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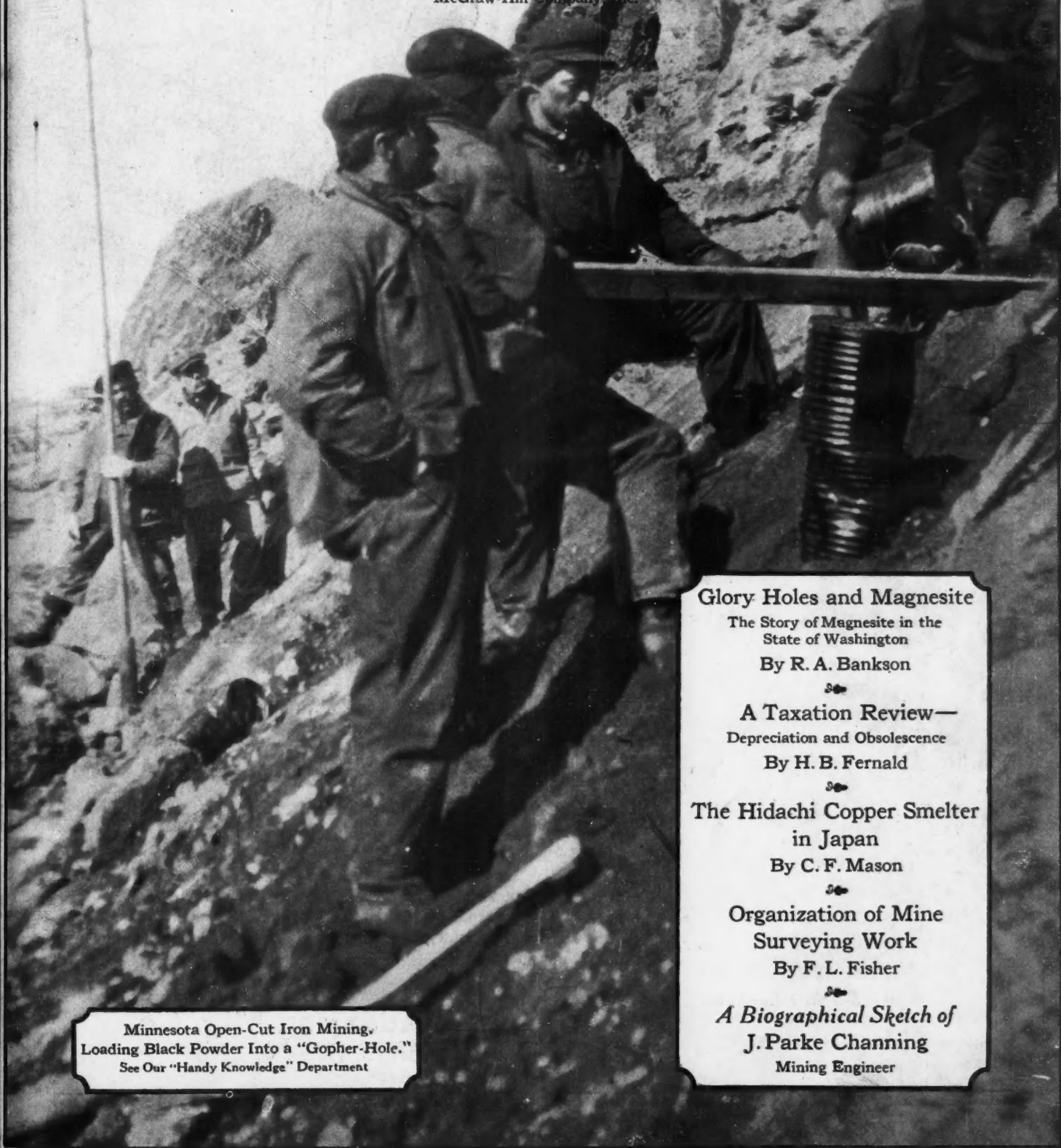
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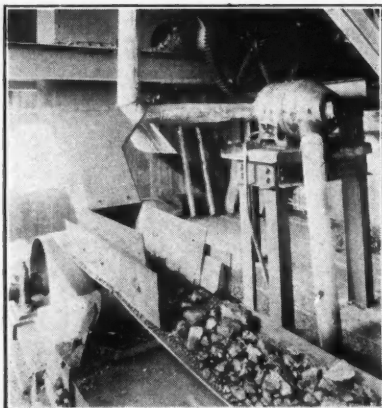
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Number 2

Why Is Copper a Luxury?

PROSPERITY among copper producers cannot be expected to follow a general resumption of business activity as quickly as would be the case if the large stocks of metal were absent. These have been but little reduced during the last year, if at all, and may even be sufficient to supply the 1921 demand without further production. Plainly, then, it is to the interest of copper producers to market these stocks as rapidly as possible, and something more radical must be done than sitting in an office and waiting for a buyer to come along. This fact has been realized and already steps have been taken to institute a selling campaign which will be more productive of results.

About a year ago some of the more important copper producers and brass manufacturers formed an organization called the Copper and Brass Research Committee to investigate trade conditions. This committee has recently published a series of reports in which the reasons for the slump in copper are enumerated. Our readers are generally familiar with what these reasons are: Mainly, the general slump in business, especially in the automobile trade, and the unloading of Government stocks of copper, brass and scrap. But it is to another reason, minor and yet fundamentally important to copper men, that we wish to call attention. The use of substitutes, inspired by war necessity, has outlived war conditions. It is pointed out that the tendency is constantly increasing to use cheaper and less efficient metals than copper and its alloys for plumbing and roofing supplies; for screws, nuts, hinges, bolts, screens and kitchen utensils; in automobiles and the manufacture of pins. To counteract this tendency the committee advocates an extensive advertising campaign similar to the successful publicity work which has been carried on by the zinc and nickel producers during the last year. The sales of Monel metal have been tripled by eight months of advertising, and it is thought that the copper industry can be aided by the same means. To have a more efficient organization for the furtherance of the copper producers' interest, a Copper and Brass Institute is likely to be formed during the coming year.

We are strongly in favor of this campaign and wish those behind it the utmost success. However, we believe that a fundamental objection to the use of copper must be removed before sales can be increased to any extent by publicity methods; an objection which seems to us highly important and yet which seems to have been overlooked. That is, the seemingly extortionate prices charged for copper products. No matter how enthusiastic a home builder may be, about, let us say, copper screens, his enthusiasm will quickly be cooled and his animosity aroused when he finds that copper screens sell for 15c. a square foot compared with 4c. for iron and 4½c. for galvanized iron. Now a square foot of copper

screening will certainly not contain more than a few ounces of copper and the difference in intrinsic value of the metal content in the two kinds of screening will probably not exceed one or at the most two cents. Why should not copper screens sell for 5 or 6c. per square foot instead of 15? It is difficult to see how the manufacturing cost can be so much greater; in fact, were we given a block of iron and a chunk of copper and told to make one of them into a wire screen our natural dislike for unnecessary hard work would prompt us to choose the copper. Prospective customers will want reasonable prices, and if it is impossible to lower prices the first function of an advertising campaign should be to justify present quotations, for this is the stumbling block. The American people are no longer in a frame of mind to pay what they consider to be profiteering prices.

Nor are screens the only example. The same apparently ridiculous price differential exists in other copper and brass manufactures. "What," we asked our plumber, "is the difference in price between a 30-gal. hot-water tank made of copper and of galvanized iron?" "Well, there's *some* difference. Copper tanks are so expensive we don't try to sell them and advise customers against them. A galvanized iron tank will cost about \$13 and a copper tank about \$40." The difference in value of metal in the two is five or six dollars. Again, why?

Why are copper sheets now quoted at 10c. per pound more than copper metal, whereas in July, 1914, the differential was 5½c.? Is this differential to be permanent or is it temporary, caused by high-cost stocks of raw material and high wages?

The advantages of copper over its substitutes are many. The reason why the substitutes have been used is obvious. Before advertising the glories of copper to a discerning public, some work needs to be done either among the manufacturers, wholesalers or retailers of copper products. This, if successful, should be followed by advertising, emphasizing the fact that copper and brass are not only beautiful and more efficient than substitutes but that our idea that they are luxuries is all wrong.

The Duration of the Pittman Act

THERE is considerable doubt in some quarters as to the length of time during which the Pittman Act is likely to operate, judging from inquiries we have received and the conflicting estimates ranging from three and a half to six years, that have been made by the press. The *Wall Street Journal* early in December stated that "They [the silver miners] will have a steady market for their output for the next six years, at the fixed rate of \$1 per ounce, the Government taking as much as they can produce." This estimate was evidently based on the erroneous assumption in the statement that

some 355,915,083 silver *dollars* were melted under the Pittman Act and that silver production is at the rate of 56,000,000 *ounces* per year.

The actual situation is stated simply and clearly in the Annual Report of the Director of the Mint, for the fiscal year 1920, who informs us that a total of 270,121,554 *dollars* was melted under the Pittman Act, the metal being either shipped to India or used in the United States as subsidiary silver coinage. "The act provides for the repurchase of the same quantity as contained in the *dollars* melted, about 208,000,000 *ounces*, fine." This figure is quite out of line with the *Wall Street Journal's* estimate, but in substantial agreement with the text of the telegram of the Secretary of the Treasury to the *Engineering and Mining Journal* last June, wherein the amount of silver to be repurchased was stated as 207,000,000 *ounces*. The *Wall Street Journal* has evidently confused *dollars* and *ounces* in making its estimate.

During the first six months' operation of the silver repurchases about 23,000,000 fine *ounces* was bought by the Government. At this rate, 46,000,000 *ounces* annually, it would take about 4½ years to complete the purchases. This estimate does not take into consideration a possible decline in silver production due to the curtailment in the copper and lead industries and the decline in production in important silver-mining camps, conditions which would tend to lengthen the period.

We are glad to note that the Director of the Mint in his able report emphasizes the fact that "while the Government will neither gain nor lose on the sale and repurchase of the silver, the producer of the domestic silver gets the benefit of the fixed price mentioned above when the market price goes below that point, thus tending to stabilize domestic production." On the face of it, it may appear to the uninformed that the silver producer is being favored and that ill-advised legislation is compelling the Government to purchase silver at \$1 when it can be readily obtained at 60c. Possibly other industries less fortunate than silver mining in this period of readjustment will point to the favorable position of the American silver producer and demand similar legislation. Opponents of the Pittman Act may raise the cry "class legislation."

The absurd and fallacious arguments that are usually advanced are readily disproved by anyone familiar with the unique history of the Pittman Act, its eminent fairness—with equivalent sales and purchase prices—and its remarkable stabilizing features. The Pittman Act stands by itself and most emphatically does not deserve being branded with the stigma of class legislation. The *Engineering and Mining Journal* has frequently pointed out why silver merited different consideration than other commodities used in the prosecution of the war, and one of the chief reasons bears frequent repetition: When the United States Government by means of the Pittman Act released 208,000,000 *ounces* of silver it threw upon the market the equivalent of the world's production for one year. In no other essential or unessential commodity did any government follow a similar procedure, as there was neither the means nor the incentive for accumulating such a tremendous stock of one material—whether copper or other commodity. Dumping great quantities of any material on the market in an industry would seriously disorganize it. That these silver stocks should be taken up again and the ordinary law of supply and demand then be allowed to function is but fair to the miner.

The Federated Malay States government has undertaken to purchase at a fixed price its own domestic tin production in the hope of subsequently selling the metal in a better market and tiding the tin producer over a depressed market. This is another method of stabilization, but its effect is highly problematical; in fact, of somewhat doubtful benefit in the long run. The Pittman Act of the United States does for the American silver market what is purely figurative for the Malay tin market, and unquestionably stabilizes the silver-mining industry—to say nothing of assisting lead and copper producers in reducing their costs through byproduct silver recovery, and cushioning an over-sharp readjustment.

To forestall any attempt to repeal the Pittman Act it will be well for the mining industry to be on its guard and for each and every silver producer to see that his Congressional representative is fully acquainted with the facts surrounding the repurchase of silver at \$1 an ounce, so that prompt and vigorous action may be taken at Washington to quell any ill-advised and uncalled for movement for repeal.

The Interpretation of Geology

GEOLOGY is a wonderful science. We have seen it in our time, or since a little earlier than our time, first anathemized on account of its honest explorations into facts, as the enemy and opponent of religion, and later developing into one of the cornerstones of a new and far sweeter religion. We have seen the science reaching back, through its groping researches into molten magmas—beginning with volcanoes, then intrusive rocks at greater depths, as now exposed by erosion, and so on down to the deep or plutonic rocks, in which we see evidence of swirling currents, curdling, and that affinity of like for like which produces segregated minerals and the splitting of magmas into secondary magmas of different kinds. We have seen it, leagued with zoology and botany, explore back into changing animate life, trace out the leisurely process of evolution, and so back, not to where life began, but where the darkness of the erased records closes in on us. We have seen the science decipher the miraculous story of the ice age, explain our soils and the very pebbles and boulders in our soils, and so form the basis of farm and forest surveys and classifications. We have seen it explain our hills and our plains, our city terraces fit for residences, our harbor channels fit for shipping. We have seen it trace out our stones for building, our clays for brick; and those wonderful accumulations of metals we call ore deposits. In doing this last and the other things which we have already referred to, it has proved itself an essential of industry, and the first and most necessary foundation stone of intelligent mining.

Again, our reflective thought has been in the last few years turned to the influence of geology, more acutely the geologic distribution and occurrence of ores, on human history, on commerce and politics; and it has been detected as a cause for coalitions, treaties, migrations, culture, and wars of conquest or defense. We are on our way in all these things.

There is one aspect of geology that remains undeveloped—namely, the literary value of geology, or what we may call the poetry of geology. Geology is a science that is an exposition essential for the understanding of religion, of industry, of commerce, of politics, of

the nature of God and of man: and how far has it taught humanity? What part does it take in our general education and culture? Nearly every child in the world is still taught that God made the world in six days and rested on the seventh, and not one individual out of a thousand, child or adult, knows even what geology is, let alone an understanding of its simplest truths.

There is a certain new "best seller," a novel called "Main Street." It is interesting but very trite: it is the view of life that you get through the eye of a fly, and pitifully narrow for a human being. It is hailed as a wonderful book, as the most important book of the year, by prominent literati. Now the fact is that this poor little book, and the poor little author of the book, and the poor little critics who applaud it, have the limited world and vision of the geese in the barnyard, and the barnyard gates are their horizon, and so the emotions and experiences of Mrs. Hen are very important. These seekers after thought and culture, with their literature, art, sociology, and Bohemian and Bolshevistic groups, are painfully myopic, and it is no wonder they resort to any morbidity or eccentricity to get out of the groove of their little circle. Take them up into a mountain and show them the stars; transport them to the depths of the earth, and let them see the secrets of eternity; and they shall lose interest in Chinese lanterns and salad dressings, and theories of communism, labor and privation discussed in fat luxury, as the means of culture and progress.

What we need next, then, is the literary geologist, who shall translate the wonders and poetry of the world's history into the vernacular, and let the hungry crowd see a solid substantial picture of the workings of the Infinite. In literature we remember only one outstanding union of geology and poetry, and that is a few verses in Tennyson's "In Memoriam." But in general, when it comes to interpretation of the mysteries, geologists are poor fish. They are bad business men; as the current phrase goes, they have absolutely failed to "sell the idea." They are pedantic and longwinded, full of strange terms to hide what thoughts they may have from the uninitiated; and the result is that they walk in a walled aisle, as secure from public notice as the devotees of Esperanto.

The truths of geology, or the lessons of the rocks, are perhaps the first things that should be imparted, in a scientific scheme of education; and this should be followed by elementary geography. This is the natural preliminary to a consideration of other studies of concrete or historical truths, such as the stories of animals and plants, which should follow. Then would naturally come man; and his physiology; next his history sketched from the earliest geologic record down to the present; next a sketch of his sociology; his forms of government. Next should come mathematics and physics and chemistry; and last of all the elements of grammar and philology, art and literature. Correct speaking of English, and such foreign tongues as may be, should be learned by imitation in early childhood; and the art of reading and the practice of simple arithmetic should accompany the first tales, which will be the primary lessons in rocks, animals, and plants.

Yet we find that this natural rock foundation of education and culture is floating high above it, in the air: geology is not taught at all anywhere below the colleges and not adequately there; and nowhere as a

fundamental branch of knowledge requisite to education.

Therefore, we repeat, we need still another type of geologist—the interpreter and translator. It is most natural, perhaps, that these should come from the ranks of teachers, where indeed this quality is most needed, but is conspicuously scarce. Probably Shaler in our day has been most successful in this, as Hugh Miller and Lyell were in a former generation. The other natural sciences have not been lacking in these interpreters. Conspicuous are wonder-books like Maeterlinck's, "The Bee," and Fabre's "The Spider." Who will write the epic of the subterranean forces?

The Efficiency of Geologist Versus Engineer

THOSE who remember the wonderful organization and attention to detail that characterized the last meeting of the American Institute of Mining and Metallurgical Engineers in the Lake Superior country, and who also attended the annual meeting of the Geological Society of America which was held in Chicago last week, cannot fail to have been struck with the contrast from the point of efficient management or organization. Scarcely any attention, in the latter case, was paid to the arrangement of details for the visiting geologists. Meetings were held in lecture rooms of the University of Chicago, and headquarters were established at the Chicago Beach Hotel, a mile and a half away, with no regular means of communication. The Chicago Beach Hotel is several miles out of the city. With these elementary details stated, visitors shifted for themselves. It is a credit to the hardiness of the geologists that under the circumstances so many of them finally remained for the meetings, but one could not help suspecting that if the weaker ones who must have been lost on the way were added, the attendance would have been considerably swelled. If any specific arrangements, accommodations, facilities, suggestions, or guides were provided except the bare designation of the meeting halls and the headquarters hotel, they did not reach the notice of most of those present.

These things would not be worth mentioning except that the contrast of this vagueness with the precision of the Institute meeting reveals the essential difference in efficiency between the academic type of geologist which is predominantly represented by the Geological Society of America, and the engineer. The academic life and seclusion begets vagueness, absent-mindedness, and what under the circumstances may be a wholesome disregard for time and place as compared with the development of reflective thought. "What was it" sighed the German professor, "that I wanted to remember to do today? I have been trying to recall it all the morning. Ah yes—I made a note to commit suicide today!"

The engineer is a scientist who applies his science to practical problems. The geologist who does this—the economic geologist—becomes an engineer, a geological engineer. In his work and methods there must develop the accuracy, the practical wide-awakeness, the thoroughness of attention to organization and detail, which is bred in all engineers, civil, mechanical, or mining. Not only is this engineering habit of mind thus exhibited in mode of life, but is reflected back on the geological work, which thus becomes sharper, more detailed, more concise, less imaginative, more cautious in the absence of sufficient evidence, more bold in the presence of adequate data leading logically to a certain conclusion.

WHAT OTHERS THINK

Further Thoughts on Slag Losses

May I be privileged to comment in your journal on the very interesting article recently published by Mr. Frank E. Lathe, on copper losses in slags? Mr. Lathe objects to the use of the silver nitrate method of determining suspended globules in slag on the following basis:

1. "That silver nitrate does usually dissolve copper sulphides, but not in all conditions."

Does Mr. Lathe refer to fused sulphide or to unfused minerals? *After fusion*, copper and iron sulphides tend to form a fairly uniform series of combinations ranging from low-grade matte to white metal containing dissolved metallic copper; but on cooling separate into two usual constituents, an iron sulphide saturated with copper sulphide, and a copper sulphide saturated with either iron sulphide or metallic copper. The solubility of copper sulphide in iron sulphide *at solidification* is low, so that the amount of copper dissolved and obviously insoluble in silver nitrate solution is usually negligible in dealing with small total amounts of copper in slags.

The second part of solidified matter is readily dissolved by silver nitrate. The insolubility of certain forms of *mineral* sulphides when dealing with *fused* materials is not a matter of much import.

2. "That the assumption that copper sulphide dissolved in the molten condition will not be attacked is not justified, as such sulphide would probably not be equally soluble in the solid slag, and might therefore be found in the latter as small sulphide particles readily soluble."

Does not Mr. Lathe here postulate relatively complete segregation and crystallization? It is my impression that the usual laboratory sample is chilled in taking, crystallization greatly increasing the difficulty of grinding and dissolving samples for analysis.

Moreover, inasmuch as the largest *individual* crystal (I do not here refer to segregated groups) may be micrometrically determined to be about the order of magnitude of 1/1,000 to 1/10,000 inch, the even smaller sulphide particles which might separate on cooling would probably be so minute as not to be freed by grinding to 100 or 200 mesh.

3. "That cupric oxide is slightly attacked by silver nitrate," and

4. "That cuprous oxide is readily attacked, though it does not seem to be completely soluble."

Later in his article Mr. Lathe says ". . . that copper oxide need not be expected in slags as a separate constituent. . . ."

Is it meant, then, that dilute neutral silver solution attacks the body of the slag and dissolves its oxide copper, or is Mr. Lathe referring to chemical or mineral oxides in a relatively pure form?

In this connection I would like to quote from my original publication in your journal of May 10, 1919:

"It should be understood that the method involves *no conclusions* as to the *chemical form* of suspended copper, but is an empirical method for determining between the two *physical forms* of suspended and dissolved copper."

5. "That the presence of metallic iron is not detrimental except in consuming more of the reagent."

My experience has been that a neutral silver nitrate solution, when exposed to the action of metallic iron, forms in a short time a precipitate of ferric hydrate which is at least a potential source of copper loss. This could only be redissolved by the use of acids, forming ferric salts capable of dissolving copper forms with considerable ease.

Further, Mr. Lathe bases his rejection largely on evidence as obtained by a modification of the sulphur-dioxide method for oxide copper. I do not intend at this time to enter into a criticism of this method, though a number of my acquaintances have been unable to convince themselves that it is quite all that is claimed. I must suggest, however, that anyone who has been assuming that metallic iron is harmless in this method, try the following simple experiment: To a test tube half full of water add a few drops of copper-sulphate solution, and insert a small clean piece of iron wire. Now pass in sulphur-dioxide gas, and in a very brief period of time a precipitate of *copper sulphide* is formed. (This obscure reaction has been pointed out to me by Mr. Van Arsdale, and, so far as I know, is not usually to be found in textbooks.)

Finally, in respect to analysis, may I ask why Mr. Lathe ". . . although in experiments on this material precautions had to be taken to avoid oxidation by air during filtration . . ." failed to remove magnetite crystals from his slag samples? I think some of your readers who are interested in the wet metallurgy of copper will bear me out in the statement that sulphur dioxide does not always reduce ferric iron with great rapidity, and that it is perfectly possible to have sulphur dioxide and ferric iron in the same solution.

Calculation of gold-copper ratios is at best unsatisfactory, because the very small amount of precious metal present does not permit determinations of great percentage accuracy. Moreover, one can never be sure, inasmuch as matte seems to be at least in some degree attacked by slag constituents, that one is justified in assuming no gain or loss to suspended pellets after leaving the body of the matte.

Mr. Lathe states that metallic copper usually is not found in converter slags in quantities except when overblown. He is right as to the fact, which is at least partly due to the solubility of metallics in the sulphide phase. It is my impression, however, that metallurgists usually consider metallic copper to be an intermediate stage of oxidation between the sulphide and oxide, and is it not rather curious that the matte containing little or no oxide should be a source of oxide copper in the slag without leaving considerable amounts of the intermediate state (copper) which is most assuredly the stable form under the conditions mentioned?

To any one who doubts the preponderating form of copper in converter slags to be sulphide saturated with metallic, I respectfully recommend a peek through the microscope.

CHARLES G. MAIER.

Maplewood, N. J.

Glory Holes and Magnesite

An Untechnical Account of the Situation in That Mineral—Three Operating Companies in Stevens County, Wash., Supply the Demand of the United States for Dead-Burned Magnesite, in Competition With Imports From Austria From Deposits Owned by One of the Companies

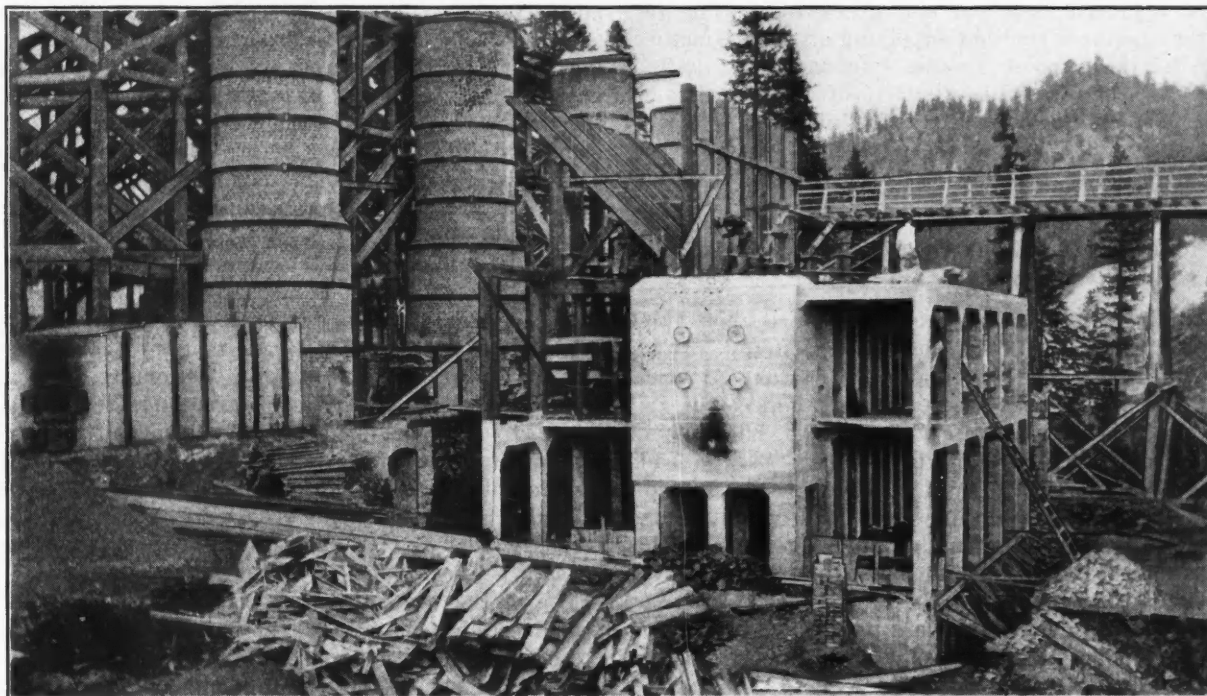
BY RUSSELL ARDEN BANKSON

Written for *Engineering and Mining Journal*

"A GLORY HOLE," a mining engineer once told me, referring to a certain well-known property, "made it possible for us to cut the cost of production in half, and thus continue operations." "And what," I asked, "is a glory hole?" "Think of an ice-cream cone made out of a mountain," was his answer, "and you have a good idea of a glory hole. It is simply a cone-shaped hole cut from the outcrop down to a tunnel beneath. The small end of the funnel touches the underground working. The ore is mined from the sides of the open funnel and dropped downward, where it is

"ferromagnesite," and refractory magnesite, or simply as magnesia. In this form it is ready for the trade.

"Dead-burned magnesite is an important refractory, its principal application being in the basic open-hearth steel furnace, although it is used in the metallurgy of copper, lead, and nickel. The hearth of the steel furnace is usually built of magnesia brick with dead-burned grain magnesite spread over it to a thickness of from twelve to eighteen inches, at the center of the furnace. Magnesite brick is also used for the bridge-work of the furnace. Magnesite enters into the production of oxy-



KILNS CONSTRUCTED FOR MANUFACTURE OF PLASTIC MAGNESITE

discharged into cars and transported to the crushers, a system which reduces the process of mining."

As it happened, almost the first words I heard when I arrived at the magnesite mines referred to a glory hole. I was informed, however, and discussed the economy resulting from the use of glory holes with intelligence. "What is magnesite?" I asked. That was a fair question, and I received my answer in technical terms something like this: "Magnesite occurs in two forms, the amorphous and the crystalline. Both forms are magnesium carbonate. The raw mineral contains from 90 to 95 per cent of magnesium carbonate, the remainder being calcium carbonate, silica, alumina, ferrous oxide and sometimes a trace of manganese carbonate. The mineral, calcined to a temperature ranging from 1,450 to 1,500 deg. C., and for a sufficient time, loses its carbon dioxide gas, the resultant material being known as dead-burned magnesite, sintered magnesite,

chloride, or sorel cement, from which exterior stucco, flooring, and other structural materials are made; fire-proof paint; carbon-dioxide gas; metallic magnesium; magnesium chloride; magnesium sulphate; basic carbonate of magnesia. It is used as a heat insulator for boilers, pipes, and similar articles; as a toilet preparation; with wood pulp for the sulphite process in paper making, and in the making of other minor products."

There are but two important places in the United States where this mineral is found. The deposits of amorphous magnesite in California are difficult to mine and are not especially suited for the refractory trade. Their product supplies the miscellaneous uses, leaving the Washington deposits of crystalline magnesite to meet the demands of the refractory industry in the United States. These deposits of crystalline magnesite are found in a range of hills in Stevens County, in the northeastern part of Washington, fifty to seventy miles north

of Spokane and eight to fifteen miles west of Valley and Chewelah.

Prior to the war practically all the magnesite consumed by the steel industry of the United States came from the magnesite mines of Austria, being mined, shipped as ballast, and laid down on the American seaboard at from \$15 to \$18 per ton. The war stopped this supply, and a hasty scramble for this essential mineral started. A world survey showed seven known magnesite localities. Four of these were eliminated at the outset, because of their location, and two of the remaining three did not supply magnesite suitable for refractory purposes. The seven localities considered were: Austria, having extensive, high-grade deposits, largely American owned and operated, but eliminated because of the war; Greece, Island of Eubœa, seized early in the war by England, to protect her own refractory interests, eliminated for the United States; Manchuria, possessing extensive deposits, American and Japanese owned, little operated, and inaccessible during the war; Venezuela, where there are extensive deposits, American owned, inaccessible during the later part of the war; California deposits, operated as a war emergency for a time for refractory requirements but supplying an unsatisfactory product for this purpose; Quebec, Canada, having limited deposits in the Grenville district, of inferior grade, worked to some extent by American interests, as a war emergency; and Washington, Stevens County, where there were large deposits, of high-grade crystalline magnesite, undeveloped.

GEOLOGICAL REPORT BASIS OF AMERICAN MAGNESITE INDUSTRY

With the results of this survey before them, the refractory interests turned their attention toward the magnesite deposits of Washington at the time America entered the war. They were directed there by F. M. Handy, of Washington State College, who, knowing of a report, made many years before, by Solon Shedd, geologist at State College, and in which the deposits of Stevens County were definitely described as crystalline magnesite, made an exhaustive investigation of the deposits, hurried East, and soon had interested capital for their exploitation.

Two operating companies were promptly in the field. They were followed by numbers of less-important producers. From \$18 per ton for the Austrian magnesite, the price began to soar as the demand grew. The price reached \$50 per ton, \$75, \$100, and on until a maximum price of \$160 was being paid for the dead-burned ore. Men who had no capital, no knowledge of magnesite, rushed into the hills and began to mine the rock. They hauled it away in wagons, carts, auto trucks—in any way to get it out. They burned it in crude furnaces of their own construction. They paid a premium to kiln owners to burn it for them. They were soon supplying the needs of the United States with from 10,000 to 12,000 tons of dead-burned magnesite a month.

