that he gets a royalty out of all the earnings from the land and also has a large acreage of leases in the vicinity.

Bad News for Potato Bugs

According to the news section of the *Mining and Scientific Press* of June 19, "Alder Island, one of the smaller of the Queen Charlotte group, consists of one large deposit of metallic arsenic." Here is news that is news. Probably when another of the smaller islands

is investigated it will be found to be of metallic silver, another of metallic antimony, another of metallic gold with the sovereign stamp partially developed, and another of that rare mineral punketite.

Cottrell's Philanthropy

A recent press bulletin of the Chamber of Commerce of the United States is rather unique in that it is devoted to a description of Dr. F. G. Cottrell's work in devising his precipitation process. It begins:

The remarkable story of how Dr. Frederick Cottrell, head of the United States Bureau of Mines, took riches from the air and presented them as a gift to humanity is strikingly told by James B. Morrow in the July number of *The Nation's Business*. Mr. Morrow says that Dr. Cottrell is one of America's greatest philanthropists as well as one of its great scientists. The fine foundations of Rockefeller and Carnegie, in some respects, seem commonplace by comparison to what Dr. Cottrell has done for humanity.

"During the years that Dr. Cottrell toiled over his invention, he earned his livelihood by teaching," the bulletin says in concluding, "and when wealth was at hand he turned it away."

Unrewarded Zeal

"M'son," said Cap'n Dick, "did'st ever 'ear tell 'ow Jan Trembath come to loose h'out with Tom Tregillis' girl jus' as 'e 'ad made up 'is min' to marry 'er? Well, I'll 'ave to tell 'e, for it do show 'ow sometimes a chap may 'itten off wrong w'en 'e 'as tha bes' of h'intentions. Tom Tregillis lived h'over on east side o' town an' Jan's boardin'-house wuz t'other way, so h'each time 'e gaws to see Mary Jane 'e 'as to walk baout a mile an a 'alf. One evenin' w'en Jan wuz sittin' up with 'er h'it starts rainin', an', dam-me, the 'eavens h'opened jus' like these 'ere cloudbursts thee reads of. The h'ol outdoors wuz wetter than w'en we cut that vug sinkin' nummer six shaf', m'son, w'en we bloody near drowned tha mine. Tom, 'e comes in tha parlor w'ere wuz Jan an' Mary Jane, an' sez 'e to Jan, 'M'son, naw use thee gawin' 'ome along this night an' spoil tha Sunday clothes. Better for thee to put up 'ere in tha spare room.' An' 'e tells Mary Jane to fix tha room h'up a bit w'ile 'e gaws h'out to set tha rain barrel for to catch sof' water for washin'. W'en tha girl comes downstairs Jan wuz gone, but, dam-me, baout 'alf 'our in 'e comes. 'W'ere 'ast thee been?' sez 'er.' 'Been 'ome,' sez 'e. 'Wo't for did'st thee go 'ome?' 'Went 'ome to get my h'umbrella,' sez Jan, 'might be still rainin' w'en I gaws to work in tha mornin' an' I'm feared for to get my good clothes wet.' 'Oh, gos along, thee gert fool,' sez she, 'didn't thee get they all wet gawin' for tha h'umbrella?' 'Oh, dam-me,' sez Jan, 'never did'st I think o' that.' An' dost thee naw, m'son, that h'after that, 'er would 'ave nothin' to do with 'e?'"

Oil and Mining Interlock

A. A. Hassan, formerly of the Great Falls Mine of Maryland, announces that he owns, controls and has under option to purchase about 100,000 acres of oil and gas leases in Texas, Louisiana, and New Mexico in about 100 counties, most of which territory he has examined personally. One-half of these holdings he will sell at reasonable prices, so as to obtain sufficient funds to start drilling on some of the remaining acreage. Mr. Hassan's offices are in Fort Worth, in the Westerbroke Hotel Building, where, according to his letterhead, there are "two entrances leading downstairs."

CONSULTATION

The Miner's Inch

"Does the miner's inch represent a definite flow of water? To one interested in measuring the flow, an answer to this question, and any other information you may give, will be appreciated. From my investigations there seems to be quite a difference of opinion as to what constitutes a miner's inch."

The miner's inch, being an orifice 1 in. square, will naturally allow varying amounts of water to pass through it, as the quantity depends upon the head. In using this hydraulic unit of measure, the head is usually arbitrarily fixed and measured to the center of the orifice. The head varies in the Western United States from 3 to 9 in., but 6½ in. is generally regarded as standard. The size of the plank through which the orifice is made may also vary from 1 to 3 in., and, furthermore, the method of cutting the hole, and its position, are subject to variation. The hole may be chamfered, flaring outwardly and placed flush with the bottom of the flume or box, or it may be raised a few inches above the bottom. All these variables greatly influence the quantity of water that is discharged by a miner's inch. From the ordinary formula, ($Q = K\sqrt{2gh}$, where $Q =$ cu. ft. per min. discharged by the orifice, K is a constant depending upon the construction of the miner's inch, ordinarily about .2583; $g = 32.2$ ft. per sec., and $h =$ head in ft.), the amount of water discharged under a head of 6.5 in. would be about 1.53 cu.ft. per min. from one miner's inch.

Various states have taken it upon themselves to establish legally the relationship between the miner's inch and the flow. Thus, California and Nevada have set 40 miner's inches as equivalent to 1 cu.ft. per sec.; in Colorado, 38.4 miner's inches = 1 cu.ft. per sec. In other Western states, such as Arizona, Idaho, Nevada, and Utah, 50 miner's inches seems to be commonly accepted as equivalent to 1 cu.ft. per sec. Frequently, when ditch companies supply the water, an arbitrary standard is set by them, to measure miner's inches.

Few Nickel Deposits

"Although I know that the United States is regrettably deficient in nickel resources, I understand that there are several localities in which nickel ore is found. Such a one is the district near Fredericktown, Mo. Can you give me the names of the other localities? Is there any duty on the imported ore?"

Though we do not claim to name in the following list every place in the United States where nickel can be found, it covers the most important discoveries and deposits: The old deposits at Gap, Pa.; the complex nickel ores at Fredericktown, Mo.; a deposit near Julian, San Diego County, Cal.; nickel-bearing veins forty-five miles from Lovelock, Nev., in the Stillwater Range; the deposits near Key West, Nev., and low-grade metal silicates near Webster, N. C. Some of these deposits are large, and only two of them, the Missouri, and Gap deposits, are known to have been exploited. There is one relatively important domestic source of nickel, however, that is frequently overlooked—the recovery as

a byproduct from copper refining. About 950 tons of nickel per year are obtained from this source.

There is no duty on imported nickel ore and nickel matte, but the manufactured product, when imported in the form of nickel, nickel oxide, pigs, ingots, bars, rods, or plates or as the component part of an alloy, is subject to a tax of 10 per cent ad valorem. Sheet and strip nickel is taxed 20 per cent.

Small Arsenic Ore Market

"Will you please tell me where I can market arsenic-bearing ores and what the price is for ore containing 40 to 45 per cent arsenic? I note that you quote the price of prepared arsenic under the heading of 'Mineral Products,' but do note quote the price for ore."

So far as we know, there is no market for arsenic ores as such. So much arsenic is produced as a byproduct to ordinary smelting that this is sufficient to supply the market, and, naturally, as it is a byproduct, it could always undersell any material which was prepared and offered as a primary product. Many ores of gold and silver and other metals are arsenical, and the arsenic, which is easily volatile, either goes up the chimney into the atmosphere or is precipitated from the fumes and marketed.

Possibilities of Mica Development

"We are interested in the mica market, and desire to know what the prospects are of successfully developing a property in this country that looks rather favorable to us."

Although mica is a common mineral, and is found extensively in the United States, the special grades that are required by the trade are not so plentiful. In fact, foreign mica, from India, Canada, and elsewhere, is imported and is generally able better to fill the rigid requirements demanded. If the mine is to be worked purely as a source of mica, a favorable location with regard to transportation and milling is essential. It is seldom that a mica property is worked for its available grindable product, and a good grade of sheet mica must usually be produced to make the operation profitable. But sheet mica, to be marketable, must yield rectangles that are at least one and a half by two inches and must split readily, and be reasonably free from foreign material and cracks. To yield this size of uncut sheet, the rough trimmed mine product must be much larger. The deposit should also contain mica that will furnish larger uncut sheets. In the ordinary mica prospect the mineral contains many imperfections, such as cracks, holes, and specks that render it unfit for commercial use. According to the U. S. Geological Survey, good sheet mica, a thousandth of an inch thick, can readily be bent into a cylinder one quarter of an inch in diameter without showing cracking. Before attempting to work your property you should endeavor to obtain all the information possible regarding the quality of your mica and the grade of mica that it is likely to produce. Prospective mica producers should proceed carefully about their enterprises.

THE PETROLEUM INDUSTRY

The Oil Shales of Estill County, Ky.

Laboratory Retorting Tests Disclose Lack of Coking Action, Which Is Prevalent in Western Shale Distillation—Simple Design of Retort—Absolute Heat Control Required for Treatment—Commercial Possibilities

BY C. S. CROUSE

Written for *Engineering and Mining Journal*

ALTHOUGH the Western oil shales have been widely advertised, and a great deal has been written about them in the last few years, little, if any, mention has been made of the vast deposits of shale in the State of Kentucky. The Kentucky shales are of Devonian origin, and outcrop extensively in a roughly semicircular formation, with Lexington as a center and an approximate radius of fifty miles, with smaller outcroppings in various places throughout the state. In addition, a large part of the state is underlain with the shale at varying depths and of varying thicknesses. In the western part of the eastern Kentucky coal field the shale is found at a relatively shallow depth, but, owing to the normal dip of the subsurface strata, it rapidly falls to deeper levels, with a thickness varying from twenty to two hundred and fifty feet, the oil sands of eastern Kentucky being found beneath the shale, which often contains gas.

Relatively little investigation has been done on the Kentucky shales. However, during the last year or more I have had the opportunity to do considerable research work on the shales coming from Estill County, in the eastern part of Kentucky.

The outcrop or weathered shale of Estill County is of brownish-black color on a fresh fracture, is often streaked with brown iron stains, and contains lesser content of oil than the unweathered shale. The latter has a velvety black appearance when freshly fractured, and, although both the weathered and the unweathered shale disclose bedding planes, the fracture does not necessarily follow these lines. The texture is fine grained, and the shale breaks easily, exhibiting no tendency to gum, as do many of the Western shales. A thin splinter ignites readily and burns with a yellow, smoky flame, and larger pieces held in the flame will crackle, emitting gas which will burn at various places over the surface. A true story is told of the man that built himself a new house, using the black shale as the building material for the chimney of his fireplace, with the result that on the kindling of the first fire the house burned down.

FAVORABLE SITUATION OF ESTILL SHALES

Large deposits of shale occur in this region along the Kentucky River, with little or no overburden, which offers a particularly advantageous condition for steam-shovel work, with plenty of water available for condensing and other refinery purpose. The nearness of the deposits to Lexington, Cincinnati, and Louisville, in connection with the necessarily good railroad service,

because of the oil and coal developments of this region, makes the conditions most favorable with regard to transportation.

All of the samples which I have tested have come from various parts of Estill County, and include both weathered and unweathered material. Although none of the deposits has been thoroughly sampled, the unweathered shales from different parts of the county show a remarkable uniformity in oil content.

APPARATUS USED IN THE TESTS

The apparatus used in the tests consists of an ordinary cast-iron retort which holds about a pound of shale and is connected by means of a gooseneck to a five-foot, home-made, iron-pipe condenser. This discharges into a graduate and consists of a $\frac{3}{8}$ -in. iron pipe running through a 2 $\frac{1}{4}$ -in. iron pipe, the latter having two short lengths of $\frac{3}{8}$ -in. pipe screwed into it, one at each end, for the ingress and egress of the condensing water. The inlet and outlet pipes are connected to the water tap and sink, respectively, by pieces of rubber tubing, the whole apparatus being supported by means of clamps from an ordinary ring stand. It will be noted that the retorting apparatus is of the simplest form, with no provision made for mechanical agitation of the shale or for the use of superheated steam, nothing being recovered but the crude oil.

METHOD OF TESTING SAMPLES

The sample is first crushed by means of a small jaw breaker or in a mortar with a pestle to a little smaller than walnut size. The selection of this size is the result of experiments on crushing and retorting material of 100-mesh and over and of various mixings of coarse and fine shale. Although no great difference in the amount of oil yield from the various sizes was noted, there was a considerable difference in the distillation or retorting time, both the very fine material and the very coarse material taking longer for total distillation than the size specified. The reason for this, in the fine material, is because it packs in the retort and, the heat being applied from the outside to the interior, a semi-insulating stratum of spent shale is soon formed, which retards distillation. In the treatment of the coarse material the reason is the same, in that the heat must travel from the outside of the lump to the center before all the oil gas can be expelled. In a retort in which the shale is subjected to agitation this difficulty will not be met

to such an extent, although very large pieces would be objectionable even then.

After the sample has been crushed and mixed, seventeen ounces are weighed out and placed in the retort. Seventeen ounces are taken merely for convenience, as, with this amount of shale, every two cubic centimetres of oil recovered represents one gallon of crude oil per short ton of shale. The cover, which is machined to fit tightly, and which, in addition, rests on an asbestos paper gasket, is then put on and forced tightly into place by means of a wrought-iron clamp and screw, care being taken to tap the cover down with a hammer several times after tightening, and then to tighten again and repeat. This is necessary because unless the retort is absolutely tight gas is bound to leak out and vitiate the results.

The retort is lifted into a ring which is supported on a stand and connected to the condenser by means of a union with an asbestos paper gasket between the end of the gooseneck and the end of the condenser tube. A large tin can with the necessary openings cut in it is then placed over the retort, so as completely to cover it, and thus conserve heat and make the temperature at both the top and bottom of the retort as nearly uniform as possible. A heavy piece of asbestos is also placed under the gooseneck where it joins the condenser, to prevent overheating and cracking of the gas. The water is then turned on in the condenser, a graduate is placed beneath its open end, a large bunsen burner is put in position beneath the retort and lighted, and the process begins.

LOSS OF OIL CAUSED BY TOO RAPID DISTILLATION

At the end of fifteen or twenty minutes, if the retort is cold, or sooner if it is hot, water begins to drop into the graduate. The heat at this time should be applied slowly, to avoid any danger of cracking the first gases that come off or of driving them off too rapidly. A certain amount of non-condensable gas is evolved at all times during the distillation, but at no time should visible gas be driven off, as this indicates too rapid distillation for the condensing system, and a consequent loss of oil.

After about six cubic centimeters of light-colored liquid (water) has collected, the oil begins to make its appearance. It is of a greenish black color, and lies on top of the water, a clear line of demarkation being visible at all times. For about three-quarters of an hour this will be condensed rapidly, and at times will drop fast enough to approximate a stream if the heat is carefully regulated. At the end of this time, or soon afterward, the evolution of oil, and with it the evolution of non-condensable gas, begins to slacken, until, between an hour and an hour and a half after the first appearance of oil, the distillation is complete.

During all of this time some water has been coming over with the oil, due to the fact that as the heat travels into the retort the oil gases are being driven off from the outside shale and at the same time the water is being driven from that nearer the center. The water generally amounts to about one-fourth of the total liquid obtained, and a separation can easily be made in a separatory funnel.

Toward the end of the distillation, or after the largest evolution of oil has taken place, the temperature may be increased somewhat, but a careful watch should be kept to see that no visible gas makes its

appearance, and at no time should the retort itself show red. After the gas has been turned off, the retort is torn down, the spent shale dumped out, and the apparatus is ready for another run. The second, as well as the following runs of a series will be completed in a shorter time than was required for the primary operation, owing to the fact that the retort is hot and also more nearly representative of the shale, for the reason that after the condenser has drained over night or longer, it takes up some oil before it will flow. The amount of oil obtained from the first run will be low, whereas that from the last will be high if the condenser is allowed to drain after the last run, although an average of the two will be normal.

RESULTS OBTAINED FROM DISTILLATION

The results of several runs on unweathered Estill County shale show an average oil yield, excluding water, of about twenty-one gallons to the ton, or a half a barrel per ton of shale. Some of the shale runs a gallon or two higher and some a little lower, but at no time is there a great variation from the average. On the other hand, the weathered shale contains from three to five gallons less oil per ton.

I have said that a large volume of non-condensable gas is evolved during the entire distillation, the amount varying directly with the quantity of oil. No facilities were at hand to determine the amount of this gas, but it was conveyed by means of a two-branched glass tube to a bunsen burner, where it burned with a good flame and a strong smell of sulphur dioxide.

There are varying amounts of pyrite in the shale, and the decomposition of this is undoubtedly the source of the sulphur. A report from one of the commercial laboratories on the gas procured from shale similar to that under discussion indicates that one ton of shale contains sufficient non-condensable gas to give a fuel value of about three and a quarter million B.t.u.

The amount of nitrogen contained was not determined directly from the gas and water obtained in distillation, although both smelled strongly of ammonia. However, considering the nitrogen found on analysis, figuring 60 per cent of it as recoverable, and transposing this into ammonium sulphate, gives a result of about forty pounds of this product per ton of shale.

A number of samples of the spent shale were treated in both the hot and cold state with water, some with hot and some with cold, and this water was then tested qualitatively for potash. All the filtrates showed some water-soluble potash, the finer-crushed shale which was treated with hot water showing the most. No quantitative tests on potash were made, but an outside test has shown nearly four pounds of potash per ton of shale, which can be recovered by merely treating with water.

FRACTIONATION OF OIL

The total product from three runs, or from three pounds of shale, was taken for fractionation. The light-colored, heavy liquid was not drawn off prior to fractionation, as it was desired to determine whether or not this was all water. The liquid, amounting to a total of 163c.c. with 45.5c.c. light colored and 117.5c.c. dark, was placed in an ordinary glass distillation flask and connected to a twenty-inch glass condenser, the heat being applied directly through a wire gauze by means of a bunsen burner.

The liquid began to boil at 60 deg. C., the first cut being taken at 150 deg. and the second at 300 deg. C. The first cut gave a total of 74.5c.c. of liquid, of which 45.5c.c., or the exact amount of the light-colored liquid in the original sample, was water. Of the remainder, 19c.c. came off below 100 deg. C. and can be called naphtha, and 10c.c. between 100 and 150 deg. C., which can be called gasoline. The second cut gave 59.5c.c. of liquid, which contained the kerosene and light lubricating oils. The residue was a black viscous mass containing some lubricants and tarry materials, but it did not coke. No attempt was made further to analyze this tar. The oil has a paraffine base, and considerable amounts of a white wax-like substance came over at about 98 deg. C.

Not including the water, the total oil from three pounds of shale is 17.5c.c., which is equivalent to 20.7 gal. of crude oil per ton of shale. Of this total, 29c.c., or 24.7 per cent, is naphtha and gasoline, and 59.5c.c., or 50.6 per cent, is kerosene and light lubricating oils. Reducing this data to gallons per ton of shale, it is equivalent to 20.7 gal. of crude oil per ton of shale, of which 5.11 gal. is naphtha and gasoline and 10.48 gal. is kerosene and light lubricating oils, leaving 5.11 gal. as a residue consisting of some lubricants, and tars. Converting these figures to gallons per barrel, two tons of shale producing a barrel of crude, there results 10.38 gal. of naphtha and gasoline per barrel of crude oil and 21.25 gal. of kerosene and light lubricating oils, or a total recovery of 31.63 gal. of naphtha, gasoline, kerosene, and light lubricants from one 42-gal. barrel of crude shale oil, which is the product of two short tons of shale.

SPENT SHALE SHOWS NO COKING

Up to this time no commercial application has been found for the spent shale, although a limited use as a black-paint base may be developed. However, indications point to the fact that the shale from shale plants will create the same sort of problem as that presented by the slag from metallurgical plants. In this connection it is important to note, in contradistinction to a great deal of the Western shale, that at no time did the spent shale coke nor were any signs of coking shown. A test run was made on 100-mesh shale and finer, with the heat carried high enough to show bright redness in the retort, and absolutely no coking was noted.

SUGGESTIONS AS TO THE PROPER COMMERCIAL RETORT

As the oil obtained from shale does not occur in it as such—that is, it cannot be removed by any wet or solution method so far as known, but, rather, must be recovered in the form of the so-called “kerogen”—a destructive distillation process must be used in its recovery. This, in turn, necessitates a retort and very close temperature control, lest the oil gases formed shall be cracked into non-condensable gas or a complete distillation be not obtained.

The shale technicians in this country have practically no precedent, for, even though the industry has been extant in Scotland for sixty-odd years, the Scotch retort is held by most of those who have studied the subject not to be applicable to best advantage to American conditions. As a result, there are nearly as many retorts as there are men interested in the technical branch of the shale industry in America, and practically all have been designed with the Western shales in mind.

However applicable these retorts may be to the Western shales—and I shall not, at this time, discuss the relative merits of the many retorts now on the market—I think that none of them precisely meets the requirements of the Kentucky shales.

These shales offer a splendid opportunity for a mechanically simple retort, and the fact that a retort should be as simple as possible cannot be too strongly emphasized, as it must run continuously, with a comparatively short distillation time, which will result in, as I have heard it put, “a stream of shale going in at one end and a stream of oil coming out of the other,” for twenty-four hours in the day and for practically three hundred and sixty-five days in the year. Such a retort is indicated by the facts that the shale will not coke and that the gas is evolved easily, and, being so indicated, it is bound to be only a matter of a short time before it is designed.

Absolute heat control is necessary, beginning with a relatively low temperature at the feed end and gradually increasing this to the discharge end, so that all of the gas may be finally evolved without undue evolution at any one point in the retort or cracking of the gases first formed. To prevent this, the gas should be withdrawn as formed or as soon as possible. Provision must be made for the use of superheated steam, as this will not only increase the ammonia yield, and probably also the oil yield, but will greatly increase the non-condensable gas yield due to the formation of water gas through the action of the steam on the fixed carbon of the shale.

COMMERCIAL POSSIBILITIES OF ESTILL SHALES

The questions, then, are, “How can the data obtained be translated into commercial terms?” and “Can the Kentucky shales be worked at a profit?” I will try to show how the former may be done, and I think that the answer to the second question is “Yes,” provided certain conditions, which I shall enumerate, are fulfilled.

First, as to how the data obtained in the laboratory will work out in practice. I feel positive that commercial recovery will show an increase of at least from four to five gallons to the ton over that shown by the laboratory method outlined. The reasons for this statement are as follows: A certain quantity of oil, probably mostly naphthas and gasolines, and amounting to several gallons per ton, is practically certain to be carried mechanically by the non-condensable gas. This was lost in the laboratory experiments, but can be saved in a commercial plant by scrubbing the gas. The use of superheated steam is almost sure to show an increase in the oil yield, and employing a continuous retort, which is always hot and in which the individual pieces of shale are in a state of agitation, will certainly cut down the distillation time and probably increase the ultimate oil yield.

As to gas, there will undoubtedly be a great abundance of non-condensable gas with which to run the entire plant, including mining and refining, and, especially with the use of superheated steam, a probable excess which may be sold for domestic purposes if the plant is situated favorably in that respect. The nitrogen and the potash have been mentioned, but this leaves a wide range of investigation yet to be pursued in the byproducts that may develop from the tarry residue left after the lighter oils have been removed.

As to commercial possibilities. Figuring conservatively on the basis of the known laboratory results,

which will undoubtedly be increased in practice, one ton of shale, which should be mined (steam-shovel methods being used), retorted, and the oil refined at the cost of a dollar to a dollar and a half a ton, will yield half a barrel of crude oil, which will refine to a little more than five gallons of gasoline and about ten and a half gallons of kerosene and light lubricants, about two and three-tenths gallons of which will be lubricating oils. Balancing the value of these products against the cost per ton, a favorable result can be obtained in figuring on oil values alone, which, I think, are the only ones that should be considered in a preliminary estimate. This is, of course, leaving out of the calculation entirely ammonium sulphate, potash, probable excess gas, and tar products.

CONDITIONS FOR LOW COSTS FAVORABLE

Of course no definite cost per ton can be given without a close study of the particular conditions involved, as they vary widely, but I have based my tentative figure of a dollar to a dollar and a half on these facts: The known character of the shale; the extremely favorable conditions under which Estill County shale is found as regards mining, water and transportation; no charge will have to be made for fuel, either for heating the retorts

or for power, as sufficient non-condensable gas is practically sure to be evolved for all such purposes; such a plant would not require a large amount of expensive labor, and amortization would be spread over a number of years, as the shale supply is enormous.

However, in my opinion, three conditions are absolutely essential to the success of a commercial oil-shale plant in Kentucky, or elsewhere, for that matter; and these are: Sufficient capital to start with, so that operations may be conducted in a large way—say from two and a half million dollars up, depending on the size of the plant desired and the conditions, the minimum plant being one of five thousand tons per day; the proper retort, and the proper management.

With the above-named conditions fulfilled, I believe that the oil-shale industry will develop into a straight mining and manufacturing proposition, with the returns coming in regularly and for many years in the future. Of course, there will be many disappointments and apparent failures, as there always are in any new venture, but I feel positive that in the hands of men of capital, breadth of vision, and faith in shale, the oil-shale industry of Kentucky will eventually develop into one of the largest sources of wealth in the state and be of inestimable value to the nation.

NEWS FROM THE OIL FIELDS

Article 27 Claimed To Be Unconstitutional

Oil Interests Seek Final and Permanent Settlement of Questions Involved in Mexican Petroleum Laws

In presenting requests for the cancellation of all petroleum decrees promulgated by the late President Carranza, and the right of unrestricted exploration and exploitation of oil lands, foreign oil interests claimed that Article 27 of the Mexican constitution, nationalizing petroleum lands, was unconstitutional. General Jacinto B. Trevino, Secretary of Industry, Commerce and Labor, to whom the request was addressed, stated, according to *El Universal*, that he had no authority to discuss the constitutionality of the decrees. He asserted that both legislative and judicial authorities had taken part in their issuance, the first having granted the President authority to make the decrees in question and the second having refused on numerous occasions to entertain appeals from the provisions of the presidential orders with respect to the petroleum fields.

Upon the conclusion of the conference, the oil men are said to have declared they would consult again with their principals for the purpose of arriving at conclusions which would permit a final and permanent settlement of questions involved in petroleum legislation.

The reported presentation of these demands came as somewhat of a sur-

prise, as provisional president de la Huerta, during his first conference with foreign newspaper men, said the petroleum interests were satisfied with the new government's program and had shown their satisfaction by beginning important work and anticipating certain payments that were required under the regulations.

Oil Swindlers Indicted

Charging misuse of the mails for purposes of defrauding investors, the Federal Grand Jury of New York City indicted four oil companies, ten brokerage concerns and more than fifty individuals on June 24. The four oil companies are the Ranger Oil Co., the W. P. Williams Oil Co., the Great Western Petroleum Corporation, and the Crown Oil Co. The brokerage firms indicted are Curtis, Packer & Co., United Securities Company, H. Kent Holmes & Co., H. Morgan Pollok & Co., Thompson, James & Co., Stickney, Rawlinson & Colclough, Crossman, Sherman & Co., George A. Lamb & Co., E. M. Fuller & Co. and Greenbaum, Bigelow & Greenbaum. Nearly all officers of the oil companies and brokerage concerns and the companies' stock salesmen also were indicted.

This action is stated by Jerome Simmons, Assistant U. S. Attorney General, to be only the beginning of extensive prosecutions against sellers of worthless stocks in oil and other industrial promotions.

Encouraging the Gasoline Supply

From Our Washington Correspondent

That the problem of obtaining greater supplies of gasoline will be solved primarily by the extraction of supplies from mineral matter, and that alcohols and other substitutes derived from vegetable matter can be but a minor factor in the situation for an indeterminate period, is the opinion of Van H. Manning, expressed as he was leaving the directorship of the Bureau of Mines. At that time the matter of substitutes for gasoline was being agitated in Congress and resulted in the preparation of the following statement, recently available, which in brief is as follows: High prices and threatened shortage have been caused by an increase in the uses of gasoline. As a solution, every encouragement should be given to the acquiring of supplies abroad, and the Government should do its utmost to provide technical and scientific guidance for the domestic industry. Serious consideration should be given to encourage the development of gasoline and gasoline substitutes; (1) by increasing the recovery of oil from our oil fields, (2) by developing processes for making synthetic gasoline out of heavy oils, (3) by encouraging the development of processes for making gasoline and gasoline substitutes out of oil shales, coals, lignites, peats, and (4) by developing processes for making alcohols and ethers from waste vegetable matter.

Deep Drilling To Be Done in Pecos County, Tex.

Oil Discovered While Prospecting for Sulphur—New Productions in McCulloch and Harris Counties

From Our Special Correspondent

A lease on 6,400 acres northeast of Fort Stockton, Pecos County, Tex., has been granted by Judge W. W. Turney, of El Paso, to J. G. Grant, of Pittsburgh. Deep drilling will be done. A small quantity of oil was discovered at shallow depth in this locality several years ago when the Arizona Mining Co. drilled for sulphur.

A well completed recently, and of interest on account of its location, is the No. 4 White of A. W. Cooper et al, near Mercury, McCulloch County. It will pump about 20 bbl. from 381 ft. No. 3 well in the same district is also pumping about the same. A shallow field of some extent may be opened here.

No large producers were completed in the coastal fields during the third week in June, but several producing wells making from 100 to 300 bbl. were brought in. The No. 2 Luscher well of the Gulf and West Production companies at Blue Ridge, Harris County has been completed. This well made an initial production of 250 bbl. from 2,640 ft. It now appears as though Blue Ridge will finally prove to be an oil field. Several other companies are actively developing there. The Gulf Production Co. brought in a well at West Columbia, flowing 100 bbl. daily. This well is 1,200 ft. northeast of any producing well, and adds somewhat to the area of the field. Production from West Columbia decreased to 15,000 bbl. daily during the third week in June.

In the Kemp-Munger-Allen field, Wichita County, the wells that came in making a large flow have settled rapidly to what is considered a normal flow, and the production from the district has decreased in consequence. Several wells producing from 100 to 400 bbl. each daily have been completed recently, however, and it is believed that the production from this field will gradually increase again. The completion of the Borg, Ard & Maer wells in Block 41 may mean an extension of the field nearly two miles south.

Development of new territory north of Breckenridge, Stephens County, continues. Good wells have been completed recently by the Sapulpa Oil & Refining Co. and the Gulf Production Co. The Texas Co., Prairie Oil & Gas Co. and the Mid Kansas Oil & Gas Co. also have producing wells in this section. One of the largest wells near Breckenridge completed recently is the Ward well of the Plateau Oil Co., making 4,000 bbl. daily.

The Casmalia field, in Santa Barbara County, Cal., has developed into an important oil producer and the yield is now 150,000 bbl. per month, according to the Department of Oil and Gas of the California State Mining Bureau.

Kentucky Oil Districts

From Our Special Correspondent

Pipe line runs reported by the Indian Refining Co. for the month of April show 181,771 barrels from Allen, Lee, Powell, and Estill counties. This is an increase of 40,000 bbl. over the highest mark for 1919, and 29,000 bbl. more than in March of this year, the highest up to that time. Of the total in April, 82,202 came from Allen County alone. The pipe line is to be extended soon into Warren County.

A \$50,000,000 syndicate is being formed to purchase the Atlantic Refining Co., and two Kentucky oil companies, the Log Cabin and the Flesher. R. M. Catts is said to have offered \$200,000 for the Log Cabin and \$500,000 for the Flesher, but neither has been accepted or even favorably considered. The new syndicate has already acquired the Old Dominion for \$6,000,000, the Pyramid for \$1,700,000, and has offered \$800,000, for the Rex, but stockholders of the latter are holding up negotiations.

In Warren County, a 75-bbl. well was brought in on the Joe Perkins lease. The Harris well, seven miles west of Bowling Green, has developed into a big producer, but has not been rated yet. The well on the J. E. Burch lease in the McGinnis pool was shot and is good for 100 bbl. a day. The Balmer well, on the Tarrant lease, is now reported making 600 bbl. a day and is only 450 ft. deep.

Oil Drilling Near Bowie, Ariz.

From Our Special Correspondent

The United States Oil & Refining Co. is drilling fifteen miles north of Bowie, Ariz. A new standard rig has been installed and operations will be continued to a depth of 5,000 ft. unless oil is struck before. The lease includes four sections of state land and four sections of located land, a total of 4,800 acres. At present the drill is between 1,050 and 1,100 ft., in stiff clay and shale. The tools and bailer show oil, and the slush pit is covered.

No capping material has apparently been cut and the formation still seems to be unconsolidated. Lack of water has been annoying, but arrangements have been made to pipe slush water from a well near by, although boiler water will still have to be hauled in. L. R. Caulfield is geologist. The principal stockholders are Lem Shattuck, C. Brewster, Frankenberg Brothers, and Dr. Bledsoe and son, all of Douglas and Bisbee, Ariz.

Natural gas has been struck near Ramsayville, Russell Co., Ont., seven miles from Ottawa, on the farm of D. J. Wallace, who was sinking a well for water. At a depth of 120 ft. a pocket or vein of gas was encountered. The gas was lighted and a flame shot up six feet. After some unsuccessful attempts, a cap was placed on the pipe. The discovery has caused some excitement in the district.

California Oil Notes

From Our Special Correspondent

In the Midway field four wells were begun near Taft, two by the Chanslor-Canfield Midway Oil Co., on Sec. 8—33-23, and two by the Fuel and Oil Department of the Southern Pacific, one on Sec. 27—31-23 and the other on Sec. 17—32-24. The Tennehil Oil Co. has spudded in its No. 10 well in the Sunset field, on Sec. 33—12-24, and the Associated Oil Co. has started its No. 57 well on Sec. 5—29-28. The Mohawk Oil Co. is drilling its No. 12 well in the Coalinga field for the second time. Five other companies are deepening or re-drilling wells in this field.

Conference Urges Gas Conservation

From Our Washington Correspondent

As a result of the agitation in West Virginia and other states to have natural gas held exclusively for the use of residents of the state in which it is produced, a conference was held in Pittsburgh on July 2 between the Public Utilities Commissioners of Ohio, Pennsylvania, and West Virginia to discuss the steps Ohio and Pennsylvania are willing to take to conserve natural gas supplies. The commissioners present at the conference were John S. Rilling, of Pennsylvania; E. D. Lewis, of West Virginia, and Byron N. Glendenning, of Ohio. Representatives of the New York, Indiana, and Maryland Public Utilities Commissions were present, as well as of the Bureau of Mines.

Secretary Payne of the Interior Department has revoked the regulation limiting to 4,800 acres the acreage which any one oil operator is permitted to acquire in the Five Civilized Tribes in Oklahoma. When this question was first taken up it was decided that the acreage which any one person, firm or corporation would be permitted to lease would be limited to prevent a monopoly of the oil and gas deposits. The rule has been enforced for several years, with the result that a large number of persons and firms are interested as lessees in oil lands belonging to Indians in eastern Oklahoma so that many of the Indians have had the restrictions removed from their land, and at present only about 15 per cent of the land allotted to members of the Five Civilized Tribes remains under the jurisdiction of the Interior Department.

General Salvador Alvarado, Minister of Finance of Mexico, has formally requested the Mexican Congress to annul the settlement with the Tehuantepeco Ry. (formerly operated by S. Pearson & Son, Ltd., of London, England.) General Alvarado declares that the government lost more than 9,000,000 pesos by the transaction.

Seventy thousand barrels of crude oil were exported from Mexican Gulf ports during the month of May, according to an official announcement made recently.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Winning of Alluvial Diamonds Described by W. L. Honnold

Ground From Shallow Deposits Usually Dry-Screened in Field—Wet Treatment for Cemented Alluvium

W. L. Honnold, speaking on May 29, last, at Johannesburg, before the meeting of the Anglo-American Corporation of South Africa, gave an interesting account of the present methods of winning diamonds from the extensive alluvial deposits of Southwest Africa. The following is taken from the London *Financial Times* on June 2:

"It is usually the procedure in the case of shallow deposits to dry-screen in the field through hand-revolved tramels, thus eliminating the material above and below the range of normal size diamonds, then transport the remainder to a wet-treatment plant, where it is jigged and the concentrates are hand-picked for diamonds. Secondary picking follows in combination with magnetic separation of associated minerals. This treatment is not necessarily complete; the coarse material eliminated in the fields may include cemented gravel-carrying diamonds, and fine material hitherto discarded no doubt carries diamonds of size now profitable.

"The first clearing of ground is bound to leave diamonds in the superficial crevices of the rock below. These are released by further weathering, which is facilitated by incidental shifting of ground into heaps. The secondary working is often justified, as in certain places the ground is worked over as many as five times. Where cementation occurs, which is often, the material discarded in the first treatment may give profitable results when crushed and treated by the wet method.

"On the Bergbau properties, particularly in the deepest deposits, cementation is so prevalent as to call for wet treatment on a large scale. This involves transportation to plant of all of the material, which is there passed through successive stages of screening, crushing, jigging and hand-sorting, the concentrates being dried for magnetic treatment and final sorting. There is a plant of this type in the Northern Block of Bergbau, which is still in course of completion, but is already treating about 12,500 cu.yd. monthly, say one-third of its ultimate capacity, recovery now being at the rate of about 7,500 carats monthly.

"A plant on modified lines is under consideration for the South Block, but will not be undertaken until conditions are more favorable for construction. Sea water is used where required. Treatment and electric power are provided by a central generating plant located at Luderichtbucht. On the

South Block of Bergbau over ninety miles of trenching and 800 ft. of test pitting have been done, with the object of proving by sampling the deposit of about 1,500,000 cu.yd. of diamond-bearing gravel, which is estimated to contain between four and five million carats of diamonds. On a portion of this block the payable ground is shown to a depth of 35 ft., although other portions are much shallower. The deposit is to a large extent suited to mechanical excavation, together with sluicing away of sand where practicable. It is in connection with this ground that new plant is planned."

Mining and Metallurgical Society Declares for American Rights

The *Engineering and Mining Journal* published in the issue of May 1 the text of a resolution balloted on by the Mining and Metallurgical Society of America. This resolution was almost identical with the Curtis bill, then before Congress, demanding reciprocity and retaliation in mining laws, and barring foreign citizens and companies from such privileges in the United States as our own citizens are deprived of in countries discriminating against American nationals.

The canvas of the ballots by the society showed that of the 150 replies received, 123 favored the passage of such a bill, 4 opposed it, and 4 were undecided. The reasons given in opposition, as published on p. 133 of the Society's bulletin for April-May, 1920, indicate objections to the phraseology rather than the object of the bill; but one reply states "it is inadvisable to copy the bad laws of other countries."

Washington State Metal Mining Association Reorganizes

With the object of bringing about a closer relation among all the mining men of Washington by promoting harmony among them, of encouraging prospecting and development, and of correcting such abuses as may crop up in the mining industry of their state, the Washington State Metal Mining Association has recently met and reorganized. The association now plans an active campaign to establish county locals through the vice-presidents, one of whom represents each county of the state. Later the association will establish co-operation with the American Mining Congress by forming a new or reorganizing the present non-operative state chapter. The meeting elected L. K. Armstrong, president; E. H. Knight, first vice-president; and M. E. Poole, secretary-treasurer. The headquarters are in the Peyton Building, Spokane, Wash.

Fatal Blasting Accident Due to Careless Tamping

Need of Proper Tools Emphasized—Penalty for Disregarding Well-Known Safety Rules Severe

In the "Reports of Investigations" for May, 1920, issued by the U. S. Bureau of Mines, Oliver Bowles and J. E. Crawshaw report on an accident of unusual character.

On April 19, 1920, a fatal explosion occurred in a limestone quarry in Pennsylvania, causing the death of six men and injury to three others, under somewhat unusual conditions. The shot that was being prepared consisted of six 5½-in. churn-drill holes in a single row. The line of holes crossed a depression that had at one time been used for the bed of an inclined track. Thus, holes Nos. 1 and 2 were on a bench about twenty feet higher than the other four holes. The approximate depth of holes Nos. 1 and 2 was 73 ft., and of Nos. 3, 4, 5, and 6, 55 ft. On account of previous blasting operations, the rock was in a shattered condition, and hole No. 1 was found to be blocked with rock fragments, so that it could not be loaded. It seemed desirable, therefore, to load hole No. 2 with a heavy charge, to compensate for the absence of a charge in hole No. 1. As the blast under consideration was small, a blasting expert was not employed, though it is customary to employ an expert for all large shots.

A line of cordeau detonating fuse was placed in hole No. 2, no electric detonators being used in the hole. After twelve or thirteen cases of 40 per cent nitro starch powder had been poured into the hole in loose form, it was found that a space of only 17 ft. remained for stemming. It was then decided that space for an additional case of powder might be obtained by tamping the charge. The tamping was done with a plunger weighing 30 or 40 lb., about 3 in. in diameter and 10 in. long, made of lead with an iron core with an iron eye in the top, to which a ¾-in. rope was attached. This weight was intended for use in sinking explosive in wet holes, and not for tamping. It is estimated that the tamping had continued at least ten minutes. The quarry superintendent had gone a considerable distance for a box of powder, returned, and reached a point about 10 ft. from the hole, when the charge exploded, instantly killing the man who was tamping and injuring the superintendent and the shovel runner, who was also near by. The rock hurled down killed five and injured another of a group of men bailing out the holes on the lower edge.

Important conclusions may be drawn from the accident to which careful con-

sideration should be given by every quarryman.

1. The explosion seems to have been caused by hard tamping with a heavy plunger. With a smooth and regular drill hole such tamping might be conducted without accident, but not in an uneven hole having jagged rock projections.

2. It is evident that for all purposes a wooden tamping bar should be used. This has been urged repeatedly by the Bureau of Mines. Even with a wooden tamping bar the tamping should not be continued beyond the minimum time necessary.

3. If it is found necessary to use a lead plunger to sink powder in wet holes, the plunger should be provided with a copper rather than an iron eye. Hammering an explosive with a heavy weight is dangerous practice.

4. A circumstance of extreme importance, in that it resulted in undue loss of life, was the employment of men on a lower ledge adjacent to a face back of which explosive was being placed. The holes of the lower bench should have been loaded first and all workmen removed from the lower bench before loading hole No. 2. Under such circumstances the premature explosion would have resulted in one fatality and two injuries rather than six fatalities and three injuries. Workmen should not be at the base of a quarry face after loading begins.