On the day the armistice was signed, Nov. 11, 1918, the price of refractory magnesite dropped, and did not stop until it was cut in half. The day before, it was worth \$160 per ton to any user. The day after hostilities ceased it was worth exactly \$80 per ton. Three-fourths of the small magnesite producers stopped. The price slumped further, and those remaining quit. There was, however, a normal demand of from 10,000 to 12,000 tons of dead-burned magnesite per month. The

first two producing companies organized, one with headquarters at Chewelah and the other with headquarters at Valley, having already invested several million dollars in their plants and in opening their quarries, determined to remain in the field and supply this demand.

In my visit to the magnesite district of Washington, I found that six mines and prospects were being operated for commercial purposes by three well-organized companies, a third company having entered the field since the signing of the armistice. I learned, also, that two of these companies were in competition with the third, the newcomer, on the alleged premise that it was operating as a bluff, and in reality was seeking to discredit the magnesite deposits of Washington, and the United States, to prevent Congress from passing a protective tariff upon magnesite, a life and death matter for its interests. The whole situation hinges on whether cheaply mined, foreign magnesite, especially the American-owned product of Austria, will replace the Washington magnesite, when conditions become settled, and thus relegate to the junk pile several millions of dollars' worth of equipment in Washington and make the deposits temporarily worthless. The executives, mining engineers, and magnesite experts of two of the operating companies declare that the entrance of the foreign product will close them up within a few months unless the protective tariff is authorized by Congress. This cannot possibly take place before 1921 is well advanced. The third company insists that there is no possibility of such a thing happening, because it owns the Austrian mines, and knows.

The controversy is not warfare between local competitive companies. It is not a fight between men over their private interests. It is a struggle to determine whether an existing American industry should jeopardize its future in extending a welcoming hand to a similar industry, American owned, on foreign soil. I found no bitter feelings between the heads of the various companies. They are friendly, but they are determined to hold out for respective principles which each believes is right: encouragement of Americans in developing foreign industries, or protection of American domestic industry.

The market for refractory magnesite is limited. All the advertising space in all the papers and magazines of the country could not make it any larger. There is no competition among the existing companies for business. The present demand is just about equal to their combined output. On the other hand, all the concerns using refractory magnesite must purchase it from one of two sources, either Washington or Austria. It is to the consumer's best interests to purchase refractory magnesite where he can secure it the cheapest. That is the weak link in the chain. Which source will offer the cheapest magnesite in the future?

The three operating companies in Washington are: The American Mineral Production Co., with general offices in Chicago and administrative offices and laboratories at Valley, Wash., near the mines. Howard F. Wierum, of New York, is general executive manager of the company. The company owns a six-mile standard-gauge railroad running from Valley up to its mine, the Allen and Moss claims, extensively worked, with about a million tons of magnesite developed, a crusher plant, new kiln, and full equipment for a maximum capacity of 500 tons of crude magnesite a day. This company also owns the Red Marble claim, several miles south,

which has been explored but not extensively worked. The company came into existence through the efforts of Major H. H. Brunt, of the British army, in response to the war emergency. It has 4,500 stockholders, who will lose practically everything they invested should the magnesite mines be forced to close down.

The Northwest Magnesite Co., with general offices in San Francisco and administrative offices at Chewelah. Roy Bishop, of San Francisco, vice-president and general executive manager, maintains headquarters at Chewelah. This company owns a million-dollar dead-burning plant at Chewelah, the largest plant in the United States exclusively for burning magnesite; the Finch mine, the most extensively operated in the Magnesite Hills and containing a million tons; the Keystone and Midnight claims, a few miles south, not yet developed; a five-mile wire-rope tram from the Finch mine to the dead-burning plant; and general equipment which gives it a present capacity of 600 tons of crude magnesite, or 300 tons of the finished product, per day. The company is a close corporation backed by the Crocker National Bank and the Crocker interests, of San Francisco, and R. S. Talbot, of Spokane, Wash.

The American Refractories Co., with general offices in Pittsburgh, Pa., and Western offices at Chewelah, Wash., where A. F. Greaves-Walker, of New York, magnesite expert of the company, is in active charge. This company is the owner and operator of the extensive magnesite deposits of Austria, and ventured into the Washington field after the signing of the armistice. It has taken leases on two extensive magnesite claims, and options on a site for a dead-burning plant at Valley and a right of way for a tram line from the mines to the terminal site, a distance of thirteen miles. The company has erected kilns at its claims and is burning and shipping 1,200 tons of burned magnesite per month to its dead-burning plant at Harper, Ohio, where it is prepared for the trade. This company is a close corporation, and through its officers and directors is closely allied with the United States Steel Corporation and numerous other powerful interests.

The American Mineral Production Co. and the Northwest Magnesite Co. have no magnesite interests other than the Washington deposits, upon which they depend for existence.

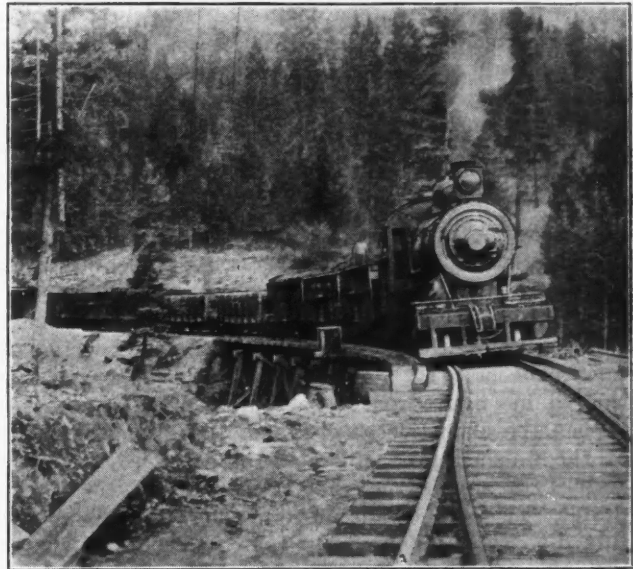
RESUMPTION OF FOREIGN SUPPLY

Soon after the signing of the armistice, small shipments of magnesite began to arrive from Austria, imported by the American Refractories Co. Immediately, the two operating companies in this country took warning, and asked Congress to place a tariff of \$15 per ton on foreign magnesite. At this move, the American Refractories Co., which had been operating in Washington only a short time, and which has its heaviest interests in Austria, immediately went before the Senate Finance Committee and protested vigorously against the passage of tariff restrictions. The Senate Finance Committee reported the bill out, but when Congress adjourned in May, 1920, it had failed to act on the measure, and it is still dormant.

Riding up to the mines of the American Mineral Production Co., in the caboose tower of the company's train, I asked Mr. Wierum what his company was going to do if the tariff was not passed. "We have existing contracts which run for some time," he answered. "After that, without a tariff—" He paused, glanced out of the tower of the slowly moving train, over across the

green valley to the east. "Well, after that the whole works will be junk. The Austrian magnesite will flood the market, at a much cheaper price than we can produce it, and we will be out."

Later, I was talking with Mr. Greaves-Walker, of the Refractories company. "What about the magnesite tariff? Will you close up your tentative operations here and turn your full attention to your extensive Austrian properties if the tariff fails of passage?" I asked him. "Not at all," he answered. "We are here to find magnesite in sufficient quantities to supply our American trade, regardless of our Austrian mines. Under the present unsettled condition in Europe it costs us more to lay Austrian magnesite down to our customers in the United States than it does to mine it here with expensive American labor, haul it thirteen miles in auto trucks over mountain roads, and ship it across the continent to our customers. We are here to find a claim with a million tons of magnesite, and, when we do that, we



LOADING OUT MAGNESITE FROM QUARRIES

are ready to spend a million dollars at once in the development of it. We will then erect a dead-burning plant here, construct our trams, and develop the property to capacity."

"Why, then, did you, as representative of your company, go before the Senate Finance Committee, when it was debating the proposed tariff on magnesite, and fight against its adoption?" was my next question. "Was that because you wished to ship increased amounts of magnesite from Austria?"

"My interests are fighting a tariff because it is absurd at this time to consider a tariff. The other two operating refractory companies of this country insisted on a tariff when the magnesite of Washington is in no danger for at least two years, as Europe is in no position to supply the trade for that length of time, owing to the unsettled conditions. We are now paying the European laborers in food and clothing which we are buying in the United States at prohibitive prices, and which bring the cost of the Austrian magnesite much higher than that mined out here. Because of that fact, there is no need for a tariff at this time. At the end of two years, if the American industry is threatened, because of improved conditions in Europe, it will then be more than a hypothetical question to Congress to ask

for a tariff on magnesite. It will then be a concrete condition to submit. The Washington mines are getting more business and making more money than ever before in their history, yet these same interests seek a tariff to protect their already safe industry. While we have spent \$3,000,000 in Austria, we will spend another million here, regardless of the former investment.

"Figures which I submitted to Congress show that approximately 80 per cent of the magnesite deposits of the world are controlled by Americans. Newspapers, magazines, banks and big business constantly urge Americans to go out into the world and grab trade for America, as the Englishman has done for England. Then when Americans do go out an immediate effort is made to put them out of business by placing a tariff against their imports, which at the same time means much more exporting from the United States.

"Our company was the first to go outside the United States for magnesite. Germany had all the available deposits in Austria and was supplying the needs of the United States refractory plants, on yearly contracts. Each year she was boosting the prices to the United States consumers, until they became prohibitive. Then our company went into Austria, opened up deposits, and began to ship, with the result that by 1908-09, through competition, we had beaten the German prices down to a reasonable figure."

INCREASING IMPORTS OF MAGNESITE

Mr. Wierum had another version of the matter in support of his stand.

"That was all brought to the attention of the Senate Finance Committee at the time it was considering the tariff," he stated. Digging into a pile of reports he showed me figures on recent shipments of magnesite. "When the armistice was signed, 12,000 tons a month of the finished product was being shipped from this district to supply the normal demand of the United States," he pointed out. "At present, shipments from this district are only 8,000 tons per month, whereas the Austrian product has crept up to 4,000 tons per month. Does that look as though we were safe for two years to come? Before the war Austrian magnesite was delivered at Baltimore at \$15 per ton. From this district to the eastern market the freight charges alone are \$16 per ton. We are only asking that a tariff of \$15 a ton be placed on foreign magnesite, to somewhat offset our freight costs, not taking into consideration the fact that it is costing from \$21.50 to \$25 per ton to manufacture our material. Our figures show that the Austrian magnesite now is being laid down in the United States at about \$21 per ton, which, even with the tariff, gives the Austrian mineral the advantage."

"What will become of the claims of the five thousand stockholders of your company if the American magnesite ceases to be of commercial value?" I questioned.

"There is one small hope left. That is the plastic trade. Wait until we go up to the mine and I will show you something."

At the mine I found a scene of activity. Dominating its surroundings was a large, specially designed kiln, practically complete, but yet to be "blown in." "That," he said, "may be our salvation." "It looks like all the other kilns I've seen," I replied. "But it isn't. That kiln is costing this company a considerable sum of money, but we are taking the gambler's chance that it will make us more money. In our laboratories at Valley we have made, during the last year, hundreds of tests

upon magnesite—more tests than were ever before made anywhere upon this mineral. The result is that we have discovered the process by which the best grade of plastic magnesite can be developed from the Washington mineral. This necessitated the construction of a specially designed kiln, which will burn the magnesite only to a certain extent.

"There is a growing demand for plastic magnesite, which we hope eventually will consume the capacity output of our plant, making us independent of the refractory trade.

"Available data show that at present there is a consumption of 100 tons of plastic magnesite per day in the United States, and that the demand is growing steadily as the superior qualities of this product become better understood by the building trades. We have reason to anticipate that in a few months the demand will reach 200 tons per day, and that it will keep on climbing. Plastic magnesite cannot be altered by heat, except at temperatures beyond the ordinary requirements, and it is not affected by water, air, or light, and will not expand or contract. A footboard an inch thick, coated with an inch of plastic magnesite and bridged across two benches, can be sprung up and down and the magnesite will not crack or show that it has been disturbed, because of its resisting power and elasticity. In making the plastic magnesite, we take the lumps as they come out of the closely controlled kiln heat and put them through the grinding mills, where they are pulverized to a 200-mesh powder, the same fineness as the best portland cement. The product will then be shipped in boxes, sacks and barrels, in carload lots. During the war the Germans and Austrians used plastic magnesite of this kind in the construction of their pill-boxes and gun bases at the front, because of the enduring qualities of the cement and the speed with which it sets. Likewise, the decks of German ships were coated with this material."

On the question of plastic magnesite Mr. Walker, of the American Refractories Co., was reticent. "We are here to supply our customers with ferromagnesite for refractory use," he said. "We have not tested the Washington magnesite for its plastic qualities, and I could not say what the prospect would be."

The Northwest Magnesite Co., according to my information, will not at this time attempt to enter the plastic trade. At present it is enlarging its operations and increasing its output of ferromagnesite.

It is generally conceded that both the American deposits and the Austrian deposits cannot at the same time be drawn on indefinitely to supply the American demand. Normal conditions in Europe will bring about cheaper labor, which will throw cheaper foreign magnesite on the American market. Deductions would seem to make it apparent that either the American magnesite industry or the American-operated magnesite industry in Austria must perish eventually. As matters now stand there are indications that the American magnesite industry needs a great glory hole to cut the cost of its production in two. The question arises: Will the tariff which the exclusively American operating magnesite companies seek be the glory hole which will save the magnesite mines of Washington? But, on the other hand, will American interests drop out of the world trade, such as has given England much of her power, because the America which has urged her citizens to reach out into the world shuts them out with a tariff when that trade is secured?

Depreciation and Obsolescence

A Review of "Bulletin F, Income Tax; Depreciation and Obsolescence; Revenue Act of 1918"*

BY H. B. FERNALD

Written for *Engineering and Mining Journal*

THE TREASURY DEPARTMENT has just published a bulletin on the subject of depreciation and obsolescence, dated Aug. 31, 1920, as indicating "the trend and tendency of official opinion in the Bureau of Internal Revenue in administering the portions of the Revenue Act of 1918 which provide for the deduction from gross income of reasonable allowances for exhaustion, wear and tear, and obsolescence of property used in trade or business."

This gathers into a pamphlet of thirty-six pages the principal Treasury decisions and rulings on this subject, with comment on the purpose and application thereof.

The general spirit of this bulletin is shown by the following extracts:

The Bureau does not prescribe rates to be used in computing depreciation and obsolescence, as it would be impracticable to determine rates which would be equally applicable to all property of a general class or character. For this reason no table of rates is published. The rate applicable and the adjustment of any case must depend upon the actual conditions existing in that particular case. (p. 4).

Where it can be shown to the satisfaction of the commissioner that the reasonable expectation of the economic life of the oil or gas deposit with which the property is connected is shorter than the normal useful life of the physical property, the amount annually deductible for depreciation may for such property be based upon the length of life of the deposit. (p. 10.)

What the fair market price or value of property was on March 1, 1913, is a question of fact to be established by any evidence which will reasonably or adequately make it appear. (p. 20.)

Consideration of the elements entering into depreciation and of the many problems arising therefrom, involves questions of great difficulty, the solution of which does not yield to exact determination in such a manner that precise rules of treatment can be established or theoretical formulæ deduced which can be applied to all cases or even to many. It is considered impracticable to prescribe fixed, definite rates of depreciation which would be allowable for all property of a given class or character. The rate at which property depreciates necessarily depends upon its character, locality, purpose for which used, and the conditions under which it is used. Manufacturing plants in the same locality, doing identically the same kind of business, depreciate at widely different rates, to a large extent dependent upon the management and the fidelity with which repairs are made and the property maintained; but so many other elements enter into the question that even the relative importance of the different factors can be determined only with difficulty and as approximations. The taxpayer should in all cases determine as accurately as possible according to his judgment and experience the rate at which his property depreciates. The rate used will, however, be subject to the approval of the commissioner.

In recognition of these facts, if understatements of taxable net income in returns are due to charging off depreciation in excess of an amount deemed reasonable by the commissioner, negligence or intent to defraud will not be im-

puted to the taxpayer unless the position taken is so unreasonable as to indicate gross carelessness or bad faith.

It is recognized also that property, for example, manufacturing machinery, may be subject to extraordinary depreciation due to being operated overtime, at an overload, or being used for some purpose for which it is not adapted. Under such conditions, a taxpayer may deduct, in addition to the amount measuring the depreciation under normal conditions, a further sum to provide for the extraordinary depreciation. It does not necessarily follow that if a machine, operated normally for eight hours a day, is operated for sixteen hours a day, it will depreciate twice as rapidly as when operated under normal conditions. The estimate of the extraordinary depreciation should be made by the taxpayer according to his judgment and experience, and will be subject to the approval of the commissioner. (p. 26-27.)

The capital sum to be replaced by allowances for depreciation should be charged off over the useful life of the property, either in equal annual installments, this plan being generally known as the "fixed percentage" method, or in accordance with any other recognized trade practice, such as apportionment over units of production. Whatever plan or method of apportionment is adopted must be reasonable and should be described in the return. The "fixed percentage" method as applied by the commissioner contemplates that the annual depreciation deductions with respect to any property should be equal; that the rate of depreciation should be assumed to be uniform during the useful life of the property, as compared with the so-called "fractional method—weighted years," "declining balance method—scientific or unscientific," "revaluation method" and "sinking-fund method," the use of which is advocated by accountants, but none of which have been approved in their entirety by the commissioner for income-tax purposes.

The only other method which has been approved by the commissioner is an apportionment of the depreciation charges over the total amount of work to be performed or over units of production. (p. 30-31.)

Reduction in the value of property due to exhaustion, wear, and tear through use in trade or business is an actual fact, whether or not evidenced by book entries.

An allowance for depreciation and obsolescence must, however, be charged off by the taxpayer in his books and records in order to constitute an allowable deduction from gross income. The manner in which it is charged off is not material, except that the amount measuring a reasonable allowance for depreciation must either be deducted directly from the book value of the property or preferably credited to a depreciation reserve account, which should be reflected in the taxpayer's annual balance sheet. The allowance should be computed and charged off with express reference to specific items, units, or groups of property, and taxpayers should keep such records as may be readily verified. (p. 33.)

Depreciation Reserves.—Amounts deductible on account of depreciation should be credited to appropriate reserve accounts and carried as a liability against the assets, to the end that when the total of these credits equals the capital-investment account no further deductions on these accounts will be allowed.

While the presumption is that amounts credited to these accounts will be used to make good the loss sustained, either through a renewal or replacement of the property or a return of capital, there is no requirement of law that the funds represented by these reserve liabilities shall be

*Procurable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5c. per copy.

held intact or remain idle against the day when they may be used in making good the depreciation of the property with respect to which the deduction is claimed or in restoring the capital invested in the depreciated assets.

The conversion of the depreciation reserve into tangible assets will not constitute such a diversion as would deny the taxpayer the right of deduction, provided in all cases that the deduction claimed in the return is reasonable.

A distribution made from a reserve for depreciation will be considered a liquidating dividend and will constitute taxable income to a stockholder only to the extent that the amount so received is in excess of the cost or fair market value as of March 1, 1913, of his shares of stock.

The most casual reading of this bulletin will indicate the great progress toward fairness and equity which it shows as compared with the department's regulations under the original income-tax law; such as the old ruling that a depreciation reserve was allowable only if a cash fund of equivalent amount were retained on hand, or those which endeavored to apply specific rates of depreciation to various classes of buildings and machinery, irrespective of the conditions of their location or use.

To some extent the change in regulations results from the broadening of the allowance for depreciation and obsolescence which was brought about under the 1918 law.

Whether or not the department was ever correct in its ruling that the law applicable to 1917 and prior years limited depreciation only to that resulting "from wear and tear due to the use to which property is put," and practically ignoring the word "exhaustion," which was specifically used in the law, is perhaps not a matter of current interest. The fact was, however, that the regulations of the Treasury Department, whether or not they justly interpreted the law, so greatly restricted the amounts deductible for depreciation on the tax returns that in many cases corporations could only have their accounts fairly and conservatively stated by setting up larger depreciation reserves on their books than the department was disposed to allow.

The rulings of the department under the new law as they appeared in Treasury Regulations 45, in the bulletins issued from time to time, and as finally summarized in the present bulletin, seem now to be such that any corporation can regularly carry fair and adequate depreciation reserves with some assurance that its financial statements and its tax returns can be in accord.

In general, the rulings are sound and can be followed as stated. There is, of course, the inevitable tendency, which arises in making general statements to cover a vast number of different cases and conditions, that some rulings should be laid down in general terms, although they were based on a particular set of circumstances, so that the rule as worded would seem to apply to cases for which it was never really intended. This is a frequent source of friction with regard to the earlier regulations of the department, and though it is inevitable that there should be some cases in which the same criticism might be directed against some of the rulings set forth in Bulletin "F" (e.g., "Obsolescence"—p. 13), they are practically counteracted by the very definite statements repeatedly made that depreciation "is an actual fact," that "the rate applicable and the adjustment of any case must depend upon the actual conditions existing in that particular case," and other like explanatory matter.

The fair spirit in which this bulletin is issued is also set forth by the reference (p. 34-35) to possible adjustment of depreciation rates previously claimed with no evidence that there would be any discrimination against

a taxpayer who endeavored fairly and honestly to review his prior practice regarding depreciation and adjust it to accord with the ruling now made by the department.

The comments given in regard to basing depreciation on the value at March 1, 1913 (p. 19) seem of particular interest to lessees. The general statement is made that depreciation charges should "be such as to amount in the aggregate during the life of the depreciating property to the value of that property as a capital asset; and that . . . this capital value should be determined as of March 1, 1913." Although this bulletin is not intended to cover the 1913 and 1916 laws, the line of reasoning here set forth would seem clearly to support the contention that, for leaseholds which had been acquired prior to March 1, 1913, depreciation should be allowed, in 1917 and prior years, on a basis of their 1913 value, rather than on a basis of their original cost.

From many aspects, this is one of the most important bulletins issued by the department, and should receive the widest possible distribution, both among the engineering and the office staffs of all mining companies.

Ontario's Mineral Production

Returns received by the Ontario Department of Mines from the metalliferous mines, smelters, and refining works of the province for the nine months ending Sept. 30, 1920, are tabulated below, and for purposes of comparison the quantities and values are given for the corresponding period in 1919. Tons throughout are short tons of 2,000 lb.

ONTARIO'S METALLIFEROUS PRODUCTION, FIRST NINE MONTHS OF 1920

Product	Quantity		Value	
	1920	1919	1920	1919
Gold, oz.	424,297	366,288	\$8,735,768	\$7,574,586
Silver, oz.	7,831,143	7,475,396	8,435,088	7,898,220
Platinum metals, oz.	213.75	87.26	13,917	4,981
Nickel (metallic), lb.	7,060,078	7,820,866	2,440,303	2,732,676
Nickel oxide, lb.	4,886,712	5,700	1,146,768	1,607
Other nickel compounds, lb.	159,725	217,135	15,362	22,279
Nickel in matte exported (a), tons.	17,446	11,301	8,723,000	5,424,552
Cobalt (metallic), lb.	159,151	93,227	373,168	174,782
Cobalt oxide, lb.	509,043	321,483	1,015,696	463,916
Other cobalt compounds, lb.	1,717	29,491	1,629	18,250
Lead, pig, lb.	1,290,726	1,481,204	117,122	54,802
Copper (metallic and sulphate), lb.	4,952,413	4,436,101	800,369	756,883
Copper in matte exported (a), tons.	9,497	6,818	2,659,160	1,908,936
Iron ore (), tons.	5,468	5,827	47,120	44,234
Iron, pig (c), tons.	49,422	30,849	1,395,948	795,009
Total.			\$35,920,418	\$27,875,713

(a) Copper in matte form was valued at 14c. and nickel at 25c. per lb. in both years. Total matte produced was 44,922 tons, of which 31,800 tons was exported.

(b) Shipments of iron ore totaled 89,931 short tons, valued at \$445,355. The figures in the table cover shipments to points other than Ontario blast furnaces.

(c) Total output of pig iron from both domestic and imported ore was 512,559 tons, worth \$14,480,794. Figures in the table represent proportional product from Ontario ore.

Although the aggregate production of mines, smelters, and refineries in the Province of Ontario for the nine months ending Sept. 30 shows an increased valuation of over six million dollars as compared with the 1919 figures, developments during the last two months have been such that a proportional increase for the full year cannot be expected. Rainfall was so scanty during the late summer and fall that the power plants supplying Cobalt, Porcupine and Kirkland Lake have been unable to meet the requirements. A power shortage setting in now may be prolonged. Furthermore, the wholesale prices of commodities have declined abruptly, and industry and commerce are feeling the effects of this inevitable aftermath of the war. Labor, however, is becoming more plentiful, and the cost of production is declining. Such circumstances are specially advantageous to the gold-mining industry, which has had to carry on during the war period under difficult conditions.

The Hidachi Copper Smelter

Highest Concrete Stack in the World, Pot Roasting of Fine Copper Ore, and Introduction of Coal Into Blast Furnace Tuyeres by Hand, Chief Features of This Large Japanese Works

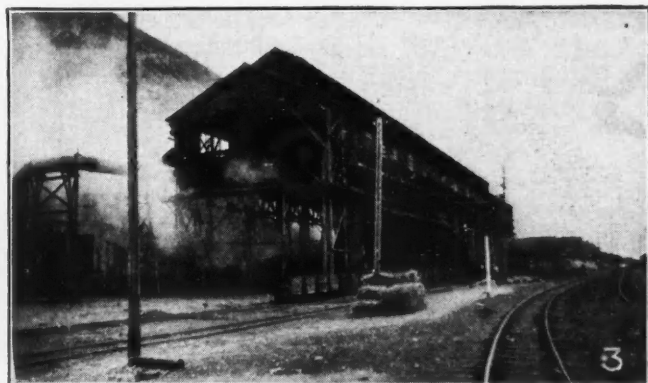
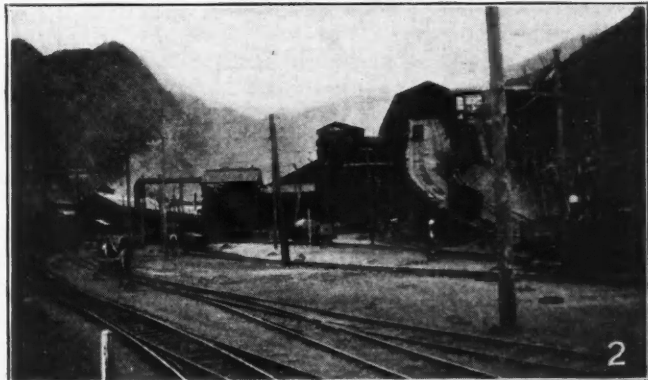
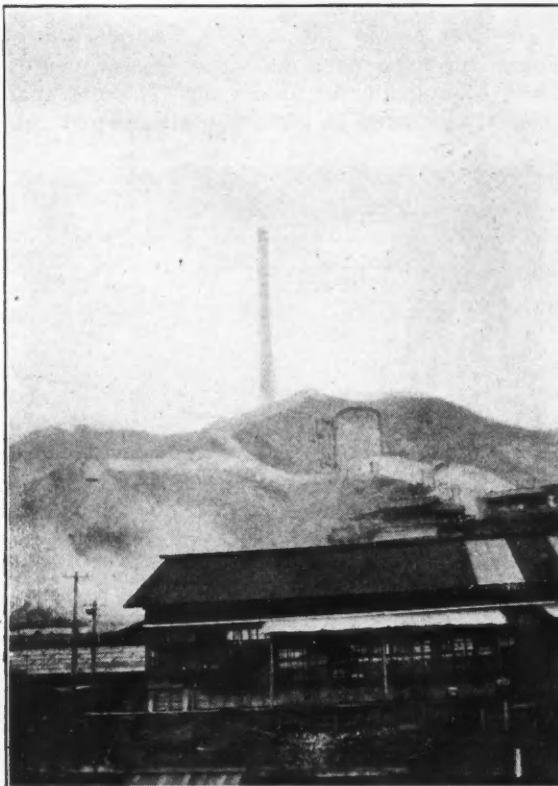
BY CHARLES F. MASON

Written for *Engineering and Mining Journal*

TO MANY American smeltermen the Hidachi copper smelter, at Ibarakiken, Tagagori, Hidachimura, Japan, is known principally as "that Japanese copper smelter where they have the highest concrete stack in the world." It is interesting to learn that this stack was built several years ago, not with the idea of establishing a world's record in chimney construction, nor because its great capacity was really needed from a metallurgical standpoint, but to protect the tobacco which is grown in the vicinity from the

smelter and mines are owned and operated by the Kuhara company), and about 30 per cent of custom ore, of which one-third is siliceous ore carrying about 3 per cent copper, and two-thirds gold- and silver-bearing quartz, containing about 85 per cent silica. The latter is used for converter flux. As received at the smelter, all of the ores contain about 40 per cent fines, separated by a $\frac{3}{4}$ -in. grizzly.

The green-ore fines and blast-furnace flue dust are sintered together in large cast-iron tapered "pots," with



1. VIEW OF THE BIG STACK FROM THE OFFICES. 2. THE BLAST FURNACE PLANT, SHOWING ENDLESS ROPEWAY FROM SINTERING PLANT. 3. SINTERING PLANT.

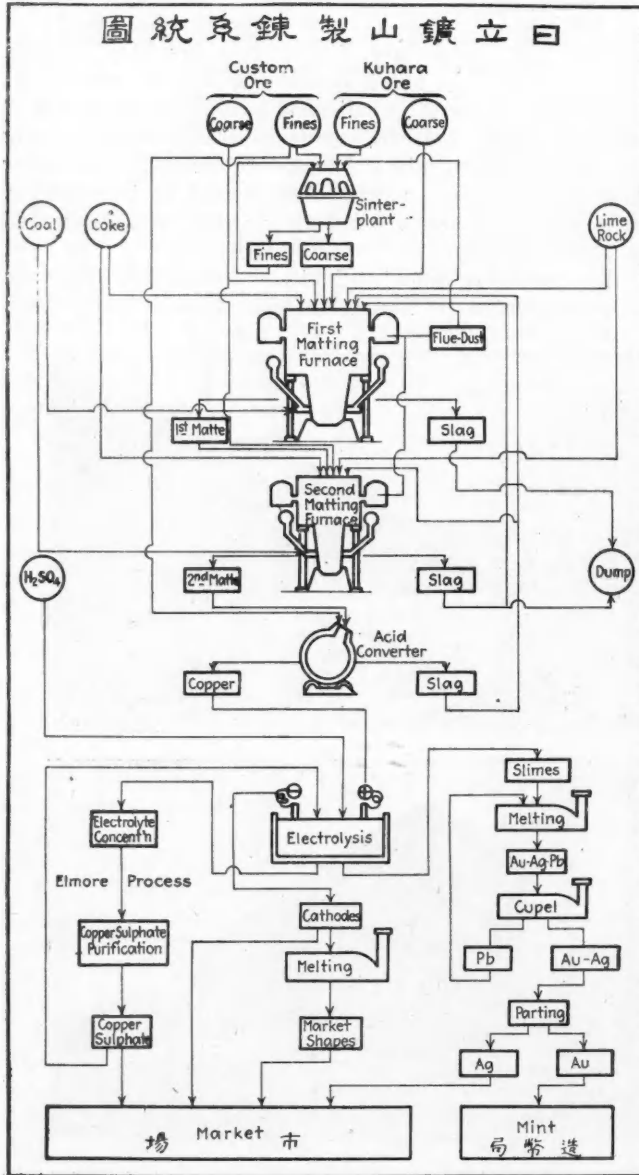
effects of the sulphur fumes. The stack rises 550 ft. from its foundation on the top of a hill about 200 ft. above the smelter and 1,220 ft. above the level of the sea, three or four miles away. It stands several hundred yards away from the nearest point of the smelter proper, to which it is connected by a main flue and a number of branches, all of which are built of reinforced concrete. It is said to have a capacity of a million cubic feet of gases per minute. Even with its great height, it is necessary to curtail smelting operations at certain times during the tobacco- and rice-growing season, when the observation stations in the vicinity report the wind in a dangerous quarter.

The ores smelted at Hidachi consist of about 70 per cent of cupriferos pyrite from the Hidachi mine (both

grate bottoms, 12 ft. in diameter and about 4 ft. in depth, having a capacity of sixteen tons per charge. A stand for one of these sintering pots consists merely of a metal ring, set about 4 ft. below the floor level, which makes contact with the lower edge of the pot all around the circumference of the latter when placed upon it. Inside of this ring is an opening which is connected with the blast main, and outside of it is an annular space which is connected to the flue, and thence to the stack. A thirty-ton overhead traveling crane places an empty pot on a stand. Rough straw mats are spread over the grates in the bottom of the pot and set afire. A sheet-steel hood, shaped like a truncated cone, the diameter of its base being slightly larger than the outside diameter of the annular flue, with inspection doors in the sides

and charging doors in the top, is lowered into place over the whole, and the blast turned on slightly. Then a charge of ore and flue-dust is dumped in by the crane from a five-ton bucket with a bell-hopper bottom, followed, when it is well lighted, by a second and then a third. The average time required for sintering a sixteen-ton charge is about five hours, and the maximum blast pressure is about fifteen ounces.

three, 20 ft.; two, 24 ft. and two, 40 ft. Only seven of the smaller furnaces are in operation at this time, six for first matting and one for matte concentration. The tonnage smelted varies from 170 tons of ore, for the 15-ft. furnace, to 250 tons, for the larger furnace, per furnace per day. The ore-column in all cases is about 11 ft. high, and a maximum blast pressure of twenty ounces per square inch is used. A 20 per cent copper matte



FLOW SHEET OF THE HIDACHI SMELTER

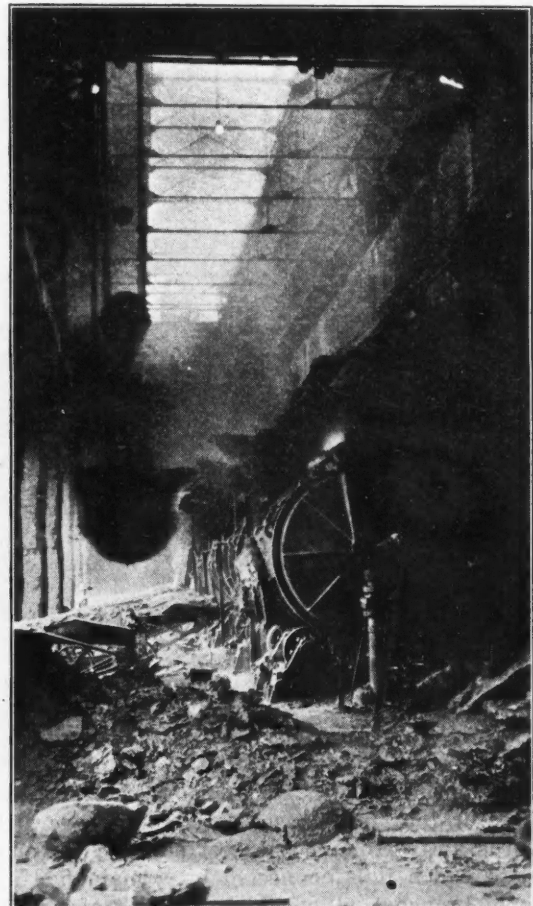
When the sintering process is complete, the hood is removed and the pot with its charge is carried by the crane to the breaking floor, where the charge is dumped and broken up by an electro-magnetic "skull cracker," the pot being ready for another charge as soon as replaced on a stand. The illustration shown on p. 57 shows the crane carrying a pot with its charge to the breaking floor. The sintered material, after being broken up, is passed over a 1-in. grizzly, where about 20 per cent is removed and reverted to the sintering process, the remainder going to the blast furnaces by means of electric locomotives and an endless ropeway, shown in one of the photographs on p. 55.

There are ten blast furnaces, all 48 in. in width at the tuyères and of lengths as follows: three 15 ft.;

TYPICAL ANALYSES—HIDACHI SMELTER, KUHARA MINING CO.

Material	Cu	Pb	Fe	Zn	SiO ₂	Al ₂ O ₃	BaSO ₄	S	CaO	MgO	MnO	CO ₂	SO ₃
Hidachi No. 1.	2.9	...	28.8	1.8	23.8	6.2	0.8	29.5	0.8	3.4	0.3	...	...
Hidachi No. 2.	3.0	...	30.0	1.9	18.5	6.2	1.2	32.5	0.9	3.9	0.4	...	...
Pyrite cinder.	2.9	...	46.6	3.6	11.1	4.0	1.1	7.0	0.9	1.4	0.1	...	4.6
Custom Cu ore	7.3	0.2	13.6	1.2	55.4	5.0	0.4	14.1	0.4	1.4	0.1	0.02	...
Au-Ag flux.	0.1	...	1.9	0.4	83.8	4.7	...	0.3	0.4	0.4	4.7	0.13	...
Sinter-cake.	3.2	0.2	35.1	1.8	30.7	5.8	1.1	5.5	0.9	2.9	1.0	...	...
First slag.	0.2	...	25.8	1.1	38.0	8.8	0.9	0.8	2.3	3.6	0.6	...	...
Second slag.	0.4	...	...	...	41.0	...	...	...	...	...	...	...	...
First matte.	20.0	...	...	...	...	...	...	...	...	...	...	...	...
Second matte.	35.0	...	...	...	...	...	...	...	...	...	...	...	...
Converter slag.	2.4	...	45.0	...	26.0	...	...	...	...	...	...	...	...

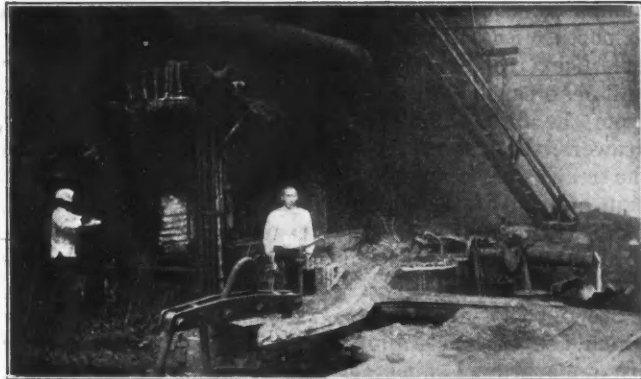
is obtained from the first furnaces, and is concentrated to about 35 per cent in the second. Water-cooled fore-hearths, of probably fifteen or twenty tons' capacity each, are used, one to each furnace, and the first matte is tapped into the pans of an endless conveyor, to facilitate cooling and breaking up. The first-matting furnaces are situated in parallel positions and charged



CONVERTER AISLE

through side doors in the tops by hand, whereas the matte-concentrating furnaces are end to end and are charged by bottom-dump cars running on a track over their tops. They have side flues, but the charging floor is remarkably free from fumes, thanks to the big stack. The flue dust is about 2.7 per cent of the ore charged.

The fuel used in the blast furnaces is 7.5 per cent of the ore charged, and consists of one-third coke and two-thirds bituminous coal. The former is charged in the usual way, with the ore and flux, whereas the latter is charged through the tuyères by means of hand-operated plungers working in small cylinders which are introduced through the tuyère caps, as shown in the illustration. The coal is crushed previously to about 1-in. size, and a charge consists of about 7 lb. Needless to say, this method, although showing fuel economy from a



BLAST FURNACE AND SETTLER

metallurgical standpoint, is wasteful of labor, and plans are being made to use pulverized coal instead.

The copper recovery in all of the blast furnaces is apparently good, being reported as 90 per cent or better for the entire plant. It will be noticed that the copper content of the first slag, as shown in the table of analyses on p. 56, is 0.2 per cent, and that of the second slag approximately 0.4 per cent. It is only recently that the second slag loss has been brought down to this figure, thereby cutting out a large amount of revert. All blast-furnace slag is granulated in water, drained, and hauled to the dump in electric cars.

Acid-lined converters of the barrel type, 68 in. in diameter and 8 ft. long, receive the 35 per cent matte direct from the small ladle-cars into which the matte-



INTERIOR OF SINTERING PLANT, SHOWING POT AND SINTER GOING TO BREAKING FLOOR

concentrating furnace settlers are tapped. There are six converter stands. The tilting device consists of a vertical hydraulic plunger, operating a rack which engages a gear on the converter trunnion. The converter blast is supplied by a motor-driven turbo-blower at a pressure of 8 lb. per square inch, and each converter has eleven 1½-in. tuyères, only nine of which are open in a new lining. The slag carries an average of 2.5 per cent copper, and

is reverted, cold, to the first-matting furnace. The blister copper is cast into 24 x 30 in. anodes, weighing about 400 lb. each, through a swinging launder, in stationary copper molds arranged in a semicircle and cooled with water jets underneath in the usual manner.

I am indebted to Mr. Tokuzumi, metallurgical engineer, and Mr. H. Kajikawa, mechanical engineer, of the Hidachi smelter, for their courteous assistance in securing the information and data presented in this article.

Geologic Explorations for Asbestos

The United States now obtains most of its high-grade, long-fiber asbestos from Canada, but geologists of the U. S. Geological Survey hope that large deposits which will yield material of good quality may yet be found in the Western States, especially in Arizona, where asbestos of unusually long fiber and silky texture has been discovered.

In the Apache and San Carlos Indian reservations, in Arizona, asbestos is found associated with rocks known by geologists as the Apache group, which is made up of several formations. The principal deposits are in the Salt River region, where the Apache group is represented chiefly by beds of quartzite and limestone, which are at many places invaded by diabase, an igneous rock. Throughout this area much diabase has been injected into beds of limestone, and the asbestos is found near the contact of the limestone with the diabase. Places where the limestone has been much broken by the diabase have been particularly favorable for the formation of asbestos. The asbestos is invariably associated with serpentine, a greenish mineral that is in some deposits in other regions mottled like a serpent's skin, and although serpentine occurs at many places without asbestos, serpentine "float" fragments of it that lie loose on the surface, having been washed out from its outcrop, are a valuable aid to the prospector for asbestos. In this region asbestos itself is also generally found as float for a considerable distance below its outcrop.

Metal Production in the United Kingdom For 1919

The following table is taken from the general report of the chief inspector of mines, and gives the official metal production of the United Kingdom and the Isle of Man for the years 1919 and 1918:

SUMMARY OF THE METALS OBTAINABLE BY SMELTING FROM THE ORES IN THE UNITED KINGDOM, 1918-1919

Description of Metal	1918		1919	
	Quantity	Value at the Average Market Price, Pounds	Quantity	Value at the Average Market Price, Pounds
Aluminum.....	(a)	(a)	(a)	(a)
Antimony, tons.....	() 4	338		
Copper, tons.....	179	22,599	144	14,176
Iron, tons.....	4,581,772	46,788,732(c)	3,808,095	51,511,064
Lead, tons.....	10,909	328,725	10,277	289,769
Silver, oz.....	79,645	15,784	68,414	16,266
Tin, tons.....	3,954	1,303,090	3,272	842,485
Zinc, tons.....	3,245	169,389	2,436	102,951
Total values.....		48,628,657		52,776,711

(a) Information not supplied. () Contained in lead ore. (c) This value is calculated on the value of pig iron exported.

Approximately 75 per cent of the Silica Brick produced in the United States is manufactured in Pennsylvania. The ganister or quartz rock from which the brick is made comes from the vicinity of Mount Union and Hollidaysburg and contains over 94 per cent silica.

Organization of Mine-Surveying Work

System of Maps in Use by Anaconda Copper Mining Co.—Office Work and Method
Of Filing—Reports on Detailed Mining Operations—Brief
Account of Drainage Layout

BY FRANK L. FISHER

Written for *Engineering and Mining Journal*

A NUMBER of operating companies in Butte were brought together into a compact organization under the name of the Anaconda Copper Mining Co. Functions having to do with the control of operations were consolidated into separate departments which served the individual properties or mines in common. The engineering department may be cited as an example. One of the first important steps undertaken by this department was the establishment of a surface triangulation system which tied all of the individual surveys together. Starting with a base line, points were accurately located by transit in strategical positions relative to the respective properties throughout the district. Between these points courses and distances were determined, and thus the various surveys tied in to the base line. The triangulation points were given either numbers or names. Both triangulation points and the mine shafts were mapped on a scale of 1,400 ft. to one inch. This gave a base map of convenient size.

Many intermediate survey points on the surface were necessary to tie to the system new improvements constantly being made, such as buildings, railroads, shafts, pipe lines, and the like. These necessitated the running of traverses from the nearest triangulation points, frequently at no little distance, each time it became necessary to map a new improvement. Closed traverses tying in these more temporary points to the triangulation were thus established. These were platted on a scale of 600 ft. to one inch. A co-ordinate system was next determined upon. All surveys are considered to be in the northeast quadrant of a circle. Imaginary east-west and north-south co-ordinate base lines are thus established which are sufficiently far south and west of the properties to include within the quadrant all probable lateral expansion of the company's operations.

A working scale of fifty feet to the inch was decided upon, and from the maps platted upon this scale other maps are reduced in scale as needed by means of the pantograph. A unit map, eighteen inches north and south by twenty-four inches east and west, was also adopted. The units are joined by co-ordinate numbers running in series from west to east and south to north, and extending beyond the company's property boundaries. The unit map on the fifty feet to one inch scale includes a distance of 800 ft. north and south and 1,100 ft. east and west. A one-inch border is allowed on the sheet. The surface map shows claim lines and all excavations, shafts, and improvements. Additional sheets are prepared for each level of the underground workings immediately below the limits of the unit surface map. Two-inch squares, each representing one hundred feet on a side, and numbered at each intersection according to the number of hundreds of feet north or east of the co-ordinate base lines, are drawn upon each unit sheet.

An index map on a scale of 1,000 ft. to one inch

shows the position of the small unit maps, which are numbered sequentially from west to east and from south to north. Shafts and names of mines are shown upon the index map, so that the number of any particular unit map can be quickly determined and the map taken from the files. Cabinets each holding fifteen shallow drawers, the size of the unit maps, are used to contain the maps. A single drawer contains a surface unit map and all of the levels below the unit surface map, the series of drawers being numbered from top to bottom, and from west to east to correspond to numbers on the index.

Stope books are used to supplement the unit maps which are for vertically separated planes where there are underground workings from one to two hundred feet apart or according to the distance separating the levels. The pages of the stope book are the same in size and ruled similarly to the unit maps. When the book is open, the two pages represent the same surface area as two east and west units. The levels are platted in the stope books according to their elevations, and on the intervening pages the stopes are platted to scale, one floor, representing approximately eight feet vertically, being platted on each double page. The books are also numbered to correspond to the index system and are kept on edge in cases of about the size of those used for the maps. The numbers read down from north to south, and to the right from west to east.

The surveying field books are leather bound, $8\frac{1}{2}$ x $5\frac{1}{2}$ in. in size. They contain eighty double pages, numerically numbered on the right-hand page. Each book is a continuation of the one preceding, for convenience in indexing. The pages are lined from left to right like ordinary letter paper. On the left-hand page, columns are ruled vertically to keep the notes in order. The headings are from left to right: Transit (including back sight and set up); Height of Instrument; Angle Right (always doubled for permanent points to insure against error in reading, or, in some cases where great care is needed, as many as six or more angles read, and entered here, and the average used); Courses, both magnetic and true (the former is noted merely as a check on the turning of the angle, from which the true course is computed); Vertical Angle and Slope Distance; Height of Point (the vertical height of the foresight above the height of instrument, so that the elevation of all points may be recorded as surveyed); and Station to Floor (the distance of the station vertically above the floor, in order that all floor elevations below survey stations may be determined as needed to plan out grades to be used in connecting workings, the platting of longitudinal sections, and similar work). On the right-hand page a column is provided on the left-hand side for horizontal distances. The remainder of the page is ruled in squares for descriptive notes and sketches.

The mines are surveyed monthly and the notes cal-

culated in the office. The calculations are made in books 12 x 8½ in. in size, containing 100 double pages each. The right-hand page is numbered similarly to the field books, for indexing purposes. The books are made in sets of two, numbered alike, and in each respectively surveyor and assistant go through the same calculations as a check to prevent error. The right-hand page is ruled from left to right and the spaces from top to bottom contain in order: Backsight and Set-Up; Azimuth of the Course from Backsight to Set-Up and Angle Right from this course; Calculated Course and Horizontal Distance; North and East Ordinates; Station Number and Elevation of Survey Station. The left-hand page is blank, and is used for calculations and sketches. After calculations have been made, the field and calculation books are co-indexed, the work is platted into the stope books by reference to both, and from the stope books transferred to the fifty-foot scale level maps. From the level maps the new portion is transferred to the 100 and 200-ft. scale maps by pantograph.

MONTHLY POSTING OF MINE MAPS

Each month the set of mine maps, made on tracing cloth on the 150-ft. scale and kept at each mine, is sent to the office and posted to date by tracing from the office maps. The superintendent and his assistants are provided with sets of leather-bound tracings of the mine workings on a scale of 200 ft. to one inch, which is a convenient size to carry underground with them. These are posted regularly from the 200-ft. scale maps. Upon completion of platting, the notes in field and calculation books are copied into ledgers, numbered and indexed similarly to field and calculation books. A record is thus kept in the office of all finished work. As the field and calculation books become filled, they are indexed and filed in cases for convenient reference.

MEASURING CONTRACT WORK

At present, the contract system is in operation in the mines, and weekly payment to the miners is made on the basis of a fixed price per cubic or linear foot of ground mined or timber placed in position. On Wednesday of each week the engineers measure the work finished in the preceding seven days. Field stope books are used, and sketches made showing the work accomplished in relation to the sill floor work which has been already surveyed. The field stope books are 11½ x 5½ in. in size and contain 100 double pages ruled in one-inch squares, with inter-ruling of from one-eighth to one-sixth inch squares representing square-set timbers in plan.

A sketch is made of the sill floor showing timbers, chutes, and survey stations. From this as a basis, each floor of the stope or raise, above the sill floor, is sketched in accurately, showing timbers, offsets, and outline of the floors. Recently, these books have been supplemented by the use of loose-leaf field books of about the same size, but containing, in addition to the sheets ruled in squares (each square representing in plan a square set, 5 ft., 4 in. on a side), other sheets ruled for the purpose of sketching cross and longitudinal sections which give the height of the regular sets, 7 ft. 10 in., as well as the breadth. This has been found a more convenient method of showing stopes that have irregular or no timbering, as, for example, rill and stull-timbered stopes.

The use of the loose-leaf books obviates carrying the permanent field stope books through the workings. As

the work represented in them is transferred regularly to the permanent field books, the danger of the loss of sheets containing sketches is minimized. From the sketches and measurements, a weekly report is made in triplicate, one copy for the superintendent, one for the mine foreman, and one to be kept in the engineering office as a record.

The record in the field stope books is platted to scale monthly in the office stope books in proper relation to the surveyed sill-floor work. At the end of each year, all work finished during the year is given a distinctive color. A quick visualization of the approximate time required for certain work is thus possible, as well as the ready finding of the exact date of any particular piece of work from the records.

MONTHLY PROGRESS REPORTS

At the end of each month, a report is made showing the progress in feet and excavation in cubic feet of ore and waste made in each drift, crosscut, raise, shaft, winze, stope, or other working, together with the costs, such as mining, development, and filling, for each vein. This report is permanently recorded in progress books, from which, at the end of the year, an annual report of operations is made and from which the data are obtained for the annual calculation of ore reserves.

From the monthly report a clerical report is also made monthly, in which, under the caption of development, is given footage and cubic feet excavation for crosscuts, shaft sinking, raising, and station cutting; under the caption of drainage, advance and excavation of drifts, crosscuts and sumps; under the caption of mining and breaking ground, stope advance and excavation in sills, and raises in ore; under the caption of mining and breaking ground-filling, advance and excavation in raises, winzes, and drifts in barren veins and waste, and lateral drifts and crosscuts therefrom; under the caption of ventilation, advance and excavation in raises, winzes, drifts, crosscuts and shafts; and under the caption of fire expense, advance and excavation in raises, drifts, and crosscuts. A report is made for each mine annually, and under the caption of veins there is given the advance made in ore and waste, number of stope sets removed, and cubic feet extracted from stopes, drifts, laterals, crosscuts, raises, winzes, and shafts.

ANNUAL CALCULATION OF ORE RESERVES

Ore reserves are calculated annually. To facilitate this computation, longitudinal sections have been made of the workings upon the veins on a scale of 100 ft. to one inch, and they are posted once a year just prior to the calculation of reserves. The sections are drawn on east and west or north and south planes, depending upon whether the course of the vein is more nearly east and west or north and south. The sections are divided into "blocks" or areas of convenient size extending between two levels on the dip of the vein, and on the strike for any convenient length up to three or four hundred feet, depending upon the regularity of the orebody in its course and upon the assays obtained upon samples.

From the assay reports for the drifts and raises which bound the blocks more or less completely, the approximate percentage of copper and zinc contained in the blocks is calculated, together with the average width of ore, due allowance being made where the course of the vein materially departs from the east-west or north-south planes. The contents of the block in cubic feet is then calculated, the percentage of waste deducted,

and the remainder divided by ten, the approximate number of cubic feet of ore per ton, this giving tons of ore in that part of the "reserves." The posting of the sections indicates the amount of decrease made in each block by mining during the year, or, in case of new development work, the increase in ore blocked out. By summation and subtraction the "net reserves" resulting from the year's work are given for that horizon upon the vein in question. Summation for all exposed horizons upon all of the veins will determine the total net reserves.

The elevation of the collars of all shafts has been established by accurate leveling from bench marks, in many cases the triangulation points, or, in other instances, apparently permanent points, established at convenient places, where they may be needed in the future for determining elevations. These elevations have been carefully checked to form a primary system of leveling, and are platted on a scale of 1,400 ft. to one inch.

The exact elevations of shaft collars having been established, the elevations of the floors of each level at their intersection with the shafts are determined by measuring down from the respective shaft collars with a steel tape. The underground survey elevations are based upon these results. It is necessary that the elevations be correct, as the properties are in many cases in close proximity and it is desirable from the viewpoint of safety to know exactly at what point workings will connect.

DRAINAGE SYSTEM OF ANACONDA GROUP

Before the consolidation, the various mines were drained through their own shafts, but as they were gradually consolidated into groups and later under one company, a more economical system of drainage was developed. A pumping unit was installed on the 1,200-ft. level of the Leonard mine. The Boston and Montana group, comprising the Mountain View, Pennsylvania, Leonard, West Colusa, and East Colusa mines, was drained by connections made on this level. Similarly, at the High Ore mine, pumps drained the remaining properties. On the 1,800-ft. level of the Boston and Montana group, like connections were made later. The other properties for the most part are drained by the High Ore pumps at various levels.

When the High Ore mine attained a depth of 2,800 ft., a more comprehensive plan of drainage at this level was decided upon for all of the mines. Connections have been made, or will be made as fast as the mines reach the 2,800-ft. level, for drainage through the two systems, one at the High Ore and the other at the Leonard. It is planned to install drainage units at each thousand feet difference in elevation. The drainage crosscuts are driven upon a fall of eight inches per 100 ft., with an additional fall of one foot per 1,000 ft. as a margin of safety.

In addition to the work as outlined in the foregoing, the engineering staff is called upon to plan and supervise all underground development. In the determination of lines and grades to be used in making connections between various workings or in constructing shafts by raising, extremely accurate and painstaking work is essential if time is to be saved and expense minimized. The engineering staff is also a link in the safety-first organization. The first-aid units which the company has organized of late years have become capable and efficient, with the result that there is a

low accident ratio when the number of operating properties and men employed is considered. Most of the engineers have qualified in the first-aid course. In fighting fires the engineering staff is called upon to devise methods for expeditiously getting at the source of the trouble as well as to keep operations away from sections which have been temporarily or permanently sealed up on account of fire, in order that work may proceed in the remainder of the property without danger.

Electric Melting Furnaces Used by Mint

One of the changes brought about by the Director of the Mint has been the installation of large-capacity electric melting furnaces in lieu of small gas- and oil-burning furnaces. An electric furnace of 1,000 lb. capacity installed at the Philadelphia Mint demonstrated that it was equal to nearly four gas furnaces, with a fuel saving of about 50 per cent. An additional furnace having a capacity of one ton has been installed at the Philadelphia Mint, and an electric furnace of one-half ton capacity has been installed at the San Francisco Mint. The installation at the Philadelphia Mint of mechanical conveyors for the handling of metal ingots, strips, disks, and coin, in lieu of hand trucking, has brought about a labor saving of 40 to 50 per cent in these processes. Tandem arrangement of six rolling machines brought about a labor saving of 75 per cent in operation.

Analysis of Samples of Ancient Armor

The analysis and microscopical examination of about one dozen samples of ancient armor from the Metropolitan Museum of Art, New York, have been completed by the Bureau of Standards, Washington. The analysis indicates that all the samples were made from very pure wrought iron converted into steel by the old cementation process, as would be expected. The carbon determination was made on the entire cross-section, as the material of all the pieces was too thin and corroded to make it possible to obtain samples from different layers.

The microstructure indicates that the process was very similar to our wrought-iron process. The metal was then carbonized, probably by a supplementary process, hammered into sheets differing in hardness (i.e., in the amount of carburization), and these sheets were welded together. The whole was then hammered into shape and quenched, thus producing the final hardening effect.

Swedish Iron-Ore Production in 1919

According to the Swedish Board of Trade, the total production of iron ore in Sweden in 1919, including both lump ore and "slig," amounted to 5,040,000 tons, compared with 6,620,000 tons in 1918 and 7,480,000 tons in 1913. Only in the great strike year of 1909 was the total output less than in 1919. Of the output, 2,970,000 tons, or 58.79 per cent, was mined in Norbotten. The value of the ore won in 1919 is stated to be 72,630,000 kroner, against 90,860,000 kroner in 1918. The average annual production per miner, which was 633 tons in 1913, declined to 561 tons in 1918 and further to 474 tons in 1919.

Mining Engineers of Note

J. Parke Channing

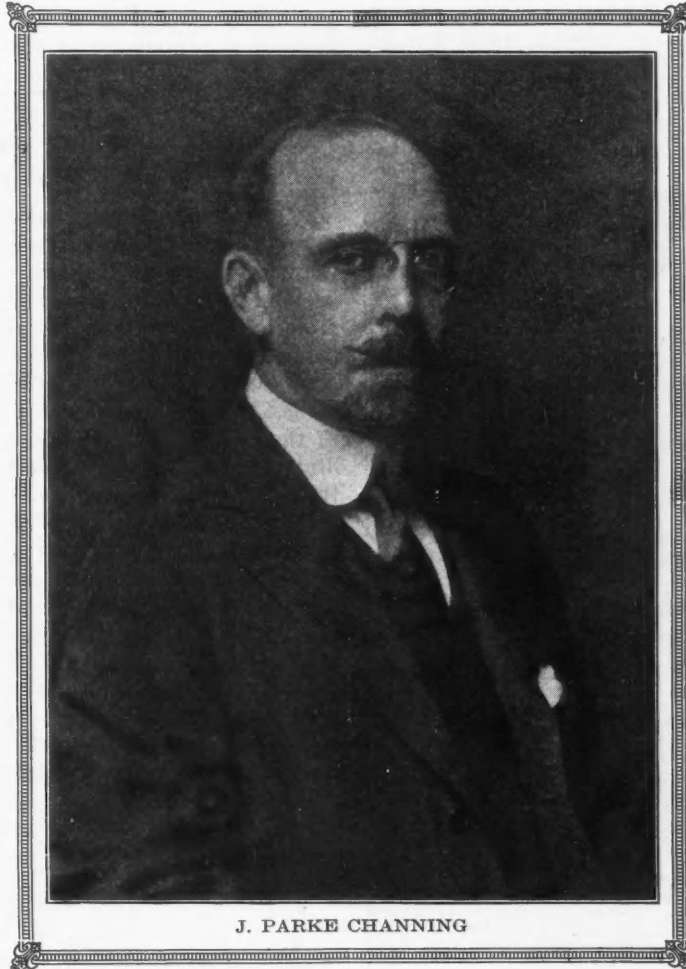
PROMINENT among the mining engineers of note who have taken an interest in the good of their profession is J. Parke Channing. Mr. Channing, who was born in New York and was graduated in 1883 from the Columbia School of Mines, gained his early experience in the Lake Superior copper and iron districts, where he remained ten years with the exception of about a year spent in Honduras. He was early associated with Frank Klepetko, then mining engineer of the Osceola and Tamarack mines, and was with the Tamarack when its No. 1 vertical shaft—a great undertaking in those days—struck the Calumet lode. While in the copper country he made the suggestion that better instruction should be given in mining in Northern Michigan. From this resulted establishment of the Michigan College of Mines. From the copper country Mr. Channing went to the then new Gogebic iron range and helped explore and develop it. In 1887 Michigan passed a mine inspection act and he was the first mine inspector for Gogebic County, a position which he held for three years. In 1890 he took charge of the East New York iron mine at Ishpeming, Mich., and later was in charge of the explorations for iron ore conducted by a subsidiary of the Chicago, Milwaukee & St. Paul Ry. While at Ishpeming his public spirit again manifested itself, and at his suggestion the Lake Superior Mining Institute was formed, Nelson P. Hulst being the first president and Mr. Channing second. In 1893 he was appointed assistant to the manager of the Calumet & Hecla Mining Co., but his stay there was short. They say that he was too progressive and ahead of his time. Mr. Channing then went to Montana and was again associated with Frank Klepetko, who was manager of the Boston & Montana, which later on was consolidated with Anaconda. Here he got his first practical experience in copper metallurgy at the B. & M.'s Great Falls works. One of the leading interests in the Boston & Montana was the firm of Lewisohn Brothers and in 1897 Mr. Channing associated himself with them as consulting mining engineer and has been with them ever since. In 1889 the old firm of Lewisohn Brothers, as a result

of Mr. Channing's examination and report, took over the properties of the Tennessee Copper Co., which were developed and equipped by him. The technical success of this operation was due to the combination of Lake Superior methods of mining with Montana methods of smelting. After a few years' operation, during which time the ore had been heap-roasted and smelted, Mr. Channing introduced pyritic smelting, based upon the experience of Robert Sticht in Tasmania, and the late W. H. Freeland at the mines of the Ducktown Sulphur, Copper & Iron Co., a neighboring company. Still later he built for the company a large sulphuric acid plant to utilize profitably the fumes from the furnaces. In 1905 Mr. Channing examined and reported upon the properties of the Nevada Consolidated Copper Co., and on the strength of his report large financial interests completed the development and equipment of the Consolidated property. In 1906 Adolph Lewisohn, the surviving partner of the old firm of Lewisohn Brothers, organized the General Development Co., of which Mr. Channing was made vice-president and consulting engineer.