5. Every quarryman will observe that the conditions surrounding this shot were unusual. Quarry operators should give more careful supervision to blasts of unusual character than to regular blasts where all operations are standardized.

6. The Bureau of Mines has pointed out that the employment of thoroughly competent blasting experts is to be recommended. Such experts are employed for large shots in the quarry under consideration, but it seems advisable to extend this practice to include all primary blasts.

7. Quarrymen should familiarize themselves with the various safety rules promulgated by the Bureau of Mines and should endeavor on every occasion to put them into practice. Such rules may be obtained upon application to the Director of the Bureau of Mines, Washington, D. C.

Federal Reserve Board Comments on Mining Situation

In reviewing the general business situation for May, the Federal Reserve Board commented on the metal mining situation as follows:

"Metal mining has shown a slight improvement in Colorado, despite some shortage in labor, while lead and zinc have shown a price reaction on the Joplin market, although much of the output is still in cars and on the sidings. The average price for lead ores is one of the highest for many months, but the supply of ore is insufficient to meet demand. Production, however, is fairly well maintained."

American Engineering Council Indorses New F. A. E. S.

Engineering Council has in many ways aided and furthered the creation of a comprehensive representative body of engineers, and extended great assistance to the Organizing Conference held in Washington recently. The Council has now capped its past performances, writes its secretary, A. D. Flinn, with the following actions taken at its regular meeting on June 17, after hearing a report on that conference:

"Voted, that Engineering Council heartily indorses the plan of organization of the Federated American Engineering Societies and the American Engineering Council, adopted by the Organizing Conference of technical societies in Washington June 3 and 4, and authorizes its Executive Committee to proffer and perform on the part of Council such assistance as may be practicable in completing the work of the Organizing Conference and of the Joint Conference Committee of the Founder Societies in establishing the American Engineering Council.

"Voted, that Engineering Council authorizes its Executive Committee to deal with any question of co-operation with the Joint Conference Committee of the Founder Societies, relating to the permanent organization of the Federated American Engineering Societies, which may come up during the summer.

"Voted, that the secretary be instructed to invite to future meetings of Engineering Council delegates of the societies participating in the Organizing Conference in Washington, June 3 and 4, and editors of technical journals who may be interested."

Arsenic Content of Superior Copper Ores

Copper arsenides have been found in a number of the Lake Superior copper mines. At present Ahmeek is producing varying quantities of agodonite, domeykite and whitneyite, these three minerals occurring in rich pockets. In the Mohawk mine there are pockets of the same ores and, in addition, a fourth arsenide, mohawkite. Algodonite carries 83 per cent copper and 16 per cent arsenic. It must be handled in lots that will give a smelter furnace a full charge. Domeykite ordinarily carries 71 per cent copper and 28 per cent arsenic. Whitneyite was found on surface at the old Pewabic property, at the Cliff and at the Minnesota mine in Ontonagon County, now the Michigan.

The showing of this arsenical copper ore, to be distinguished from the native copper, keeps increasing at both Mohawk and Ahmeek and is a factor in their total output. At present much of it is stocked at the smelters awaiting its special treatment. Seneca is expected to find this sort of ore in paying quantities. The Copper Range mines, on the Baltic lode, have opened up some of it, indicating that it is not exclusively a Kearsarge lode product.

Conference Approves Distributing Plan for Natural Gas Conservation

The tentative resolutions on natural gas conservation which have been adopted by the National Committee on Natural Gas Conservation were approved by a conference of state and public utility officials in Washington on June 11. The resolution follows:

"Whereas, the National Committee on Natural Gas Conservation, appointed by the Secretary of the Interior to work out a constructive program in co-operation with the U. S. Bureau of Mines for the conservation of natural gas, has, at a conference of Governors and Public Utility Commissions of the natural-gas producing states, held at Washington, D. C., on June 11, 1920, submitted its report, wherein is set forth in detail the methods to be employed in the production, transmission and consumption of natural gas, in order that the failing supply thereof be properly conserved, therefore be it

"Resolved, That this conference approve the recommendations so made by the National Committee on Natural-Gas Conservation, acting in co-operation with the U. S. Bureau of Mines, and we hereby respectfully urge that the recommendations so made be carried out by all natural-gas companies and their patrons, to the end that this valuable natural resource may be conserved for public use over an extended period."

This conference was opened by Secretary Payne of the Department of the Interior, following the course of Secretary Lane, who initiated the matter. F. G. Cottrell, director of the Bureau of Mines, who presided, set forth the keynote of the conference in the following language:

"This is a matter not of individual concern of each state, and it was thought necessary to call this general conference rather than to take up the matter individually with the several state governments, as there are problems of mutual concern, and it will be far more effective if it will be possible to obtain unified action throughout the various natural-gas using states and communities."

As a result of the conference, a tentative agreement was reached that the state public-service commissions of Pennsylvania, Ohio, and West Virginia would meet with utility interests of the three states on June 29 in an effort to determine a mutually satisfactory plan for the development of distribution of the natural-gas supplies of the tri-state field. If some protective program is worked out for this territory it is hoped that a similar plan can be adopted for the Kansas, Oklahoma, Missouri situation.

M. L. Alexander, the conservation commissioner of Louisiana, also stated that he expected to introduce in the legislature of his state, now in session, appropriate measures to give effect to the program recommended by the resolutions here adopted.

Book Reviews

The Engineering Index, 1919. Published by the American Society of Mechanical Engineers, New York City; 6½ x 9½; cloth; pp. 528. Price, \$4.

This book is similar to, and a continuation of, the annual indexes of engineering articles which have been published heretofore by the Engineering Magazine Co. The A. S. M. E. has now taken over the work, and the present book presents, in bound form, the references published monthly during the year in *Mechanical Engineering*, the journal of the society. The Engineering Societies' Library receives regularly about 1,100 periodicals, reports and other publications devoted to science and engineering, which have been reviewed for the purpose of compiling the present volume. Over 12,000 articles are here indexed, each item concluding with a note summarizing the article in a few words. All forms of engineering are covered, but necessarily some published articles of lesser importance, and those of specialized interest, have been omitted. The work has been well done, and the book will be valuable to those who are frequently required to consult references on various engineering subjects.

While on the subject, we might add that the Engineering Societies' Library, 29 W. 39th St., New York, makes a specialty of looking up published information on any given subject for engineers, its files being particularly complete. Abstracts or photostat copies of articles are made, the cost being commensurate with the work done. Those who wish to collect all available information on any subject will find it to their interest to get in touch with this organization. E. H. R.

Technical Papers

Copper in Slags—On May 19, 1919, the *Engineering and Mining Journal* published the results of some investigations made by Maier and Van Arsdale on the manner in which copper is held in slags. A further report on more extended investigations by the same authors may be found in the June 16 and 23 issues of *Chemical & Metallurgical Engineering* (New York, 25c. each). Like the former articles, these last are well illustrated by photomicrographs which show that the prills of matte are floated in the slag by minute bubbles of SO₂; the latter resulting from a chemical reaction between the sulphides of the matte and ferric iron (including magnetite) in the slag. The matte thus floated takes the form of white metal by this reaction. The present articles discuss the composition of converter slag as well as that from

blast and reverberatory furnaces and show what happens when converter slag is poured into a reverberatory. For best results a reducing zone should be maintained in the latter in the region where the converter slag is poured. Or, preferably, a separate reverberatory furnace smelting a pyritic siliceous material and producing a low-grade matte should be used for the purpose, as is done at Anaconda.

Increase of copper in matte is generally thought to result in increased slag loss, but the connection is shown to be not truly causative. It is the highly oxidizing condition of the furnace, necessary to produce a high-grade matte, which is the direct cause of suspended copper sulphide loss, through the formation of ferric iron and its subsequent reaction with matte particles.

The average dissolved copper content of blast furnace slags is about 0.16 per cent, regardless of the grade of matte, and of reverberatory slags, about 0.21 per cent. Converter slags vary more, but the dissolved copper is around 0.50 per cent. Further justification is offered for the silver nitrate method of determining dissolved copper and a method is given for the approximate determination of ferrous and ferric iron in slags.

This paper is of importance as a guide to further experimental work on a practical scale, and as an explanation of hitherto little-understood phenomena, even though no concrete information is given which is likely to result in the immediate improvement of smelting practice.

Industrial Fellowships—The Seventh Annual Report on the Industrial Fellowships of the Mellon Institute, Pittsburgh, Pa., is now available. Anyone who has a problem requiring investigation may contribute a sum of money to the Institute which will be adequate for the purchase of any special apparatus required as well as paying the salary of the investigator. The Institute will select a proper person to carry on the work, give him laboratory and library facilities, and assure careful direction to the progress of the research. All results belong exclusively to the donor. Some of our readers will remember that it was while working on one of these fellowships that the late H. P. Corless developed the use of alpha-naphthylamine in flotation. C. L. Perkins and R. E. Sayre are now doing similar work there, and G. A. Bragg is also engaged in experimentations into metallurgical methods of the copper industry.

Lake Superior Iron Ores—"The Future of the Lake Superior District as an Iron-Ore Producer," by Edward W. Davis, has recently been issued as Bulletin No. 7 by the Experiment Station of the Minnesota School of Mines, Minneapolis. This treatise deals with the necessity of utilization of low-grade ore materials if the district is to maintain its production. Various estimates place the time period for the removal

of merchantable ore at from fifteen to thirty years, and this limit will terminate the usefulness of the district as an iron-ore producer unless successful economic methods can be devised for the handling and treatment of enormous tonnages of low-grade ores. A general review of the methods of concentration now used and of the experimental work being done are given. Attention is called to the operations of the Mesabi Iron Co. on the eastern end of the Mesabi Range, where this company is completing a plant for the treatment of low-grade magnetic ores, and to the importance that may be attached to the economic success of the experiment.

Iron-Ore Transportation—In the July issue of *Mechanical Engineering*, issued by the A. S. M. E., appears an article by William S. Mitchell, "Design of Ore Fleet for Upper Mississippi," an abstract of a paper presented at the spring meeting of that society. Two experimental trips which were made during the war for the purpose of determining the possibilities of the upper Mississippi River route for ore transportation are described. Following the success of these experiments, the United States Shipping Board, Emergency Fleet Corporation, appropriated a fund of \$3,860,000 to cover the cost of construction of nineteen barges and four towboats, together with provision for adequate terminal loading and unloading apparatus. It is estimated that the annual capacity of such a fleet operating between St. Paul and St. Louis will be 576,000 tons, this figure including Minnesota iron ore on the down trip and coal or other commodities on the up trip. Details of construction of the barges and towboats are given and sketches shown.

Gypsum—Those interested in this subject should write to the American Society for Testing Materials, 1315 Spruce St., Philadelphia, for "Report of Committee C-11 on Gypsum." It is a thirty page pamphlet, giving proposed specifications for gypsum and gypsum plasters, and methods of chemical analysis.

Queensland Mining Industry—The April number of the "Queensland Government Mining Journal," (Brisbane, price 6d., postage extra) contains an excellent review of the mining industry of that province during 1919, with a map in colors. The most important minerals produced are copper, coal, gold, and tin.

Smelter Smoke Litigation—E. E. Thum has an illustrated article in the June 23 issue of *Chemical & Metallurgical Engineering* (New York, 25c.) on the smoke litigation in the Salt Lake Valley. The history of the suits is given briefly and the principal points in the decree recently issued by Judge Johnson are discussed. The A. S. & R. has reduced injury by closing down certain smelting units when conditions of light, temperature, humidity, and wind direction are unfavorable.

MEN YOU SHOULD KNOW ABOUT

A. G. McGregor, metallurgical engineer, of Warren, Ariz., is in New York on business.

E. C. Humphreys is inspecting the fluorspar properties of the Lordsburg, N. M., district.

J. T. Pardee will do work in glacial geology in Montana and Washington during the present field season.

M. C. Lake, geologist for M. A. Hanna & Co., is examining copper properties in the Lordsburg, N. M., district.

E. G. Sievers is engaged in an investigation of natural-gas gasoline in the Charleston, W. Va., and Tulsa, Okla. fields.

James G. Ross, mining engineer, of Milton Hersey Co., Ltd., Montreal, is examining properties in the Western States.

M. Stockder, of American Smelting & Refining Co., has been looking over copper properties in the Lordsburg, N. M., field.

James MacNaughton, general manager of Calumet & Hecla Mining Co., is in Boston.

C. E. Siebenthal has returned to Washington after visiting zinc mines in Wisconsin and lead mines in southeastern Missouri.

Frederick G. Shipley has been appointed chief engineer of the Moctezuma Copper Co. of Nacozari and Pilares, Sonora, Mexico.

Arthur J. Collier has completed an inspection of the Osage petroleum district, but will visit several small fields in Wyoming prior to his return to Washington.

William R. Todd, president, and **W. Parsons Todd**, vice-president, of Quincy Mining Co., 32 Broadway, New York City, are visiting the company's mine at Hancock, Mich.

Nelson H. Darton has been granted an extension of furlough by the U. S. Geological Survey, that he may continue to Nov. 30 on the private oil work he is doing in Mexico.

W. G. Mather, president of the Cleveland-Cliffs Iron Co., and **Samuel L. Mather**, president of Pickands, Mather & Co., are expected to return from Honolulu by June 30.

Errol MacBoyle, consulting and mining engineer, president of Durango Silver Mines, is in Mexico inspecting the company's property. His address is: Hobart Building, San Francisco, Cal.

T. Wayland Vaughan will examine the Tertiary strata at several points on the Pacific Coast, during the summer months, with the idea of making comparisons with Tertiary strata on the Gulf and Atlantic coastal plains.

Alan M. Bateman, professor of economic geology at Yale University,

and editor of *Economic Geology*, New Haven, Conn., has gone to British Columbia and Alaska on professional business.

H. C. Plummer, former assistant superintendent of the Cananea Consolidated Copper Co. at Cananea, Sonora, Mexico, is mine superintendent for the Arizona Commercial Mining Co. at Globe, Ariz.

W. V. Van Camp, recently of the field force of the Consolidated Arizona Smelting Co. at Humboldt, Ariz., has taken charge of underground operations with the United Verde Copper Co. at Jerome, Ariz.

R. C. Brown has resigned as chief engineer for the New Cornelia Copper Co., Ajo, Ariz., and will open an engineering office in Los Angeles, Cal. He will be succeeded by **G. F. Coope**, of Ajo, Ariz.

G. F. Loughlin, who is in charge of the Mineral Resources Division of the U. S. Geological Survey, is conducting some field work in eastern Massachusetts. **J. P. Dunlop** is acting in his absence from Washington.

Morris P. Kirk, has resigned as general manager of Yellow Pine Mining Co., Goodsprings, Nev., effective July 1. Mr. Kirk plans to engage in the ore-purchasing business in the Southwest, with headquarters in Los Angeles, Cal.

Prof. J. C. McLennan, of the University of Toronto, who was scientific advisor to the British Admiralty at the close of the war, is in London arranging with the Admiralty for the establishment of a helium gas plant in Canada.

K. D. Koliashnikoff, resident manager of Kyshtim Corporation, Ltd., 7 Gracechurch St., London, E. C., and Kyshtim, Perm, Russia, is in San Francisco, Cal. He is preparing for a trip through the mining districts of western North America.

Horatio C. Ray, professor of ore dressing, University of Pittsburgh School of Mines, has resigned to accept a position with the Keystone Consolidated Publishing Co., Pittsburgh, Pa. His address after July 1 will be 711 Penn Ave., Pittsburgh, Pa.

John A. Dresser, consulting geologist of Montreal, will head a party including **Professor McLean**, of Toronto University, and **Edmond Speaker**, of the Department of Geology, Johns Hopkins University, to make investigations in the Peace River region for the British Columbia government.

Allen Murray Yonge, mining and consulting engineer, of 229 East Main St., Staunton, Va., has resigned his position with the Crimora Manganese Corporation, of Virginia. He is leaving this week on an inspection trip to the properties of the Keith-Marshall interests in the West Indies.

L. T. Buell, mining engineer, after several years in Chile and other South American countries, has been on an extended vacation in the United States.

He is now accepting a position with the Phelps Dodge Corporation, in Douglas, Ariz. Mr. Buell's latest address was P. O. Box 100, Miami, Ariz.

D. G. Kerr, of New York, vice-president of the United States Steel Corporation; **M. Shiras**, ore agent for the corporation, and **A. Klingerman**, of Pittsburgh, together with president **W. J. Olcott** and other officials of the Oliver Iron Mining Co., have been making a tour of the Michigan and Minnesota iron ranges during the last ten days.

Gerald S. Lambert, assistant professor at Leland Stanford Jr. University, has been appointed associate professor of geology, and **Dr. A. E. Koenig**, assistant professor of chemistry at the University of Wisconsin, has been appointed associate professor of chemistry at the Montana State School of Mines.

Alfred James, of 28 Victoria St., London, S. W. 1, a past president of the Institution of Mining and Metallurgy, sailed from New York for England on June 26. Mr. James had been on an inspection trip through the United States and Mexico, and reported conditions in the latter country to be better than is generally believed.

Dr. E. P. Taylor, agricultural extension director at the University of Arizona, has resigned to take up commercial work in the agricultural department of the Anaconda Copper Mining Co. of Montana, which will engage in the manufacture of fertilizer from sulphuric acid produced at the Anaconda works and from Western phosphate beds. Dr. Taylor will have offices in Chicago.

J. Parke Channing, vice-president of the Miami Copper Co., was the principal speaker at a recent meeting of the Globe-Miami Chapter of the American Association of Engineers. **Arthur Crowfoot**, of the concentrating department of the Arizona Copper Co., Ltd., read a paper before the Clifton-Morenci Chapter, on the handling of low-grade sulphides in the company's experimental mill at Morenci, Ariz.

Benedict Crowell, mining engineer, president of the Rosiclair Fluorspar & Lead Mining Co., and senior member of Crowell & Murray, 407 Perry Payne Building, Cleveland, Ohio, has resigned his position as First Assistant Secretary of War, effective June 30. Mr. Crowell, as First Assistant Secretary, was in charge of the munitions program during the war and of the adjustment of claims and contracts of munitions-making firms since the armistice.

Thomas H. O'Brien, formerly manager of the Dawson (N. M.) Coal Co., has been appointed general manager of Inspiration Consolidated Copper Co., Miami, Ariz. Mr. O'Brien assumes his new duties at once and relieves **Dr. L. D. Ricketts**, vice-president and general manager, of the additional work he undertook when **Charles E. Mills**, the previous general manager, resigned to go into public service. Mr. O'Brien will also be in charge of the International Smelting Co.'s smelter.

Second Prevention of Accidents Conference Held at Duluth

Representatives of Lake Superior Iron and Copper Companies Meet Again With Bureau of Mines Officials—Permanent Organization Effected, With George Martinson President—Operators Urged To Send Teams to Contest at Denver Next September

By ELLERY E. ANDERSON

Special Correspondence of the *Engineering and Mining Journal*

The second annual meeting of the Lake Superior Prevention of Accidents Conference was held at Duluth, Minn., June 23, 24 and 25. Like the first, it took place in the sun room of the Spalding Hotel, under the auspices of the U. S. Bureau of Mines. C. E. Julihn, district mining engineer of the Minneapolis district of the bureau, conducted the sessions. Representatives from practically all the important iron and copper companies were in attendance, as well as from the Bureau of Mines.

The morning of the first day was devoted to the registration of delegates and to brief introductory remarks by Mr. Julihn. At noon the delegates adjourned in a body to luncheon, renewing the session at two o'clock with the consideration of a paper written by Dan Harrington, supervising engineer of the U. S. Bureau of Mines, Golden, Col., on the subject of "Metal Mine Ventilation and Its Relation to Safety and Efficiency in Mining Operations." Mr. Harrington was unable to be present, so the paper was read by R. V. Ageton, of Houghton, Mich., also of the Bureau of Mines. A. A. Krogdahl, safety engineer of the Oliver Iron Mining Co. at Virginia, Minn., followed with a paper on "Mine Ventilation on the Mesabi Range." The technical features of the first day consisted entirely of these two papers on mine ventilation, a comparatively new phase of Lake Superior mining. Both papers emphasized the relation of mine ventilation to efficiency and both brought out interesting discussion. It was pointed out that, although mine ventilation is primarily a humane project, it can be justified as a business proposition in that it increases production and reduces accidents. Instances were cited of many mines and stopes where the air was considered to be pure but upon analysis was found to be impure. Good ventilation in many instances made the miners more alert with regard to both ore shoveling and safety.

At the close of the discussion the chairman announced that it was the desire of the Bureau of Mines that the conference should perfect its own organization and prepare to conduct future conferences under its own auspices. He expressed the entire willingness of the bureau to assist as far as possible in the conduct of future meetings, but explained that the movement should thenceforth stand on its own feet and be conducted with the support of the bureau but not under its direction. Accordingly, Steven Quayle, safety engineer of the Hanna Ore Min-

ing Co., was elected chairman of a committee to be of his own choosing, to perfect plans of organization to be submitted for approval on the second day. In the evening the delegates were the guests of the Lake Superior Industrial Bureau at a dinner and vaudeville entertainment at the Kitchi Gammi Club.

SEBENIUS DISCUSSES MESABI OPEN-PIT METHODS

On the following day the session was opened with a paper read by John Uno Sebenius, chief mining engineer of the Oliver Iron Mining Co., Duluth, on "Development of Mesabi Range Open-Pit Methods To Offset Labor Shortage." After a brief preface on Mesabi Range geology, Mr. Sebenius dwelt on the flexibility of open-pit methods used on the range and the quick expansion of production possible in them as exemplified by the great increase in shipments made necessary by the war. He also pointed out the increasing popularity of such methods and the fact that many orebodies formerly held to be workable only by underground development are now considered to be easily available by open-pit methods. He cited instances of properties partially depleted by underground methods, which have lately been stripped and developed as open pits. This tendency, he said, was partially owing to labor shortage and in part to the much smaller accident-per-ton factor possible by open-pit methods. Shortage of labor was also given as one of the principal causes of the development of labor-saving devices which, it was said, in the six years elapsed since the first marked scarcity, have been perfected to such a point that the operator can now proceed with 85 per cent of the number of men formerly required and this in the face of considerably increased production. The locomotive crane, the 300-ton shovel, the 30-yd dump car, the track shifter and the tie tamper were cited as instances of mechanical improvements.

W. A. McGonagle, president of the Duluth, Missabe & Northern Ry., gave an informal and brief history of ore transportation in the Lake Superior district, beginning with 1882. Byron D. Shove, safety engineer for the Oliver company, at Ironwood, Mich., then presented a paper on "Methods Employed in Maintaining Safety in Underground Mining on the Gogebic Range." In it he gave a detailed outline of the safety organization of the Oliver company on the Gogebic Range. The speaker en-

larged on the success attained in interesting bosses in direct charge of the work in the safety movement and pointed out the absolute necessity of arousing the interest of these men before any results might be obtained. A very general discussion, bringing out the details of safety organization, followed the reading of the paper.

A paper, entitled "Safe and Dangerous Practices in the Use and Care of Explosives Underground and in Open Pits," was next presented by Spencer P. Howell, of the Bureau of Mines, Pittsburgh, Penn. Misfires and their prevention and the possibility of serious accidents through premature explosion caused by electrical storms were the principal points dwelt upon. The speaker submitted the record of experiments proving that three hours should be allowed to elapse before approaching a misfire.

PERMANENT ORGANIZATION ELECTS GEORGE MARTINSON PRESIDENT

The organization committee, composed of Steven Quayle, Major E. L. Flynn, C. D. Chappell, George Martinson and E. L. Cochran, submitted a tentative plan of permanent organization, suggesting that the affairs of organization be concentrated in the hands of a president, vice-president and secretary; that arrangement be made for annual conferences similar to those of 1919 and 1920; that a shorter name be chosen for the organization; and that the Bureau of Mines be requested to submit these plans to the various operators for their approval. These suggestions were adopted by the conference. George Martinson was elected president, C. D. Chappell vice-president, and Steven Quayle secretary. The papers of the afternoon session were postponed to enable the delegates to accept an invitation to inspect the plants of the Minnesota Steel Co.

A. H. Trestrail, safety engineer for Pickands, Mather & Co., presented the first paper on the third day, entitled "Stench Test at Bennett & Caspian Mines of Pickands, Mather & Co." The tests were conducted by introducing ethyl mercaptan and amyl ethylate into the air lines leading to the working places, when by means of observation stations placed at varying distances from the point of introduction, it was demonstrated that the former was quicker to reach the working place, also more pronounced. Regular injectors for introducing ethyl mercaptan into the air lines are now installed as warn-

ing signals in case of mine fires or other general mine catastrophes.

CALUMET & HECLA EFFICIENCY METHODS DESCRIBED

Ocha Potter, chief efficiency engineer and superintendent of the experimental mine for the Calumet & Hecla Mining Co., presented a paper on "Recent History of Copper Mining in the Lake Superior District." A brief summary of conditions in the copper country, indicating the necessity of improved methods or a complete shutdown, prefaced the paper, after which the improvements which have been worked out were taken up at length. Chief among these was the introduction of the one-man drill, which was given the larger share of credit for the increase in production per man from 11.42 tons in 1912 to 26.92 tons in 1919, the cost per

ton of rock in the meantime being reduced about 3 per cent in spite of doubled labor and supply costs. The development of the storage battery locomotive to the point where it trams 6.8 tons per kw.hr. an average distance of 800 ft. was also taken up, as well as the increase in mill recovery from approximately 17 lb. in 1918 to more than 22 lb. in 1919. It was pointed out that this large increase in recovery was not accomplished at the sacrifice of valuable material in any quantity whatever, but by the simple expedient of close supervision over the miners when placing holes for blasting. The tendency of the contract miner to edge his holes into the foot and hanging walls was discouraged, it was stated, by from four to six daily inspections of each stope, thereby slightly increasing the cost at the breast but decreasing

the haulage, hoisting and crushing cost per pound of copper produced. The paper was delivered in sections covering drilling and blasting, tramping and slushing, timbering, hoisting, and mining, and each subdivision discussed at length by the conference before passing to the next.

At noon the conference adjourned to the lunch room of the Spalding Hotel, where the delegates were the guests of the subsidiary companies of the U. S. Steel Corporation. Afterwards D. J. Parker, chief of the mine rescue cars and stations division of the Bureau of Mines, Pittsburgh, Pa., spoke on the "Importance of Annual First Aid and Mine Rescue Contests," urging that wherever possible teams be sent to compete in the annual contest that is to be held at Denver, Colo., on September 9 next.

THE MINING NEWS

LEADING EVENTS

Car Shortage Causes Zinc Companies To Shut Down

Suspension Will Last Two Weeks—
Move Will Be Followed by Effort
To Curtail Output

Following a meeting held at Miami, Okla., on June 24, all the leading zinc ore producing mines of the Kansas-Missouri-Oklahoma district will be closed down from June 26 to July 10, the most notable shutdown in the history of the field. The explanation of the shutdown, as announced, is the inability of ore shippers to get cars for shipments, and also to permit the miners to participate in the wheat harvest.

In previous years attempts have been made to get the larger operators together on a shutdown program, and it was accomplished this time only after weeks of effort. In the past, one large interest in particular had proved a stumbling block, always refusing to agree to a shutdown program, but this time it has agreed, and it appears that the cessation of operations will amount to fully 90 per cent throughout the field. A few mines will operate on reduced schedules by special agreement.

It is understood that the shutdown will be followed by an equally serious effort to curtail output permanently in accordance with the actual demands of the smelters, and to allocate production to the different companies on some basis to be agreed upon. The move is considered locally as the most radical and most likely to produce permanent good results for the field of any in the history of the district. The effects of car shortage upon mining in other sections of the country are marked. In Alabama, some companies are buying their own cars.

WEEKLY RESUMÉ

The leading producers of zinc ore in the Joplin-Miami district agreed on June 24 to close down from June 26 to July 10 in consequence of the acute car shortage. Iron and steel companies in the Birmingham district of Alabama, similarly affected, are reported to be taking steps to acquire their own railroad cars to insure a steady supply of ore. Charles Butters, speaking recently in Nogales, Ariz., proposed an interesting plan for providing a silver coinage for Mexico; this plan calls for an arrangement between the silver producers and the Mexican government under which the mints will be rebuilt to mint part of the silver output. Great activity is reported in northern Manitoba this season, centering naturally at the Flin Flon property. In Washington, the War Minerals Relief Commission has handled 70 per cent of the claims made, the remainder including some of the largest. The engineering committees of the National Research Council have been named.

Arizona Mining Companies Seek Lower Assessment

Based upon the comparative inactivity of the copper market for the year past, a number of Arizona mining corporations are asking decreased valuations on their properties for purposes of taxation. The Arizona Copper Co. has asked at least a decrease of \$1,000,000 from the tentative figures of \$25,000,000 in the State Tax Commission's estimates. The commission also has been asked to lower the figures on the Grand Reef property in western Graham County, now operated by the Aravaipa Leasing Co. and secured from the John W. Mackay estate. It has been assessed at \$200,000 and the company has asked that this be reduced 50 per cent.

Silver Coinage for Mexico Proposed by Charles Butters

Suggests That Producers Furnish Minting Facilities Under Arrangement With Government

"Mexico is absolutely devoid of coin," says Charles Butters. "Why should her silver be offered at a constantly falling price to the market when it is absolutely needed in Mexico to give a basis for business? As the need of 200,000,000 to 300,000,000 oz. of silver money is absolutely essential in Mexico, I should supply it in this way:

"Let the producers form an association to coin this under an arrangement with the Mexican Government by which the former supply the necessary minting facilities and issue the coins as desired. The producers in Mexico will pay all their Mexican bills in this silver, pay their laborers and for supplies bought in Mexico, which would immediately absorb more than half their output, diminishing to this extent the bullion to be marketed, which would so reduce the new supply that production would appreciate. The producer could buy export goods for his silver and export other commodities instead of silver if he had the coin to pay in.

"To furnish the coinage facilities I would say: Let the producer build the mints under a concession. Whatever profit was made in the coinage let that be credited to the cost of depreciation on the mint. When this amortization was completed by return of capital and interest, then turn the mint over for Government operation. The producers would have lost nothing; the Government would have lost nothing. The price of silver naturally under a plan of this kind would go to coinage value

eventually. Should such a value be reached before the amortization was complete, the mints could still remain under the concession for, say, a period of two years, to insure the producer his return of capital. In this case, as the producer would be getting coin value, he could consider that within at least two years the difference between a market of 80c. and, say, \$1.25 would mean a return of capital.

"I propose a coinage uniform with that of the United States, of the same fineness and weight, but our 50 cent pieces would become pesos and our dollars two peso pieces, and so on, and when silver became coinage value in both countries, the money would be interchangeable.

"I see that the U. S. Mints refuse to give out coin for bullion sold to them. This position is untenable, because the function of the U. S. Mint is to coin according to demands, and if the demand is powerful enough and the American companies use their silver in the business, the Government will never be able to get its silver back, but that would make no difference, as the people would have the silver."

The subject of a silver coinage for Mexico was discussed by Mr. Butters on June 16 before the Nogales (Ariz.), Chamber of Commerce. In his speech he dealt with the matter at greater length than in the preceding remarks here given, which are from a letter written by him to his New York office.

"Mexico is practically stripped bare of metallic money and the nation's business is being halted for lack of small change to carry on trade with the smaller merchants," said Mr. Butters at Nogales. "Before Mexican retail trade can resume anything like normal conditions it will be necessary to provide the people and merchants and banks with metallic money.

"Mexican mints are not working, and this, coupled with the fact the revolutions and world markets' demand for silver during the late war sent billions in silver bullion out of Mexico, has left that country minus the needed medium of exchange in carrying on retail trade.

"Mexican mines are producing silver and ought to produce much more. The trouble is twofold. The silver output in Mexico today is practically all speculative in that the silver bullion is being shipped out of Mexico for export and sale in the markets of India and China, via San Francisco. An equal fault in the silver market is that the price of silver to producers is so low that it cannot be mined at a profit.

"We face, therefore, the three-way need in the Mexican silver market. First, the necessity for providing Mexico with hard money and plenty of small change. Second, the necessity of increasing the market value of raw silver from the mines so that production can be stimulated and the miners receive a profit on their production. Third, the creation of a market for Mexican silver right in the territory in which it is produced.

"With a home market made for the

silver, and the demand created for silver in that home market by filling the need of Mexico for silver coinage, the price is bound to be better to the producers for their bullion bars.

"The silver mining men of Mexico are forming an association, the object of which is to re-establish and rebuild the mints of Mexico in the various states and that these mints then be used for the coinage in Mexico of the hard money in change necessary to supply the public, the banks and the merchants with the necessary metallic coin to carry on their trade and business.

"The plan in brief is that the silver men make a deal with the Mexican government to rebuild the mints and put them in operation for free and unlimited coinage in Mexico of silver bullion. The cost of the rebuilding of mints is to be taken from the 10 per cent production tax levied by the government on the silver output at the mines and by charging off each year a certain per cent of the 10 per cent federal production tax, the balance to be paid the government in cash as at present. Then at the end of a specified term of years when the mints shall have been rebuilt and are in full operation, these mints shall be turned back to the Mexican government without further charge."

Electric Smelting Planned on Large Scale in Norway

"In northern Norway," says a translation from *Verdens Gang* (June 12, 1920), "very large industrial undertakings are developing. Glomfjord will be first—if we leave out Narvik, which is virtually a shipping port for ore. At Glomfjord 150,000 hp. can be regulated for big industries. Of this about 45,000 hp. is on the point of completion. The first large industry is a large electric zinc smelting proposition, which is also nearly ready to make a start."

In *Bergverksnyt* (Kristiania) of Oct. 3, 1914, it was stated that "the Glomfjord company is the largest of its kind in the whole of north Norway. The company was the first to come under the new concession law for water power regulation. It is computed that when the whole of the construction is completed some 60-70,000 hp. will be available. . . . What the power is to be used for has not yet been decided, but it is said that electric smelting on a large scale has been planned, and in several places in north Norway a number of ore beds have been secured."

Would Avert Closing of Cornish Tin Mines

Sir Edward Nicholl recently asked in the House of Commons whether, in view of the fact that notices had been given by several tin mines of Cornwall of their intention to close down, the government intended to take immediate steps to carry out the recommendations of the Non-Ferrous Mines Committee and make suitable grants from the funds in the hands of the development commissioners.

Fast Nearing Production Stage at Sacramento Hill

Phelps Dodge Expects To Start Mining Early Next Year—New Mill Ready Then—Remodeling Tyrone and Nacozari Plants

At the outset of the Sacramento Hill steam-shovel operations of the Copper Queen branch of the Phelps Dodge Corporation at Bisbee, Ariz., the total amount of waste to be removed before ore production starts, which will be early in 1921, was 6,167,000 cu.yd. Of this 4,370,000 cu.yd. was removed by the end of April so that 71 per cent of the waste stripping necessary before ore production starts was then complete. It is expected at present that steam shovel operations will be ready for steady production early in 1921.

It is anticipated that the new mill for handling the concentrating ore from the steam shovel pits will also be complete very early next year, the exact month being dependent on the supply of labor during the remainder of the year and also on steel deliveries. This mill is being designed by H. Kenyon Burch and is planned for the treatment of 4,000 tons of ore daily. A large part of the excavation and concrete work is complete. Erection of steel for the new machine shops and also for the carpenter shop and supply house was recently completed and is now proceeding over the ore bins at the head of the mill. During the last month some of the low-grade leaching ore taken from Sacramento Hill averaging between 0.5 per cent copper and 1 per cent copper has been heaped at the site of the proposed new leaching plant which is a little below the mill.

The remodeling of the Tyrone mill at the company's Burro Mountain branch, in New Mexico, is practically complete and operations are expected to be resumed there within thirty to sixty days. The new flow sheet will permit the treatment of 2,000 tons per day but it will be a few months before the mine will be able to adjust itself to this tonnage. The flow sheet consists of primary and secondary fine grinding with gravity concentration in between, and with pneumatic flotation following the secondary fine grinding, and tables following the flotation.

Construction work is under way in the mill of the Moctezuma Copper Co. at Nacozari, Sonora. To date this has consisted of tearing out the equipment and old foundations in the south half of the present mill. Later this year this side of the mill will be re-equipped on the lines of the latest flowsheet. It is expected that operations can start in this half during the first quarter of 1921. Two thousand tons of ore per day will be handled in half of the mill. In the meantime, current operations are continuing in the north half of the mill at the rate of about 1,500 tons per day. When the alteration of the south side of the mill is completed, it is expected that part of the north side will then be remodeled so as to provide a mill able to treat 3,000 tons daily.



NEW IDRIA QUICKSILVER MINING CO., IN CALIFORNIA, DELIVERS RED HOT CALCINES TO DUMP BY AERIAL TRAMWAY

Prospectors Drawn to Manitoba This Season

Flin Flon Development Progressing—Gordon Claims Being Drilled—Gold Strike Near Elbow Lake Causes Rush

Mining activity in Northern Manitoba is chiefly confined to three sections namely, the copper area, in which are the Mandy and Flin Flon properties, north of Schist Lake; the gold area in the vicinity of Cranberry and Copper lakes, which lie approximately 20 miles east of the Mandy; and 80 miles farther east the Herb Lake section of the gold area, which is reached from the Hudson's Bay Ry. From The Pas this railway maintains a tri-monthly service to the Herb Lake district and adjacent points along the railway for 214 miles.

Northern Manitoba this year is attracting many prospectors and men looking for prospects that will warrant the expenditure of money in development. On a whole the country is comparatively free from wild-catting and a healthy development of different discoveries is under way.

Mining of high-grade copper ore at the Mandy has been completed. The Mandy machinery purchased by the Flin Flon Syndicate has been moved and installed at the Flin Flon property, and is now operating in conjunction with the plant which was purchased from the Beaver Lake Mining Co. and moved from Beaver Lake to the Flin Flon ground. The plant is now in full

operation and two shafts are down 75 and 60 ft. respectively. These are being sunk 1,000 ft. apart on the foot wall of the orebody. Work is being rushed on them, but is somewhat retarded by excessive water from Flin Flon Lake. The saw-mill, part of the Mandy plant purchased, has been set up on the north shore of Schist Lake, four miles from the mine, and is running to capacity cutting lumber for camps and mine timber. A passable wagon road from Schist Lake to the mine has been built.

The underground development work at the mine is being done under contract by the Longyear company. At the present 120 men are employed in connection with this work.

The present work is being done by the Flin Flon Syndicate to check the results determined by diamond drilling during the last two years. Results from new development will determine whether the syndicate will take up its option

to purchase during the latter part of this year.

In the gold area at Cranberry and Copper lakes, diamond drilling is being done by Smith & Travers, drilling contractors of Sudbury, Ont., on the gold property known as the Gordon claims. Sufficient drilling has been done to indicate a large tonnage of gold quartz carrying some sulphides. The third drill hole, cutting the orebody at the 150-ft. level, showed a width of 51 ft. of ore. Assay results from these have not been received.

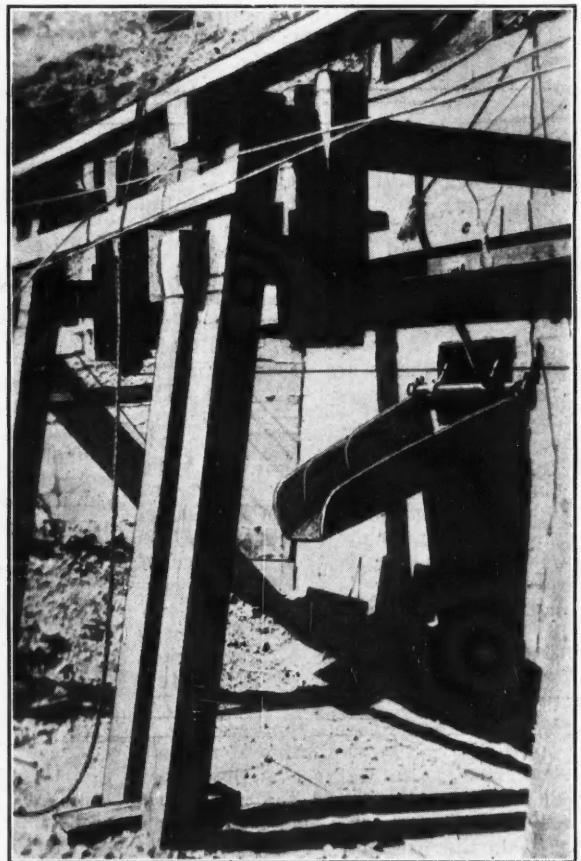
Further northeast in this district in the Elbow Lake area, prospecting is being vigorously carried on, owing to a recent discovery of gold on the Webb claims. Very rich specimens have been brought out from this area, which has caused the prospectors in the surrounding country to concentrate there, in a stampede. The district has long been a promising one for exploration, but until this year prospectors in this large area met many difficulties.

Aerial Tramway Used for Handling Red Hot Calcines

New Idria Quicksilver Co. Carrying Discharge from Rotary Furnaces to Dump Through Air

The New Idria Quicksilver Mining Co., at Jamestown, San Benito County, Cal., has recently erected at its reduction plant a wire rope tramway for transporting the red hot calcine from the rotary furnaces to the dump. The furnaces are arranged in parallel 25 ft. apart. Each discharges into a small hopper from which the calcine is in turn discharged into a single 2-ton tramway bucket. The bucket, which is of the ordinary type, travels along the line of spouts. An arc gate at each spout controls the discharge of the calcine.

The tramway, which was erected by the Painter Tramway Co., of San Francisco, is 1,100 ft. long and is supported by two wooden towers, one an intermediate and the other a terminal tower. The latter is constructed so as to take up the pull of the stationary cable without guys. The spans are respectively 500 and 600 ft. The stationary or track cable is 2 in. in diameter and of "solid" or smooth-coil construction. The traction cable is $\frac{3}{4}$ in. in diameter. The bucket weighs 900 lb. and is dumped automatically by a tripper. The rope speed is 600 ft. per minute and the capacity of the tramway 20 tons per hour. The terminal is 100 ft. higher than the loading chute.