Under the latter this company found the Miami mine and later on organized the Miami Copper Co., one of the so-called porphyry properties. It has had an excellent record as a producer of copper, Mr. Channing being its vice-president.

Mr. Channing was one of the founders, in 1908, of the Mining & Metallurgical Society of America, of which organization he was president for the years 1910-1912. In 1914 Columbia University conferred on him the degree of master of science.

In February, 1918, he was elected chairman of Engineering Council, which he held until Dec. 31. Engineering Council was replaced on Jan. 1 by American Engineering Council, of which Herbert Hoover is president and Mr. Channing one of the four vice-presidents. Mr. Channing has particularly interested himself in the human side of engineering and in impressing upon engineers that they are the men on whom devolves the duty of bringing about proper co-operation between capital and labor.



J. PARKE CHANNING

HANDY KNOWLEDGE

Loading Black Powder Into "Gopher Holes"

Written for *Engineering and Mining Journal*

A method of loading "gopher holes" used in one of the large open-pit iron mines in northern Minnesota is shown in the accompanying illustration. The powder is poured directly from the can into a small wooden launder, which is inclined so that the powder will run into the hole. The launder is of sufficient length to reach the end of the hole, so that the explosive may be poured in without leaving a train of powder, and the



LOADING BLACK POWDER INTO "GOPHER HOLES"

inner portion of the hole may be filled first. These "gopher holes" are usually 15-in. in diameter and sometimes as much as 25 ft. long. They are dug into the stripping banks by means of long-handled shovels and are usually "sprung" or chambered before the charge of powder is placed. The springing consists of a preliminary blasting with dynamite so that the "gopher hole" is enlarged inside. From five to ten kegs (25 lb.) of black powder are used for the final blasting. This practice of "gopher holing" is used to bring down high banks in the open pits where it is desired to entirely remove the overburden or to break down the bank which might be a menace to the men working below.

A covered box, provided with a hopper bottom and fastened to one end of a closed launder, is sometimes used for the same purpose. The powder is poured

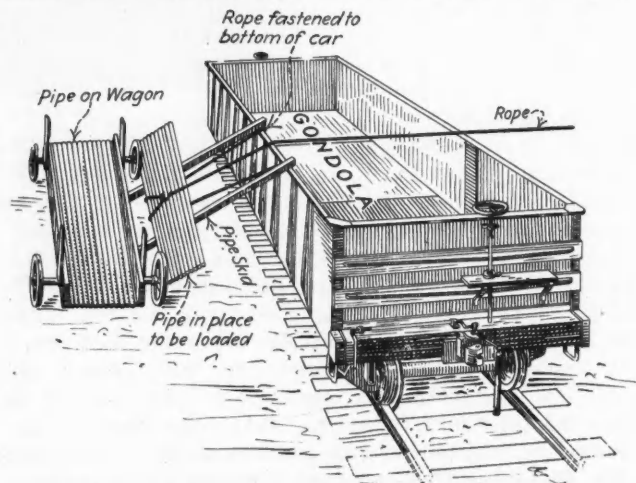
directly into the hopper, the cover shut, and a plug closing the bottom of the hopper is removed by a cord through the cover, permitting the powder to run out. The launder is then given an oscillating motion, so that the powder will run into the hole. This contrivance is safer than the launder previously described, as it is possible to protect the powder from the danger of flying sparks.

Method of Loading Drill Stem and Casing

Written for *Engineering and Mining Journal*

A simple and rapid method of loading drill stem and casing from wagons or trucks into gondolas is shown in the accompanying illustration. The wagon is drawn up parallel to the railway car and at a convenient distance from it. Two skids are so placed that they extend from beneath the wagon to the top of the near side of the car. Two 20-ft. lengths of casing or stem can be used for skids. Both ends of a stout rope are tied to the bottom of the car on the side nearest the wagon and at points directly under the upper ends of the skids. The rope is then passed up the inside of the car and out to the wagon in such a fashion that it forms a "V" with the apex at the wagon.

Several pieces of pipe are then laid together across the skids, and the center of the rope is passed under all of them and back over the top. A chain, or another piece of rope, is fastened to the apex of the rope loop with a hook, and then passed over the car to a double-tree on the opposite side of the car from the wagon. A team of horses, hitched to the doubletree, is driven straight away from the car, and the shortening rope loop causes the bundle of pipe to roll over and over up the



MANNER OF LOADING DRILL STEM AND CASING

skids until the pipe falls into the car. As the pipe moves up the skids the two sides of the rope "V" slip further out on the pipe and prevent one end of the bundle of pipe from traveling faster than the other end and eventually slipping off the skids. With this arrangement two men and a team can load a considerable quantity of casing in a short time.

Punching Holes in Bucket Elevator Belts

By punching holes through the belt for the bolts, the tensile strength is materially reduced. An ingenious method of avoiding this decrease in strength that is worthy of universal adoption is used by one of the large mining companies, according to an article in the *South African Mining and Engineering Journal*. A punch is made from a piece of bar steel a little larger in diameter than the elevator bolts used. One end is tapered down to a sharp point, and the other end is drilled and tapped to suit the thread on the bolts. A bolt is screwed into the threaded end of the punch, which is then driven through the belt and the punch unscrewed from the bolt. In this way none of the warp threads of the fabric are cut, as they are simply pushed aside to make room for the bolts, and the strength of the belt is unimpaired. The method as described is limited in its application to "rubber" belts and fabric belts generally.

Thermit Welding of Cast Iron

In thermit welding, the superheated steel produced by the reaction, when tapped into the mold surrounding the weld, naturally fuses back into the fractured parts two or three inches on either side, and the whole mass, solidifying at one time, effects the repair. The excess metal of the weld may then be removed or not, as the necessity indicates.

In cast-iron welding, steel is the welding medium, and the weld material will, therefore, necessarily consist of a mixture of this steel and the cast iron of the parts being welded. The graphite carbon in the cast iron, therefore, combines with the thermit steel, thus making a high-carbon steel, which usually can be machined only by grinding. This material, however, is not so brittle as cast iron and is physically stronger.

The weld material, being steel, has double the shrinkage of the cast iron. This difference in shrinkage is of no importance where the section welded is approximately square. Where, however, the length of the section at the fracture is four or five times its width, the difference in shrinkage is evidenced by one or more minute cracks perpendicular to the line of the weld and extending through the weld material only. These cracks are caused by the difference in shrinkage, the cast-iron parts tending to restrict the shrinkage of the thermit steel along the length of the piece. Hair-line cracks will be found in the welding of sections such as, for example, 12 in. x 2 in., but would not be found in sections 12 in. x 12 in. The cracks are unimportant, as they are parallel to the line of strain. Extended experience indicates that thermit welds are successful where the length of the fractured section is not in excess of four times its width and where the subsequent machining can be done by grinding rather than by the usual processes.

A Crushed Ore Feeder Which Is Economical Of Head Room

BY HAROLD A. LINKE

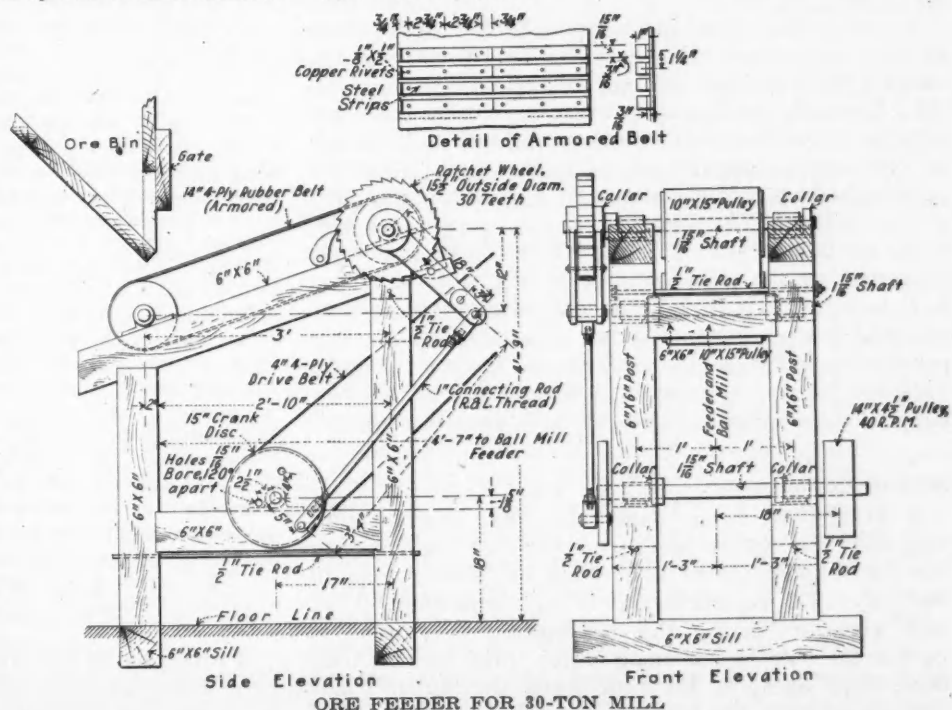
Written for *Engineering and Mining Journal*

In designing a thirty-ton pilot mill for the A. H. Jones Co., metallurgists, of Salt Lake City, it was necessary to provide for a crushed-ore feeder which would not entail loss of mill head room, which would permit of close regulation, be fool-proof, and less expensive than the regular feeders carried in stock by machinery houses. The sketch herewith presented shows the details of the one designed. Regulation of the feed may be done by adjusting the bin gate or by attaching the connecting rod to different holes in the ratchet wheel arm or crank disk. The feeder belt is inclined at an upward angle and the length between pulleys will depend upon the angle of inclination and the mill heights which it is desired to save.

The material of which this feeder is made is all stock, as follows:

- 6 common flat boxes, 1 1/8 in.
- 12 bolts 3/4 x 7/8 in. for same.
- 12 1/2-in. mal. washers, for same.
- 1 shaft 1 1/8 in. x 3 ft. 2 in.; keyseated for 10 x 15 pulley and ratchet wheel.
- 1 shaft 1 1/8 in. x 2 ft. 6 in.; keyseated for 10 x 15 pulley.
- 1 shaft 1 1/8 in. x 3 ft. 4 in.; keyseated for 14 x 4 1/2-in. pulley and crank disk.
- 6 split safety collars 1 1/8 in.
- 9 ft. 3 in. of 4-ply rubber belt, armored as shown.
- 2 c.i. solid pulleys 10 x 15 in., 1 1/8 in. bore.
- 1 c.i. solid pulley 14 x 4 1/2 in., 1 1/8 in. bore.
- 1 ratchet wheel (15 1/2 in. outside diam., 2 1/2 in. plus or minus face), with arm; 1 1/8 in. bore.
- 1 crank disk, 15 in. diameter 2 in. plus or minus face; 1 1/8 in. bore as shown.
- 1 crank pin 1/2 in. x 4 in. plus or minus.
- 1 connecting rod with ends, as shown.
- 1 pin, 1/2 in. x 6 in. plus or minus, with washers and keys.
- 1 pawl, 2 in. x 6 in. x 2 1/2 in. with pin, washers, and keys.
- 1 pawl, 2 in. x 6 in. x 2 1/2 in. with pin, washers, keys, and box.
- Armor plates and rivets for belt.

The only special work was the armoring of the belt. The cost, except for the drive belt and timber frame, was \$156.94 f.o.b. factory. The weight was 760 lb. Plunger feeders of equal capacity cost \$285 and \$350, and roll-type feeders, \$300.



BY THE WAY

Real Miners Wanted

"Tha need for miners, real miners, m'son, be jus' as gert today as t'were back long we an' in that h'early days," said Cap'n Dick. "I remember back in tha h'eighthies one o' tha cow punchers from tha foot'ills came to Grass Valley one h'afternoon an' w'en 'e'd put 'is cattle to pasture an' 'is 'orse in tha livery barn 'e starts forth to see tha town an' celebrate. Didn't seem to make no difference to 'e jus' w'ot 'e ad to drink, so long as t'was wet an' tasty an' strong h'enough. A'for' h'evenin' 'e 'ad grawed noisy an' boisterous. 'Baout nine o'clock a crowd o' we miners wuz standin' in front o' tha bar in Si Rowe's place, 'avin' tha las' glass o' beer a'for' we went 'long 'ome to bed, w'en this 'ere cowboy chap rushed in tha front door an', without sayin' a bloody word, min' you, 'e pulled forth two gert guns from 'is fuzzy pants an' shot away h'all tha lamps 'angin' from tha ceiling. Some o' we chaps, as couldn't get h'out tha back door soon enough, wuz cut h'up a bit with broken glass. By tha time both guns wuz h'empty tha constable h'appeared an' put Mister Cowpuncher in jail. 'E wuz boun' h'over for trial for disturbin' tha peace an' Nick Trebilcock wuz drawed, 'long with h'others, for jury duty. Nick never 'ad served h'on jury before, so 'e figgers this 'ere wuz somewhat o' a honor. Bein' mighty careful o' 'is h'answers to tha questions tha lawyers h'asked 'im, 'e wuz gettin' long fine an' looked sure 'nough like 'e would get h'on that jury. Finally tha prosecutin' lawyer h'asked Nick, "'Ave you h'ever 'ad contact with this man in a business way?" 'No, sir,' sez Nick. 'I've never worked contract with un. W'en I do work contract I 'as a real miner for a pardner, an' no bloody cow puncher like 'im.'"

An Honest Effort

According to reports in the press Senator Ashurst of Arizona had a busy time on Dec. 29 trying to learn whether the President had signed the assessment work bill. He made considerable progress, that is, from one building to another, but late that night he put the job on next day's calendar as unfinished business. No satisfaction was obtained either from Secretary Tumulty or Mrs. Wilson. The Senator's efforts actually took him to the residential section of the White House, somewhat disconcerting the policemen there, who were at a loss as to how far their jurisdiction extended over a Senator constitutionally immune from arrest. The latter's persistence reflected the anxiety of his constituents. This was no way for the President to treat a Senator and of his own party at that, or so thinks Mr. Ashurst.

Iron in Connecticut

A Bridgeport, Conn., paper says that iron ore running 200 lb. to the ton has been discovered in excavating for the foundations of a building on State Street in that city. The contractors, it is said, however, will not stop work to "permit the development of a mine to pursue the lode." The imagination, fired by this incident, leaps ahead to the time when the higher grade deposits of today are worked out and the efforts of the

Mesabi Iron Co. and Replogle Steel to concentrate lean ores shall be ancient history. It may be then that ores running 10 per cent iron will be eagerly sought. The earth's crust has been estimated to contain about 5 per cent iron on the average. Possibly when metallurgy has sufficiently advanced this crust will be indiscriminately mined and shoveled into Somebody's patent disintegrator and the iron separated from the other elements at, of course, a ridiculously low cost. Someone in Bridgeport is evidently thinking in advance of his time.

Dowser Nissley Makes Good

Down in Pennsylvania lives a strong minded people that will not be coaxed out of its old beliefs. Despite the volume of testimony that has been published against the efficiency of "water witching," the people of Ephrata, Pa., are rejoicing over having located two sadly needed wells with the aid of a peach twig in the worthy hands of one "dowser" named Nissley. The following from the *Lancaster Examiner* speaks for itself:

Ephrata, Dec. 9—The members of Ephrata borough council are 'as happy today as a bunch of miners that located a gold mine, as they have been successful in locating several good springs that have helped considerably in relieving the water shortage.

During the latter part of the summer Ephrata's water supply had reached such a stage that certain parts of the town were without water for several hours each day. The water situation was under discussion in every nook and corner of the borough, and many were of the opinion that the only way to overcome this shortage would be to build a filter plant and use the water from the Cocalico Creek. This plan was strongly resented by a number of citizens, as they did not care to have Ephrata lose the reputation it has gained far and wide through its pure mountain water, and insisted on drilling wells on the Ephrata ridge.

But where were the wells to be drilled? This was the question that was asked by many and finally answered by resorting to an ancient method of locating underground springs by means of the divining rod or peach twig. A number of citizens curious to know the possibilities of this method, traversed the mountain side with a peach twig and after several interesting experiences agreed that this would be the only logical way of locating a spot where a well might be drilled and be sure of a supply of water. A number of councilmen became interested and soon had a "dowser," as the English call him, on the job in the person of Jonas Nissley, of Salunga. Mr. Nissley located a spot on the Ephrata ridge near the borough pumping station, where a shaft 201½ ft. was sunk by the well drillers, E. G. Meyers & Co., of Salunga. This well was given a hard test and after pumping continuously for 29 hours an average of between 40 and 50 gallons per minute was maintained with no apparent effect on the supply.

So well pleased were the members of the council with their find that it was decided to make another search and drill another well. The services of "Dowser" Nissley were again secured and he located a spot on the Ephrata ridge a short distance from the pumping station. A shaft of about 200 ft. was sunk and after giving this well a 24-hour test on Tuesday and Wednesday, a flow approximately 50 gallons per minute was maintained with no effect on the supply. The possibilities are that a third well will be drilled shortly.

To a number of people this method of locating water may seem like a fairy tale, on a par with consulting the ouija board for certain information. Nevertheless, this method has been in vogue for over 400 years and proven successful in most instances. History on this subject informs us that the hazel twig was successfully used in locating springs after large sums of money had been fruitlessly spent in boring for water.

It would be mean to take the joy out of Ephrata's life by making fun of its peach twig. After all, they found the water and care little about the means employed.

Society of Economic Geologists Holds Meeting In Chicago

Many Interesting Papers Mark First Gathering of New Organization—R. A. F. Penrose, Jr., Discusses Relation of Economic Geology to General Principles of Geology—A Central Bibliography Urged

THE Society of Economic Geologists held its first meeting in Chicago Dec. 28 to 30, with headquarters at the Chicago Beach Hotel. Meetings were held at the University of Chicago. The society, at the invitation of the Geological Society of America, whose meetings were held at the same time and place, affiliated itself with the latter society to the extent of selecting one of its members to serve as one of the vice-presidents of the Geological Society of America.

At the meeting of Tuesday, Dec. 28, in Rosenwald Hall, President R. A. F. Penrose, Jr., read the opening address, on "The Relation of Economic Geology to the General Principles of Geology." According to Mr. Penrose, the term economic geology is used to indicate the application of the general principles of geology, that is, purely philosophic geology, to material uses. Scientific research is possible in both these phases of geology. Research in purely philosophic geology consists in an effort to unveil the as yet undiscovered secrets of the earth; research in applied or economic geology consists of making useful to mankind the various facts that purely philosophic geology has disclosed, but it may even go further and disclose some of these facts itself.

Many geologic phenomena have been utilized by mankind long before their scientific significance was known, he continued. Prehistoric man often lived in caves of immense proportions with no conception of their origin until geology in modern times demonstrated how they were formed. The discovery of water in artesian wells was made centuries before its geologic cause was known; while the discovery of oil in borings was simply a wild venture until some thirty-odd years ago Dr. I. C. White pointed out the geologic structure affecting its accumulation.

PRACTICAL USE OF GEOLOGICAL PHENOMENA NOT RECOGNIZED AT FIRST

On the other hand, stated Mr. Penrose, many geologic phenomena have not been used for practical purposes until long after their discovery and were at first considered only of scientific interest. Thus the careful petrographic study of rocks, developed so wonderfully in recent years, was at first considered a study of only scientific interest, but it has now become of very great importance in deciding the resistance of different rocks to atmospheric and other conditions. If such knowledge had been available in by-gone ages many stone structures now crumbling in ruins might have been saved for later generations, for they would have been built of different materials. Even in modern times the brown sandstone in some of the magnificent buildings of New York, now crumbling in premature decay, might have been substituted by more durable rocks; and many of our highways, quickly torn to pieces by the automobile, might have been made durable for ages.

Where research in theoretic geology ends and that in economic geology begins is indefinable, in Mr. Penrose's

opinion. The work in one is a supplement of that of the other, and no distinctive line can be drawn between them. Both strive for the truth, whether that be simply scientific or economic. Likewise among economic geologists no sharp line can be drawn. Many of the latter devote their time to particular subjects, but they are all geologists and they are all devoting their attention to the application of geology to useful purposes. There should therefore be no distinction between those geologists who devote themselves to iron, copper, oil, clay products, saline deposits, and other metallic or non-metallic materials. The only difference between the oil, the iron, and other economic geologists is in the matter of detail. There has been a disposition of one class or other to assert its superior importance over the others. Such a feeling seems out of place in the broad conception of the grand work of geology applied to the great industries of the world. The workers are all economic geologists; they are all applying their services to special subjects, and any envious distinction as to the special object to which their talents are applied is unworthy of the greatness of their work. No class of economic geologists should vie with another for importance or notoriety, but they should all work together in the great effort for the benefit of industry and mankind.

ATTITUDE OF MINING COMPANIES TOWARD GEOLOGISTS HAS CHANGED

Many can remember when the great mining companies smiled condescendingly at the assertion of geologists that they could be of service to them, Mr. Penrose remarked. The mining companies of those days sought the old prospector, or the so-called old-time miner, for advice, and were often sadly misled. Today all these conditions have changed. Every great mining company or oil company has its corps of geologic experts, often supplied with very elaborate laboratories for purely scientific research in each particular industry. The economic geologist has become indispensable to the mining industry, and many a great mining operation today would either never have been started or would have absolutely collapsed without his expert knowledge. Hence the time is ripe and even more than ripe for the organization of a society such as is now represented by the Society of Economic Geologists. Such a society was advocated by J. E. Spurr at a special meeting which he called during the meeting of the Geological Society in Boston in 1919, and the present Society of Economic Geologists is the direct outgrowth of his suggestion.

"During the recent war many geologists, both economic and pure scientific, nobly gave their services in one way or another entirely to our country, and research departments were largely depleted of their workers," said Mr. Penrose. "With the termination of the war some of the research workers in geology have returned to their old pursuits, but I believe that now

more than ever the world is in need of work in geologic research. Cannot the economic geologist increase his assistance in this matter by drawing scientific conclusions from his vast practical experience in commercial work? Business difficulties often prevent this, but in many places these can be honorably overcome. Much work of this kind has already been done, but vastly more can be accomplished. Let the economic geologists be men who discover new constructive ideas as well as use the ideas formulated by others. In the conception of such an ideal I look forward with unwavering confidence in the future for good to mankind and usefulness to science which will be exerted by the Society of Economic Geologists, both as a national and an international organization."

DR. LEITH PLEADS FOR NATIONAL POLICY FOR MINERAL RESOURCES

Following Mr. Penrose's address, Dr. C. K. Leith, of the University of Wisconsin, in a communication to the society, pleaded the necessity of a well-considered and co-ordinated national policy for mineral resources, and stated that this could most understandingly be worked out by economic geologists, who specialized on the distribution and reserves of the metals. The discussion led to the adoption of a motion for the appointment of a committee to consider this problem, and the council of the society subsequently appointed C. K. Leith and J. E. Spurr on this committee.

Dr. Waldemar Lindgren, of the Massachusetts Institute of Technology, gave an interesting talk on "Nickel Sulphides" and the possibility of enrichment of nickel ores, in which he indicated the evidence of the formation of secondary richer nickel sulphides in nature from poorer ones, this enrichment in different cases being accomplished by descending surface waters, as at Sudbury, or by ascending warm waters, as at the Key West mine, in Nevada.

A paper on the "Scientific Byproducts of Applied Geology," by George Otis Smith, director of the U. S. Geological Survey, was read by Philip S. Smith, assistant director. Dr. Smith said:

Byproduct is a term that suggests large-scale industrial engineering and perhaps even "big business." Byproduct practice carries the complex idea of waste turned into profit, of painstaking engineering converting the raw material into many products, and of persistent salesmanship that finds a market for commodities as varied as dynamite and toilet sets or hams and violin strings. Yet, except in its larger commercial aspect, byproduct practice is not limited to modern times or to large corporate enterprise; conserving the incidental or the "left-over" was also a virtue of our forefathers. The giving of value to the additional or secondary products and their successful disposal with profit to all, however, seems the modern expression of old-fashioned thrift.

So while, no doubt, applied geology has always paid its tithes in the form of incidental contributions to the theoretical side of the science, it is probably true that as our geologic efforts have been spread over larger fields, with greater variety of endeavor, these scientific byproducts have come to represent greater values to the world of science. As a large operator in applied geology, the United States Geological Survey would be blind to its opportunity if it failed to utilize these scientific byproducts, and indeed it is to be hoped that this Federal service has caught the commercial spirit at least to the extent of seeing large profits in byproducts. The other type of byproducts—economic results incidental to research—would make a more impressive showing; but that is another story, well worth telling under other auspices.

In the program of geologic work of the United States Geological Survey for the last decade three phases of applied geology stand out prominently—land classification, oil and gas exploration, and the study of mineral reserves both in our own and foreign countries. Each of these phases represents a task laid upon the Survey by a national need, but neither of them at first glance is expected to include research into fundamental principles of the science of geology. In fact, they have all been looked upon as a levy upon the science rather than as an aid to its progress. However, it may be opportune to pause and suggest some of the valuable byproducts of all this work that has absorbed so much of the activities of geologists of high scientific training and attainments. To list all these scientific byproducts, however, would result in a bibliography imposing in both length and quality.

The principal beneficial influence of land classification surveys upon our science has operated through the requirement of quantitative detail and the necessary training for close observation. The geologist trained in this work has through great travail of spirit attained notable accuracy in field methods, which has reacted favorably upon standards of work throughout the field organization.

The results of scientific value incidental to the large expenditures of effort and money in the classification of public coal, phosphate, and oil lands have included the increased interest in stratigraphic problems and the increased attention to structural details, overlooked in broad regional studies, and to variation in sedimentation. It is not too much to say that a large part of the present knowledge of the Cretaceous and early Tertiary stratigraphy and paleontology of the West can be traced directly to the public coal-land work, broadly administered by Campbell. The Laramie question became a live issue; Stanton, Lloyd, and Hares recognized and discussed new problems in the Lance of the northern area, just as Gilmore contributed to the paleontology of the southern area; Lee and others made substantial revisions of the stratigraphic column for the eastern flank of the Rocky Mountains; and far to the north, Hollick's monographic study of the Cretaceous flora of Alaska and Martin's work on the Mesozoic stratigraphy of Alaska, of which the Triassic chapter has been published, are a direct outgrowth of the coal and oil investigations. With these and many other highly scientific contributions in mind, it is not too much to credit the fifteen years devoted so largely to examination of the nation's coal lands with an addition to our geologic knowledge of the West fully comparable with the pioneer results of the similar period of exploration over the same area forty years earlier. The new geologic map of Wyoming now ready for publication is in largest part the result of the activities directed primarily to classifying oil and coal land.

RESULTS OF STRUCTURE STUDY

Less obvious, perhaps, have been the scientific results of the increased attention given to structure, such as the recognition and description of the Bannock overthrust by Richards and Mansfield in mapping phosphate rocks in Idaho or the interpretation of the Hart Mountain overthrust by Hewett as a byproduct of his coal and oil work in Wyoming, although the discovery of this great overthrust is to be credited to Dake. These are displacements on a large scale, but observations of structural details have formed an essential part of the general geologic descriptions by other geologists. A few petrographic contributions have also resulted, such as the discovery of the nepheline basalt on the Fort Hall Indian Reservation by Mansfield and the detailed mapping of the Leucite Hills by Schultz.

The close observation necessary in tracing coal outcrops and in valuing public lands according to the thickness and character of the coal beds has naturally led to intensive study of variation in sedimentation. Thom's work on the Lance and Fort Union sediments, in which the source of sediment deposited in flood-plain swamps is traced by means of microscopic examination, and Hewett's discovery of the persistent presence of bentonite in the Upper Cretaceous series, proving volcanic activity in four states, are important contributions to paleogeographic science—despite the bar sinister.

The observed influence of the oil and gas studies by the Federal geologists has aroused a larger interest in geophysics and in physical chemistry, an influence which shows itself for the most part only indirectly but is none the less of large profit to our science. Here again close attention to structural details is yielding theoretical contributions, but probably the most noteworthy byproduct of the oil and gas work of the United States Geological Survey has been the augmented interest in the petrology of sedimentary rocks. For purposes of correlation and of interpretation of the details of "oil sand" stratigraphy, petrographic methods must be developed and used. Questions of oil genesis, accumulation, and recovery lead to theoretical problems whose solution will deepen our insight into earth processes.

The study of mineral resources stimulated by the war also yielded scientific profits, both subjective and objective. Foremost among these I would place the appreciation of the physiographic relation of manganese oxide deposits to stages of planation and of the fact that degree of rock decay depends more upon physiographic stage than upon climate; and the tracing of deposits of manganese ore disclosed in the Appalachian Valley region a planation stage that had previously received little attention.

The study of the literature of foreign mineral reserves as a part of the American problem of raw material supply has also added to our appreciation of exact statement in geologic reports. The critical reader of scientific literature may even profit by the faults of others, and our geologists who have made largest use of the reports on the ore deposits of the world have acquired the keenest understanding of what standards are needed in geologic work, in both field and office. This intensive study of the commercial side of geology should tend to make our science more exact.

PURE SCIENCE SIMPLY "NOT-YET-APPLIED" SCIENCE

In the course of a discussion at the Baltimore meeting of the Geological Society of America, Dr. Iddings hesitated to characterize pure geology as unapplied geology, and my suggestion was that pure science is simply not-yet-applied science. I believe this descriptive definition stands the test of our experience, and a long list of economic byproducts of pure geology could be cited as proof. One such example of the later application of the results of a purely scientific investigation to everyday use of large value may be mentioned here because it illustrates the final point I wish to make. Alden's glacial studies in Wisconsin, which were continued over a decade and covered about 10,000 square miles, resulted in two professional papers, one bulletin, and one geologic folio, each a contribution of high scientific and educational value. Now, an extensive and intensive program of state highway construction has given to this geologic study a value not anticipated. Measured by the commercial standards of value, Alden's glacial mapping is expected to save the State of Wisconsin in the location of road material at least two and a half times what the geologic work cost the Federal Survey. The economic byproduct thus more than repays the production costs, and any economist can see a large profit in the operation.

The general trend in useful geology is to call for quantitative results, and indeed exactness is more truly scientific than vagueness. Moreover, the testimony of experience is that whatever the purpose of a geologic project, if its execution is thoroughgoing, its methods exact, and its standards high, it will yield byproducts of value. It is therefore from the best of scientific research that economic byproducts are obtained and it is only from applied geology well applied that scientific byproducts may be expected. The incidental is not accidental.

The personal element in geologic byproduct practice is not to be overlooked in this brief résumé of the subject. Geologists differ in both their telescopic and their microscopic vision, and even more in their catholicity of interest. The field observer whose eyes are open to every type of geologic phenomena is pre-eminently a byproduct man; and whether his primary object is the examination of a dam site or the correlation of two interglacial formations, he returns with note book and mind enriched with all that he

saw, so that the byproducts may eventually outvalue the answer to his original problem. Mr. Gilbert well illustrated the geologist whose researches yielded so great a wealth of products, and in his work the line between pure geology and useful geology was not marked. In that type of geology, broad in scope and accurate in detail, byproducts of high value can always be expected.

EXPERIMENTS ON ACCUMULATION OF OIL IN SANDS DESCRIBED

At the conclusion of Dr. Smith's paper an interesting talk on the "Results of Experimental Work on the Accumulation of Oil in Sands" was given by W. H. Emons, and George Thiel, of the University of Minnesota. In a series of bent glass tubes, representing anticlinal and other structures, if sand containing a little oil was put together with water, no segregation of the oil took place; but if a very little gas of any kind were introduced, the surface tension of the oil films on the sand grains was affected, and the oil accumulated at the tops of the anticlines. The suggestion was made that artificial pressure in the field might do the same thing, after the ordinary flow of oil was exhausted.

Dr. J. F. Kemp, of Columbia University, described occurrences of metallic ores where copper ores occurred at lower horizons than lead and zinc ores, according to the law which has been so often described. Dr. D. F. Hewett, of the U. S. Geological Survey, discussed the existing bibliographies of economic geology, and argued for a central bibliography under the auspices of the Society of Economic Geologists.

A smoker was held in the evening, in conjunction with the Geological Society of America.

SECOND SESSION ON FOLLOWING DAY

The second session of the Society of Economic Geologists was held at 2 p.m., Wednesday, Dec. 29. A committee was appointed to consider the question of an international bibliography of economic geology, and report to the council, following out the discussion of the subject by Dr. D. F. Hewett on the previous day.

Roswell H. Johnson contributed a thoughtful paper on the "Influence of Spacing of Oil Wells on Acre Yield," in which the necessity for more accurate statistical information, in order to arrive at a tabulation which might be used as a practical guide in deciding as to well-spacing, was pointed out.

Prof. Edson S. Bastin, of the University of Chicago, contributed a paper on the "Origin of the Silver Ores of the Comstock Lode," in which the results of microscopic study of the ores was described. In general, he found quartz, zinc blende, and chalcopyrite somewhat earlier, and galena, argentite and gold somewhat later throughout the ores, although all represented one general period. The point of interest was that the argentite was not derived from the galena, but was contemporaneous with it. This paper aroused considerable discussion, J. E. Spurr pointing out that at Tonopah and also at Aspen, Col., the rich silver sulphides had been found to be primary, and not secondary, as hasty conclusions based on the analogy of the copper ores might decide. A question was raised by B. S. Butler as to the connection of the hot waters at the Comstock and at Tonopah with the genesis of the ores, in the course of which Prof. G. D. Louderback cited the hot waters of the neighboring Steamboat Springs, now depositing cinnabar, the sulphide of mercury, and other metallic minerals.

THE PETROLEUM INDUSTRY

The Legal Status of Oil-Shale Deposits On the Public Domain

BY JAMES R. JONES*

Written for *Engineering and Mining Journal*

THE provisions of the act of Feb. 25, 1920, so far as they relate to deposits of oil shale, are as follows:

Sec. 21. That the Secretary of the Interior is hereby authorized to lease to any person or corporation qualified under this act any deposits of oil shale belonging to the United States and the surface of so much of the public lands containing such deposits or land adjacent thereto as may be required for the extraction and reduction of the leased minerals, under such rules and regulations, not inconsistent with this act, as he may prescribe; that no lease hereunder shall exceed five thousand one hundred and twenty acres of land, to be described by the legal subdivisions of the public-land surveys, or if unsurveyed, to be surveyed by the United States, at the expense of the applicant, in accordance with regulations to be prescribed by the Secretary of the Interior. Leases may be for indeterminate periods, upon such conditions as may be imposed by the Secretary of the Interior, including covenants relative to methods of mining, prevention of waste, and productive development. For the privilege of mining, extracting and disposing of the oil or other minerals covered by a lease under this section the lessee shall pay to the United States such royalties as shall be specified in the lease and an annual rental, payable at the beginning of each year, at the rate of 50c. per acre per annum, for the lands included in the lease, the rental paid for any one year to be credited against the royalties accruing for that year; such royalties to be subject to readjustment at the end of each twenty-year period by the Secretary of the Interior: Provided, That for the purpose of encouraging the production of petroleum products from shales the secretary may, in his discretion, waive the payment of any royalty and rental during the first five years of any lease: Provided, That any person having a valid claim to such minerals under existing laws on Jan. 1, 1919, shall, upon the relinquishment of such claim, be entitled to a lease under the provisions of this section for such area of the land relinquished as shall not exceed the maximum area authorized by this section to be leased to an individual or corporation: Provided, however, That no claimant for a lease who has been guilty of any fraud or who had knowledge or reasonable grounds to know of any fraud, or who has not acted honestly or in good faith, shall be entitled to any of the benefits of this section: Provided further, That not more than one lease shall be granted under this section to any one person, association, or corporation.

Sec. 29. That any permit, lease, occupation, or use permitted under this act shall reserve to the Secretary of the Interior the right to permit upon such terms as he may determine to be just, for joint or several use, such easements or rights of way, including easements in tunnels upon, through, or in the lands leased, occupied, or used as may be necessary or appropriate to the working of the same, or of other lands containing the deposits described in this act, and the treatment and shipment of the products thereof by or under authority of the Government, its lessees, or permittees, and for other public purposes: Provided, That said secretary, in his discretion, in making any lease under this act, may reserve to the United States the right to lease, sell,

or otherwise dispose of the surface of the lands embraced within such lease under existing law or laws hereafter enacted, in so far as said surface is not necessary for use of the lessee in extracting and removing the deposits therein: Provided further, That if such reservation is made it shall be so determined before the offering of such lease: And provided further, That the said secretary, during the life of the lease, is authorized to issue such permits for easements herein provided to be reserved.

Sec. 30. Each lease shall contain provisions for the purpose of insuring the exercise of reasonable diligence, skill, and care in the operation of said property; a provision that such rules for the safety and welfare of the miners and for the prevention of undue waste as may be prescribed by said secretary shall be observed, including a restriction of the work day to not exceeding eight hours in any one day for underground workers except in cases of emergency; provisions prohibiting the employment of any boy under the age of sixteen or the employment of any girl or woman, without regard to age, in any mine below the surface; provisions securing the workmen complete freedom of purchase; provision requiring the payment of wages at least twice a month in lawful money of the United States, and providing proper rules and regulations to insure the fair and just weighing or measurement of the coal mined by each miner, and such other provisions as he may deem necessary to insure the sale of the production of such leased lands to the United States and to the public at reasonable prices, for the protection of the interests of the United States, for the prevention of monopoly, and for the safeguarding of the public welfare: Provided, That none of such provisions shall be in conflict with the laws of the state in which the leased property is situated.

Sec. 37. That the deposits of coal, phosphate, sodium, oil, oil shale, and gas, herein referred to, in lands valuable for such minerals . . . shall be subject to disposition only in the form and manner provided in this act, except as to valid claims existent at date of passage of this act and thereafter maintained in compliance with the laws under which initiated, which claims may be perfected under such laws, including discovery.

The act does not apply to lands in forest reserves created under the Appalachian Forest Act, approved March 1, 1911; in national parks; in military or naval reservations; or in Indian reservations. Whether it applies to ceded Indian lands depends upon the laws controlling their disposition.

OIL-SHALE CLAIMS LOCATED UNDER LODE LAW SHOULD HAVE MINERAL DISCOVERY

Previously to Feb. 25, 1920, oil-shale deposits were located under the mining law of 1872 with its amendments, and it is probable that a considerable acreage of oil shale has been located and is now being held under that law either as lode or as placer claims. It is important, therefore, that all who are interested, or likely to become interested, in property of this character should keep in mind the salient features of the mining law.

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One of the requirements of this law is that each claim must be supported by the discovery of mineral. It has been held that a discovery sufficient to justify a miner in the expenditure of further time and labor with the expectation of finding a paying deposit is a sufficient discovery to meet the requirements of the law. What tests as respects discovery will be applied to oil-shale claims where their validity may be brought into question before the Land Office or in the courts cannot be foreshadowed with certainty, but the discovery on which a claim is based should afford reasonable ground for believing that the deposits may be placed on a commercial basis.

It is probable that most oil-shale deposits which have been located under the mining law have been located as placer claims. The size of such claims is limited to twenty acres for one person, and a corporation is considered to be an individual and may not locate a claim in excess of twenty acres, but two or more persons may associate themselves together and take up a claim consisting of twenty acres for each person, with the limitation, however, that no claim may exceed 160 acres, no matter how many persons may be in the association holding it. If an individual or a corporation wishes to locate more than twenty acres of placer ground, more than one claim must be taken up and each claim must be supported by a discovery and \$100 worth of annual development work. One discovery will support a claim of 160 acres held by an association of eight persons or more, and requires the performance of only \$100 worth of annual development work. It is probably these provisions regarding development work and discovery which have given rise to many of the so-called "dummy" locations of mining claims on public lands; i. e., the use of the names of persons having little or no interest in the matter, with the object of getting them to assign their interest to some person or corporation after the location has been made and thereby giving to the assignee the advantage of a claim consisting of more than twenty acres, and usually of 160 acres, upon which only \$100 need be expended during the year. Once the location

has been made in good faith by two or more persons, however, they may, having thus established their interests, assign such interests to a single person or to a corporation.

LIMITATIONS ON SIZE OF LODE CLAIMS

Regarding any deposits which may have been located under the lode law, it should be noted that the Federal law limits the size of lode claims to 1,500 ft. along the vein or lode, and to 300 ft. on each side of the middle of the vein at the surface, and this size may be further restricted by state statute or local regulation. The discovery should have been well identified either by means of a shaft at least ten feet deep from the lowest rim, or by an open cut, crosscut or tunnel of the same depth, or an adit at least ten feet in along the lode from the point where the lode may be in any manner discovered. These or similar requirements are contained in the laws of many of the public-land states.

By an act of Congress approved July 17, 1917, the owners of mining claims were relieved from the performance of annual development work for the years 1917 and 1918 and by an act approved Nov. 13, 1919, they were relieved from the performance of such work during the year 1919. Any person who wished to take advantage of these acts, however, was required to place on record in the office where the record of the claim in question was recorded a statement of his intention to hold such claim. Where owners of claims neglected either to perform the necessary work or to file such a statement it would probably be held that the claim lapsed with the approval of the act of Feb. 25, 1920, and could not afterward be revived.

According to an article which appeared in the *Salt Lake Tribune* of Nov. 26, 1920, 2,240 acres of oil-shale deposit in Garfield County, Col., have recently been patented. This is said to be the first deposit for which patent has been obtained. It lies within a Naval Reserve, and a protest was filed by the Navy Department against the application, but the protest was evidently withdrawn without a contest.

NEWS FROM THE OIL FIELDS

Legality of Townsite Drilling in Mexico To Be Tested

From Our Special Correspondent

Drilling has been started in the *funda legal*, or townsite of Zacamixtle. This is a test case well to see whether the government will deem this act legal or not. Much agitation has been shown in the Mexico City papers over this matter, and it is difficult to tell just how it will turn out. It happens that the townsite lies on the line of production through Zacamixtle, and consequently it is a very valuable piece of land.

It is rumored that the Aguila company has brought in a well in the Tempol Valley, but no details are available as yet, because of lack of communication between this field and

Tampico. Much wildcatting is going on in this section of the country, and it is said by several of the well-known geologists of this section to be the next pool in the Mexican oil fields.

Over sixteen million barrels of oil were shipped from Mexican fields during the month of November. The Aguila, Huasteca and Transcontinental companies all shipped over two million barrels each. Island, Texas, Mexican Gulf, Cortez and Cias del Agwi companies all shipped upward of a million barrels each.

Buckley-Thompson well No. 2 showed 3 per cent salt water recently and was "pinched in" to one-half its initial production. With the passing of this well this famous lot has only one producer left, which is Nichol's well No. 1. The well of Jones & Buchanan is

still bridged, and it is doubtful if it will ever produce any oil for the market. The surface of the ground for several hundred yards around is covered with waste oil which flows through the oil saver, and great care has to be taken that this does not catch fire. The drillers are hard at work on this well, setting forth every effort to break the bridge and bring the well to production.

The Transcontinental Co. had a large gas blowout on its well No. 1 on Lot 198, Amatlan. The depth of this well is slightly over two thousand feet. It is gassing continually and the pay is expected in the next few feet. A tank site is being excavated and the tank will be well under construction before the well comes into production.

The United States Mexican Oil Cor-

poration has started development of its properties in Mexico, and it is expected by next June it will be one of the big producers of both Panuco and the lower field crude. An inspection trip of its properties here was made by several of the officials of the company.

Texas Companies Reduce Crude Oil Purchases

From Our Special Correspondent

The Humble Oil & Refining Co. has announced that after Dec. 27 its purchases of crude oil from the central west Texas fields would be reduced 50 per cent. The other 50 per cent normally purchased from pipe-line runs will be stored in the nearest steel storage tanks at the rate of 3c. per bbl. per month according to the regular storage contract. It is stated the company's pipe-line runs in west Texas have been about 31,000 bbl. daily. The Breckenridge Townsite field will be the most affected by this new order. This is on top of 50 per cent and 30 per cent cuts in pipe-line runs in Oklahoma by the Texas Co. and Prairie Pipe-Line Co. respectively.

The Humble Oil & Refining Co. recently completed its No. 3 Robinson well, in the north extension of the West Columbia field, at 3,134 ft. The well came in making 1,500 bbl., of which 5 to 6 per cent was salt water. Several other wells are being drilled in this section north of the Texas Co.'s Abrams lease tract.

At Hull, Liberty County, the Pulp Production Co.'s No. 5 Thomas Fee was completed recently at 2,700 ft. making 2,500 bbl.

Notes From Louisiana Fields

From Our Special Correspondent

One of the largest wells completed recently in northern Louisiana was brought in by the Lee Oil & Refining Co. at Pine Island, Caddo Parish. This is the No. 2 Fee, making 4,000 bbl. from 2,200 ft. The well is in the southwest corner of Sec. 33-21-15.

The Simms Petroleum Co. has purchased the Shaw lease, in the Homer field, from the Western Oil Fields Corporation. The reported price is \$250,000.

It is reported that the White Eagle Oil Co. has recently brought in a gusher on Sandy Bayou, on the east side of Ouachita River, sixteen miles south of Columbia, Caldwell Parish.

A rush for oil leases in the Brazeau forest reserve at the foothills west of Edmonton, Alberta, recently took place, as the result of which, since Dec. 6, the Edmonton land office received in fees \$23,926. The officials estimate that about 95,000 acres have been filed on, half of which, under the new regulations, is reserved for the Crown. The leading interests represented are the Imperial Oil Co. and the Oliphant-Munson Collieries.

Commission Finds Wyoming Oil Controlled

The Federal Trade Commission on Jan. 3 sent to the Senate and House of Representatives its report on the petroleum industry of Wyoming, which in abstract is as follows:

"The attention of the commission was drawn to the situation in Wyoming by a complaint regarding certain alleged unsatisfactory conditions in connection with the production and sale of crude petroleum marketed under certain contracts in the Salt Creek, Wyoming, field. It soon became evident that there were monopolistic conditions in the production, pipe-line transportation, refining and wholesale marketing of crude petroleum and its products throughout the entire Rocky Mountain section and the scope of the commission's inquiry was broadened to include such phases of the petroleum business of that section.

"The geographic isolation of the Wyoming oil fields with reference to the prolific Mid-Continent and California field and the absence of pipe-line transportation to large consuming centers make it necessary for the producer to sell his crude petroleum to local refining companies. The only refineries outside of the state that purchase Wyoming crude are comparatively small ones which are largely dependent upon this source of supply. These refineries are in Colorado, Utah and the Province of Saskatchewan, Can.

"There is greater concentration in the control of the production of crude petroleum in the Wyoming oil fields than in any other field in the United States. The Midwest refining interests, according to admissions of representatives of both the Standard Oil Co. (Indiana) and of the Midwest Refining Co., are now for all practical purposes under the control of the Standard Oil Co. (Indiana), which together with other Standard Oil companies, now controls the bulk of the crude petroleum produced in Wyoming. This control on the part of the Midwest interests has been largely acquired through long-time contracts which expire Jan. 1, 1934. The Ohio Oil Co., a Standard company, has the largest owned production in the state, and in addition to this controls considerable quantities through working agreements. During the period 1917 to 1919 the Midwest interests controlled from 65 to about 69 per cent of the state's production; the admitted Standard interests controlled from 27 to 29 per cent. Together these two interests controlled from about 93 to 97 per cent of the total production.

"The Wyoming oil fields are so distant from large consuming centers of refined products that no extensive pipe lines have been built to such points; and the different oil fields in the state are so widely separated that the pipe lines do not form a complete system but consist of comparatively short lines which connect a single field with a refinery or railroad."

Wyoming Well Brought in Following Contract Expiration

From Our Special Correspondent

The Ohio Oil Co. recently brought in a well on the Dixon farm, in the Rock Creek field, flowing 1,000 bbl. per day. Work on this well had been under way for over a year. The Lance Creek Royalties Co., a royalty owner on this land, and the owner of the land have notified the Ohio Oil Co. that the latter's lease has been cancelled on account of alleged violation of its contract in failing to complete the well within the stipulated time limit.

The Elkhorn Oil Co. is now making a good production of oil from its holdings in the Big Muddy field. It has also purchased a lease in the Cat Creek field, in Montana, and will begin drilling soon.

The United States Supreme Court recently dissolved the injunction obtained by the Midland Carbon Co. and the Occidental Oil & Gas Co., restraining the State of Wyoming from imposing the penalties prescribed by the gas conservation laws of the state. These two companies have been operating carbon-black plants near Crowley and in Lovell in violation of the ten-mile proximity statute. The penalty is a fine of \$100 to \$1,000 for each day of operation.

Kentucky 1920 Production Below That of Previous Year

From Our Special Correspondent

The production of crude oil in Kentucky for 1920 will aggregate 8,750,000 bbl., according to latest estimates. These figures show a falling off of approximately 500,000 bbl. from the 1919 output.

In eastern Kentucky, Johnson County district, Gibson and associates who are drilling an advance test on Paint Creek have a showing of 100 bbl. daily. Several new wells drilled in Magoffin County made from ten to fifteen barrels. Three five-barrel pumpers and one strike making ten barrels are reported from Lawrence County.

The Lee-Estill-Powell-Wolfe districts show a number of moderate strikes. No late completion has been reported above twenty barrels. In southern Kentucky recent completed work was restricted to Wayne County, where two dry holes, two five-barrelers and one ten-barrel pumper were reported.

The western Kentucky district, Warren County, shows two new wells averaging 75 bbl. and a number of smaller strikes. Simpson County reports scattered strikes; one puncture in the Wheat pool is estimated at 40 bbl. Christian County is a new section of western Kentucky that is attracting attention, and a number of tests are now being made.

A report states that Gilbert well No. 4, on Brush Creek, Cumberland County, came in and is flowing. It is regarded by oil men who have seen it as one of the best wells that have been developed in that territory.

Book Reviews

Geology of the Non-Metallic Mineral Deposits Other Than Silicates. Vol. I, Principles of Salt Deposition. By Amadeus W. Grabau, S.M., S.D. 6 x 9; pp. 435. McGraw-Hill Book Co., Inc., 1920. Price, \$5.

This volume is a geological treatise on certain non-metallic minerals. As the author states in his preface, it may be designated as "a handbook of salt-geology," if we use the term salt in a sufficiently broad sense to include nitrates, borates, phosphates, and similar deposits. Chapters I and II are devoted to the chemistry and mineralogy of these salts, and are naturally chiefly compilations. Chapter III treats of the sea as a source of saline deposits; Chapter IV of the condition of deposition of sea salts in nature; chapters V, VI, and VII, of salts in sea-margin deposits, and deposits from the evaporation of a cut-off portion of the sea. Chapter IX treats of salts of "connate" origin; that is, salts derived from marine sediments which have retained some of the salts of the sea in which they were originally deposited. Chapter X discusses salts leached from older rock-salt deposits, and Chapter XI salts leached from the decomposition products of older rocks, and also the concentration of salts by plants. Chapter XII covers the "playa" or alkali flat deposits of complex salts, like those of Nevada and California; Chapter XIII, the occurrence and origin of nitrate deposits; Chapter XIV, deposits of phosphate of lime; Chapter XV, the salt deposits from mineral springs and volcanic fumaroles. Finally, in separate chapters are treated the "salts" which are secondary or alteration products, as gypsum and dolomite from limestone; the changes of structure and occurrence imposed on salt bodies by earth pressure, including a discussion of the famous "salt domes" such as those of Texas and Louisiana; and the conditions of salt deposition in former geological periods.

There is no doubt that this is a valuable and a scholarly volume, which should be in the library of every geologist; and that it will be a great aid to our comprehension of the origin of the abundant and economically important non-metallic minerals treated. It bears evidence of thorough research, and carries a judicial mode of statement and of balancing various evidence and different points of view. Students of economic geology in the universities, as well, should certainly include this in their reading. The tendency is perhaps to be a trifle detailed in the descriptions and discussions, with possibly too much attention to detail and statistics to be ideal as a textbook; but, when all is said, the size of the volume remains reasonably modest. The discussions of precipitation of salts like lime, manganese, and silica by marine

organisms, and of other salts, like soda and potash, by plants, are among the very valuable features. The book would perhaps have been better rounded without the last chapter on the conditions of salt deposition in former geological periods, as this chapter is a trifle hypothetical, but in all it occupies only twelve pages. J. E. S.

Fuel Oil in Industry. By Stephen O. Andros. Cloth; pp. 244; illustrated; 6 1/2 x 9 1/4. Chicago. Shaw Publishing Co., 1920. Price, \$3.75.

To those unfamiliar with the several uses of fuel oil in industry, the formidable list which appears in the appendix of this book is enlightening. The list includes 85 of the purposes for which fuel oil may be used and indexes the importance which may be attached to this source of energy. The increasing attention paid to liquid fuel makes the book a particularly timely and valuable one, and the manner of presentation is good. The preliminary chapters deal with general facts concerning principles of fuel oil combustion, physical and chemical properties of fuel oil, distribution and storage, heating and pumping. The later chapters cover the application of fuel oil to specific industries such as steam navigation, locomotives, iron and steel, sugar, glass, and ceramics; also its utilization in the heating of buildings and in gas making. Altogether, the subject is presented in readable fashion and will be found most suitable as a reference or text book. D. E. A. C.

MacRae's Blue Book. Cloth, pp. 2,000, 8 x 11. Published by MacRae's Blue Book Co., Chicago. Price, \$10.

This is a buying guide containing the names and addresses of 35,000 American manufacturers; the manufacturers of 14,000 classifications of material; an index of trade names of materials with the manufacturers thereof; about 75 pages of miscellaneous tabular matter such as is found in manufacturers' handbooks; and about 150 pages of list prices of materials. The last is a distinguishing feature of this book.

Gypsum—A very complete book of 326 pages has just been issued by the U. S. Geological Survey as *Bulletin* 697; entitled, "Gypsum Deposits of the United States." It takes the place of *Bulletin* 223, published in 1904, and is obtainable from the Superintendent of Documents, Washington, D. C., for 50c. The first forty-five pages are of general interest to those engaged in the industry, being devoted to the mineralogy and geology of gypsum, analyses and methods of analysis, production, methods of mining and milling and uses. The remainder of the book describes the various deposits of the United States in detail by states. The American gypsum production in 1918 was worth \$11,000,000, most of it coming from New York, Michigan and Iowa. Its principal uses are as wall plaster, land plaster and as a retarder in portland cement.

Technical Papers

Copper Converting—A ten-page paper describing the converting practice at the Spassky copper smelter, Akmolinsk, Siberia, appears in the *Bulletin of the Institution of Mining and Metallurgy* for November. Copies of the paper may be obtained from the offices of the Institution, 1 Finsbury Circus, London, E. C. 2, for 1s. There are two 10-ft. Great Falls type, magnesite-lined converters and a 55 per cent matte is treated, requiring slight modifications of ordinary practice.

Mine Surveying—The November issue of *The Anode*, published by the Anaconda Copper Mining Co., Butte, Mont., contains an interesting eight-page article entitled, "Engineering in the Anaconda Copper Mining Company's Mines in Butte." A brief history of the science of mine surveying is given, followed by a discussion of modern methods as used by the Anaconda staff.

Electrolytic Zinc—The Anaconda electrolytic zinc plant at Great Falls, Mont., is the subject of a 55-page paper just published by the American Institute of Mining and Metallurgical Engineers, 29 West 39 St., New York. The paper goes into considerable detail regarding the equipment and process. Another valuable article entitled "Electrolytic Zinc Methods" appeared in the Dec. 4 issue of *Mining & Scientific Press* (420 Market St., San Francisco, Cal.; price, 15c.).

Hoisting—"Rational Design of Hoisting Drums" is the title of a paper by Everett O. Waters which appears in the December issue of *Mechanical Engineering*. (29 W. 39 St., New York.) The discussion is confined to the determination of the flange shape and thickness and that of the thickness of the drum body. Several formulæ relating to the above are deduced.

Petroleum Research—The U. S. Bureau of Mines, *Reports of Investigations*, Serial 2,177, obtainable on request, is a five-page pamphlet describing the work and aims of the Petroleum Experiment Station at Bartlesville, Okla.

Natural Gas—The forty-four-page section of *Mineral Resources*, 1918, entitled "Natural Gas and Natural Gas Gasoline," has just been published by the U. S. Geological Survey, Washington, D. C. There is no charge.

Refractory Brick—*The Iron Trade Review* for Dec. 2, 1920 (Cleveland, Ohio; price, 25c.) has a three-page article on linings for electric furnaces, in which the properties of the following refractories are discussed: fire clay, silica, magnesia, chrome, bauxite, zirconia, carborundum, and alundum.

Asbestos—"Asbestos in South Africa" is the title of a two-page report issued by the U. S. Bureau of Mines, Washington, D. C., *Reports of Investigations*, Serial 2 179.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

New York Section of Mining and Metallurgical Society Meets

Mining and Industrial Conditions in Poverty-stricken China Sketched by H. Foster Bain

The New York Section of the Mining and Metallurgical Society of America listened to an interesting address by H. Foster Bain on the evening of Dec. 29. J. A. Church, Jr., presided. The subject was "Problems Fundamental to Mining Enterprise in the Far East." Dr. Bain presented a general review of conditions. Among other things he stated that the Far East is not a rich country. It is poor as compared with Europe and America. Trade must be a give and take. The countries are largely self-contained. A selling campaign necessitates a campaign to increase buying power. Successful development of trade depends on thorough study of local conditions and customs, and primary rather than secondary contact through trading companies. The Chinese do not produce enough mineral to supply their own requirements.

In developing new industries Dr. Bain showed how difficult it would be to induce the working population to change from habitual employments to new ones. The seasonal requirements of the agricultural industry were exceedingly difficult to overcome. Under the existing sociological conditions there is little incentive to individualism and industry must contend with closely knit family groups. In addition, there is the general lack of sanitation and the fact that the climate over considerable areas is a tropical one. European powers that have established themselves in the Far East hold on to what each has for the benefit of its own nationals, and it is a fact that many countries are not freely open to aliens.

The mineral resources of China, according to Dr. Bain, have been overrated. Many of the mines are small and the mining conditions in general are comparable to those which prevail in the southeastern part of the United States. The mineral production is small and is made under unusual transportation and local conditions. Foundries and machine shops are essential parts of mining plants. While the day's pay is small, other factors have to be considered and these in themselves are more important than day's pay. Labor is largely employed under a contract system; workers are indifferent to accuracy, as there is no standardization of local weights and measures; and efficiency is low. Transportation is difficult and costs high. Absence of a common law for both native and foreign, exchange difficulties, and local customs are matters of no mean moment.

Dr. Bain is of the opinion that the

Far East is no place for the shoe-string promoter, but that well organized companies would find it a remunerative field. At the close of the meeting many of the members asked questions and the interest taken in the subject was keen.

E. J. Mehren Addresses A. S. C. E. Describes Western Europe of Today from the Engineer's Point of View

At the meeting of American Society of Civil Engineers in New York City, on Jan. 5, Edward J. Mehren, editor of *Engineering News-Record*, gave an address on "Europe Today—An Engineer's Impressions." His interesting remarks presented a brief summary of present industrial and political conditions in England, France, Belgium, Holland and Germany. The lantern views presented illustrated engineering works and other features.

Economic Liaison Subcommittee Secures Information on Strategic Materials

As the result of a letter addressed by the Secretary of State to the Secretary of War on Feb. 25, 1919, there was organized the Economic Liaison Committee, the members of which represent the departments of State, Treasury, Navy, Post Office, Interior, Agriculture, Commerce, Labor, and also the Interstate Commerce Commission, Federal Reserve Board, Federal Trade Commission, Shipping Board, War Finance Corporation, Tariff Commission, and Council of National Defense. The object is to aid the foreign trade advisor in helping both State and War departments to secure information that they need.

Late in that year the Economic Liaison Subcommittee on Strategic Materials was created for the purpose of obtaining information in regard to the production possibilities of this country and of other countries with respect to commodities the procurement of which would probably be difficult in the event of war. It is now actively engaged in this work. Concerning the need for such work the Chief of Staff of the Army has the following to say in his latest report:

"In order that the War Department may be prepared to meet any emergency which may arise, it is essential to have on file and ready for immediate use complete data as to the probable requirements of the army and the sources from which these requirements can be met. There has been initiated in the War Department the computation of war requirements based on an assumed military program and an assumed army organization. The computation of war requirements is a

comparatively simple matter and the arrangements already made are such as to insure its being carried to completion as rapidly as authorized personnel will permit.

"The question of ascertaining the sources of supply is a more difficult one. It is a serious error to assume that in the event of war supplies can be obtained from sources which will be ascertained after declaration of war. This was, in fact, what was done in 1917, and the fallacy has been clearly demonstrated. There appear to be two courses open to the War Department.

"The two courses referred to are: (1) For the War Department alone to make a thorough investigation without reference to other Government departments, of all sources of supply of raw materials and manufactured articles. This will involve great expense, will require years of work and much duplication of effort, and when completed will be practically useless, as it will be out of date; (2) to make use of information filed in other Government departments or readily obtained by them. The second method is the one that is being followed.

"Assuming that the probable requirements of the War Department are known and that other Government departments have furnished full information as to the sources of supply available in this country and in other countries, there yet remains one other item of information of vital importance to the War Department which can be obtained in no other way than through other Government departments. This is the requirements of the Navy, Shipping Board, and other Government agencies and of the public. No matter how accurately War Department requirements are known, or how carefully the sources of supply may have been checked, the information will be comparatively useless unless it is known what part of the existing sources of supply will be available for use by the War Department.

"In order that this question may be answered, it will be necessary for all departments to determine their own needs and for some department to determine the needs of the public. The War Department alone cannot obtain the information essential for insuring its own efficient operation in the event of war."

Engineering Council recently sent out a copy of the Final Report of its Committee on Classification and Compensation of Engineers. At its meeting on Dec. 16, 1920, council voted to concur in the recommendations of the committee, and to refer that report to American Engineering Council. Address: 29 West 39th St., New York City.

MEN YOU SHOULD KNOW ABOUT



H. FOSTER BAIN

H. Foster Bain, mining engineer, of Washington, D. C., has been nominated by President Wilson to succeed Dr. F. G. Cottrell as Director of the Bureau of Mines.

Mr. Bain was born at Seymour, Ind. After his graduation from Moore's Hill College, Indiana, in 1890, he spent two years at Johns Hopkins University and later received his doctor's degree from the University of Chicago. He was educated and trained as a geologist and mining engineer. He was one of Herbert Hoover's assistants in London on the Belgian relief work during the war. From 1909 to 1915 he was the editor of the *Mining & Scientific Press* of San Francisco, Cal., and later the editor of the *Mining Magazine* of London, England. He made some important mining investigations in south and central Africa and later undertook similar investigations in China. At one time he was a mine operator in Colorado and once was connected with the U. S. Geological Survey. Subsequently, he was the first director of the Geological Survey of Illinois.