CHUTE OF ROTARY FURNACE BY WHICH CALCINES ARE DISCHARGED INTO TRAMWAY BUCKET, IDRIA, CAL.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Revision of Mining Law Expected at Next Session

That Proposed Calls for Changes Regarding Extralateral Rights and Size of Claims

It is expected that the effort to secure the revision of the mining law will be begun immediately on the convening of Congress in December. A great deal of thought and labor has been expended on a draft of the bill which has been placed in the hands of the Committees on Mines and Mining of the Senate and of the House. This draft was prepared by a committee consisting of W. R. Ingalls, Walter Douglas, J. Parke Channing, J. R. Finlay, John Hays Hammond, L. D. Ricketts, Horace Winchell, and James R. Jones. The committee, in preparing this draft of the bill, was governed largely by the returns from a questionnaire containing thirty-three specific questions regarding mooted points in the existing law.

The principal point of difference is the section of the law pertaining to extralateral rights. With minor differences the wording of the draft of the bill covering the ownership of minerals within the claim is that adopted by a large number of mining societies. That section of the proposed bill reads:

"Subject to the existing extralateral rights of mining claimants or patentees, the holder or patentee of a mining claim located hereafter shall have the exclusive right of possession and enjoyment of the surface held by him and of the minerals under it, bounded by vertical planes passing through the surface boundaries of said land, but shall not have the right to follow any mineral deposit beyond said planes. And the holders or patentees of claims heretofore located shall have similar exclusive possession of all the minerals in said claims that is not covered by any existing extralateral rights."

In that connection the Ingalls committee calls attention to the following:

"Inasmuch as the owner of unpatented mining claims does not at present possess 'exclusive right of possession and enjoyment of the surface' for purposes other than mining (see *Teller v. U. S.*, 113 Fed., 273, 51 C. C. A., 230; *U. S. v. Rizzinelli*, 182 Fed., 685), it is suggested that it may be advisable to separate this paragraph in order to qualify the rights of the owner of an unpatented claim. For example, after the words 'shall have,' in the part relating to unpatented claims there might be inserted the words 'for mining purposes.' The construction at present given to the words 'exclusive right of possession and enjoyment of all surface' would not make it necessary to change the above paragraph, but the Forest

Service may take the view that this proposed new legislation, if enacted, in the light of existing law might be construed so as to give the owner of an unpatented claim the right to the timber on his claim."

In the proposed bill mineral deposits on the public lands are declared to be free and open to exploration and purchase by citizens of the United States only. In that connection, the committee calls attention to the following:

"A Mr. F. W. Carnahan, who appears to be connected with the International Copper Co., of Clarkston, Wash., wrote to the Bureau of Mines from Leland, Ore., suggesting that the mining law should be changed so as to permit aliens to take up mining rights on the same terms as American citizens. His argument is that such privileges are conferred on Americans in Mexico and most of the other Latin American countries, and that if we do not reciprocate there will eventually be discrimination in these countries against Americans who wish to take up such rights. He was promised that the question would be put before the committee. There may be pointed out in this connection that mining on American public land is free while in the other countries which Mr. Carnahan has in mind, a charge of some nature is usually made for such mining and those countries are anxious to have foreign capital come in and develop mines. Moreover, to make any change will probably bring up the question of the privileges to be granted to Orientals, with resulting embarrassments."

The draft of the bill provides that all mining claims shall be located in the form of a square containing forty acres. The committee points out that this could be changed so as to make the form of the claim either a square or a rectangle or the provision might be made so that the claim could be of any size not exceeding forty acres.

The proposed bill does not change the requirement that the annual assessment work is to be at the rate of \$5 per acre. The committee calls attention to the suggestion that, instead of requiring development work to be performed and proved in terms of money, some other index be used as, for example, that the claimant be required to perform 1,000 cu.ft. of excavation work annually for each claim and 5,000 cu.ft. in all, in order to obtain a patent.

In a recent opinion the Interstate Commerce Commission points out that tariffs on infusorial earth are not restricted to ground earth. In some cases higher rates have been applied where the earth is in blocks. The United Verde Extension Mining Co. was the complainant.

Large Claims Still Awaiting War Minerals Commission

Thirty Per Cent Remain To Be Handled—Anaconda Claim Voluntarily Withdrawn

Having made recommendations on 70 per cent of the cases before it, the War Minerals Relief Commission plans to wind up its work not later than January 1. Recommendations have been made in 850 cases, out of a total of 1,203. The commission has given some preference to the smaller claims on the assumption that the claimants were less able to wait for their money. The cases remaining include some of the larger claims. More than half of the original amount claimed is involved in the 30 per cent of cases still to be handled.

The claim of the Anaconda Copper Mining Co. for \$500,000 to cover losses in connection with its manganese and ferro-manganese operations has been withdrawn voluntarily by that company. The improvement of the ferro-manganese market, if sustained for a few months, will give the Anaconda company an opportunity of recouping the losses it suffered.

Awards recommended by the commission during the week ended June 19, were as follows: (The name of the claimant, the mineral, the amount recommended and its percentage relationship to the amount claimed are shown), Pruitt, Conway & McGlawn, manganese, \$4,802.38, 41 per cent; J. Paul Jones, manganese, \$929.85, 73 per cent; James O'Brien, chrome, \$815.30, 31 per cent; Strange Mining Co., manganese, \$95,633.04, 33 per cent; Western Ore Co., chrome, \$6,762.84, 35 per cent.

Name Engineering Committees of National Research Council

The personnel of the various committees comprising the division of engineering of the National Research Council has just been selected. The division of engineering is conducted under the immediate direction of Dr. Comfort A. Adams, Lawrence professor of engineering at Harvard University. He now is on leave and is giving his whole time and energy to the work of the division. With Dr. Adams on the executive committee of the division are G. H. Clevenger, Henry M. Howe, D. S. Jacobus, Charles F. Rand, H. H. Porter and Bradley Stoughton.

The pulverizing committee, which is a joint committee of the milling committee of the A. I. M. E., consists of the following:

Robert H. Richards (honorary chairman), professor emeritus of mining engineering, Massachusetts Institute of

Technology; G. H. Clevenger (chairman) consulting metallurgist and vice-chairman of the division of engineering, 29 West 39th St., New York; Frederick Laist (first vice-chairman) Anaconda Copper Mining Co.; Charles E. Locke (vice-chairman) professor of mining engineering, Massachusetts Institute of Technology; Paul Avery, E. S. Bardwell, John W. Bell, C. H. Benedict, A. L. Blomfield, F. S. Bosqui, F. W. Bradley, H. K. Burch, Charles Butters, W. A. Caldecott, D. S. Calland, John M.

Callow, Robert C. Canby, J. Parke Channing, Charles A. Chase, A. J. Clark, David Cole, E. W. Davis, J. V. N. Dorr, Arthur S. Dwight, H. W. Fox, C. H. Fry, H. W. Gepp, Rudolph Gahl, H. A. Guess, R. S. Handy, Frank Janney, A. H. Jones, R. T. T. Kiliiani, C. B. Lakenan, W. P. Lass, Luther W. Lennox, Robert S. Lewis, A. D. Marriott, Jr., Charles W. Merrill, L. D. Mills, B. S. Morrow, Walter Neal, E. H. Nutter, T. M. Owen, C. Q. Payne, John B. Porter, Elmer R. Ramsey, L. D. Ricketts, W. M. Rose-

berg, Lewis G. Rowland, T. B. Stearns, E. A. C. Smith, W. G. Swart, A. F. Taggart, Arthur Thacher, George D. Van Arsdale, Thomas Varley, A. P. Watt, Bulkeley Wells, Albert E. Wiggin, George H. Wyman, Jr., and R. B. Yerxa.

The committee on uses of tellurium and selenium is: A. E. Hall (chairman), American Smelting & Refining Co., Omaha, Nebraska; H. D. Greenwood, V. Lenher, Oliver C. Ralston, E. W. Rouse, S. Skowronski, and A. W. Smith.

NEWS BY MINING DISTRICTS

ALABAMA

Iron and Steel Companies Buying Rolling Stock To Ease Transportation Situation

Birmingham—Transportation is now proving one of the greatest difficulties in the production of iron ore in Alabama, though labor is not as plentiful or efficient as might be expected. Pig iron and steel manufacturing companies, which must have a regular supply of ore, are purchasing railroad cars themselves to put in a service between their mines and their furnaces. The Alabama company is among the latest to put in this service, buying eight ore cars which will come near caring for a steady production at one of their smaller mines. This company has two blast furnaces in operation at Gadsden, Ala. The Tennessee Coal, Iron & Railroad Company will have two more cars with which to handle its ore.

For several years the Tennessee company has been considering an ore railroad from its mines at Fossil, on Red Mountain, to the blast furnace plant at Ensley. At one time it was reported that an aerial tramway was planned and, later on, an overhead railway line. Recently rights of way were obtained through the Federal Court to build an overhead railway line over the tracks of the Birmingham Railway, Light & Power Co., which concern is in the hands of a receiver. This was thought to mean that steps are being taken to build the proposed ore railway in the near future. Estimates of costs, however, made at intervals since the first consideration of the plans, give larger and larger figures until, it is heard, that the expenditures at present appear to be a little excessive. The development of the Tennessee company's ore mines on Red Mountain is such that an aerial or overhead railway would not only expedite the handling of the ore but would ease the situation at the furnaces as to ore supply.

The Gulf States Steel Co. is losing but little time in developing its deep ore mining proposition at Shannon, where, after several years of hard work, the slope was driven to the ore. Drifts on the ore must still be driven. A little ore is being taken out but it will be sev-

eral months before the expected daily output will be attained. This is one of the biggest developments in years for this district.

H. L. Brittain, of New York, and associates are said to have looked at ore and coal properties on what is known as Pigeon Mountain, north of Gadsden, Ala., and south of Chattanooga, Tenn., in Georgia, to the west of Rome, Ga. Henry L. Brittain is at the head of the Mobile Shipbuilding Co., which has as subsidiary the Birmingham Steel Corporation, a steel fabricating plant in Birmingham. The ore on Pigeon Mountain is reached by the Tennessee, Alabama & Georgia Railroad, which at present extends from Chattanooga to Gadsden. No positive or definite information is as yet given out by the promoters though property owners in the vicinity are hopeful that plans looking to the development will be consummated.

ARIZONA

Globe—George Wilson and H. Woodward, of Globe, have purchased the claims of Howard Gravelle, near Superior, for \$50,000. The property was located two years ago.

Greaterville—The St. Louis mine at Greaterville has been taken over by the Liberty Silver Mines Co., a corporation headed by J. C. Forney. The former owner, J. B. Anderson, retains a large interest. C. H. James has been retained as consulting engineer. The shaft, now in 3 ft. of good ore at 145 ft., is to be deepened.

Ajo—Cornelia Extension, near Ajo, is reported planning a reduction plant and a narrow-gauge railroad to connect with the Gila Bend broad gage.

The New Cornelia Copper Co. has given a building lot and \$500 in cash and General Manager J. C. Greenway has given \$250 to the American Legion post at Ajo, Arizona, as the start of a building fund.

Tombstone—Here about 40 leases are being operated. Monthly shipments of about 100 carloads are being made to El Paso of ores that sample from \$10 to \$50 a ton.

CALIFORNIA

Mammoth Reserves Increased—Keystone Mine for Sale—Silver Ore Found in Alcalde Mines

Portola—The mill of the Gruss Copper Co. is now being remodeled and in the next forty days should be ready. Orebodies on the 200 and 400 levels are improving in width and values.

Kennett—Active work is being carried on in some of the mines operated by the Mammoth Copper Co. It is expected that the smelter will be blown in early in 1921. Ore reserves in the Mammoth have been greatly increased in the last year.

Shawmut—The output of the Belmont Shawmut Mining Co. is keeping 70 stamps dropping. A full crew is working at the mine and the management is experiencing little labor trouble. The Shawmut is controlled by the Tonopah Belmont Development Co.

Amador City—Negotiations for the sale of the Keystone mine are under way. The mine has exhausted its facilities for storing tailings, and has been unable to secure additional adjoining ground at a reasonable price. Limited prospecting will continue.

Grass Valley—High-grade silver ore has been found in the Alcalde creating much interest. At present the silver is occurring in small shoots, accompanied by gold. Developments are continuing on the main gold ledge and the mill is reported to be crushing ore of medium-grade.

The operators of the Boundary group have acquired the Black Hawk 5-stamp mill and are transferring the plant to their own property, where it is expected to be in commission inside of two months. Development work has reached a depth of 150 ft. and much decomposed quartz, rich in gold, has been opened.

Kelsey—A 3-ft. ledge of gold quartz is reported to have been cut in a virgin section of the North Star mine. It is planned to push developments on a larger scale. The mine has been idle for several years.

Idria—Fire destroyed part of the New Idria Quicksilver Mining Co.'s plant recently. The extent of the loss is not known.

COLORADO

Ouray-Silverton Road Now Open

Ouray—The Ouray-Silverton road is now open and traffic is passing both ways. This will allow of a much-belated opening up of the Ironton, Red Mountain and Chattanooga sections.

The Eurades Mining Co. finished installation work and began drilling on June 20, ten days ahead of schedule. A long cross cut west will be driven through the andesite, as well as several drifts on veins. A number of types of drill are being tried out thoroughly with the intention of standardizing on the drill found best suited to the ground. Raising on veins will also be done later.

Golconda Mines Cons., Lake City, has resumed work at the Golconda mine, where ore is being mined for shipment. Headquarters are being finished at Rose's Cabin at Henson Creek and the work of building a new mine plant in Hurricane Basin is starting. The company will buy an air compressor, drills and equipment for drifting and raising at this plant.

The Barstow lease has just finished its mill run of gold ore mined last winter but is unable to ship because the Silverton Ry. has not yet run its first train of the season. The mill run yielded enough 16-oz. gold concentrates to ship.

The Silver Mountain Mines Co. has abandoned mining ore in the winzes and old upper workings, although considerable time and money were spent in equipping these workings. Work has been resumed in the new workings below in the Concave tunnel, which should have been continued from the first.

Davis and Kinley have reported a strike of good gold ore in the B. B. property up Corbett Creek near the old Teller mine. This has not been developed and may be only a pocket; but very good ore has been produced in this neighborhood in times past and many prospectors believe that adequate work will develop some good bodies. The district has been neglected for years.

Labor conditions at Ouray have improved much in the last ten days and are now much better than for a long time.

Mayday—Lon Wigmore and associates have secured a lease on the Lucky Moon and have started a tunnel to cut a vein along a fault where good ore was mined a few years ago. This property has been idle for several years.

Lessees are reported to have taken over the Mountain Lilly above La Plata and have begun work there.

Thomas Welborn and Joe Clark are making an examination of the Tomahawk, with the view of taking a lease on it. They are also working the Idaho dump and have shipped two cars of \$40 ore from it.

Fred Marr has secured a contract at the Ten Broeck and has started work with a small force.

William Graffin has a force at work on the Copper Queen.

IDAHO

Chicago-Boston Makes New Discovery on Surface—Paragon at Murray To Sink Below Creek Level

Wallace—On the west side of the gulch, about 500 ft. from the shaft and 400 ft. above it, a ledge has been uncovered on the Chicago-Boston property. It is 22 ft. wide with streaks and bunches of galena the full width, making a remarkable showing practically at grass roots. It is believed that this is a continuation of the Chicago-Boston vein, although it is quite probable that it may be the Kill Buck vein, which lies south of the Chicago-Boston and belongs to the same company, control of which is under option to John A. Percival, of New York, president of the Callahan Zinc-Lead Co. A crosscut is being run to the Kill Buck vein from the bottom of the 200-ft. shaft on the Chicago-Boston, and preparation is being made to deepen the shaft 200 ft. A splendid showing of lead-silver ore has been developed on the 100 and 200 levels.

William Fahle, manager of the Independence Placer Co., accompanied by nine men, has gone to the company's ground on the North Fork of the Clearwater River, near the old camp of Moose City, where he will build a bed-rock flume and also a ditch a mile and a half long to provide water for hydraulic mining. The property is remote and all supplies must be packed 55 miles from Rivulet, Mont., the nearest railroad point. The ground has been held for years, for lack of money. Funds are said to be available now. The ground has been thoroughly prospected.

A meeting of stockholders of the Leslie Copper Mining Co. will be held in Wallace on July 8 to vote on the proposition to transfer all property of the company to the Amazon-Dixie Mining Co. in exchange for 1,000,000 shares of stock, the plan being to increase the capital stock of the latter company to that extent, making its total capitalization 2,500,000 shares. The holdings of the two companies join and cover the same vein.

The main tunnel of the Amazon-Dixie is being extended into Leslie ground. In the Amazon-Dixie proper considerable ore has been exposed in the main tunnel, from which a shaft has been sunk 400 ft. On this level a good grade of lead-silver ore has been opened for 350 ft. Preparations are being made to sink 400 ft. further, and a complete electric equipment is being installed for the purpose. The company is controlled in Cleveland, Ohio. The property is situated at Sildix, Montana, just across the state line.

Murray—The Paragon Mining Co., which recently purchased the claims owned by the Murray Hill Mining Co., together with a 100-ton mill, is overhauling the mill and expects to have it running about July 15, taking lead and zinc ore from the Murray Hill mine. At the same time the shaft on the Paragon, now down 60 ft., will be deepened 300 ft. This company has shipped consider-

able lead and zinc, from ground above the level run from the bottom of the shaft. The sinking of this shaft will be the first attempt to test the ore-bodies of that section below the creek level, and the result is therefore being watched with unusual interest.

MICHIGAN

Gogebic Range

Pabst Mine Down Temporarily Owing To Accident

Ironwood—Most of the mines on the Gogebic Range were shut down on June 24 because of the celebrations of mid-summer day by the various nationalities. There has been no change in the general operating conditions. The movement of ore from the mines continues to be far below normal.

The Pabst mine was shut down several days due to an accident to the electrical haulage system. For three years or more this mine has had great difficulty in keeping its levels open for haulage. Although new ground, it is very heavy, due to operations in the Newport mine adjoining, and in several places the bottom comes up and the back comes down. About seventy men are employed in this non-productive repair work.

MINNESOTA

Cuyuna Range

Cuyuna—Wiston Dear Co. has started to load manganiferous ore from the Sagamore with a drag-line excavator. The drainage drift, 95 ft. below the lowest point of the pit, has been advanced 300 ft. north under the orebody.

JOPLIN-MIAMI DISTRICT

Oklahoma-Missouri-Kansas

Baxter Springs, Kan.—The Tampa Mining Co. has purchased the Brown Bros. lease and concentrator, located just southeast of the U. S. Smelting Co.'s mill about five miles west of Baxter. The mine was opened and the mill built in 1917 by J. Wise Brown, of Tulsa, and Frank Brown, of Kansas City, and was first known as the Brown-Head mine. It has been a steady producer, though not notably rich. G. C. Warren, of Tampa, Fla., is the principal in the Tampa company and will be general manager.

The Chanute Spelter Company's new mine on the Hartley land, west of Baxter, Kan., is proving the best of the year in the district. It is just being opened up, so its recent feat in turning out 475 tons of concentrates in the week ended June 12 is worthy of note. The company, which is a subsidiary of the American Metal Co., has spent over a million dollars in development work on the land, most of this amount going for pumping operations, so the success is deserved. It is expected that four or five other mines will be opened in the vicinity before winter.

Joplin—Drury Adams, of Batesville, Ark., has taken over the controlling interest in the Louisiana mine, four

miles southwest of Joplin, and will actively manage the property. Steam power will be changed to gas at once. The mine is located in an entirely new field in the Joplin camp, and though not fully developed, has given promise of being a steady producer. Operations are carried on at 150 ft., where faces 7 ft. in height have been developed.

Picher, Okla.—To aid the district in its trouble with frequent car shortages, the Mineral Belt R.R., with headquarters in Miami, has recently ordered 300 new freight cars and expects deliveries to start immediately.

MONTANA

Anaconda Continues To Bar I. W. W.—Men More Efficient at North Butte

Butte—Little improvement in production is looked for this month from Anaconda as compared with May when the output showed a falling off of 6,100,000 lb. of copper as against the yield for April. If so disposed, Anaconda could employ more men, but such a course might entail a departure from its announced policy of barring employment to all the I. W. W. and other radicals, and it is proposed to worry along to weed out the reds, as it is believed that they cannot continue to agitate in the Butte district if they are unable to live there.

The high-grade orebody recently uncovered during the sinking of the Stewart shaft will be crosscut from the 3,800-ft. level.

The orebody which the Davis-Daly has opened on the 2,500-ft. level of the Colorado mine is attracting much attention locally in view of its high grade. This ledge strikes into the property of the Butte & Ramsdell for 250 ft. and the Davis-Daly has concluded a satisfactory arrangement whereby it will hoist the ore. Notification has been given the Butte & Ramsdell to assemble its working forces and start production. Cutting of the No. 2 vein on the 2,700-ft. level is expected soon.

Stopping operations on the 500-ft. level of the Main Range mine of the Tuolumne has opened a 5-ft. body of native silver ore. Crosscutting for the Rory O'More vein on the 1,200-ft. level has been suspended temporarily, the face being about 25 ft. from the fissure.

A marked increase in efficiency is the outstanding feature of the operations of the North Butte company, it being estimated that 700 men now are doing the work formerly done by 1,000. Retimbering of the Speculator shaft in sections is in progress. The company plans to sink this to the same depth as that of the Granite Mountain, which is down 3,800 ft., and to connect the two shafts. Concreting of the Speculator shaft is also proposed. A part of it has already been fireproofed.

Shipments from the Crystal Copper's Goldsmith mine are ranging around 500 tons monthly, with the ore running well in silver. The ore is principally coming from the 600-ft. level and the workings above.