The first thing Mr. Bain did after taking his doctor's degree was to obtain employment as a shift boss in a mine with the idea of gaining first-hand experience in that phase of practical operation. He took charge of a gold-silver operation known as the Franklin mine in Clear Creek County, Col. The mine labor employed was Italian. Some friction had arisen as to the selection of a night shift boss the first Sunday after Mr. Bain's arrival. The affair had given rise to a serious fistie encounter which kept Mr. Bain busy during his day of rest in negotiations with the keeper of the jail and the physician in charge of the hospital. This was followed a few

days later by another ramification of the feud in which work on the property was stopped by a concealed rifleman who amused himself by making the mine mouth his target. Finally, however, Mr. Bain got things running smoothly as far as open hostilities were concerned, but he learned that mining involves a great deal more than a knowledge of engineering and geology. In fact his first task on that job was to teach the men to use hammer drills, which just were coming into use at that time. The difficulties which he experienced in teaching his Italian workmen to operate the new type of drill is a story in itself.

Mr. Bain claims a connection with the introduction of pajamas into the Far West. With John Finch, he was doing some exploration work on a western Indian reservation. Early one morning a group of American cowboys rode up to their tent and found Finch still clad in his pajamas. It was a new form of dress to them and Mr. Bain immediately was pressed for an explanation of such a strange costume. Fearing that the cowboys might be called upon to show some disapproval of such a type of night apparel, Mr. Bain stated that Mr. Finch was clad in a Hindoo garb, worn during oppressively hot weather. The incident occurred at the height of the summer when that particular section was suffering from great extremes of temperature. It resulted in the immediate dispatch of a mail order to Chicago for a similar "Hindoo" costume for each cowboy in the party.

In addition to Mr. Bain's contact with English mining affairs, during his residence in England as editor of the *Mining Magazine*, he has been engaged in consulting work on the Rand, the Belgian Congo, and other mining regions of Africa. He also has had considerable experience in the Far East. During the two year trip from which he has just returned, he made mining examinations in ten Oriental countries.

Edmund Guggenheim and E. A. Cap-pelen Smith sailed on the "Santa Luisa" on Dec. 29, for Valparaiso, Chile.

George Gray, of the Dome staff at Porcupine, Ont., has been appointed manager of the Associated Goldfields, Larder Lake, Ont.

James M. Platt, mining engineer, of Los Angeles, Cal., is examining mining property in Michoacan, Mex. He will go to Mexico City from there.

Howard K. Welch, manager of the Hardshell mine at Patagonia, Ariz., has returned to the mine after spending several months in New York City on a visit.

R. P. McLaughlin has resigned his position as State Oil and Gas Supervisor for California, and has resumed private practice as petroleum engineer and geologist with offices in San Francisco, Cal. J. B. Case is temporarily in charge of the supervisor's office.

E. W. Skeats, professor of geology in Melbourne University, Melbourne, Australia, has been spending a few days in

Washington, D. C., visiting the technical bureaus there of interest to him. Professor Skeats is on his way back to Australia from a stay in England.

Mark R. Lamb, mining engineer, president of the New York Steel Exchange, sailed Jan. 1, on the "Martha Washington," for South America. Mr. Lamb is making his periodical visit to those South American mines for which he is purchasing engineer in New York.

R. N. Marble, superintendent of the Mahoning mine, at Hibbing, Minn., resigned that position on Jan. 1, 1921, and will be succeeded by H. S. Wallins. The new superintendent has had charge of the ore transportation division of the office of the general manager of Great Northern R.R., at Superior, Wis. Before going to Superior, Mr. Wallins had been resident engineer for the Hibbing district of the Great Northern, and formed a wide circle of acquaintances on the Mesabi Range.

SOCIETY MEETINGS ANNOUNCED

The provincial branch of the Canadian Institute of Mining and Metallurgy will meet at Vancouver, B. C., Feb. 9, 10 and 11, 1921.

American Electrochemical Society will hold its Spring Meeting at Hotel Chalfonte, Atlantic City, N. J., April 21 to 23, 1921. Plans have already been made, and Dr. Carl Hering, Philadelphia, Pa., is chairman of the committee on arrangements.

The Boston Section of American Society of Mechanical Engineers meets with the Boston Section of A. I. E. E. on Jan. 18, 1921. The joint meeting will be addressed by W. S. Murray, chief engineer of the Super Power Survey; his subject will be "The Super Power System."

The Northwest Mining Convention plans to meet at Spokane, Wash., Feb. 28-Mar. 5, 1921. The convention hall and exhibition rooms will be in the Spokane Hotel. Committee headquarters for mail, telegrams, and express will be at 415 Chamber of Commerce Building. L. K. Armstrong is chairman, M. E. Poole, secretary, and F. C. Bailey, treasurer, of the committee of control.

OBITUARY

Miguel Tinoco, formerly prominent in mining in Mexico, and recently carrying on a private banking business in Torreon, Coahuila, committed suicide about Dec. 24. The probable cause of the act was his pending bankruptcy. He was past fifty years of age.

THE MINING NEWS

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

LEADING EVENTS

Ottawa Ruling Aids Flin Flon Project

Blister Copper May Be Refined in U. S.—Product Under \$10 Per Ton Exempt from Royalty for Ten Years

To facilitate the development of the Flin Flon copper deposit in Manitoba, involving the building of a railway approximately 100 miles long, the erection of a mill and smelting plant at a cost of about \$3,000,000, and the development of water-power with 35 miles of transmission line at a cost of not less than \$2,000,000, the Canadian government has issued an Order in Council making important changes in the mining regulations as affecting this enterprise. The regulation requiring that all ores shall be treated and refined in Canada is set aside, owing to the cost that would be involved in shipping the blister copper for final treatment to the Trail smelter in British Columbia, and permission is granted to export blister copper, the product of the mill and smelter, for refining for a period of ten years unless in the meantime facilities have been established in Canada for the electrolytic refining of this product as cheaply and efficiently as elsewhere. Under a previous Order in Council dated Dec. 13, 1910, it was provided that no royalties should be charged on the products of copper mining locations up till Jan. 1, 1921. It is now provided that products of the Flin Flon mine, in which the gross recoverable values average less than \$10 per ton and which are reduced to blister copper at the mill and smelter, shall be exempted from royalty for ten years from Jan. 1, 1921.

Suit Over Engineer Mine Lost by W. Pollard Grant

Judgment has been given against W. Pollard Grant, a lawyer, of Vancouver, in his suit for a declaration that he holds legal title to a one-fifth interest in the Engineer mine of the Atlin district, B. C. This is a step towards clearing up the estate of the late Captain Alexander so that a transfer of the Atlin property can take place. As soon as a clear title can be delivered it is expected that the Engineer mine will be sold for a substantial figure, that development will be initiated without delay, and that the work will mean much for the advancement of that part of the north country. Captain Alexander went down two years ago when the "S.S. Princess Sophia" sank.

WEEKLY RESUMÉ

The assessment work bill providing six months' grace for claim holders was signed by the President on the last day of the year. Announcement has been made of the naming of H. Foster Bain to succeed F. G. Cottrell as Director of the U. S. Bureau of Mines, the latter having resigned to become head of the division of chemistry and chemical technology of the National Research Council. In Minnesota the matter of tonnage tax legislation is again before the state legislature. At Spokane, it has been announced that the Bunker Hill & Sullivan company will erect an electrolytic zinc refinery at Kellogg. In Canada, a movement is under way among operators of British Columbia to have the Dominion Government establish an 80-cent minimum price for Canadian silver. At Cobalt, curtailment of operations is increasing, an abundance of labor being reported everywhere. In Mexico further steps by the government to relieve the mining industry are anticipated.

Manganese Mine in Brazil Sold to U. S. Steel Corporation

A large manganese property in Brazil has been acquired by the U. S. Steel Corporation. When questioned as to the purchase Judge Elbert H. Gary, chairman of the board, said:

"After long negotiations we have purchased the Morro da Mina properties about 300 miles from Rio Janerio, in the State of Minas Geraes, Brazil. This mine contains a very large tonnage of good manganese ore. We are very much pleased with the purchase, as it makes the corporation independent concerning manganese ore, which is an essential in the manufacture of iron and steel. We have been receiving shipments from Morro da Mina for years."

The Steel Corporation has also announced that it will give its employees the privilege to subscribe to the common stock of the company at 81.

Licensing of Engineers Sought in Texas

The El Paso chapter of the American Association of Engineers will urge the passage of a bill through the State Legislature this year which will require the certification, after examination, of all engineers in Texas.

Tonnage Tax Before Minnesota Legislature Again

Commission Divided as to Advisability of Net Profit Tax in Place of Ad Valorem Method

The question of a tonnage tax has again come before the Minnesota Legislature. Years ago there was a tonnage tax but very little ore was mined during its existence of sixteen years. In 1897 this law was repealed due to an opinion of the Attorney-General that it was unconstitutional. Since then iron ore has been taxed on a valuation basis. For many years, however, the question of a tonnage tax has come up annually.

The State Tax Commission has rendered a report to the Governor in which many suggestions are made. The three outstanding recommendations are: That the tax imposed under the law be in lieu of all other taxes on mineral lands; that the taxable value of iron ore for county and local purposes be reduced from 50 to 33½ per cent of the true value; and that the method of determining net profits for the purpose of taxation be definitely fixed by law.

The commission is not in entire agreement as to the wisdom at this time of such a change, namely, of substituting a net profit tax on mined iron ore for the present *ad valorem* method, although admitting the feasibility of the plan so far as state taxes are concerned. Any form of double taxation which has been proposed is disapproved, as it would be a super tax and the validity of the same is very questionable. To support this position, it is pointed out that a similar law which tended to levy 2½ per cent of the market value of all anthracite coal mined in Pennsylvania was declared unconstitutional. Another point upholding their position is to the effect that no other state in the Union imposes a double tax on mineral lands unless the license or privilege tax imposed on the output of persons engaged in mining iron ore in Alabama is considered a double tax and in like manner 4½ per cent on the income of corporations engaged in mining in the State of New York, but in this case since other industrial corporations in New York pay this tax there is no discrimination against mineral lands.

A very wise recommendation is made to the effect that this tax problem be settled with reasonable assurance of permanency as it is not only desirable

but almost imperative if the state desires to reap full benefit from the great mineral deposits within its bounds. It is pointed out that millions have already been invested in mining and millions more will have to be invested in the future if the immense deposits of low-grade and magnetic ore are to be made merchantable and that it is only fair to prospective investors that methods of taxing and values arising from such investments should be fixed with some assurance of future permanency. The commission also cautions in regard to any increase in the tax burden on lean ores as the result would not only be discouraging but without doubt would stop their future development. The state could well afford to exempt low-grade ores, it holds.

Bunker Hill and Sullivan To Have Electrolytic Zinc Refinery

Company's Smelter Director in Spokane Says Plant Will Be at Kellogg—Also Buys Into Seattle Company

That the Bunker Hill & Sullivan company will erect a million dollar electrolytic zinc refinery at Kellogg, Idaho, and through the purchase of an interest in the Northwest Lead Co., of Seattle, has entered into the manufacture of lead plumbing material, was announced by Frank M. Smith, smelter director of the Bunker Hill & Sullivan company, with offices in the Paulsen building, Spokane, Wash.

"The company has definitely decided to go into the zinc field," said Mr. Smith. "An electrolytic zinc plant is to be built at Kellogg to treat the Star ores, probably using this process. We are making arrangements with the owners of the Star mine that, when market conditions are favorable, the mine will be operated and the ores treated at the Bunker Hill & Sullivan plant.

"The ore is a complex zinc-lead ore from which two classes of concentrates will be made—lead, which will be treated at the smelter, and zinc, which will be handled by the proposed new electrolytic plant. The initial capacity will be 25 tons of metallic zinc a day, so arranged that the capacity can be increased to 50 tons a day when market conditions warrant. The plant will cost approximately \$1,000,000 for the first unit. We are going ahead with the plans so that they will be in readiness for use as early as next year if building costs justify. It will be two years probably before the plant is in operation.

"The Bunker Hill & Sullivan company has bought a substantial interest in the Northwestern Lead Co., of Seattle, a concern manufacturing lead pipe, sheet lead, lead traps, bends and many other lead products for the plumbing trade. This company has been operating for the last two or three years and has used the Bunker Hill & Sullivan pig lead exclusively. Now that the Bunker Hill & Sullivan company has acquired a financial interest in the company, it is proposed to extend its market in the northwest territory."

Mining in Peru in 1920 Copper Production Dropped Somewhat; Silver Increased—Vanadium Exports More Than Double

Special Correspondence

Although the output of Peruvian copper for 1920 will show a material decrease as a result of the world's present subnormal demand, the exports of both silver and vanadium, particularly for the first six months for which figures are available, show a marked increase. During the first half year of 1920 exports of copper bars amounted to 33,574,264 lb. as compared with 42,614,992 lb. for 1919; silver bars 82,340 oz. as compared with 47,332 oz. and 6,444,800 lb. of vanadium ores as compared with 2,688,000 lb. for the first half of 1919.

Cerro de Pasco Copper Corporation's production of copper for 1920, partly estimated, is 52,334,308 lb. as compared with 57,028,288 lb. in 1919 and its maximum output of 71,243,548 lb. in 1917. For 1920 it will have a record

its Yauricocha property 450,000 tons of exceptionally high grade ore averaging 16 per cent copper and 2 oz. silver per ton. This development represents not more than 5 per cent of the company's mineralized area. A 100-ton blast furnace is now being installed at Yauricocha and an additional 200-ton smelter purchased which is scheduled for operation by July, 1921. The company has opened numerous drifts and entries at its coal mines in the Jatunhuasi field for large scale production and now has in continuous operation a battery of ten beehive coke ovens with additional ovens under construction. The company's auto-truck road is in operation, with White 5-ton trucks, from the Central Railroad at Pachacayo, 35 miles to the coal mines and coke ovens, and the remaining 20 miles to Yauricocha copper mines will be in operation early in 1921.

Vanadium Corporation of America's property, at Minas Ragra, which has the world's largest deposit of vanadium ore, has been largely extended during



MINAS RAGRA VANADIUM MINE, DEPARTMENT OF JUNIN, PERU.
PROPERTY OF VANADIUM CORPORATION OF AMERICA

production of 5,959,085 oz. of silver as compared with 5,325,321 oz. in 1919. Notwithstanding the present inactivity in the copper market the company is proceeding with the construction of its new 2,500-ton smelter plant at Oroya scheduled to begin operation in 1922. The new cutoff railroad from the company's Morococha mines down to Oroya has just been completed. The company's ore reserves are ample and average 5 per cent copper at Cerro de Pasco and 10 per cent at Morococha or a general average of 7.2 per cent. In addition to the copper ore reserves, 18,800,000 tons of oxidized silver and silver pyrite ores assaying 8 to 18 oz. silver per ton have been definitely reported by the company's engineers.

The French company at Huaron near Cerro de Pasco has, during the past year been mining and smelting an average of about 180 tons of ore per day yielding 14 tons of copper.

Peruvian Copper & Smelting Company has now blocked out in various shafts, drifts, crosscuts and tunnels at

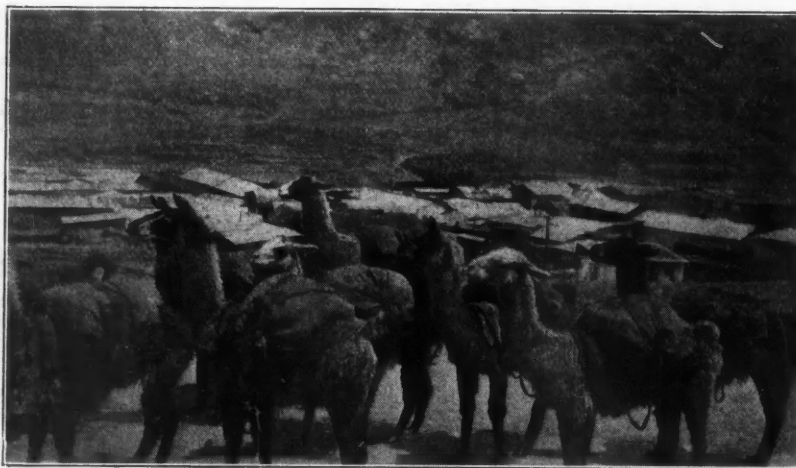
the past year, including new hydroelectric and concentrating plants. As noted in a preceding paragraph the output of vanadium for the first half of 1920 more than doubled that of the corresponding period of 1919 with a reduced output now following the slump in the steel industry.

At Huancavelica, the ancient mercury mines operated extensively in Spanish colonial times have been taken over by a successful Peruvian mine operator. The old Belen tunnel has been cleaned out, a new crosscut driven to get under the main ore shoot of the Santa Barbara mine and an experimental furnace erected to determine the best method of treating the ore. The prospect is that this section may again become a large factor in mercury production.

Gold production in Peru as elsewhere, has been at a disadvantage during its recent era of depreciated purchasing power. The Santo Domingo mine which in the 1907 and 1908 period yielded \$3,000,000 and is said to have had a total output of \$12,000,000, has slowed

down its operations during the last year owing to lack of adequate transportation and scarcity of labor in that remote section of Peru.

The present activity of the Cerro de Pasco company as well as the Peruvian Copper & Smelting Co. in pushing construction for increased and new plant facilities in the present copper market is believed to be fully justified in view of the opportunity for low cost production. This is made possible by the exceptionally high-grade ores handled and the large supply of native labor available to each of these companies. Under these conditions copper-silver production is likely to be maintained in Peru when the combination of high-priced labor and low-grade ores makes production unprofitable in other countries.



LLAMAS CARRYING CALCINED VANADIUM ORE, A FORM OF TRANSPORTATION EMPLOYED UNTIL RECENTLY IN PERU BY VANADIUM CORPORATION OF AMERICA

Mining Suffered in Cuba in 1920 Matahambre Sole Producer of Copper and Buycito of Manganese—Holguin Gold Mines Shut Down

Special Correspondence

Mining activities received a serious setback during 1920. The extraordinary price in sugar, a staple in which nearly all Cuban capital is involved, and the failure of late mining enterprises to make good, have made it quite a task to arouse interest in mining ventures of any kind or to obtain further support for those under way at the present time.

Drilling for oil on a small scale has been carried on in the provinces of Pinar del Río, Habana, Matanzas, and Santa Clara. In the first two no success is reported. In Matanzas, east of the Harbor of Cárdenas, a well driven to a depth of 1,500 ft. in sedimentaries near an igneous contact has encountered oil of 28 deg. Baumé, which will have to be pumped. In Santa Clara, close to the boundary of Matanzas, drilling continues in a small area where natural gas issues from the soil not far from a contact between sedimentaries and an igneous intrusion. One of the four wells in this place is equipped for pumping, and partial tests so far show a yield of four barrels per hour. The

oil is colorless, of aromatic smell, and 65 deg. B. The oil from the latest well is lighter, namely 75 deg. B. This oil is sold just as it flows from the ground for power purposes. It is said to be used in automobiles.

The iron companies operating on the northern and southern coast of the province of Oriente have united under the name of Bethlehem Cuba Iron Mines Co. Ore exported during the year comes exclusively from the southern coast, whence 518,342 tons averaging 58 per cent iron had been sent to the states up to the first of December. Extensive improvements are reported under progress in the northern coast properties (Mayarí), and it is said that production will be resumed sometime next year.

Compensation for Injury Must Be Sought Within Year

Application for injury under the Utah compensation law to be effective must be made within a year of the date on which the injury occurred, according to a decision of the Supreme Court written by Justice S. R. Thurman. The decision sets aside an award of \$4,500 made by the state industrial commission to Fortunata Parone, widow of Gaetano Parone, formerly an employee of the Utah Consolidated, and killed in July, 1917.

Mexican Government Said To Be Coining Gold

The Mexican Government is said by the New York Times to be coining gold, while the coinage of silver has been reduced to a minimum. At the present time the government has 251,000,000 pesos in gold in circulation and 50,000,000 in silver. Although the ratio is five to one the government has practically stopped coining silver, and the mint is busy on gold coins, copper pieces and small change.

Steel Corporation Reported Seeking Coal Land

The U. S. Steel Corporation is said to be negotiating for a huge tract of coal land near Waynesburg, Pa. The amount involved is estimated at \$20,000,000. The acquisition of this land will serve to protect the company against future scarcity of fuel.

Indians Start Something New in Arizona

For the first time in the history of the Arizona Surveyor General's office Indians have asked for a survey of mining claims. The property lies on the San Carlos reservation and is claimed by James Stevens, an employee of the Copper Queen smelter at Douglas, and John Case, both full-blood Apaches.

Civil Service Examinations

Metal mining engineer, \$4,000 to \$4,800; associate metal mining engineer, \$3,000 to \$4,000; assistant metal-mining engineer, \$2,000 to \$3,000, and junior metal-mining engineer, \$1,500 to \$3,000. Open competitive examination for both sexes; men preferred for these positions in Bureau of Mines. Applications received up to and including Jan. 18. Those interested should apply for form 2118 to the Civil Service Commission, Washington, D. C., stating title of examination desired.

Replogle Steel Declines Bid for W. & N. Road

The Replogle Steel Co. is said to have been offered \$2,000,000 for the Wharton & Northern R.R., which offer it has turned down. Resumption of operations will depend on the iron and steel market.

The Matahambre copper mine has been the sole exporter of copper during the year. Difficulties at the mine and in shipping have curtailed its exports to about 8,000 tons in the first six months of the year. It has been doing better in the second semester, and the manager states that it is now shipping at the rate of 3,000 tons a month. The shipments, consisting of concentrates and ore, average 22 per cent Cu. The concentrating plant of this mine has been doubled during the year, and is now ready to operate at 480 tons per day.

Manganese is being worked only at Buycito, Oriente, where an American company has been active for several years. Its exports up to Dec. 1 were 3,000 tons of 53 per cent Mn ore. It has recently denounced 7,000 hectares of manganiferous and 1,000 hectares of cupriferous ground.

No chrome has been exported, but a certain amount of work has been done at the Cromita and Caledonia mines in the Province of Oriente, as well as the Nueva Union and Providencia claims in the Province of Matanzas.

The gold mines at Holguin, Oriente, shut down in March. Their production in the first two months of the year was 1,468 tons of ore assaying approximately \$10 per ton.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Assessment Work Bill Signed on Last Day of Year

Senator Thomas, of Colorado, Discusses Situation From Another Viewpoint—Predicts Total Suspension

The President waited until the last day of the year to sign the bill extending the time in which assessment work on mining claims may be performed. There was some apprehension felt that he might possibly veto the bill, which led Senator Ashurst, of Arizona, to propose that Congress remain in session so that an attempt could be made to pass the bill over the President's veto. The failure of the measure to become a law, Senator Ashurst told the Senate, prior to the signing of the bill, would precipitate protracted litigation and great financial loss among miners and prospectors in the West.

During the discussion in the Senate, Senator Thomas, of Colorado, among other things, said: "There are two sides to this question. I am in receipt of numerous letters and telegrams protesting against the passage of the bill. Many of these communications come from miners who are out of employment. They say that if the law is not suspended, they can make \$100 upon each of these claims by performing the work which the statute requires. I shall, therefore, with some philosophy, feel resigned if the President should not approve the measure. Large areas of the public domain are held by men under mining locations who do not patent their claims, because when patented they have to pay taxes upon them. If they can get out of doing the required statutory work by appealing on an easy Congress, which yields to them, why not entirely repeal the law?"

Senator Thomas predicted that the requirement would be suspended later. Senator Ashurst disputed that opinion and expressed himself positively as being of the belief that no exemption from the 1920 work would be allowed.

New Bill Makes Metric System Compulsory

A bill providing for the compulsory use of the metric system as the single standard of weights and measures in the United States has been introduced in the Senate by Senator Frelinghuysen, of New Jersey. The bill was introduced at the request of advocates of the metric system. Senator Frelinghuysen explains that the introduction of the bill by him does not necessarily carry with it any support on his part for the measure, but he sees no reason why the measure should not be introduced so that members of Congress might acquaint themselves with it.

Passage of McFadden Gold Bill Urged by Raker

Describes Discouraging Situation in Gold Camps as Witnessed by Himself

In a speech on the floor of the House, on Dec. 30, Representative Raker, of California, urged the consideration of the McFadden bill at an early date. His remarks were as follows:

"Gold is the only one product in the United States that did not enhance in value or could not enhance in value during the war. Every other product, no matter what it was, raised from 10 to 1,000 per cent. The mining man's material, his labor, his powder, everything raised from 10 to 1,000 per cent.

"From personal observation, in going over a part of Nevada, and practically all the mining territory of California and southern Oregon and southern Idaho this summer I found this to be the true situation. In the mining counties not only in the State of California but in every other state of the Union the last census shows a decrease instead of an increase where it ought to have been an increase had the mining industry been properly provided for and taken care of. There is a bill now before Congress known as H. R. 13,201, and called the McFadden bill. That bill simply authorizes \$10 per ounce for gold that is produced after the enactment of the law when the gold is used for mechanical purposes. There is no bill pending in Congress that will do as much for this great interest of this country as that legislation. It simply requires that those who use this gold shall pay a reasonable price for it. They have been getting it at a nominal price, the standard price, but so far as all other charges are concerned—and you may look into every industry that has used gold during the last five years—they have made a raise in their price incommensurate with every other product, while as a matter of fact they pay less for every other product produced.

"Twice in the history of this country has California come to our relief and to the relief of the world in producing gold that we needed to maintain and stabilize our credit. It is no burden upon the government; it is no special privilege granted to anyone; but you have fixed by your law the value of an ounce of gold and provided that it cannot be raised or lowered, so far as the miner who produces it is concerned, in selling it to the market. Think of it, a great product like this, that means so much not only to California and the West but to every state in the Union and to the Federal Government!"

H. Foster Bain Named To Succeed Cottrell as Director

Nominee Familiar With Work of Bureau of Mines—Wide Experience on Both Sides of Water

H. Foster Bain, of California, has been nominated by the President to be Director of the U. S. Bureau of Mines. He succeeds Dr. F. G. Cottrell who leaves the Bureau to become the head of the division of chemistry and chemical technology of the National Research Council. During the war Mr. Bain was assistant director of the Bureau of Mines and takes over the direction of the Bureau with an intimate knowledge of its functions.

In the course of his letter of resignation sent to Secretary Payne, Dr. Cottrell said:

"In tendering my resignation may I recall to your mind that, in accepting this position upon the resignation of Director Manning last June, I explained to the Secretary of the Interior that I had previously made all my plans to resign from the position I then occupied as assistant director and to give my undivided attention to the position of chairman of the division of chemistry and chemical technology of the National Research Council.

"I accepted appointment as director of the Bureau of Mines on the understanding with Secretary Payne that I would continue therein until an available successor should be found who was thoroughly acceptable to him and to the mining industry.

"The time having now arrived when Secretary Payne is ready to recommend a successor, I am placing my resignation in his hands for transmittal to you.

"It would be with very deep feelings of personal regret that I should take the present step were it not that the position in the Research Council will still permit me to co-operate very closely with those particular aspects of the Bureau's work for which I feel myself best fitted."

War Mineral Awards

During the week ended Dec. 24 awards were recommended by the War Minerals Relief Commission as follows (the name of the claimant, the mineral, the amount recommended and its percentage relationship to the amount claimed is shown): D. J. Sullivan, chrome, \$368.70, 26 per cent; John F. Campbell, manganese, \$2,331.76, 16 per cent; Frank Trumble, chrome, \$227, 21 per cent; H. J. Barton, chrome, \$268.79, 71 per cent; Morgan-Leitcher Co., chrome, \$5,060.33, 23 per cent; Chrome Mining Co., chrome, \$9,364.58, 73 per cent.

NEWS BY MINING DISTRICTS

Special London Letter

Operators Conservative Pending Absorption of Stocks—Results at Hampton Plains Disappoint Some

By W. A. DOMAN

London, Dec. 20—Metal mining companies have sustained some pretty hard shocks of late, each in its turn. First the base metals felt the influence, and then those termed precious. Gold producers, however, have benefited by the higher selling price, and silver which for a considerable time fetched a figure it had not enjoyed for years, is now on the down grade. The decline has left its mark not only on share quotations but in the mining world. Companies desirous of raising capital for extending operations are finding circumstances adverse. Were it not for general world conditions the money would doubtless be forthcoming, but when, owing to slackness of trade, industrial companies and merchant firms, whose reserves and spare cash are invested in Government and other securities, are compelled to realize for the purpose of meeting taxation and carrying on, the attractions of mining enterprises appear less rosy. The Burma Corporation is a large silver producer, and naturally feels the influence of the reduced absorptive power of China and other Far Eastern countries. The Broken Hill mines are also affected, and it would seem as though the prolonged strike of the miners, now at an end, will be followed by a period of enforced short working owing to the condition of the silver, lead and zinc markets. An indication of this was given in a rather rough and ready manner by the announcement that the Zinc Corporation and the Camp Bird company would not pay their fixed preferential dividends for the current half year. The Board of Directors are not downhearted, but pending absorption of stocks and improved metal prices, conservation of financial resources is regarded as the best policy to pursue. It is argued that Europe can consume tremendous quantities of the base metals when the economic situation of the different countries enables a resumption of trade and commerce.

Last week I reported that the Government of the Federated Malay States had temporarily fixed the minimum price for Straits refined tin at \$110 a picul. It has since been announced that the pegging is about \$10 higher. This action may prove effective for a time, but the law of supply and demand will assert itself in due course. Some of the leading Straits tin mining companies are feeling the strain, as holders of Siamese, Renong and Malayan know to their cost. If anything the position is worse in Cornwall. The leaders of the industry, Oliver Wethered, the Thomases, Messrs. Bewick, Moreing &

Co., remain the optimists they always were. The stuff is there, they say, and in due course when monetary conditions improve, Cornwall will be as flourishing as ever she was. There is nothing like cheery leaders to maintain the flagging spirits of the investor.

Another illustration of this is to be found in the case of Hampton Properties, a company working on the Hampton Plains field in Western Australia. The discovery created intense enthusiasm at the outset, but when people began to lose their money and hopes and prognostications were falsified depression set in. In fact it has been stated that the field will not be anything of a producer. The chairman of the Hampton Properties took quite the right line, and pointed out to the shareholders that it was not a few sensational assays that made the success of a field, but half ounce ore and plenty of it. Latest advices are to the effect that the mine is showing 12 dwt. over 60 inches. The future appears so hopeful that people on the spot have expended \$5,000 in erecting a hotel.

CANADA

British Columbia

Canadian Operators Want 80c. Minimum for Silver—Dolly Varden Ry. Down for Winter

Nelson—West Kootenay mining operators and the Associated Boards of Trade of Eastern British Columbia are behind a move in the direction of making representations to the Dominion government at Ottawa to have a fixed Canadian price for silver of a minimum of at least 80c. per oz., such figure to be paid by the government for all silver produced in Canada that is offered, the metal to be used for coinage purposes. The movement is as yet only in its preliminary stage, but will doubtless gather support from other sections interested in silver production.

A Nelson syndicate holding a lease on the Gold Hill mine at the head of Forty-Nine Creek plans to start shipments from the property at an early date, with a view to a thorough testing of the ore for milling.

It is indicated that there is a possibility of resumption of operations on an old time scale at the Rossland properties of the Consolidated Mining & Smelting Co. of Canada at an early date. These mines, including War Eagle, Centre Star and LeRoi, which in past years have been prolific producers of gold-copper ores have maintained only small scale operations for some years past, but with cost of labor dropping, efficiency increasing and a prospective decrease in cost of supplies, the outlook for profitable operation, provided some material increase in copper prices manifests itself is considered excellent.

R. R. Hedley, at one time manager of the Hall Mines smelter, at Nelson, has associated himself with J. T. Tipping in operation of the Black Prince mine, near Slocan City, and some good ore is being shipped.

Watson & Wolverton, of Nelson, who leased the Granite-Poorman mine in November, have been maintaining operations at both mine and mill.

S. and E. Terzian, of Hall Siding, have been securing excellent results from development work done recently on the Morning Star group, which is located on the Nelson & Ft. Sheppard branch of the Great Northern. Values are chiefly in gold and silver and present plans are to maintain development all winter.

Kitchener—A small crew is maintained on development work at the Leadville group, six miles from Kitchener, on the Crow's Nest branch of the Canadian Pacific railway. It is stated that there is a possibility of a wagon road being constructed to the property.

Ymir—The Mining Corporation of Canada is dropping the bond held by it on the Yankee Girl property, near Ymir. The owners, it is understood, have plans completed for other interests to take over the group.

Rossland—Le Roi No. 2, Rossland camp, more generally known as the Josie, is at present inoperative, with exception of cleaning up and shipping an accumulation of ore on hand. The shutdown is due chiefly to the prevailing low price of copper.

Princeton—The Princeton Mining & Development Co., Ltd., has completed its plant and will again take up development work. Three tunnels have been driven and considerable copper-silver ore of milling grade has been disclosed.

Stewart—At the Premier mine, the winter's work is in progress. Supplies for the mill are being taken in over the snow, sixty-five horses being used. Ore is being taken by the same means to tidewater for shipment to the smelter. The mill is about three-quarters completed. About 200 men are employed. Two 5-ton Holt tractors are being used over part of the trail. The installation of the hydro-electric power plant is finished.

Anyox—Following the laying off by Granby Con. of about 400 men and the announcement that unless the employees were prepared to accept a reduction in wages of about 75c. a day, it would be necessary practically to cease operations, the attitude of labor has been in doubt. Nothing has developed, however, and work is continuing. It is assumed that the men have acquiesced in the cut proposed.

Alice Arm—The Dolly Varden mine railway has closed down for the winter.

Over 1,000,000 oz. of silver has been produced since September, 1919. High-grade ore has been sacked and shipped to the Tacoma smelter and the lower grade has been going to Granby's smelter at Anyox.

Trail—Shipments received at the Consolidated smelter from Dec. 15 to 21 totaled 9,967 tons from the following properties:

Mine	Locality	Wet Tons
Canada Copper,	Allenby.....	161
Horn Silver,	Chepaka.....	53
Josie, Rossland	.....	257
North Star,	Kimberley.....	190
Paradise, L. Wintmore.....		138
Company Mines	.....	9,168

Ontario

Curtailment Increases at Cobalt—No Power Relief at Porcupine Before Spring—Labor Surplus Everywhere

Cobalt—Further curtailment of operations is being evidenced in Cobalt owing to the low price of silver. The Kerr Lake has stopped production but will continue development. The Dominion Reduction plant, which treated Kerr Lake ores and Peterson Lake tailings, will be completely closed down by about the middle of January. The Peterson Lake will confine its operations to a small amount of development work. The Beaver is still further curtailing operations and is seriously considering a complete shut-down. Their action will probably depend upon the cost of labor. It is understood that a cut in wages is being contemplated and this may be a sufficient inducement for some of the mines to keep operating. In the meantime, the power situation has improved and it is probable that the mines will be able to continue operations throughout the winter.

Shipments over the T. & N. O. Ry. during November totaled 589 tons from the following shippers: Beaver, 30; Bailey, 75; Coniagas, 84; Dom. Reduction, 42; La Rose, 99; McKinley-Darragh, 43; Nipissing, 152, and O'Brien, 64. This tonnage was consigned as follows: Deloro S. & R. Co., Marmora, Ont., 357; Coniagas Reduction, Thorold, Ont., 146; A. S. & R., Pueblo plant, 44, and A. S. & R., Perth Amboy, 43.

The Crown Reserve of Cobalt will resume diamond drilling on its claims north of Block B of the Associated Goldfields early in the year.

Porcupine—In Porcupine, however, practically all hope of additional power before spring has been given up. It is understood that companies without power contracts will not be able to obtain a supply. This, however, is a very small quantity. The Dome and Hollinger by using their auxiliary steam plants will be able to continue operations at their present output, which is, of course, much below their capacity. The McIntyre will have to reduce about 30 per cent.

At the annual meeting of the Keora Porcupine on Dec. 28 a complete new board of directors with one exception

was chosen, consisting of J. R. Ness, W. Claude Fox, W. B. Gunton, George Mulholland and W. E. Smith. The following officers were elected: President and managing director, W. B. Gunton, vice-president; J. R. Ness; secretary-treasurer, W. E. Smith.

Larder Lake—At a recent meeting of the Associated Goldfields a vote of confidence was given to the directors. The company has \$850,000 cash in the treasury. It has been decided to defer the building of a mill until more development work has been accomplished. A new company, with a capitalization of \$30,000,000, has been formed to take over the various holdings of the company.

Sudbury—In the Sudbury field, due to a limited market for nickel, the three companies are operating at reduced capacity. The output of the International Nickel Co. is less than one-third of its maximum wartime production and over 1,000 men have been laid off. There is now a surplus of labor in all of the mining camps of Ontario for the first time in five years.

An official arbitrator is to be named to adjust claims made for damage resulting from smelter smoke in the Sudbury district, Ontario, according to advices from Toronto. It is said that there will be appeal from the decision of this arbitrator.

Manitoba

Herb Lake—At the Rex mine the shaft has been put down to the 200-ft. level with a continuance of the vein matter and drifting at this level has been started. The force of miners has been increased and three shifts a day are being worked.

Rice Lake—The shaft on the Pan Extension is down to the 200-ft. level where the vein is 4 ft. wide. Sixty tons of ore has been taken out which it is proposed to ship to Denver for refining.

The contract for sinking the shaft at the Gold Seal has been completed to the 210 ft. level and some drifting done at that depth. The vein has been in the shaft from the 160-ft. level down and is 4½-ft. wide showing heavy mineralization and some free gold.

MEXICO

Government Delays Relief Measures for Mining Industry

Durango—Although the Federal government has been studying the problem of how to open the mines for more than a month, and the metropolitan newspapers have given out the results of the Cabinet meeting in which it was determined to take off all the taxes on mining until such time as the price of silver in New York returned to 70c. per oz., no decree has yet been issued by the President and the mines continue to close down. In November, on account of the low price of silver, lack of coal and coke, as well as high wages, the Cia. Minerale y Metales (American Metal Co.) closed all its smelters and mines, and of course its

customers had to close down also. The American Smelting & Refining Co. has so far kept all its smelters running, although several of the lowest grade mines have had to shut, and according to statements from officials the company expects to keep running and maintain its organization even without profits in the hope that the Mexican government will take some definite action to remove the present tax of 11c. per oz. on silver and that the price in New York may react within a reasonable time.

The Governor of Zacatecas has been quite active in urging immediate and drastic action toward relieving the mining industry of its high taxation burdens, and has even proposed that the government buy the silver production of the Mexican mines and either coin it or hold it until the price reacts. The Governor of Durango indicated in an interview published in the *Journal* a few months ago his great desire to assist the mining industry of Durango by encouraging in all legitimate ways the investment of capital, but no well-defined policy along this line has been announced, and it would seem that all that can be expected from the state governments in this crisis is that they voluntarily renounce the 2 per cent state tax on the gross value of the production of the mines. This action would be of great advantage to all low-grade properties, because in many instances this tax makes the difference between profit and loss.

Most of the mines in the Chalchihuites and Sombrerete (Zacatecas) districts have closed down and the remainder are running with a reduced force. Some new properties which were about ready to start operations have naturally suspended indefinitely the date for beginning production. The Cia. Eureka M.O. y Anexas of the Tejaman district in Durango was unable to start operations in October as announced, because a part of the machinery failed to arrive, and with the fall in silver prices the company will doubtless await the general adjustment of prices before starting up.

The Guanecevi district continue shipments to the Asarco (Durango) smelter but the other shippers have suspended shipments under their contracts with the melters that have been closed down, and so the tonnage of the district is about half. Nothing is being received from the Topia district at present, although the Canelas district which is adjoining and producing ores of equally high grade in silver and lead continues to make small shipments. Lack of transportation has not been sufficiently overcome to date to induce larger companies to enter those fields and so only individuals and small companies are operating in this latter field in spite of the apparent bonanzas reported in that section.

Promontorio, Durango, an old producer, continues a small but regular shipment of concentrates from the old dumps, but no effort has been made to work the mines as formerly.

As labor in Mexico has not yet realized the general economic situation and the adjustment crisis that is taking place and which must also reach the laborers in the mining industry in all districts the whole future for some months to come must be considered as grave and very unsettled; for unless silver and other metal prices should react to war prices, which no one believes, labor must take part in the readjustment by accepting reasonable reductions in wages, which labor is not ready to do at present.

Coahuila

Torreón Smelter To Be Enlarged

Torreón—The Torreón smelter is to be enlarged and its capacity increased. The *Minerales y Metales* company, owners of the Torreón, Mapimi and Monterrey smelters, are to make the Torreón plant their principal one. Owing to the superior railroad facilities to and from the mining camps of the states of Coahuila, Zacatecas, Durango and Chihuahua, Torreón has been selected for this purpose. Railroads run out in all four directions from Torreón to the principal camps and connect with important branch lines which extend to other mining districts. Torreón is on a direct line from the border at El Paso and Eagle Pass, with railroad facilities to the Coahuila coal fields and the Tampico oil region.

George Stinson, representing the Rosario Mining Co., has filed on a group of claims in the Prieto mountains near Bermejillo. The ores from this district are giving good values in silver and cinnabar. Development work will be carried on pending the receipt of titles which have been applied for through the Torreón mining agency.

Juan M. Hernandez has made application through the mining agency at Torreón for titles to the Lentisco group of mines in the Reyes mining district, State of Zacatecas. These mines were worked extensively before the revolution and produced large amounts of rich gold and silver ores, but were allowed to become delinquent for non-payment of taxes during the revolution.

MINNESOTA

Mesabi Range

Oliver Iron Using 30-cu.yd. Automatic Dump Cars on Stripping—State Mines Tonnage Larger in 1920

Duluth—Pickands Mather & Co., the M. A. Hanna Ore Co. and the Republic Iron & Steel Co. have recently held meetings, presided over by the respective general managers and attended by the general superintendents, superintendents of mines, and heads of departments. Operations of the past season were discussed together with plans for the future.

Virginia—A new and interesting feature of stripping operations has been introduced by the Oliver Iron Mining Co. in the use of 30-yard automatic dump cars of which 130 have been ordered for the various pits. In many

instances these cars will require heavier equipment of every description, which has also been ordered where need for it exists.

Hibbing—The mines operated by the State of Minnesota report a great increase in tonnage of iron ore shipped during the 1920 season in comparison with that shipped in 1919. The 1920 shipments totaled approximately 5,912,088 tons against 3,836,099 tons in 1919. These shipments came from twenty-two properties of which nine were open pits, nine underground mines and four were combinations of both open pits and underground mines.

The Oliver Iron Mining Co. is working eleven shovels in its open pits in the Hibbing district, ten of them being on stripping. Five shovels are working in the Hull-Rust pit, one in the Sweeney, one in the Sellers and two in the Morris. Two shovels are in the Kerr pit, one of which is cutting a new approach to the pit for handling ore next season and the other casting lean ore on the north bank.

MICHIGAN

Menominee Range

Diabase Dike Found in Balkan Mine at Alpha

Crystal Falls—Mining men of Iron County are greatly interested in the dike which has been found in the Balkan mine at Alpha as this is the first dike found in an Iron County mine. It cuts off the ore completely, but it is known that ore lies beneath. The dike is of diabase and similar to that found on some of the other iron ranges. It cuts across the vein at an angle from the footwall to the hanging, being fan-like in shape. A drill has been put through it and ore found below, but the extent of the deposit has not been determined thus far.

MISSOURI

Operations in Southeastern Lead Belt—De Soto Stops Work at Lee Mine

Fredericktown—The Picher Lead Co. is still drilling on the Schulte tract, near Fredericktown, which it has under option and are said to have struck some very good lead ore.

Annapolis—The Annapolis Lead Co. will complete its initial shaft in the orebody this month at a depth of about 400 ft. This mine is located at Annapolis, on the main line of the Iron Mountain R.R., in the southern part of Iron County.

Vineland—The DeSoto Mining Co. has stopped work on the Lee mine, near Vineland, and will not erect the Joplin mill recently purchased until lead recovers.

The Wherry Syndicate has started drilling on the Big River, south of Vineland, where it has a large tract under option. It is drilling near an old pyrite mine from which considerable pyrite was shipped several years ago. This occurs in a faulted, brecciated limestone.

MONTANA

Elm Orlu Curtails Somewhat—Butte Western May Start Sinking

Butte—Anaconda's production of copper is coming from the Tramway, Badger State, Steward and West Colusa mines. The output at present is about 10,000,000 lb. per month compared with a normal production of 26,000,000 to 27,000,000. The company's zinc production is about 5,000,000 lb. per month, or about half of normal. This is coming from the Emma mine of the Butte Copper & Zinc Co. and from the Nettie.

The Rainbow vein in Butte & Superior's Black Rock mine will be cut on the 2,300-ft. level within three months, it is expected. Raising from this level to the 2,000 to connect with the No. 3 shaft will be completed first before the Rainbow and Jersey Blue fissures are developed below the 2,000. Sinking of the No. 2 shaft with the 2,600-ft. level as objective is under way.

Sinking of the Main Range shaft from the 1,200 with the 2,000 level as the objective continues the principal work at this property of the Tuolumne Copper Co.

Operations have been curtailed somewhat at the Elm Orlu mine in consequence of the reduction of the number of shifts employed at the Timber Butte Milling Co.

Installation of an electric pump has been completed on the 300-ft. level of the Butte & Plutus with a view of continuing sinking to the 400 level.

The Butte-Western Silver Mines is expected to start sinking from the 200-ft. level. Discovering of high-grade ore has been reported on the 200 level, one of the old time silver-gold shoots having been uncovered in the southwestern part of district, where a number of the early day silver bonanzas were discovered.

High-grade silver ore continues in fair tonnage on the 500- and 600-ft. levels of the Crystal Copper.

Lump Gulch District—The Liverpool Silver plans to sink from the 700 to the 900-ft. level.

Good ore is reported to have been found on the Pay Back property.

Sinking operations have been practically completed to the 400-ft. level of the Little Nell and drifting will be started soon.

Winston District—Driving of a tunnel 2,305 ft. by the Chicago-Montana, thus completing a contract, brings the heading about 150 ft. distant from the Eureka vein.

Champion District—Permission has been asked of the forestry officials by the Butte Jardine to build a six-mile power transmission line through the Deer Lodge national forest to furnish power for the mill now under construction.

Elkhorn—The Boston & Montana's 700-ton concentrator is under cover and it is said that the installation of machinery shortly will be under way.

Neihart—Cascade Mines & Mills suit has been brought by a lessee against

the plaintiff claiming that he has lost \$6,000 because of alleged violation of a lease in the Moulton mine. At present the company is not operating its properties.

Wickes—Operations at the Mount Washington have been suspended by the Angelica Mining Co. and construction of a 150-ton concentrator is planned.

Warm Springs—Installation of machinery at the Willard mine by the Jefferson & Teton has been completed and the property placed in shape for operations throughout the winter.

Saltese—The Tarbox is continuing drifting operations easterly on the 800-ft. level with the south vein as the objective.

COLORADO

Restoration of Old Rate on Bullion Hoped For

Silverton—The Ariadne Mining Co. is a new corporation, capitalized for \$1,100,000, divided into 11,000 shares of a par value of \$100, for the purpose of taking over and operating the Ariadne mine. Alfred Illes is manager. Development has opened a 2-ft. vein of galena, at a distance of 650 ft. from the portal of the lower tunnel, and 550 ft. below the surface. An aerial tram from the mine to the railroad is under consideration. The company has \$50,000 cash in its treasury to expend on equipment and development.

Durango—Several pockets of rich silver-bearing ore have been opened by recent development in the Esmeralda mine. A trial shipment to the smelter returned 300 oz. silver per ton. W. B. Cauble is manager.

Idaho Springs—A consignment of pitchblende, weighing about 5,200 lb. and valued at \$5,000, was shipped recently from the Gold Rock property in Russell Gulch. The deposit is one of the largest ever found in the district.

Denver—Colorado mining men are hoping that the hearing, held in Chicago recently, of the Western Trunk Lines Association on freight rates on bullion to seaboard and eastern refineries, will result in the restoration of the old rates. It is believed that any reduction in rates will be followed by a reduction of smelting charges in Colorado. George E. Collins, governor of the Colorado Chapter of the American Mining Congress, and A. M. Henderson, member of the executive committee of the Colorado Metal Mining Association, represented Colorado's mining interests at the hearing in Chicago.

UTAH

Salt Lake Valley Smelters Receiving Smaller Tonnages—Operators Fighting Freight Increase

Salt Lake City—Lessened tonnages of lead ores are coming in to the Salt Lake smelting plants owing to the low price of lead, which has caused curtailment of shipments and in a number of cases cessation of operations by properties in Utah and adjacent states

shipping to the local smelters. Smelting costs are high, but the smelters find it impossible to increase charges from the fact that most of the ores coming in are being smelted under long time contracts; also increased charges would result in a further curtailment of the tonnages of lead ores coming in and in the closing down of more mines. Producers of lead ore with a high silver content are able to keep going, owing to the working of the Pittman Act, keeping silver at \$1 for sale to the government. In the case of siliceous silver ores with little or no lead content the smelters do not find it advantageous to take too much of this ore without the lead ores to offset it.

Utah operators are hopeful that the ruling of the state public utilities commission refusing increased freight rates on intrastate shipments of coal and low-grade ores will be allowed by the Interstate Commerce Commission to stand. At the hearing before the commission just completed at Washington the Utah traffic bureau through H. W.

daily. The first shipment of 4 cars of ore has been made to the new mill.

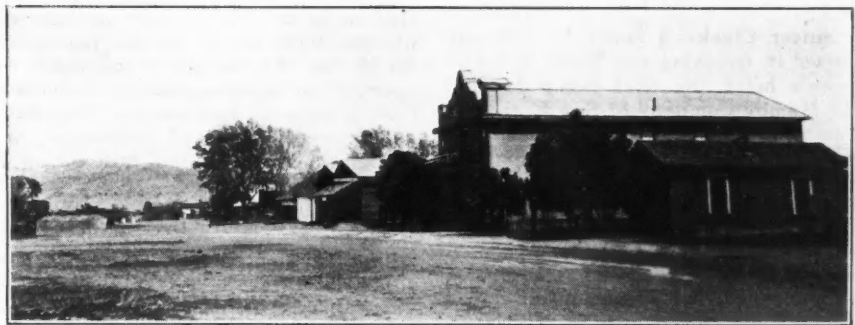
Park City—Shipments for the week ended Dec. 25 amounted to 2,318 tons, as follows: Judge M. & S., 1,199 tons; Silver King Coalition, 614 tons, and Ontario, 515 tons.

ARIZONA

Hardshell at Patagonia Resumes Development—Van Dyke Again Operating

Phoenix—Parker Woodman, for years connected with the Copper Queen at Bisbee, has taken charge of operations at the Kay copper property, 40 miles north of Phoenix on the Agua Fria. Work has been held up several months by non-delivery of a large electric hoist, that now is at hand. Power is taken from a main line that lately was completed between Mayer and Phoenix. The main three-compartment shaft is to be driven deeper.

The State Corporation Commission has given El Tiro Leasing Co. of Silver Bell permission to sell 250,000 shares of stock at \$1.



PATAGONIA, ARIZ.

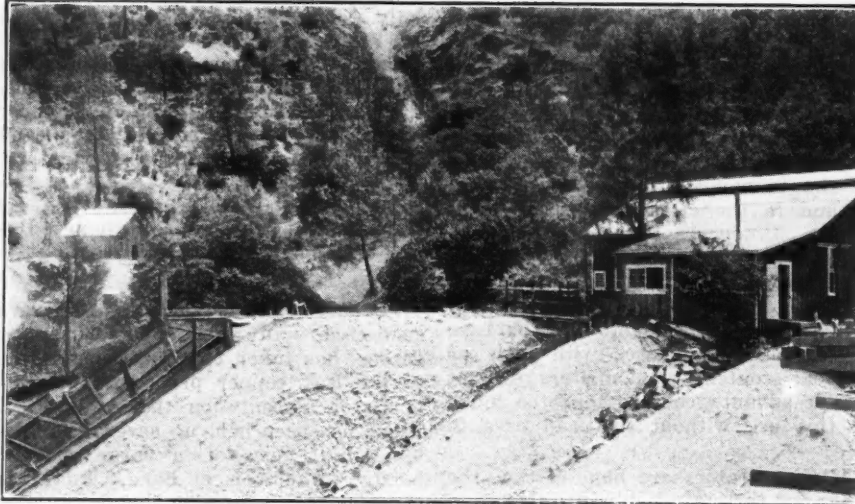
Prickett presented figures and exhibitions to show that Utah rates have always been higher than in other sections similarly situated, and that if an increase were granted at this time it would result in the closing down of practically every mine. Walter Fitch, president of the Chief Consolidated mine at Eureka, testified at the hearing. The Chief mine producing annually ore of a gross value of \$3,000,000 to \$4,000,000 would have added to its monthly expense account through increased freight rates, if granted, \$20,000 to \$30,000. With such an increase, Mr. Fitch stated, there would be but one course open to the management, i. e., to close down. And what is true of the Chief holds for the other large mines of the tinctic and other Utah districts.

Eureka—Tinctic shipments for the week ended Dec. 25 amounted to 172 cars. Shippers were the Tinctic Standard, 50; Chief Con., 45; Dragon, 22; Eagle & Blue Bell, 13; Iron Blossom, 13; Iron King, 9; Victoria, 7; Gemini, 4; Mammoth, 2; Gold Chain, 2; Colorado, 2; Swansea, 2, and Tinctic Drain Tunnel, 1. The Tinctic Standard, which has been shipping at the rate of almost 10 cars of ore daily, is, through an order from the smelter, cutting down shipments to about 300 tons of ore

Morenci—William B. Gohring, of Bisbee, has been engaged as consulting engineer for the Stargo group of 26 claims near Morenci, with M. J. Hanlon in direct charge. The operating company, headed by George J. Stoneman, of Los Angeles, recently completed payment for the property and now will spend \$50,000 in development work.

Miami—Work has been resumed on the Van Dyke property at Miami. Stations and ore pockets have been cut on the 1,220 and 1,550 levels, on which there will be lateral development. The upper level is in carbonates and the lower in a chalcocite zone.

Patagonia—The Hardshell Mining Co. has been financed to resume development work through the new vertical shaft, and the work began on Jan. 5. Recently, fifteen cars of lead sulphide and carbonate ore have been shipped from the Gardner lease, and at this time three cars are en route to the smelter. Average assays on smelter settlements are about 34 oz. silver, and 44 per cent lead. Production from the old workings will be substantially increased during the coming year. The 420-ft. level from the new shaft will be advanced to cut the vein under the ore shoot from which shipments are now being made.



AT CARSON HILL, CAL.—FINNEGAN MINE BUILDING ON LEFT; GLORY HOLE OF MELONES MINING CO. IN UPPER CENTER; BLACKSMITH SHOP AND DUMP OF CARSON HILL MINING CO.'S MORGAN MINE ON RIGHT

CALIFORNIA

Kate Hardy Mine Closed for Winter —Oneida Hoist Sold for Old Iron

Sutter Creek—A small force is employed in wrecking the South Eureka's Oneida hoist, the work being done by the Hamby Company of San Francisco. The mining company has concluded to sell it for old iron. The hoist is situated about one-half mile below Martell station. The mine has not been in operation for fifteen years, except for a short interval. The mill was demolished several years back. The Oneida company paid one dividend, but it has always been looked upon as a "water-hole" until the discovery of ore at the north end led the South Eureka Mining Co. to pay \$100,000 cash for it.

Angels Camp—There are many low-grade mines in the Angels mining district which will be opened up in the event of the passage of the McFadden bonus bill. Among the larger low-grade properties which will resume if this takes place is the Gold Cliff mine of the Utica system. Operations will also then be resumed in the Lee mine at Altaville, the Angels Quartz and others.

Sonora — The Mexican mine, which was recently purchased from Booker & Vaville by Rossler, Ryan & Fetter, is yielding specimens of high-grade ore. During the last few days several pieces of ore well shot with gold have been taken out. Indications are that the seam will lead to a large pocket. The mine is said to have yielded \$100,000.

It is unofficially stated that a ledge 3½ ft. wide of high grade ore has been struck on the 1,900-ft. level of the black Oak mine near Soulsbyville. The ledge has been opened for a distance of 40 ft. with good ore all the way. The force employed will be increased.

Iron Mountain—The Mountain Copper Co. is shipping about 600 tons of ore daily to the chemical works on San Francisco Bay. The Hornet mine is yielding 100 tons a day and the Iron Mountain 500 daily.

Forest—The delay in completing the mill at the Kate Hardy mine has caused the closing down of the property for the winter. There is a good ledge on this property and a large amount of ore has been taken out and placed on the dump. As the mill is not ready to operate, and as it is necessary to handle the ore twice on that account, the shaft will be closed most of the winter, although work on the mill will continue as rapidly as possible.

NEVADA

Milling at Con. Mayflower to Be Resumed March 1—Silver Pick Retains Lease on Goldfield Con. Claims

Pioneer — Improvements completed lately by the Cons. Mayflower Mines Co. include a 20,000-gal. oil storage tank, assaying and surveying equipment, and additions to the mill, together with changes and rearrangement of machinery. Long drifts from the main shaft are nearing the Starlight workings, where the best ore has been found. Assay maps of all work-

ings are being made, involving the crushing of several hundred large samples. W. J. Tobin, manager, is planning to resume milling about March 1.

The Reorganized Pioneer Mines Co., with property adjoining the Mayflower, is sinking to water level. The shaft is nearing the 800-ft. point and some water is coming in.

Goldfield—The Silver Pick Cons. retains its long-term lease on parts of the Red Top and Mohawk claims of the Goldfield Cons., recently relinquished by the latter company to the Goldfield Development Co.

Eureka—The once-famous Eureka Con., on Ruby Hill, is shipping low-grade silver-lead ore with a high iron content to Utah smelters for flux. High-grade ore is being shipped to smelters from the Eureka-Croesus and Eureka-Holly mines. Nearly all the smaller properties are closed for the winter.

Lovelock—The Nevada Sheba Mining Co., owning the old Queen of Sheba mine in the Humboldt Range, Pershing County, has been sued by workmen and other creditors.

Cortez—The Arctic tunnel of the Cons. Cortez Silver Mines Co. at a point over 1,600 ft. from the portal cut a fissure in the limestone that is correlated with one of the secondary fractures in which good ore was stoped from the upper tunnel workings. A short raise showed the fissure to be wider above and the filling a soft, brecciated porphyry like that found in ore-bearing areas above. The tunnel is nearing the 1,700-ft. point and is being advanced to connect with an incline from the upper tunnel which is in good ore.

Rochester—Rochester Silver Corporation has reported to its stockholders that on Nov. 30 there was 1,000 tons of broken ore ready for transportation to the mill. The average number on the payroll in November was 111. Tonnage milled in same month was 4,613.



PLANT OF IDAHO-MARYLAND MINES CO., GRASS VALLEY, CAL., SHOWING HEADFRAME AND SHOPS

THE MARKET REPORT

Daily Prices of Metals

Dec.	Copper, N. Y. net refinery*	Tin		Lead		Zinc
		99 Per Cent	Straits	N. Y.	St. L.	St. L.
30	12.25@12.50	30.75	34.50@35.25	4.75	4.65	5.70
31	12.00@12.25	31.25	35.00@35.25	4.75	4.65	5.70
Jan. 1	.....	.....	.....	.....	.....	.....
3	12.25	32.00	35.00@35.25	4.75	4.65	5.60
4	12.25@12.50	32.00	35.75@36.00	4.75	4.60@4.70	5.55@5.60
5	12.50	32.50	36.25@37.00	4.75	4.60@4.70	5.50@5.55

*These prices correspond to the following quotations for copper, "delivered": 12.50 @ 12.75, 12.25 @ 12.50, 12.50, 12.50 @ 12.75, and 12.75c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

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

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

Monthly Average Prices for December:

Copper:	
New York Electrolytic.....	13.188
London Standard.....	75.702
London Electrolytic.....	85.905
Lead:	
New York.....	4.727
St. Louis.....	4.717
London.....	24.089
Silver:	
New York, foreign.....	64.774
New York, domestic.....	99.500
London.....	41.845
Sterling Exchange.....	348.101
Zinc:	
St. Louis.....	5.824
London.....	27.762
Tin:	
99 per cent.....	31.135
Straits.....	34.058
London.....	212.440
Antimony.....	5.534
Quicksilver.....	49.577

London

Dec.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3 M	Spot	3 M	Spot	3 M
	Spot	3 M							
30	72	73 1/4	80	207	212	23 1/2	24 1/2	27	28 1/2
31	71 1/2	72 3/4	80	205 1/2	210 1/4	23 1/2	24 1/4	26	27 1/2
Jan. 1	.....	.....	.....	.....	.....	.....	.....	.....	.....
3	71 1/2	73 1/2	80	206 1/2	211 1/2	24 1/2	25	26 3/4	28
4	72	73 1/2	80	205 1/2	210 3/4	24 1/2	25	26 3/4	27 3/4
5	72 3/4	73 1/2	80	205 1/2	209 3/4	23 1/2	24	26 3/4	27 3/4

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

Silver and Sterling Exchange

Dec.	Sterling Exchange	Silver			Jan.	Sterling Exchange	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
30	352 1/4	99 1/2	65 1/2	41 1/4	3	353	99 1/2	65 1/2	41 1/4
31	353	99 1/2	64 1/4	40 3/8	4	354	99 1/2	65 1/2	41 1/2
Jan. 1	.....	.....	.....	.....	5	357 1/2	99 1/2	67 1/2	42 1/2

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

Metal Markets

New York, Jan. 5, 1921

With the New Year a slightly better feeling can be noted in the metal trade, although sales continue disappointing.

Copper

During the last week the market has been pretty thoroughly combed for possible buyers. Some small dealers may be willing to lay in a supply of copper at present prices, but the larger consumers show absolutely no interest for tonnages of any size. Either they have stocks which they consider sufficient or they have not the money to buy; they are making no complaints about prices. Most of the business of the last few days has been done at 12 1/4c.

delivered. Yesterday and today practically all sellers seemed inclined to quote higher prices than this, although it appears that no business is resulting. Most of the large producers refuse to sell at these prices, but they have broken under the 14c. quotation and large tonnages could be obtained from them now at 13@13 1/4c. delivered, were any one in the market. Copper for forward delivery has been held a little firmer by those who have been selling at 12 1/2c., and March delivery was not obtainable at any time under 12 1/2c.

The Copper Export Association has adopted the policy of selling in Europe at the low prices now current in New York, and is reported to be selling some metal at prices which will net American producers about 12 1/4c. New York. Fairly

large amounts of copper have been sold in Europe recently, but much of it has been bought from agencies abroad. The Export Association has no doubt reduced its price to meet this competition.