What appears to be a good deposit of copper ore has been opened at the Butte-Duluth property, which is being operated by the Mines Operating Co. Shipments are being made to the Anaconda leaching plant.

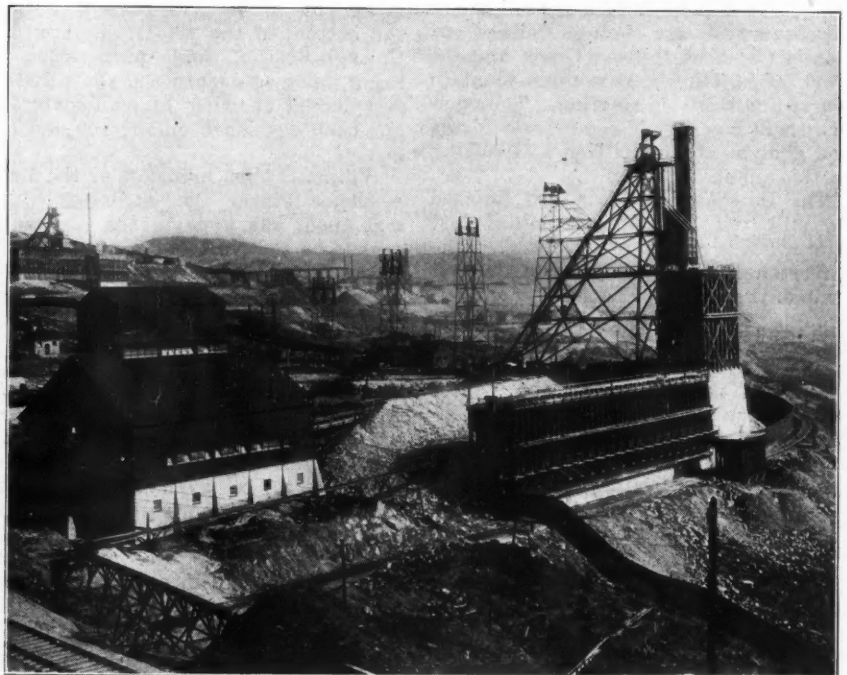
Sinking of the Plutus shaft of the Butte & Plutus is under way from the 200-ft. level to the 400 at which depth it is planned to drive the first crosscut to the Norwich orebody.

Champion district—High-grade silver ore recently cut at a depth of 450 ft. in a tunnel being driven to reach a point under the workings of the old Champion mine is showing a width of four feet, and carrying about 200 oz. of silver and a comparatively high gold content. The orebody thus far has been cut at two points 50 ft. apart.

from where laterals will be run north and south, with east and west crosscuts at intervals. This is one of H. G. Humphrey's allied corporations. It is capitalized at 2,000,000 one dollar shares.

Battle Mountain—Ten shafts have been sunk to bed rock in the Copper Basin placers and from the bottom of one a crosscut is being run to determine the channel's width. Water is scarce and machinery is being installed to pump from a deep shaft in a nearby quartz mine. This property has been idle for six or more years owing to litigation.

Pioneer—Consolidated Mayflower and other companies using distillate for generating power have been notified by the Standard Oil Co. and other con-



Schoettner Studios, Butte
GRANITE MOUNTAIN MINE PLANT, NORTH BUTTE MINING CO., BUTTE, MONT.

Elkhorn—Foundations for the 500-ton mill of the Boston & Montana company have been completed.

Corbin district—The property of the Alta-Montana has been leased to L. S. Roper, of Helena, who will continue driving a crosscut on the 1,300-ft. level with the old Alta vein the objective.

Unwatering of the 400-ft. shaft of the Corbin Copper King claim is to begin shortly.

Helena—A compressor plant and ore bins have been installed in the Soler Mining Co.'s Stemwinder property.

NEVADA

Paramount Comstock To Work Central Group

Virginia City—The Paramount Comstock Mines Co., recently incorporated, has secured the mineral rights to a depth of 1,000 ft. on the ground owned by the Best & Belcher, Gould & Curry, and the Savage, collectively known as the central group. A tunnel will be driven to the center of the orebody,

cerns that a sufficient supply of distillate will not be available in future; therefore it is necessary to remodel the distillate-burning engines at the Mayflower to burn crude oil. The work of making these changes has been started.

Manhattan—A drift from the White Caps shaft has cut the vein east of the fault on the 800-ft. level. The shaft will be sunk 200 ft. deeper.

Hamilton—J. D. Tilford, who is working a lease on the Midvale, has contracted with the smelter at Midvale, Utah, to treat 200 tons of silver-lead ore a month. The Midvale is equipped with a 75-ton concentrator.

Eureka—The receiver of the defunct Bank of Eureka, which failed ten years ago, has given an option on the Ricco Homestead mine to W. A. Simpkins, of San Francisco. One of the provisions is that \$1,000 must be expended monthly on development work.

Winnemucca—The new compressor at the Rexal mine is now in commission.

Pioche—The Black Metals is sacking 50 tons of ore daily from the 325 north level. The last carload shipped averaged 285 ozs. of silver per ton, 25 per cent lead, with some gold and copper.

Tule Canyon—The Silver Hills Nevada Mines Co. has exercised its option on the Jagers mine and has also met the first payment on the Ingalls mine, adjoining. A 5-stamp mill is working on the oxidized surface ores taken from both properties in sampling. These have averaged \$20 a ton.

Ryepatch—Six feet of ore on the Boardinghouse vein has been uncovered in virgin ground on the Ryepatch mine, below the old workings.

NEW MEXICO

Lordsburg—The fluorspar industry in this vicinity has received an impetus through the firm of H. C. Humphreys & Co., of Chicago, which has contracted for all the fluorspar produced. This includes the output of the Great Eagle mine here, the Luckey properties near Duncan, Ariz., and mines near Hatch, N. M., where a representative, M. C. Myers, formerly of Pittsburgh Pa., will be stationed, to handle spar from the Rio Grande Valley.

ores will be made to the smelter soon.

Deadwood—Work has been resumed at the Ironsides on Squaw Creek. Extensive development work will be started immediately and the company is preparing to continue work.

The Elder tunnel is nearing completion and should tap the workings of the Iron Hill mine during July. It will be over 1,300 ft. long and will drain the old workings, making them accessible to lessees. The mine was once one of the richest silver properties in the district.

CANADA

British Columbia

Road To Be Built Beyond Premier—Consolidated's Copper Smelter to Resume

By ROBERT DUNN

Stewart—Great activity is reported at the towns of Hyder and Stewart, respectively the American and Canadian gateways to the Salmon and Bear River mineral zones of Alaska and northern British Columbia. Real estate values have climbed and accommodation is at a premium. Every northbound vessel from Seattle and Vancouver has brought in many newcomers.

results in rendering the Portland Canal district of British Columbia accessible to prospectors and in facilitating the development of those properties on which work already is under way.

It is indicated that this road will meet the needs of a number important mining enterprises, among which are the Big Missouri Group, on which work has been in progress for over a year and which still is being vigorously prosecuted, the company intending to do about 12,000 ft. of diamond drilling within the next few months; the Mineral Hill, on which there has been nearly two years' work; the Hercules, which is to be opened up this summer, supplies already having been forwarded; the Silver Tip and Silver Crest, being developed by Vancouver City interests; and the several groups of claims of the Algonic Development Co.

The latter company controls a subsidiary known as the Northern Light Consolidated Group, with claims adjacent to the Premier mine, and it is planned to diamond drill this season. The company also has the Spider Group under option. It is situated on the west side of Long Lake, is equipped with an air compressor and other plant and will be opened up to a considerable extent as soon as weather conditions permit.

The Monitor group of claims, Salmon River, is reported to have been bonded by Vancouver interests.

Nelson—The annual meeting of the California Mining Co. was held recently at Nelson. Officers were elected as follows: President, John R. Cassin, Spokane, Wash.; vice-president, J. B. Schieger of La Crosse, Wis.; secretary-treasurer, W. B. Orndorff, Spokane; auditor, John Fraser, Nelson; mine superintendent, W. H. Turner, Nelson. Installation of new equipment in the Athabasca mill is progressing.

Trail—The site of the Consolidated's new concentrator has been definitely selected. It is between the towns of Rossland and Trail, on the hillside and within reach of an adequate and certain water supply. A spur line is to be built by the C. P. R. from Warfield to the new mill site, following a line surveyed by one of the Consolidated staff. This road will be down grade from Warfield.

The company's copper smelter is expected to resume operations immediately with one furnace. The Canada Copper will not be ready to ship concentrates to Trail before September.

The magnetic test mill, operated for some time on the Sullivan ores in competition with the Sullivan flotation mill, is being dismantled.

Ore shipments received at the Consolidated smelter during the week ended June 14 were as follows:

Mine	Location	Gross Tons
Bluebell.....	Riondel.....	192
Bell.....	Beaverdell.....	70
Emerald.....	Salmo.....	31
Electric Point.....	Boundary.....	110
Florence.....	Princess Creek.....	35
Jose.....	Rosland.....	115
North Star.....	Kimberley.....	345
Spokane Trinket.....	Ainsworth.....	29
Company Mines.....		5986
Total.....		6,913



PLANT AND DUMP AT PORTAL OF MAIN TUNNEL OF BOSTON & MONTANA COMPANY AT ELKHORN, MONT.

Two old copper properties, the Cobre Negro and the Nelly Bly, both patented, have been taken under a lease and bond by parties identified with large iron and coal interests of Cleveland, Ohio. A geologist is on the ground making an examination. This ground joins the 85 mine on the west and the Bonney-Consolidated property on the north.

SOUTH DAKOTA

Homestake To Send First Aid Team to Denver Meet

Lead—The Homestake Mining Co. will send a first aid and mine rescue team to the Bureau of Mines Meet at Denver this September.

Galena—The Horseshoe Comet mine has been leased to Grimshaw and Koenigsberger, of Deadwood. Work has been started putting the property in shape and shipments of lead-silver

George Clothier, government mining engineer, has recently pointed out emphatically that there are but three actually proven mines in the northwest district, namely, the Premier, in the Salmon River section; the Dolly Varden, in the Alice Arm section, and the Engineer, in the Atlin district. There are many properties of an extremely promising character under development.

It is apparent that Mr. Clothier would warn operators and prospectors not to take too much for granted. Claim holders, he thinks, are apt to hold out for too high prices for prospects.

The construction of a road by the British Columbia Government from the Premier mine, Salmon River, to the Joker Flats and the reported decision of the United States authorities to expend about \$100,000 this summer in opening up the American section of this mineralized zone should have important

Phoenix—The mining camp of Phoenix is gradually being dismantled. The Granby Consolidated has a crew of men removing its plant and shipping it to Grand Forks and elsewhere, twenty or thirty cars having been forwarded already. This work will not be finished before August, when the C. P. R. will remove its steel. Its depot is being taken away. The Great Northern has been busy in dismantling its railway line for the last month. Several buildings in the town also are being taken elsewhere.

H. S. Munroe, the newly appointed general manager of the Granby Consolidated Mining & Smelting Co. in British Columbia, before leaving to take up his work at Anyox made a public statement, which, in part, is as follows:

Ontario

The Ontario Bureau of Mines will make a re-survey of the geological conditions of Cobalt this summer. The former survey by Prof. Willet G. Miller was found to be of very great benefit in the development of the mines, and it is believed that the extensive amount of underground work done since that time will prove of material aid in carrying on the re-survey. Cyril W. Knight, assistant Provincial Geologist, has been given charge of the work and is now in the field. He has selected the Beaver-Temiskaming area as a point of beginning. A careful examination will be made of surface and underground works, linking up each property, as the survey proceeds. It is hoped to complete the work this year.

It is stated that the British America

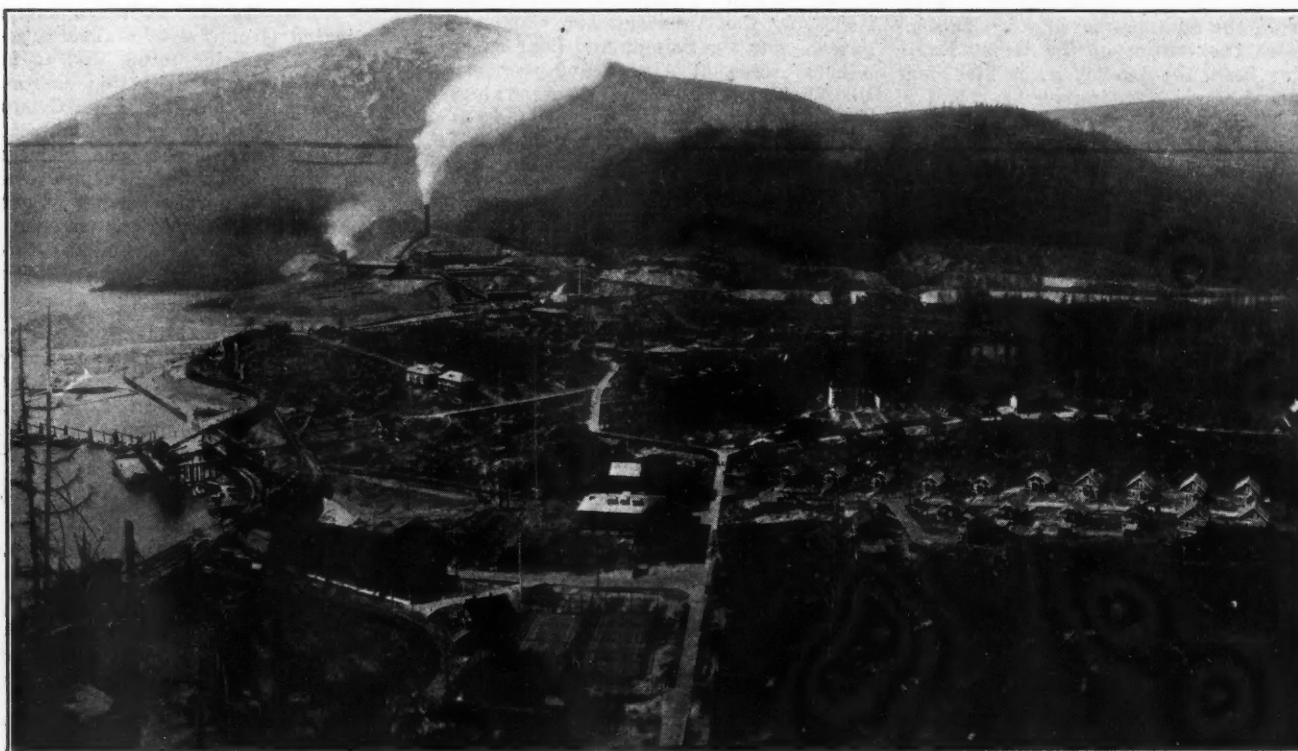
in Bucke Township, operations on which were discontinued in 1907 owing to financial difficulties. The workings have been dewatered. A strong calcite vein carrying milling ore is in evidence in the shaft.

The Victory has increased its capital from \$500,000 to \$2,000,000. M. R. Cartwright, formerly manager of the Adanac, has been appointed manager.

South Lorrain — An encouraging quantity of good silver ore has been cut on the lower levels of the Keeley. Drifting operations have been carried into the adjoining Beaver Lake property, which is under option to the controlling interests of the Keeley.

VENEZUELA

The Venezuelan government has granted a contract to an American cit-



SMELTER OF GRANBY CONSOLIDATED MINING, SMELTING & POWER CO. AT ANYOX, B. C.

"I have just made an inspection of the Cassidy coal holdings on Vancouver Island. Cassidy is a miniature Gary and we expect to continue and expand our coal holdings at that point. The Granby company has achieved prominence in the mining world under its former management and our policy will continue to be one of progress. We hope to increase copper production at Anyox and to mine more coal at Cassidy.

"As to the Granby operations at Anyox it may be stated that the difficulties at the coke plant, incident to new operations of this character, are rapidly being overcome and in the course of a few weeks a satisfactory solution will be found which will make Granby entirely independent, as far as its coke supply is concerned."

Nickel Corporation, which blew in its new smelter at Nickelton in January, has found the cost of labor and supplies much higher than estimated. As the company's only certain market was in England, the government guaranteeing to take a certain tonnage for a certain number of years, the exchange situation is also no doubt a determining factor. The company is employing about 800 men and recently purchased a large number of water-Leyner drills.

Gowganda — At the Trethewey's Castle property a vein of good ore has been found to run directly under the office. The vein recently found near the lake edge is being developed, four shipments of ore having been made since operations were started.

Cobalt — Work has begun on the Ruby, adjoining the old Green-Meehan

ized for the construction of an electric railway from San Felix, on the Orinoco River, to the Guasipati gold fields, as well as the rental of the Caroni River Falls to furnish the necessary hydroelectric power.

SIAM

Two dredges, which the Yukon Gold Co. formerly used in its Alaskan operations, have been received at the company's tin property in Siam. These will be set up as soon as possible and production should start toward the end of this year. The Yukon Co. has to date invested a large sum in its Siamese tin venture, from which it hopes to recoup some of its losses in gold mining and meet its outstanding obligations. The company will confine its Siamese activities to tin mining.

THE MARKET REPORT

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Silver and Sterling Exchange

June	Sterling Exchange	Silver			June	Sterling Exchange	Silver		
		New York, Domestic Origin	New York, Foreign Origin	London			New York, Domestic Origin	New York, Foreign Origin	London
24	396	99½	90	50½	28	396	99½	93	53
25	396	99½	90	50½	29	394½	99½	92	52½
26	396	99½	90	50½	30	394	99½	91	52

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.

On the authority of the Secretary of the Treasury, we quote 100c. per oz. for silver, 1,000 fine, delivered at the option of the Director of the Mint to the New York Assay Office or to the mints in Philadelphia, Denver, or San Francisco, and proved to the satisfaction of the Treasury Department to have been mined, smelted, and refined in the United States. This quotation is retroactive to May 13.

Daily Prices of Metals in New York

June	Copper		Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.	
24	17.85	45.50	47.00	8.15	7.90	7.40	
25	17.85	45.00	47.00	8.15	7.90	7.40	
26	17.90	45.50	47.75	8.15	7.90	7.40	
28	18.00	45.50	48.75	8.15	8.00	7.45	
29	18.10	45.50	48.75	8.25	8.10	7.50	
30	18.10	45.00	48.00	8.40	8.20	7.55	

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 prompt and nearby deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point. All prices are in cents per pound.

Copper is commonly sold on terms "delivered," which means that the seller pays the freight from refinery to buyer's destination. The delivery cost varies, and it would be confusing to figure net prices on individual transactions. Consequently, an average deduction is made from the "delivered" price. At present the average cost of delivery from New York refineries is 0.15c. per lb., and that deduction is made to arrive at the New York price. When copper is sold f.o.b. or f.a.s. New York, of course no deduction is made.

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 special shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

June	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3 M	Spot	3 M	Spot	3 M
	Spot	3 M							
24	84½	86½	99	247½	250½	32½	33½	39½	41½
25	83½	86	99	245	247½	31	32½	39½	41½
26	...	...	...	...	...	...	...	...	...
28	84½	87½	99	244½	246½	32	33½	38½	40½
29	85½	88	99	246½	250½	32½	33½	39½	41½
30	86½	89	99	246	251	33	34½	40½	42½

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

Metal Markets

New York, June 30, 1920

But little real change can be chronicled in the metal market for the last week. The volume of sales was even less than usual. However, a more hopeful feeling seems to be in evidence, no doubt inspired by the stronger tone of the London market during the last three days.

Copper

Second-hands seem to be momentarily fairly well sold up, and there was a disposition, both with them and on the part of the smaller producers, to raise

prices about ½c. over those quoted last week. Whether or not the price will be allowed to drop back in July remains to be seen. The position of the large producers is unchanged. The principal consumers overbought early in the year, for they were unable to use as much metal as they expected, owing to unsettled industrial conditions.

Export business is little changed. It amounts to something like 40 per cent of domestic production, compared with about 50 per cent before the war.

Lead

Lead is decidedly quieter. Prompt metal is still in demand, and the price

Monthly Average Prices for June

Copper:	
New York Electrolytic	18.065
London Standard	87.864
London Electrolytic	101.909
Lead:	
New York	8.323
St. Louis	8.169
London	34.330
Silver:	
New York	90.957
London	51.096
Sterling Exchange	393.663
Zinc:	
New York	7.815
St. Louis	7.465
London	41.193
Tin:	
99 per cent	46.125
Straits	48.327
London	250.614

we quote holds in general for July deliveries. August lead has been sold as low as 7.50c., St. Louis, but is in no great demand. A 1,000-ton lot of Penarroya lead has been offered for prompt shipment from Spain at 7½@7¾c., duty paid, New York, but found no takers. This could doubtless be delivered here early in August, but the quantity seems to be too large to be assimilable.

Zinc

London accounts seem to be nearly liquidated, and the price is slowly improving, a tendency which is expected to continue. It may not be long before London again will be a buyer in the local market. A decreasing supply, due to partial stoppage of work in the Joplin mines, will also tend to better prices. On the other hand, the sheet mills have a demand for unionization of all shops which they must meet, and are likely to decide on closing down as an alternative to taking this step. Should this occur consumption would be decreased considerably, at least temporarily. Also, it must be remembered that we are away above London parity, today's London price being equivalent only to about 6.80c., St. Louis.