The U. S. Geological Survey reports stocks of refined and blister copper on hand in this country on Dec. 31 as 874,000,000 lb., compared with 904,000,000 lb. at the end of 1919.

Lead

The American Smelting & Refining Co.'s price of 4.75c., New York and St. Louis, continues.

Inquiries have been better during the last week, and numerous sales of small tonnages have been made by various producers. Sellers seem well satisfied with the market under the prevailing business conditions, and in general have their metal pretty well sold up. The storage-battery makers of course are not active consumers just now, but paint and cable manufacturers seem to be in the market, and a considerable amount is also in demand by dealers. The price for prompt metal for delivery at almost any point in the East or Middle West, with the exception of St. Louis, is 4.75c. At St. Louis the price seems to be about 10 points under this. Today the London price is down about £1, but unless it falls further, producers here do not seem disposed to make any concessions.

The U. S. Geological Survey reports lead production from domestic ores during 1920 as 447,000 tons, compared with 377,201 tons for 1919.

Zinc

The market for this metal continues as lifeless as usual. The only thing of interest is a disposition on the part of

some large consumers to inquire into European sources for their supplies. European zinc can be obtained delivered at the Atlantic seaboard for 5.35@5.45c.

Tin

Tin has been a little firmer here with the rise in sterling exchange. The withholding from the market of supplies from the Straits is almost certain to have an effect, also, and by the end of the month high-grade tin promises to be fairly scarce and at a higher premium over 99 per cent than at present. Electrolytic has been in feeble demand at, or slightly below, Straits.

Straits tin for future delivery: Dec. 30th, 35.75@36c.; 31st, 36@36.25c.; Jan. 3d, 36@36.25c.; 4th, 36.50@37c.; 5th, 37.25@37.50c.

Arrivals of tin in long tons: Total for December, 2,470; Jan. 1st, Straits, 10; 3d, Straits, 5; London, 100; 4th, Straits, 150. It now appears that on Dec. 28, 620 tons of electrolytic tin was exported to London.

Silver

Since our last report the market has broadened and a considerable speculative account has been operating. China has been a buyer, both in this market and in London, but on Dec. 29, according to London reports, China resold previous purchases, with the result that the quotation dropped to 41½d. on the 30th. The market is sensitive, and the tendency uncertain, with buyers holding off at today's higher level.

Mexican Dollars—Dec. 30th, 49½; 31st, 48½; Jan. 3d, 50; 4th, 50; 5th, 51½.

Gold

Gold in London: Dec. 30th, 116s. 4d.; 31st, 116s. 1d.; Jan. 3d, 115s. 11d.; 4th, 115s. 10d.; 5th, 114s. 10d.

Foreign Exchange

A pronounced strengthening in sterling took place during the last week. On Tuesday, Jan. 4th, francs were 5.825c.; lire, 3.40c.; and marks, 1.335c. New York funds in Montreal, 17½ per cent premium.

Other Metals

Aluminum—List prices of 28.3@28.5c. are purely nominal.

Antimony—Chinese and Japanese brands, 5½@5¾c.; market quiet. W.C.C. brand, 6¼@6½c. per lb. Cookson's "C" grade, shipment from England, 9½c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony (200 mesh), 7@7¼c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb₂O₃, wholesale lots, 7c.

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

Cadmium—Nominal, \$1.40 per lb.

Cobalt—Metal, \$5 per lb.; black oxide, \$3.50 per lb.; sulphate, \$1.35.

Iridium—Nominal, \$325 per oz.

Magnesium—Crude, 99 per cent, \$1.35 per lb. f.o.b. Philadelphia.

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

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

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

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

Palladium—\$75 per oz.

Platinum—Firm at \$75 per oz.

Quicksilver—Nominally \$45 per 75-lb. flask. San Francisco wires \$47@50. Dull.

Rhodium—\$200@225 per troy oz.

Ruthenium—\$175@200 per troy oz.

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

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

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

Metallic Ores

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

Manganese Ore—40@45c. per unit, seaport; chemical ore (MnO₂) \$60@65 per gross ton, lump; \$75@80 per net ton, powdered.

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

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 40c. per lb. in ton lots.

Titanium Ores—Ilmenite, 52 per cent TiO₂, 1¼@2c. per lb. for ore. Rutile, 95 per cent TiO₂, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite, 60 per cent WO₃ and over, per unit of WO₃, \$4@4.50, f.o.b. mines; wolframite, 60 per cent WO₃ and over, per unit of WO₃, \$3.50, in New York.

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

Vanadium Ore—\$1.50 per lb. of V₂O₅ (guaranteed minimum of 18 per cent V₂O₅), New York.

Zircon—Washed, iron free, 5c. per lb.

Zirkite—According to conditions, \$70@90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at \$1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Dec. 31—Zinc blende, per ton, high, \$36.95; basis 60 per cent zinc, premium, \$29; Prime Western, \$27.50;

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

finer and slimes, \$25@22.50; calamine, basis 40 per cent zinc, offerings \$20, no sales. Average settling values: Blende, \$35.50.

Lead, high, \$58.05; basis 80 per cent lead, \$55@47.50; average settling price, all grades of lead, \$54.75 per ton.

Shipments for the week: Blende, 4,518; lead, 656 tons. Value, all ores the week, \$191,780.

Shipments for the year: Blende, 564,316; calamine, 10,136; lead, 88,954 tons. Value, all ores the year, \$35,630,590.

Compared with 1919, blende shipments were 95,138 tons more, calamine 1,906 tons less, a net zinc ore increase of 93,232 tons. The lead increase is 16,595 tons.

Platteville, Wis., Jan. 1.—No market report and no demand for ore. No ore shipped out of the district during the week. Shipments for the year 1920: Blende, 60,506; calamine, 2,551; lead, 4,562; sulphur ore, 1,342 tons. Shipped during the week to separating plants, 1,007 tons blende.

Non-Metallic Minerals

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

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

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

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

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

Fluorspar—Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, \$25 per ton, f.o.b. Illinois mines, and \$25.50, f.o.b. Kentucky; ground, suitable for acid, chem-

ical or enameling purposes, \$60; lump, \$17.50, f.o.b. Tonuco, N. M. In Canada 85 per cent calcium fluoride sells for \$20 per ton, f.o.b. Madoc; output limited. Canadian price generally \$18 (Canadian currency) per ton, f.o.b. mines.

Fuller's Earth—\$16 per ton, carload lots, f.o.b. New York.

Graphite—The 90 per cent crucible grade is held in Alabama for 9c. per lb. and 85 per cent grade, 7@9c. Lubricating grade commanding the best price is a fine flake, passing a 100@120 mesh, and running higher than 96 per cent carbon. Linotype machines use a flake passing 90 mesh and standing on a 120 screen, with 90 per cent carbon, retailing at 75c. to \$1 per lb. and selling to jobbers at 11@40c.

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

Kaolin—See China Clay.

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

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

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

Mica—India block mica, slightly stained, per lb.: No. 6, 50c.; No. 5, \$1.20@1.40; No. 4, \$2@3; No. 3, \$4.25@5; No. 2, \$5.50@7; No. 1, \$8. Clear block: No. 6, 55c.; No. 5, \$1.75; No. 4, \$3.25; No. 3, \$5; No. 2, \$6.50; No. 1, \$8; A1, \$10; extra large, \$25; all f.o.b. New York; ground, \$150 per ton, Philadelphia. Domestic, uncut, f.o.b. Franklin, N. C., as follows: Scrap, \$45@50 per ton; punch, 10c. per lb.; circle, 15@25c.; 1½ x 2 in., 75c.; 2 x 2 in., \$1.15; 2 x 3 in., \$1.65; 3 x 3 in., \$2.10; 3 x 4 in., \$2.50; 3 x 5 in., \$2.75; 3 x 6 in., \$3.75; ground 165 mesh, \$150@170 per ton; ground roofing mica, \$60; mica washers, 75c.@2 per lb.; 1½-in. disks, No. 1, \$1.40 per lb.; No. 2, \$1.25. The foregoing domestic prices obtain also in the Chicago district.

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

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

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

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 16½c.; Spanish lump, 14@16c.; domestic fines, f.o.b. mines, Georgia, 12@14c.

Quartz—(Acid tower) fist to head, \$10; 1½ to 2 in., \$14; rice, \$17; all net ton, f.o.b. Baltimore; lump, carload lots, \$5@7.50 net ton, f.o.b. North Carolina mines.

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

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

Talc—Paper making, \$12@22 per ton; roofing grades, \$9.50@15; rubber grades, \$12@18; all f.o.b. Vermont. California talc, \$20@45, talcum powder grade. Southern talc, powdered, carload lots, \$12@15 per ton; less than carload, \$25, f.o.b. cars; freight to New York \$5.25 per ton, carload lots; less than carload lots, \$9.25. Imported, \$50@60; Canadian, \$20@40 per ton.

Mineral Products

Arsenic—White arsenic, 11½@12c. per lb.; sulphide, powdered, 15@15½c. per lb. in carload lots.

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

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

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

Ferro Alloys

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

Ferrocobalt—Per lb., \$12@15.

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

Ferromanganese—Domestic 76 to 80 per cent, \$120@125, freight allowed; \$120, f.o.b. seaboard bases; resale, \$115; English, \$110, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, \$60, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, \$2 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, \$55@60; 50 per cent, \$78@80; 75 per cent, \$140@145.

Ferrotungsten—Domestic, 70 to 80 per cent W, 55@60c. per lb. of contained tungsten, f.o.b. works. Foreign, 60c.

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

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

Ferrovanadium—Basis 30 to 40 per cent, \$6@6.50 per lb. of V contained, according to silicon content, f.o.b. works.

Metal Products

Copper Sheets—Current New York list price, 21½c. per lb.; wire, 16½c.

Lead Sheets—Full lead sheets, 8½c.; cut lead sheets, 8½c. in quantity, mill lots.

Nickel Silver—34½c. per lb. for 18 per cent nickel.

Yellow Metal—Dimension sheets, 20½c.; sheathing, 20½c.; rods, 3 to 3 in., 17½c.

Zinc Sheets—\$11.50 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 11½c. per lb.

Refractories

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

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

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

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

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

Iron Trade Review

Pittsburgh, Jan. 4, 1921

Under date of Dec. 31 the Republic Iron & Steel Co. reduced its prices on tubular goods to the Industrial Board level. The other independent pipe mills have been taking similar action to that of Republic, some lists being dated Jan. 1 and others Jan. 3. There was not as general closing among independent steel mills last week, as had been predicted, as a few mills operated at rates up to 50 per cent.

Pig Iron—As was expected, a prominent Valley producer of bessemer and basic iron announced with the opening of business this month that it is prepared to sell bessemer or malleable at \$32 and basic at \$30, Valley, representing reductions of \$3 from previous nominal quotations. Foundry is quotable \$2 lower, at \$33, with further readjustment to be expected. W. P. Snyder & Co. announce averaged prices for December, computed from actual sales reported, of \$35, Valley, for bessemer and \$33 for basic. The average quotation on foundry iron was \$35.76.

Charcoal and Coke

Charcoal—Willow, 7c. per lb. in bbls.; hardwood, 5½c. per lb., in 250-lb. bbls. Barrel charge is 35c. additional.

Connellsville—Furnace, \$6.25@7; foundry, \$5@5.50.

COMPANY REPORTS

Butte and Superior Mining Co. Suspends Productive Operations

Zinc; Montana

The following statement of the Butte and Superior Mining Co. shows the principal operating features for the third quarter of 1920, as compared with those for the first and second quarters of the current year:

	Third Quarter 1920	Second Quarter 1920	First Quarter 1920
Dry tons of ore milled . . .	92,659	81,619	130,204
Average zinc content (per cent)	13.075	13.339	14.164
Average silver content (oz. per ton)	5.251	5.340	5.530
Tons zinc concentrates produced	21,854	19,281	32,535
Average zinc in zinc concentrates (per cent)	52.564	52.774	53.859
Total zinc in zinc concentrates (lb.)	22,974,345	20,350,566	35,045,757
Average silver in zinc concentrates (oz. per ton)	19.316	19.429	19.499
Mill recovery (per cent zinc recovered in zinc concentrates)	94.815	93.457	95.018
Direct mining cost per ton	\$7.624	\$7.000	\$5.521
Direct milling cost per ton	\$3.142	\$3.456	\$2.610
Total direct cost, mining and milling (per ton) . . .	\$10.766	\$10.456	\$8.131
Indirect or general costs (per ton) exclusive of freight	\$0.699	\$1.066	\$0.497
Total costs (per ton)	\$11.465	\$11.522	\$8.628

Development work during the period consisted of 1,658 ft. of drifting, 2,019 ft. of cross-cutting, 880 ft. of raises and winzes, 55 ft. of station cutting and 173 ft. of shaft sinking and raising, or a total development of 4,785 ft., exclusive of diamond drilling. Diamond drilling to the extent of 220 ft. was done on the 2,300-ft. level as the beginning of a comprehensive plan of diamond-drill exploration of the ground from the lower levels.

The financial results for this quarter, as compared with the previous quarters of 1920, are as follows:

	Third Quarter 1920	Second Quarter 1920	First Quarter 1920
Net value of zinc concentrates at mill	\$629,953.69	\$587,957.25	\$1,224,548.17
Net value of lead concentrates at mill and residual values	228,365.26	177,854.27	506,301.96
Miscellaneous	16,814.28	27,619.63	19,920.18
Metal inventories and quotations	85,000.00	.....	.....
	\$960,133.23	\$793,431.15	\$1,750,770.31
Operating costs, depreciation, shutdown expense, etc.	1,062,351.72	940,432.97	1,123,514.36
Profit	(a) \$102,218.49	(a) \$147,001.82	\$627,255.95
(a) Loss			

The above statement includes charges for depreciation and shutdown expenses, but no allowance has been made for depletion or taxes. The average price used in estimating the income for the quarter was 7.6355c. per lb., but since the close of it, the market price has dropped much lower.

During and since the close of the quarter it has become increasingly evident that productive operations could not be maintained without serious loss in the face of continuing high costs and the prevailing unsatisfactory market and price for zinc. Operations have for several months been conducted on the basis of reduced output, and all possible means toward economy have been employed in an effort to limit operating losses to some moderate amount, which would be no more burdensome than the unavoidable maintenance expense in connection with suspended operations. To this end the tonnage was recently reduced to the minimum that would support continuous operation at one-half the mill, in the hope that some improvement in metal prices might justify continuing operations on a minimum scale. Such hope has proved futile, and as this report is written, the directors have decided to suspend productive operations entirely until such time as the margin between costs and

selling price warrants their resumption. A skeleton organization will be maintained by employing as much of the present operating force as practicable in a development program of moderate scope. Such limited quantities of ore as it is found necessary to remove in connection with development work will be stored for future use, as milling operations will be entirely discontinued.

The El Oro Mining and Railway Co. Has Profitable Year

Gold; Mexico

The annual report and audited statement of accounts of the El Oro Mining and Railway Co. for the year ended June 30, 1920, shows a net profit of £62,946 15s. 6d. earned for the period. Out of this sum the directors declared dividend No. 29, of 5 per cent, or 1s. per share, tax free, for the year 1919-1920, which was paid on Nov. 18, 1920. Important changes in the political condition of the Republic of Mexico have taken place during the last year, and have so far had a beneficial effect on the mining and industrial situation.

The report shows that 366,730 tons of ore, having a gross value of \$8.77 per ton (U. S. currency), was treated in the reduction works, producing bullion which realized \$2,789,457.27 (\$1,984,926.16 gold value, remainder silver), or \$7.61 per ton, resulting in a net profit of \$326,909, or £81,727.

Working costs show some reduction, being returned at \$6.70 per ton, against \$6.80 during the preceding year. Taxation is still a serious burden. The sum paid for Mexican state and federal taxes in the accounts presented, which is included in working costs, amounted to \$381,017.72.

An estimate of the amount of ore in sight on June 30 last is placed at 293,779 tons, which compares with 333,135 tons on June 30, 1919. As 368,538 tons was extracted during the year, it follows that 329,182 tons of new ore was developed during that period.

The gross earnings of the company's railway during the year amounted to \$236,699, against operating expenses of \$92,981, leaving a profit of \$143,718. This is the largest net sum earned in any one year by this department.

The Suchi Timber Co., a subsidiary, fulfills a useful and profitable purpose, and has recently distributed a dividend, tax free, of 25 per cent.

At the last general meeting, the shareholders approved the policy, then submitted by the directors, of investing the surplus funds of the company, as opportunity offered, in other mining properties in Mexico. Options have already been secured on favorable terms over two mining properties, one with a well-established record of production, and the other of more recent discovery. Both these mines offer inducement for development, and give encouragement for the belief that work thereon will be successful. Other important enterprises are now the subject of negotiations. Profit and loss account follows:

DEBIT			
	£	s.	d.
Mining expenditure	614,667	11	0
Railway department expenditure	23,245	4	6
London expenses	2,045	13	0
Directors' fees	2,200	0	0
Depreciation of plant and machinery	25,000	0	0
Provision for income tax and corporation tax	43,600	0	0
Balance, carried to balance sheet	62,946	15	6
Total	773,705	4	0
CREDIT			
	£	s.	d.
Bullion recovered	696,394	4	8
Railway department receipts	59,181	5	8
Interest and dividends	8,543	9	10
Sundry receipts	777	7	6
Exchange profit on remittances	8,808	16	4
Total	£773,705	4	0

METAL STATISTICS

Monthly Average Prices of Metals

Silver

	New York		London		Sterling Exchange	
	1919	1920	1919	1920	1920	1921
January	101.125	132.827	48.438	79.846	367.082	
February	101.125	131.255	48.027	85.005	337.466	
March	101.125	125.551	48.171	74.194	370.870	
April	101.125	119.779	48.886	68.848	392.438	
May	107.135	102.585	52.104	60.010	383.360	
June	110.430	90.957	53.896	51.096	393.663	
July	106.394	91.971	54.133	53.736	385.538	
August	111.370	96.168	58.835	59.875	360.404	
September	114.540	93.675	61.668	59.476	350.370	
October	119.192	83.480	64.049	54.197	346.460	
November	127.924	77.734	70.065	50.952	342.333	
December	131.976	64.774	76.432	41.845	348.101	
Year	111.122	100.900	57.059	61.590	364.840	

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

Copper

	New York		Standard		London	
	1919	1920	1919	1920	1919	1920
January	(a) 18.918	92.238	118.095	106.619	123.238	
February	16.763	18.569	78.700	120.188	95.700	126.950
March	14.856	18.331	76.821	109.533	82.071	118.348
April	15.246	18.660	77.300	103.025	82.200	111.500
May	15.864	18.484	77.767	96.750	81.227	109.200
June	17.610	18.065	83.062	87.864	85.900	101.909
July	21.604	18.576	99.576	90.148	103.046	106.455
August	22.319	18.346	97.300	93.935	106.429	111.143
September	21.755	18.144	100.767	96.381		111.905
October	21.534	15.934	103.418	93.327		104.905
November	19.758	14.257	98.894	84.807		94.614
December	18.295	13.188	103.708	75.702		85.905
Year	18.691	17.456	90.796	97.480		108.839

(a) No market. New York quotations, cents per lb. London, pounds sterling per long ton.

Lead

	New York		St. Louis		London	
	1919	1920	1919	1920	1919	1920
January	5.432	8.561	5.316	8.300	37.227	47.095
February	5.057	8.814	4.784	8.601	28.675	50.256
March	5.226	9.145	4.992	8.894	27.952	46.054
April	4.982	8.902	4.722	8.618	24.888	39.225
May	5.018	8.576	4.773	8.352	23.852	38.488
June	5.340	8.323	5.070	8.169	22.544	34.330
July	5.626	8.338	5.408	8.283	23.457	34.960
August	5.798	8.687	5.583	8.725	24.750	36.304
September	6.108	8.177	5.853	8.160	25.330	35.452
October	6.487	7.070	6.249	7.018	28.473	35.238
November	6.808	6.159	6.649	6.127	34.731	32.489
December	7.231	4.727	6.955	4.717	41.202	24.089
Year	5.759	7.957	5.530	7.830	28.590	37.832

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

Tin

	New York		St. Louis		London	
	1919	1920	1919	1920	1919	1920
January	67.702		61.596		248.557	376.512
February	66.801		58.466	59.932	223.963	395.750
March	67.934		61.037	61.926	236.843	369.489
April	72.500		61.120	62.115	225.275	345.450
May	72.500		53.230	55.100	234.398	294.813
June	71.240		46.125	48.327	238.263	250.614
July	68.000		45.798	49.154	253.272	261.886
August	57.226		43.856	47.620	273.625	274.048
September	54.482		41.940	44.465	280.102	270.120
October	54.377		39.310	40.555	279.239	258.190
November	53.307		35.667	36.854	283.556	241.080
December	53.870		31.135	34.058	314.113	212.440
Year	63.328		48.273	49.101	257.601	295.866

New York quotations, cents per lb. London, pounds sterling per long ton.

Zinc

	New York		St. Louis		London	
	1919	1920	1919	1920	1919	1920
January	7.272	9.483	6.922	9.133	56.045	58.643
February	6.623	9.058	6.273	8.708	46.150	61.338
March	6.500	8.881	6.150	8.531	38.500	53.467
April	6.465	8.534	6.114	8.184	36.118	47.388
May	6.429	7.938	6.079	7.588	35.477	45.088
June	6.901	7.815	6.551	7.465	36.763	41.193
July	7.873	8.070	7.523	7.720	41.815	41.886
August	7.789	8.185	7.439	7.835	39.338	41.220
September	7.510	7.717	7.160	7.661	40.955	39.690
October	7.823		7.473	7.150	43.630	39.756
November	8.177		7.827	6.247	46.588	35.028
December	8.700		8.350	5.824	53.101	27.762
Year	7.338		6.988	7.671	42.879	44.372

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

Antimony and Quicksilver

	Antimony ()		Quicksilver ()	
	New York	1920	New York	1920
January	10.577		90.192	
February	11.588		84.432	
March	11.056		92.611	
April	10.500		102.192	
May	9.655		89.560	
June	8.289		90.154	
July	7.500		90.333	
August	7.177		83.806	
September	7.113		75.000	
October	6.723		67.200	
November	6.109		58.417	
December	5.534		49.577	
Year	8.485		81.123	

(a) Antimony quotations in cents per lb. for ordinary brands. (b) Quicksilver in dollars per flask.

Pig Iron, Pittsburgh

	Bessemer		Basic		No. 2 Foundry	
	1919	1920	1919	1920	1919	1920
January	\$33.60	\$40.47	\$31.40	\$39.88	\$32.40	\$39.86
February	33.60	42.95	31.40	42.61	32.40	43.40
March	32.54	43.40	31.40	42.90	29.12	43.40
April	29.35	43.72	27.15	44.22	28.15	43.90
May	29.35	44.00	27.15	44.88	28.15	45.36
June	29.35	44.89	27.15	45.41	28.15	46.40
July	29.35	47.21	27.15	47.42	28.15	46.56
August	29.35	48.90	27.15	49.88	28.15	49.35
September	29.35	50.46	27.15	50.46	28.15	51.96
October	29.35	49.21	27.15	44.38	28.30	48.58
November	31.60	41.26	31.56	39.20	32.16	42.61
December	36.57	36.96	35.32	34.90	36.86	37.73
Year	\$31.11	44.45	\$29.26	43.85	\$28.35	44.93

In dollars per long ton.

Monthly Crude Copper Production, 1920

	August	September(a)	October(a)	November
Alaska shipments	5,762,551	1,635,677	4,984,219	12,802,696
Arizona Copper	3,000,000	3,000,000	2,800,000	2,800,000
Calumet & Arizona	5,200,000	4,292,000	3,802,000	3,486,000
Con. Ariz. Smelting	975,000	950,000	865,000	750,000
Inspiration	7,200,000	6,500,000	7,000,000	5,350,000
Magma	556,760	663,219	750,814	671,752
Miami	4,630,725	4,549,140	4,582,293	4,505,232
New Cornelia	3,842,000	3,314,000	3,450,000	2,670,000
Old Dominion	2,802,000	1,957,000	2,912,000	2,563,000
Phelps Dodge	5,875,000	6,381,000	5,309,000	5,492,000
Shattuck Arizona	194,003	166,513	206,772	6,063
Ray	4,505,000	4,502,000	3,990,800	3,975,000
United Verde	5,125,000	4,837,000	5,858,000	4,030,000
United Verde Extension	5,805,568	3,327,644	3,864,756	2,642,812
Calumet & Hecla	7,520,107	7,278,215	7,945,502	7,326,763
Other Lake Superior	6,000,000	6,000,000	6,000,000	6,000,000
Anacanda	11,800,000	11,100,000	11,000,000	11,100,000
East Butte	1,566,800	1,634,260	1,626,980	1,658,860
Nevada C. S.	4,650,000	4,650,000	4,650,000	3,950,000
Chino	4,000,140	5,161,894	3,933,435	4,000,000
Utah Copper	4,820,000	8,420,000	8,000,000	9,120,000
Eastern Smelters	1,600,000	1,600,000	1,600,000	1,600,000
Others, estimated	15,000,000	13,000,000	10,900,000	10,200,000
Total United States	116,430,634	104,919,262	105,231,571	106,700,178
Imports: Ore and concentrates, etc.	11,040,057	10,132,777	9,626,502	
Imports in blister, etc.	20,320,824	20,428,866	24,559,763	
Grand total	147,791,535	135,480,905	139,417,836	
British Columbia:				
Granby Cons.	2,471,200	2,239,174	2,293,500	2,465,585
Mexico:				
Boleo	618,390	440,720	617,200	771,680
Cananea	3,500,000	3,500,000	3,500,000	3,500,000
Phelps Dodge Mexican properties	2,490,000	1,617,000	1,817,000	2,666,000
Other foreign:				
Cerro de Pasco	4,440,000	4,360,000	4,698,000	3,612,000
Chile	10,640,000	9,496,000	9,420,000	8,859,984
Katanga	4,615,176	None	2,697,696	
Backus & John ton.	1,580,000	1,560,000	1,740,000	1,548,000

Comparative annual copper production follows:

	1918	1919	1920
January	165,431,568	135,733,511	121,903,744
February	160,011,364	111,649,512	117,450,000
March	185,525,168	102,040,460	120,309,316
April	163,207,096	98,808,998	116,078,871
May	181,070,350	92,652,975	114,964,207
June	166,723,599	95,856,570	116,107,856
July	159,329,031	100,369,247	109,729,510
August	165,550,799	107,994,040	116,460,654
September	157,992,487	108,703,075	(a) 104,919,262
October	168,638,775	115,143,143	(a) 105,231,571
November	159,217,588	117,289,735	106,700,178
December	161,801,916	102,997,633	

(a) Revised

MINING STOCKS

Week Ended January 1, 1921

Stock	Exch.	High	Low	Last	Last Div.
COPPER					
Adventure.....	Boston.....	*60	*55	*60	Sept.'20, Q .50
Ahmeek.....	Boston.....	45	40	45	
Alaska-B.C.....	N. Y. Curb.	18	16	18	Mar.'19, 1.00
Allouez.....	Boston.....	35	30	33	Nov.'20, Q 1.00
Anaconda.....	N. Y.....	6	5	6	Oct.'18, .50
Aris. Com'l.....	Boston.....	9	9	9	Sept.'19, Q .25
Big Ledge.....	N. Y. Curb.	42	39	41	Dec.'20, Q 1.00
Bingham Mines.....	Boston.....	250	210	250	June '20, Q 5.00
Calumet & Aris.....	Boston.....	*13	*11	*13	
Calumet & Hecla.....	N. Y. Curb.	6	6	6	Dec.'18, SA 1.00
Cerro de Pasco.....	N. Y.....	26	24	26	Dec.'20, Q 1.00
Chief Consol.....	Boston Curb	2	2	2	Nov.'20, Q .10
Chile Copper.....	N. Y.....	9	8	9	
Chino.....	N. Y.....	19	16	19	Sept.'20, Q .37
Columbus Rexall.....	Salt Lake.....	*32	*32	*32	
Con. Aris.....	N. Y. Curb.	1	1	1	Dec.'18, Q .05
Con. Copper M.....	N. Y. Curb.	1	1	1	
Copper Range.....	Boston.....	27	25	26	Sept.'20, Q .50
Crystal Copper (new)	Boston Curb	*41	*32	*36	
Davis-Daly.....	Boston.....	5	4	5	Mar.'20, Q .25
East Butte.....	Boston.....	8	7	8	Dec.'19, A .50
First Nat'l.....	Boston Curb	*70	*56	*65	Feb.'19, SA .15
Franklin.....	Boston.....	2	2	2	
Gadsden Copper.....	N. Y. Curb.	*26	*20	*25	
Granby Consol.....	N. Y.....	17	15	17	May '19, Q 1.25
Greene-Cananea.....	N. Y.....	19	16	19	Nov.'20, Q .50
Hancock.....	Boston.....	2	2	2	
Houghton.....	Boston Curb	2	2	2	Oct.'20, Q .05
Howe Sound.....	N. Y. Curb.	2	2	2	
Inspiration Con.....	N. Y.....	32	28	31	Oct.'20, Q 1.00
Iron Cap.....	Boston Curb	6	6	6	Sept.'20, K .25
Isle Royale.....	Boston.....	16	15	16	Sept.'19, SA .50
Kennebec.....	N. Y.....	17	15	17	Dec.'20, Q .50
Keweenaw.....	Boston.....	1	1	1	
Lake Copper.....	Boston.....	2	1	1	
La Salle.....	Boston.....	1	1	1	
Magma Chief.....	N. Y. Curb.	16	15	15	Jan.'19, Q .50
Magma Copper.....	N. Y. Curb.	*15	*7	*8	
Majestic.....	Boston Curb	1	1	1	Nov.'17, Q 1.00
Mason Valley.....	Boston.....	2	1	1	
Mass Consol.....	Boston.....	3	3	3	
Mayflower-O.C.....	Boston.....	3	3	3	
Miami.....	N. Y.....	15	14	15	Nov.'20, Q .50
Michigan.....	Boston.....	2	2	2	
Mohawk.....	Boston.....	43	40	43	Nov.'20, Q 1.00
Mother Lode (new).....	N. Y. Curb.	5	5	5	
Nevada Con.....	N. Y.....	9	8	9	Sept.'20, Q .25
New Arcadian.....	Boston.....	3	3	3	
New Baltic.....	Boston Curb	3	3	3	
New Cornelia.....	Boston.....	14	13	13	Aug.'20, .25
Nixon Nev.....	N. Y. Curb.	5	5	5	
North Butte.....	Boston.....	9	8	8	Oct.'18, Q .25
North Lake.....	Boston.....	*40	*25	*40	
Ohio Copper.....	N. Y. Curb.	1	1	1	
Ojibway.....	Boston.....	16	15	15	Dec.'18, Q 1.00
Old Dominion.....	Boston.....	23	20	22	June '20, Q .50
Osceola.....	Boston.....	23	20	22	June '20, Q .50
Phelps Dodge.....	Open Mar.	†175	†150	†150	Oct.'20, Q 2.50
Quincy.....	Boston.....	35	34	35	Mar.'20, Q 1.00
Ray Con.....	N. Y.....	11	10	11	Dec.'20, Q .25
Ray Hercules.....	Boston Curb	5	5	5	
St. Mary's M. L.....	Boston.....	29	25	28	June '20, K 2.00
Seneca