Tin

This metal has been inactive, and there seems to be no reason for the daily fluctuations. Spot Straits is none too plentiful. A boat arrived yesterday with 1,350 tons, but it is stated that most of this has been sold to tin-plate mills in the Pittsburgh district. Some of it, however, may be resold in case of a shortage. Electrolytic has been unusually quiet, marked discounts over Straits not tempting consumers. The strike at the A. S. & R. tin refinery was quickly settled.

Straits tin for future delivery: June 24th, 46½@46¼c.; 25th, 45½@46¼c.; 26th, 46½@47c.; 28th, 46½@47c.; 29th, 46½@47c.; 30th, 46½@47c.

Arrivals of tin in long tons: June 23d, Bristol, 235; Rotterdam, 200; 24th, Liverpool, 25; 25th, London, 75; 28th, London, 50; 29th, Straits, 1,350; London, 100.

Silver

Eastern exchanges still show lack of firmness. The future of silver depends to a large extent on the China situation. The export trade still continues dull, with no movement of bullion of importance to the East. Shanghai stocks remain unchanged. Tenders of "domestic" silver to our Mints at \$1 per oz. 1,000 fine are now in operation.

Mexican Dollars, June 24, 68¼c.; 25th, 68¼c., 26th, 68¼c., 28th, 70c.; 29th, 69¼c.; 30th, 68¼c.

Gold

Gold in London on June 24th, 104s.; 25th, 103s. 7d.; 28th, 103s. 7d.; 29th, 104s.; 30th, 104s.

Foreign Exchange

No outstanding changes mark the foreign money market during the last week except a decline in Indian rupees from 38.25c. a week ago to 35.25c. yesterday and a decline of Brazilian rios from 26¼c. to 23.62c. In units to the dollar, francs were quoted on Tuesday at 12.20 and lire at 16.97. German marks, 2.60c, and New York funds in Montreal, 12½c. premium.

Other Metals

Aluminum—Ingot, 33c. per lb., with 32@32½c. open market for 98@99 per cent virgin.

Antimony—Market continues weak. Spot, 7½@7¼c. per lb.; Cookson's "C" grade, 14c. Chinese and Japanese brands, 7¼@7¼c. W. C. C. brand, 8c.

Antimony, Needle—Chinese needle antimony, lump, firm at 9¼c. per lb. Standard powdered needle antimony (200 mesh), 12 to 15c. per lb. Unchanged.

Bismuth—\$2.70 per lb., 500-lb. lots. Market very quiet.

Cadmium—Nominal, \$1.40@\$1.50 per lb. Unchanged.

Cerium Metal—Ingot form, \$8@\$9 per lb.

Cobalt—Metal, \$2.50 to \$3 per lb.; black oxide, \$2 per lb.

Iridium—Nominal, \$300 per oz. No business.

Magnesium—Metallic, 99 per cent or over pure, \$1.60@\$1.85 per lb., 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.; Monel metal, shot, 35c.; blocks, 35c., and ingots, 38c. per lb.

Osmium—Open market, \$50@\$75 per troy oz.

Palladium—\$75@\$85 per oz.

Platinum—Market weak at \$80@\$90 per oz. Little business transacted.

Quicksilver—Market steady; \$90 per 75-lb. flask. San Francisco wires \$85. Steady.

Ruthenium—\$200@\$220 per troy oz. Unchanged.

Selenium, black, powdered, amorphous, 99.5 per cent pure, \$1.75@\$2 per lb.

Thallium Metal—Ingot, 99 per cent pure, \$18@\$20 per lb.

Metallic Ores

Bauxite—Containing about 52 per cent alumina, less than 2 per cent iron oxide and up to 20 per cent silica, and artificially dried to contain not more than 4 per cent free moisture, \$10 per gross ton at mine; 54 per cent alumina and about 15 per cent silica, \$11; averaging 57 per cent alumina, 8 to 12 per cent silica, less than 3 per cent iron oxide, \$13 on basis of 8 per cent free moisture. Ores of very low silica content suitable for manufacture of aluminum oxide and hydrate of alumina command a fancy price.

Chrome Ore—Guaranteed 50 per cent Cr₂O₃ foreign ore with a minimum of 6 per cent silica, 72@80c. per unit, New York. California concentrates, 50 per cent Cr₂O₃ and upward, 60@65c. per unit, f.o.b. mines.

Iron Ores—Lake Superior ores, per ton, delivered at Lower Lake ports; Old Range bessemer, \$7.45; Old Range non-bessemer, \$6.70; Mesabi bessemer, \$7.20; Mesabi non-bessemer, \$6.55. Producers and consumers are protesting proposed increased freight rates.

Manganese Ore—\$5@90c. per unit, 50 per cent Mn content, c.i.f. Atlantic seaport; chemical ore (MnO₂) \$75@\$85 per gross ton.

Molybdenum—85 per cent MoS₂, 85c. per lb. of contained sulphide.

Tantalum Ore, guaranteed minimum 60 per cent tantalum acid, 65@70c. per lb. in ton lots.

Titanium Ores—Ilmenite, 52 per cent TiO₂, 2c. per lb. for ore. Rutile, 95 per cent TiO₂, 20@25c. 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, \$7 f.o.b. mines; wolframite, 60 per cent WO₃ and over, per unit of WO₃, \$6.50@\$7.50 f.o.b. mines.

Uranium Ore (Carnotite)—\$2.75@\$3 per lb. for 96 per cent of the contained oxide (U₃O₈). Ores must contain a minimum of 2 per cent U₃O₈.

Vanadium Ore—\$1 to \$2.50 per lb. of metallic vanadium content.

Zircon—Washed, iron free, 10c. per lb. Zirkite—\$90@\$100 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., June 26—Zinc blende, per ton, high, \$48.10; basis 60 per cent zinc, premium, \$46; Prime Western,

\$45; fines and slimes, \$42.50@\$40; calamine, 40 per cent zinc, \$36. Average settling prices: Blende, \$42.32; calamine, \$36.78; all zinc ores, \$42.25.

Lead, high, \$101.60; basis 80 per cent lead, \$92.50@\$90; average settling price, all grades of lead, \$100.36 per ton.

Shipments the week: Blende, 10,310; calamine, 127; lead, 2,169 tons. Value, all ores the week, \$658,710.

Shipments for six months: Blende, 297,580; calamine, 4,978; lead, 46,349 tons. Value, all ores six months, \$19,894,930. The shipment is an increase of 26,419 tons blende and 8,060 tons lead; decrease, 2,262 tons calamine. The increased value is \$6,660,000 over the first six months of last year.

Buyers held out until 10 o'clock today on offerings of \$43.50 basis Prime Western, but advanced to \$45 since that hour, sellers declining to accept less.

Producers claim 90 to 95 per cent of the production will be down the next two weeks. Buyers acknowledge there will be 60 per cent reduction in output. Mine owners have organized a two weeks' holiday, and it is claimed that it will be nearly general.

Platteville Wis., June 26—Blende, basis 60 per cent zinc, \$49 base for high-grade. Lead ore, basis 80 per cent lead, \$90 per ton. Shipments for the week: Blende, 1,076; lead, 267; sulphur ore, 65 tons. Total shipments of blende and calamine for the first half of the year show a decrease of 26 per cent from the corresponding figures of 1919. Shipped during the week to separating plants, 2,982 tons blende.

Non-Metallic Minerals

Asbestos—No change since last issue.

Barytes—Crude, 88 to 94 per cent barium content, \$8@\$10 per net ton; ground (white) \$22@\$25 in bags, carload lots; (off-color) \$18@\$20 in bags, carload lots; all f.o.b. Kings Creek, S. C. Crude, 88 to 94 per cent, \$12 per gross ton; ground (white) \$23@\$25; ground (off color) \$16@\$19 per net ton, f.o.b. Cartersville, Ga. Crude, 88 to 94 per cent, \$23; ground (white) \$40.50; ground (off color) \$27 per net ton, less than carload lots, f.o.b. New York.

Chalk—Domestic, extra light, 5@6c. per lb.; light, 4½@5½c.; heavy, 4@5c.; English, extra light, 5@7c.; light, 5@6c.; dense, 4½@5c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Imported lump, \$25@\$35; imported powdered, \$30@\$60; domestic lump, \$10@\$20; domestic powdered, \$25@\$30, all per net ton, f.o.b. New York. Crude, \$8@\$12 net ton, f.o.b. Virginia points; ground, \$15@\$40 net ton, f.o.b. Virginia points.

Feldspar—Crude, \$7.50@\$8 per gross ton, f.o.b. Maryland and North Carolina points; \$7.50@\$10 f.o.b. Maine; ground, \$22@\$25, car lots, f.o.b. Baltimore; ground, \$16@\$20, f.o.b. North Carolina points; \$16 to \$20 per ton, No. 1 ground, f.o.b. New York State.

Fluorspar—Standard grade, domestic washed gravel, f.o.b. Illinois and Ken-

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

tucky mines, \$25 per ton; lump, \$17.50, f.o.b. Tonuco, N. M.

Fuller's Earth—Domestic, granular, \$25; powdered, \$18, f.o.b. mines, Florida; imported, powdered, \$35@\$40 per ton.

Graphite—Crucible flake, 85 per cent carbon content, 8c.; 88 per cent, 9½c.; 90 per cent, 10½c., all f.o.b. New York. Mexican, amorphous, \$45@\$55 per short ton; Korean, 3½c. per lb.; Madagascar, 8c.; Ceylon, 4½@15½c. There has been no change of note in the Alabama graphite market since the last report. Demand for small quantities of lubricating grades continues to come in, and a large number are repeats. The prevailing price of this material in packages is 25c. per lb. Car lots can be sold at any time, with the tendency toward higher prices. Dust grades continue about as previously quoted.

Gypsum—Raw crushed rock, \$3.50@\$4 per ton; raw ground fine, \$4@\$4.50; calcined stucco, \$9, all f.o.b. works. Containers extra. Wholesale, plaster of paris, carload lots, \$3.75 per 250-lb. bbl., alongside dock, New York.

Kaolin—See China Clay.

Limestone—For fluxing, \$1.65@\$1.75 per net ton, f.o.b. Howellville, Pa. 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.

Magnesite Brick—See Refractories.

Magnesite, Calcined—High-grade caustic calcined, lump form, \$35@\$40 per ton, carload lots, f.o.b. California points. Freshly ground calcined, suitable for flooring trade, \$65@\$75 per ton, f.o.b. Eastern points.

Magnesite, Dead-Burned—\$32.50 per net ton, Chewelah, Wash.; \$50@\$60, Chester, Pa.

Mica—Imported block mica slightly stained, per lb.: No. 6, 50c.; No. 5, \$1.20@\$1.40; No. 4, \$2@\$3; No. 3, \$4.25@\$5; No. 2, \$5.50@\$7; No. 1, \$8. Clear block: No. 6, 55c.; No. 5, \$2; No. 4, \$4; No. 3, \$5.75; No. 2, \$7; No. 1, \$9; A1, \$14; extra large, \$25, all f.o.b. New York; ground, \$85@\$100 per ton, Philadelphia.

Monazite—Minimum of 6 per cent thorium oxide, \$42 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports, 68 per cent tricalcium phosphate, \$6.85; 70 per cent, \$7.35; 74 to 75 per cent, \$10; 75 per cent minimum, \$10.50; 77 per cent minimum, \$12.50.

Pumice Stone—Imported, lump, 4@5c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish, fines, per unit 12c. c.i.f.; furnace size, 16½c.; run of mine, 12@14c.; domestic, fines, f.o.b. New York, 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.

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

Talc—Paper making, \$9.50@\$14 per ton; roofing grades, \$8@\$9; rubber grades, \$9@\$15, all f.o.b. Vermont. California talc, \$20@\$35, talcum powder grade. Southern talc, powdered, carload lots, \$12 per ton; less than carload, \$15, f.o.b. cars. Freight to New York, \$5.25 per ton, carload lots; less than carload lots, \$9.25. Imported, \$60@\$70.

Mineral Products

Arsenic—White arsenic, 14@15c. per lb.; sulphide, powdered, 20@21c. per lb., f.o.b. works.

Nitrate—Soda, \$3.85 per cwt., ex vessel, Atlantic ports. Market quiet.

Potassium Sulphate—Domestic, \$2.25@\$2.50 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrocobalt—For 15-18 per cent material, \$200@\$250 per ton, f.o.b. Niagara Falls, N. Y. Unchanged.

Ferrocium—Per lb., \$12@\$15. Foreign conditions as affecting the price of American goods remain unchanged.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 19@20c. per lb. of chromium contained; 4 to 6 per cent carbon, 20@21c.

Ferromanganese—For 76@80 per cent, \$250 spot; \$225 prompt; \$200 contract, freight allowed; Spiegeleisen, 18 to 22 per cent, \$75, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, \$2.25@\$2.75 per lb. of contained metal.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, \$60@\$65; 50 per cent, \$80@\$90; 75 per cent, \$150@\$160.

Ferrotungsten—70 to 80 per cent W, 90c.@\$1.10 per lb. of contained tungsten.

Ferro-uranium—35-50 per cent U, \$7 per lb. of U contained.

Ferrovandium—Basis 30-40 per cent, \$6.50@\$7.75 per lb. of V contained.

Metal Products

Copper Sheets—No change in Jan. 7 price of 29½c. per lb.; wire, quoted 22@22½c.

Lead Sheets—Full lead sheets, 12½c.; cut lead sheets, 12½c. in quantity, mill lots. Unchanged.

Nickel Silver—Unchanged at 39½c. per lb. for 18 per cent nickel.

Yellow Metal—Dimension sheets, 26½c.; sheathing, 25½c.; rods, ½ to 3 in., 23½c. Unchanged.

Zinc Sheets—\$12.50 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 12c. per lb. Unchanged.

Refractories

Bauxite Brick—56 per cent alumina, \$145 per 1,000, f.o.b. Pittsburgh.

Chrome Brick—9-in. straights and sizes, \$80@\$90 per net ton, Baltimore;

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

3 x 4½ x 2½ in., \$90, Chester, Pa., carload lots.

Chrome Cement—45 to 50 per cent Cr₂O₃, in sacks, \$50 per net ton, Chester, Pa., carload lots.

Clay Brick—First-quality fireclay, per 1,000, \$45@\$55, Pennsylvania; \$40@\$50, Kentucky; \$40@\$50, Ohio; \$45, St. Louis; \$75, New Jersey; second quality, per 1,000, \$35@\$45, Pennsylvania; \$30@\$40, Ohio.

Magnesite Brick—9 x 4½ x 2½ in., \$90 per net ton, Chester, Pa.; 9-in. straights, \$90, Baltimore; 9-in. sizes and shapes larger than 9 in., regular extras. (For lead-burned see Magnesite.)

Silica Brick—Nine in. and 9-in. sizes, per 1,000, \$51@\$55, Birmingham, Ala.; \$50@\$55, Mount Union, Pa.; \$55, Chicago district.

Iron Trade Review

Pittsburgh, June 29, 1920

The Amalgamated Association at the last moment made overtures to the sheet and tin mills that have hitherto signed its scale, for another conference, and the conference begins its sessions today at Columbus, Ohio. The change of front is presumably due to many of the men assuring the officials that they did not wish a strike. Another factor probably was the reported compromise whereby the A. A. of L. will give the Amalgamated Association a 51 per cent representation on the new iron and steel industry organizing committee it is to set up, pursuant to resolution at the recent Montreal convention.

All branches of the iron and steel market continue quiet. Except for buying from the Steel Corporation, consumers preserve a conservative attitude, limiting their commitments to such early deliveries as they feel they must have. Prices for prompt shipment continue to soften, lessening the premiums over late deliveries, which show practically no decline. Most buyers evidently feel that eventually the whole steel market will decline to the Steel Corporation prices, which are those of the Industrial Board schedule of March 21, 1919.

Pig Iron—A sale of 2,000 tons of bessemer, delivery over two or three months, sets the market at \$44, Valley, as minimum, or \$1 advance, and a somewhat similar sale of basic sets that market at \$44, Valley, a 50c. advance. Foundry remains at \$45, Valley. The market remains quiet.

Steel—The market continues quiet, with prices nominal, at \$60@\$65 for billets and \$75 for sheet bars.

Charcoal and Coke

Charcoal—Willow, 7c. per lb. in bbls.; hardwood, 4½c. per lb., in 250-lb. bbls.

Connellsville—Furnace, \$14@\$16; foundry, \$15@\$17.

New River—Furnace, \$12.50@\$15, and foundry, \$12.50@\$14 per ton.

Pocahontas—Furnace, \$12.50@\$13.50 per ton.

Wise County—Furnace, \$12.50@\$15 per ton; foundry, \$12.50@\$14 per ton.

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	125.531	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	.....	48.813	54.133	.....
August	100.292	111.370	.....	49.077	58.835	.....
September	101.125	114.540	.....	49.500	61.668	.....
October	101.125	119.192	.....	49.500	64.049	.....
November	101.125	127.924	.....	48.969	70.065	.....
December	101.125	131.976	.....	48.492	76.432	.....
Year	96.772	111.122	.....	47.516	57.059	.....

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

Copper

	New York		London			
	Electrolytic		Standard		(b) Electrolytic	
	1919	1920	1919	1920	1919	1920
January	(a) 18.918	92.238	118.095	106.619	123.238	126.950
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	.....	99.576	.....	103.046	.....
August	22.319	.....	97.300	.....	106.429	.....
September	21.755	.....	100.767	.....	.....	.....
October	21.534	.....	103.418	.....	.....	.....
November	19.758	.....	98.894	.....	.....	.....
December	18.295	.....	103.708	.....	.....	.....
Year	18.691	.....	90.796	.....	.....	.....

(a) No market. (b) See note on page 43.

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	38.480
June	5.340	8.323	5.070	8.169	22.544	34.330
July	5.626	.....	5.408	.....	23.457	.....
August	5.798	.....	5.583	.....	25.330	.....
September	6.108	.....	5.853	.....	28.473	.....
October	6.487	.....	6.249	.....	34.731	.....
November	6.808	.....	6.649	.....	41.202	.....
December	7.231	.....	6.955	.....	.....	.....
Year	5.759	.....	5.530	.....	28.590	.....

Tin

	New York				London	
	1919		1920		1919	1920
	99%	Straits	99%	Straits	1919	1920
January	67.702	61.596	58.466	59.932	248.557	376.512
February	66.801	61.037	61.037	61.926	223.963	395.750
March	67.934	61.120	62.115	62.115	236.843	369.489
April	72.500	53.230	55.100	55.100	225.275	345.450
May	72.500	46.125	48.327	.....	234.398	294.813
June	71.240	.....	.....	.....	238.263	250.614
July	68.000	.....	.....	.....	253.272	.....
August	57.226	.....	.....	.....	273.625	.....
September	54.482	.....	.....	.....	280.102	.....
October	54.377	.....	.....	.....	279.239	.....
November	53.307	.....	.....	.....	283.556	.....
December	53.870	.....	.....	.....	314.113	.....
Av. 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	.....	7.523	.....	41.815	.....
August	7.789	.....	7.160	.....	39.338	.....
September	7.510	.....	7.473	.....	40.955	.....
October	7.823	.....	7.827	.....	43.630	.....
November	8.177	.....	8.350	.....	46.588	.....
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	42.954	31.40	42.61	32.40	43.40
March	32.54	43.40	31.40	42.60	29.12	43.40
April	29.35	43.72	27.15	44.22	28.15	43.90
May	29.35	.....	27.15	.....	28.15	.....
June	29.35	.....	27.15	.....	28.15	.....
July	29.35	.....	27.15	.....	28.15	.....
August	29.35	.....	27.15	.....	28.15	.....
September	29.35	.....	27.15	.....	28.15	.....
October	29.35	.....	27.15	.....	28.30	.....
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.

Monthly Copper Production

The table which appears herewith represents the crude-copper content of blister copper, in pounds.

MONTHLY CRUDE COPPER PRODUCTION, 1920

	February	March	April	May
Alaska shipments	5,121,609	4,897,088	6,507,515	7,331,594
Arizona:				
Arizona Copper	3,000,000	3,000,000	3,000,000	3,000,000
Calumet & Arizona	5,268,000	4,428,000	3,176,000	4,760,000
Cons. Ariz. Smelting	910,000	1,250,000	1,200,000	1,250,000
Inspiration	7,200,000	6,500,000	6,000,000	7,500,000
Magma	729,546	830,235	895,082	918,321
Miami	4,089,520	4,091,535	4,924,420	5,054,760
New Cornelia	2,872,000	3,408,000	3,560,000	3,720,000
Old Dominion	2,103,000	2,358,000	2,180,000	2,287,400
Phelps Dodge	5,535,500	6,145,000	5,700,000	6,761,000
Shattuck Arizona	340,384	344,938	214,122	219,118
Ray	3,885,000	3,900,000	4,500,000	4,260,000
United Verde	6,490,000	5,900,000	5,300,000	5,400,000
United Verde Extension	2,977,898	3,977,898	3,270,718	3,219,934
Michigan:				
Calumet & Hecla	8,660,052	9,880,577	9,532,476	8,803,811
Other Lake Superior	6,420,000	6,420,000	6,420,000	6,200,000
Montana:				
Anaconda	18,500,000	18,450,000	15,800,000	9,700,000
East Butte	1,460,360	1,909,720	1,291,840	1,412,760
Nevada:				
Nevada Cons.	3,850,000	3,700,000	4,140,000	4,350,000
New Mexico:				
Chino	3,176,489	4,413,329	3,543,471	3,930,728
Utah:				
Utah Copper	9,211,806	8,894,596	9,313,227	9,904,781
Eastern Smelters	1,600,000	1,610,000	1,610,000	1,600,000
Total reported	103,401,164	106,308,916	102,078,871	101,584,207
Others, estimated	14,049,000	14,000,000	14,000,000	13,380,000
Total United States	117,450,164	120,308,916	116,078,871	114,964,207
Imports: Ore and concentrates, etc.	10,848,782	9,766,336	7,766,457	.....
Imports in blister, etc.	28,319,347	19,108,437	14,182,933	.....
Grand total	156,618,293	149,183,689	138,028,261	.....
British Columbia:				
Granby Cons.	2,180,000	2,095,500	2,105,400	2,131,219
Mexico:				
Boleo	911,051	1,193,416	1,063,168	650,908
Cananea	3,400,000	3,700,000	4,000,000	4,300,000
Phelps Dodge Mexican properties	2,050,000	1,786,000	2,098,000	1,141,000
Other foreign:				
Cerro de Pasco	4,718,000	5,658,000	3,942,000	3,890,000
Chile	8,630,000	9,256,000	8,172,000	10,300,000
Katanga	4,133,625	3,229,739	.....	.....
Backus & Johnston	926,000	958,000	1,354,000	.....

Production of the United States by months since the beginning of the year and the corresponding figures for 1918 and 1919 were as 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	.....
July	159,329,031	100,369,247	.....
August	165,550,799	107,994,040	.....
September	157,992,487	108,703,075	.....
October	168,638,775	115,143,143	.....
November	159,217,588	117,289,735	.....
December	161,801,916	102,997,633	.....

COMPANY REPORTS

Chile Copper Co.

Copper; Chile

The outstanding feature of the fourth annual report of the Chile Copper Co. for the year ending Dec. 31, 1919, is the deficit of \$287,794.78 on the books, in contrast to the surplus of \$2,002,862.80 on Dec. 31, 1918. The report shows that this large American copper-mining enterprise in South America was by no means immune to the adverse influences bearing upon the industry, despite the ability of the company to produce low-cost copper. This poor showing would have been tempered considerably had the large unsold stocks of copper on hand Dec. 31, 1919, been disposed of at any price above the cost of production.

There was produced during the year 1919, 76,717,872 lb. of copper, compared with 102,136,658 lb. in 1918, a decrease of about 25 per cent in production, and of this copper 54,556,229 lb. was sold at 18.972c. per lb. The total book cost of this copper was 18.35c. per lb. compared with 17.56c. in 1918 and 21.23c. in 1917. The following comparative table indicates the composition of these costs.

The company's large stock of refined copper is carried at cost, which is according to the 1919 rulings of the Bureau of Internal Revenue, although, to a considerable extent, sold prior to the end of the year for delivery after Dec. 31. It is significant that had these sales been booked for future

If the copper on hand and in transit were booked at say 18c. instead of at cost, the quick assets would be increased \$3,620,993.04, an indication of the showing had these conditions prevailed.

The combined statement of Income and Surplus accounts summarizes operations as follows:

Operating revenue:		
Copper sold and delivered, 54,556,229 lb. at 18.972c.		\$10,350,167.44
Operating costs:		
Costs, f.o.b. plant yards (including depreciation)	\$7,643,990.70	
Delivery and selling expense	1,085,965.20	8,729,955.90
Operating profit		\$1,620,211.54
Other income:		
Dividends—Chile Steamship Co.	\$500,000.00	
Interest and discount received	343,783.69	
Miscellaneous	25,093.63	868,877.32
Total income		\$2,489,088.86
Charges against income:		
Taxes and miscellaneous charges	\$395,556.67	
Interest on bonds of Chile Copper Co.	2,823,043.27	3,218,599.94
Loss carried to surplus account		\$729,511.08
Charges against 1919 surplus:		
Amortization of discount on bonds	\$140,000.00	
Depletion of ore reserves	1,355,507.63	
Plant superseded or abandoned, 1919	65,638.87	1,561,146.50
Loss from 1919 operations		\$2,290,657.58
Surplus from operations previous to 1919:		
Balance Dec. 31, 1918, as stated	\$2,787,881.69	
Less miscellaneous adjustments	785,018.89	
Net balance Dec. 31, 1918, as adjusted		2,002,862.80
Net deficit Dec. 31, 1919		\$287,794.78

COSTS IN CENTS PER POUND Copper Produced

	Pounds Produced	Plant Cost	Taxes, General Expenses and Miscellaneous	Estimated Selling and Delivery	Cost Expended, Selling and Delivery Included	Depreciation	Depletion	Total Book Cost
1916	41,305,477	11.75	0.61	3.10	15.46	3.48	2.94	21.88
1917	88,370,188	11.56	1.85	3.34	16.75	1.75	2.53	21.23
1918	102,136,658	10.22	0.85	2.23	13.30	1.75	2.51	17.56
1919	76,717,872	9.27	1.73	1.99	13.01	2.94	2.40	18.35

Copper Sold

Pounds Sold	Total Cost Development	Depreciation	Depletion	Total Book Cost
34,961,956	15.42	3.48	2.75	21.65
(a) 71,636,989	15.78	1.75	2.39	19.92
84,695,299	13.62	1.75	2.52	17.89
54,556,229	15.10	2.19	2.49	19.78

(a) In addition to the 71,636,989 lb. shown in copper sold in 1917 there was 14,074,317 lb. of 1916 production sold.

delivery at the sales price the year's operations would have shown a substantial profit for the Chile Exploration or operating company, instead of a loss of \$1,762,703.96.

The combined statement of the Chile Copper Co. and the Chile Exploration Co. shows at the end of the year a surplus of quick assets over quick liabilities of \$25,223,199.06 as against \$22,924,058.42 at Dec. 31, 1918, an increase of \$2,299,140.64.

The detail of quick assets and quick liabilities for 1919 is as follows:

QUICK ASSETS

Steamship investment	\$458,991.27
Materials, merchandise, on hand and in transit	8,284,202.35
Deferred accounts	216,476.31
Accounts receivable	1,460,445.69
Ore and copper in process, 12,476,396 lb. at 5.953c.	742,372.11
Copper on hand and in transit, 56,329,835 lb. at 11.572c.	6,518,377.26
Liberty loan bonds	2,000,000.00
Call loans	5,100,000.00
Cash	4,114,279.65
Total quick assets	\$28,895,144.64

QUICK LIABILITIES

Accounts payable (including accrued interest on bonds)	\$3,288,957.30
Deferred credits	302,929.92
Reserve for taxes	80,056.36
Total quick liabilities	\$3,671,945.58
Net quick assets	\$25,223,199.06

This statement shows the elimination of the net surplus of Dec. 31, 1918, of \$2,002,862.80 and the substitution of a deficit amounting to \$287,794.78, due chiefly to the fact that the large unsold stock of copper was carried at cost upon the books. The financial condition of the company would have appeared much brighter had this copper been sold above the cost of production or carried at a higher cost.

The calculation of ore reserves shows that there are 694,550,886 tons of positive and probable ore carrying 2.12 per cent copper in the company's property. The low value of the ore mined and milled during 1919 (1.62 per cent copper per ton) as compared with the estimated average value of the oxidized orebody as a whole, is due to the fact that the ore gradually increases in value with depth and that mining is still taking place in the comparatively poorer upper part of the orebody.

The plant is now capable of producing between 145,000,000 and 155,000,000 lb. of copper per year under normal operating conditions, but it is planned to enlarge this capacity when conditions warrant, in three stages: the first stage to approximately 194,500,000 lb. per year; the second to 214,500,000 lb. per year; and the third to about 303,500,000 lb. per year.

The per cent of net copper recovery in 1919 was 86.0, compared with 82.2 per cent in 1918.

MINING STOCKS

Week Ended June 26, 1920

Stock	Exch.	High	Low	Last	Last Div.
COPPER					
Adventure	Boston			*80	
Ahmeek	Boston	62½	61½	61½	Mar. '20, Q .50
Alaska-B.C.	N. Y. Curb.	1½	1	1½	
Allouez	Boston	30	28½	28½	Mar. '19, 1.00
Anaconda	N. Y.	56½	54½	55½	Feb. '20, Q 1.00
Ariz. Com'l.	Boston	10½	10½	10½	Oct. '18, .50
Big Ledge	N. Y. Curb.	9½	8½	8½	
Bingham Mines	Boston	9	8½	8½	Sept. '19, Q .25
Calumet & Ariz.	Boston	59	58½	59	Mar. '20, Q 1.00
Calumet & Hecla	Boston	320	315	320	Dec. '19, Q 5.00
Can. Copper	N. Y. Curb.	1½	1½	1	
Centennial	Boston	12	12	12	Dec. '18, SA 1.00
Cerro de Pasco	N. Y.	43½	41½	42½	June '20, Q 1.00
Chief Consol.	Boston Curb	3½	3½	3½	Feb. '20, Q .10
Chile Cop.	N. Y.	16	15½	15½	
Chino	N. Y.	30½	28½	29½	Mar. '20, Q .37½
Columbus Rexall.	Salt Lake	*46½	*43	*46½	
Con. Ariz.	N. Y. Curb.	3½	3½	3½	Dec. '18, Q .05
Con. Copper M.	N. Y. Curb.	38½	37½	37½	Mar. '20, Q .50
Cop. Range	Boston	*42	*30	*38	
Crystal Cop. (new)	Boston Curb				
Davis-Daly	Boston	8½	8½	8½	Mar. '20, Q .25
East Butte	Boston	12½	12	12	Dec. '19, A .50
First Nat'l.	Boston Curb	*95	*90	*95	Feb. '19, SA .15
Franklin	Boston	2½	1	1½	
Gadsden Copper	N. Y. Curb.			*72	
Granby Consol.	N. Y.	36½	36½	36½	May '19, Q 1.25
Greene Can.	N. Y.	30½	27½	30½	Feb. '19, Q 1.50
Hancock	Boston			4½	
Houghton	Boston Curb			*50	
Howe Sound	N. Y. Curb.			3½	Apr. '20, Q .05
Inspiration Con.	N. Y.	52½	48½	48½	Apr. '20, Q 1.50
Iron Cap	Boston Curb	9½	8½	9½	Feb. '19, M .25
Isle Royale	Boston	30	30	30	Sept. '19, SA .50
Kennecott	N. Y.	26½	25½	25½	Mar. '20, Q .50
Keweenaw	Boston	1½	1½	1½	
Lake Copper	Boston	3½	3	3½	
La Salle	Boston	3	3	3	
Magma Chief	N. Y. Curb.			*21	
Magma Copper	N. Y. Curb.			29	Jan. '19, Q .50
Majestic	Boston Curb	*18	*18	*18	
Mason Valley	N. Y. Curb.			2½	
Mass. Con.	Boston	3½	3½	3½	Nov. '17, Q 1.00
Mayflower-O.C.	Boston	6	5	6	
Miami	N. Y.	20½	20	20½	May '20, Q .50
Michigan	Boston			4½	
Mohawk	Boston	62	61	61	Feb. '20, Q 1.50
Mother Lode (new)	N. Y. Curb.	5½	5½	5½	
Nev. Con.	N. Y.	12½	12½	12½	Mar. '20, Q .25
New Arcadian	Boston			2½	
New Baltic	Boston Curb			3	
New Cornelia	Boston	17	16½	16½	May '20, .25
Nixon Nev.	N. Y. Curb.			*9	
North Butte	Boston	17½	16½	16½	Oct. '18, Q .25
North Lake	Boston			*75	
Ohio Copper	N. Y. Curb.			1½	
Ojibway	Boston	2	1½	1½	
Old Dominion	Boston	25½	25	25½	Dec. '18, Q 1.00
Oscola	Boston	39½	37½	39	Mar. '20, Q .50
Phelps Dodge	Open Mar.	†195	†180		Apr. '20, Q 2.50
Quincy	Boston	50½	49	49	Mar. '20, Q 1.00
Ray Con.	N. Y.	16½	16½	16½	Mar. '20, Q .25
Ray Hercules	Boston Curb			*75	
St. Mary's M. L.	Boston	40½	39	39	Dec. '19, 2.00
Seneca	Boston	14	13½	13½	
Shannon	N. Y.	1	1	1	Nov. '17, Q .25
Shattuck, Ariz.	Boston	8½	8½	8½	Jan. '20, Q .25
South Lake	Boston			2½	
South Utah	Boston	*12	*12	*12	
Superior	Boston	5	5	5	Apr. '17, 1.00
Superior & Boston	Boston	4	3½	3½	
Tenn. C. & C.	N. Y.	10½	9½	9½	May '18, I 1.00
Tuolumne	Boston	*60	*60	*60	May '13, .10
United Verde Ex.	Boston Curb	31½	30½	31½	May '20, Q .50
Utah Con.	Boston	6½	6½	6½	Sept. '18, .25
Utah Copper	N. Y.	67	64½	65½	Mar. '20, Q 1.50
Utah M. & T.	Boston	1	1	1	Dec. '17, .30
Victoria	Boston			2½	
Winona	Boston			*40	
Wolverine	Boston	16	15½	15½	Jan. '20, Q .50
LEAD					
Hecla	N. Y. Curb.	4½	4	4½	June '20, Q .20
St. Joseph Lead	N. Y.	15½	15½	15½	June '20, QX .50
Stewart	Boston Curb	*18			Dec. '15, .05
Utah Apex	Boston	1½	1½	1½	Nov. '18, .25
ZINC					
Am. Z. L. & S.	N. Y.	14	14	14	May '17, 1.00
Am. Z. L. & S. pf.	N. Y.			45	May '20, Q 1.50
Butte C. & Z.	N. Y.	8	7½	7½	July, '18, I .50
Butte & Superior	N. Y.	22½	21½	21½	Sept. '17, 1.25
Con. Interst. Cal.	N. Y.	14	13½	13½	June '20, Q .50
New Jersey Z.	N. Y. Curb.	201	197	200	May '20, SA 4.00
Success	N. Y. Curb.	*5	*4	*5	July '16, .03
Yellow Pine	Los Angeles	1.02	1.02	1.02	June '20, Q .03

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

Stock	Exch.	High	Low	Last	Last Div.
GOLD					
Alaska Gold	N. Y.	1½	1½	1½	
Alaska Juneau	N. Y.	2½	2	2½	
Carson Hill	N. Y. Curb.	30½	30½	30½	
Cresson Gold	N. Y. Curb.			1	Mar. '20, Q .10
Dome Ex.	Toronto	*24½	*23	*23	
Dome Lake	Toronto	*5½	*5	*5	
Dome Mines	N. Y.	9½	9½	9½	Apr. '20, Q .25
Golden Cycle	Colo. Sprgs.	*75	*73	*73	May '20, Q .02
Goldfield Con.	N. Y. Curb.	*9½	*9	*9½	Dec. '19, .05
Hedley	Boston			4½	June '19, .10
Hollinger Con.	Toronto	5.70	5.55	5.70	Apr. '20, BM .05
Homestake	N. Y.			55	Sept. '19, .50
Kirkland Lake	Toronto	*49	*47	*47	
Lake Shore	Toronto	1.17	1.07	1.17	Oct. '19, .02½
McIntyre-Poreupine	Toronto	1.82	1.80	1.81	May '20, K .05
Porcupine Crown	Toronto	*28	*27	*27½	July '17, .03
Portland	Colo. Sprgs.	*60	*56	*60	Apr. '20, Q .01½
Reorgan. Booth	N. Y. Curb.	*6	*4½	*5½	May '19, .05
Silver Pick	N. Y. Curb.	*8	*6	*7	
Teck Hughes	Toronto	*9	*7½	*7½	
Tom Reed	Los Angeles	1.45	1.19	1.32	Dec. '19, .02
United Eastern	N. Y. Curb.	3½	2½	3	Apr. '20, Q .21
Vindicator Consol.	Colo. Sprgs.	*18	*18	*18	Jan. '20, Q .01
West Dome	Toronto	*7	*6½	*6½	
White Caps Min.	N. Y. Curb.	*12	*9	*11	
Yukon Gold	Boston Curb			1	June '18, .02½
SILVER					
Arizona Silver	Boston Curb	*57	*23	*26	Apr. '20, M .03
Beaver Con.	Toronto	*42½	*41	*41	May '20, K .03
Coniagas	Toronto		12.90		May '20, Q .25
Crown Reserve	Toronto	*22	*20	*20	Jan. '17, .05
Kerr Lake	Boston	3½	3½	3½	Sept. '19, 1.00
La Rose	Toronto			*33	Apr. '18, .02
McKinley-Dar.	N. Y. Curb.			*48	Apr. '20, Q .03
Mining Corp.	Toronto	1.90	1.90	1.90	Apr. '20, Q .12½
Nipissing	N. Y. Curb.	9	8½	8½	Apr. '20, Q .25
Ontario Silver	N. Y.	6½	6½	6½	Jan. '19, Q .50
Ophir Silver	N. Y. Curb.			1	Jan. '12, .10
Peterson Lake	Toronto	*12½	*12½	*12½	Jan. '17, .01½
Sil. King Ariz.	N. Y. Curb.	*42	*35	*38	
Temiskaming	Toronto	*34	*33	*33	Jan. '20, K .04
Trethewey	Toronto	*30	*28½	*29	Jan. '19, .05
GOLD AND SILVER					
Atlanta	N. Y. Curb.	*2	*1½	*2	
Barnes-King	Butte	†1.28		1.28	Nov. '19, Q .05
Bot. & Mont.	N. Y. Curb.	*70	*60	*61	
Cashboy	N. Y. Curb.	*6	*4½	*5	
El Salvador	N. Y. Curb.	2½	2	2½	
Jim Butler	N. Y. Curb.	*16	*13	*14	Aug. '18, SA .07
Jumbo Extension	N. Y. Curb.	*6	*5	*5½	June '16, .05
Louisiana Con.	N. Y. Curb.			1	
MacNamara M.	N. Y. Curb.			1	May '10, .02½
N.Y. Hond. Rosar	Open Mar.	†113	†112½		Apr. '20, Q .50
Tonopah-Belmont	N. Y. Curb.	1½	1½	1½	Jan. '20, Q .05
Tonopah-Divide	N. Y. Curb.	1½	1½	1½	
Tonopah Ex.	N. Y. Curb.	1½	1½	1½	Apr. '20, Q .05
Tonopah Mining	N. Y. Curb.	1½	1½	1½	Oct. '19, SA .15
West End Con.	N. Y. Curb.	1½	1½	1½	Dec. '19 SA .05
SILVER-LEAD					
Caledonia	N. Y. Curb.	*26	*23	*24	June, '20, M .01
Consol. M. & S.	Montreal	25½	25	25	Apr. '20, Q .62½
Daly-West	Boston	4½	4	4½	Apr. '20, Q .15
Eagle & Blue Bell	Boston Curb	2½	2½	2½	Apr. '20, Q .10
Electric Point	Spokane	38	32	32	May '20, SA .03
Fed. M. & S.	N. Y.	13½	13½	13½	Jan. '09, 1.50
Fed. M. & S. pf.	N. Y.	35	35	35	Mar. '20, Q .75
Florence Silver	Spokane			*45	Apr. '19, .01½
Iron Blossom	N. Y. Curb.			1	Apr. '20, Q .02½
Judge M. & S.	Salt Lake			4.00	
Marsh Mines	N. Y. Curb.	*14	*10	*10	
Prince Consol.	N. Y. Curb.	1	1	1	Nov. '17, .02½
Rambler-Cariboo	Spokane	*13	*12	*12½	Feb. '19, .01
Rex Con.	N. Y. Curb.	*7	*6½	*7	
South Hecla	Salt Lake			*90	
Stand. S. L.	N. Y. Curb.	1	1	1	Oct. '17, .05
Tamarack-Custer	Spokane	2.50	2.40	2.45	Dec. '19, K .03
Tintie Standard	Salt Lake	3.20	3.05	3.05	
Wilbert	N. Y. Curb.	*5	*4	*5	Nov. '17, .01
NICKEL-COPPER					
Internat'l Nickel	N. Y.	17½	17	17½	Mar. '19, .50
Internat'l Niek. pf.	N. Y.	82	82	82	May '20, Q 1.50
QUICKSILVER					
New Honda	Boston	6	5½	6	Jan. '19, .25
TUNGSTEN					
Mojave Tungsten	Boston Curb	*10	*10	*10	
VANADIUM					
Vanadium Corp.	N. Y.	87½	82½	84	Apr. '20, I 1.50
ASBESTOS					
Asbestos Corp.	Montreal	85	80	85	Apr. '20, Q 1.25
Asbestos Corp. pf.	Montreal	94	92	93½	Apr. '20, Q 1.50
MINING, SMELTING AND REFINING					
Am. S. & R.	N. Y.	60½	58½	58½	June '20, Q 1.00
Am. S. & R. pf.	N. Y.	91	89½	90	June '20, Q 1.75
Am. Sm. pf. A.	N. Y.	74½	74½	74½	Apr. '20, Q 1.50
U. S. Sm. R. & M.	N. Y.	58	56	57	Apr. '20, Q 1.50
U.S.S.R. & M. pf.	Boston	44	42½	43	Apr. '20, Q .87½

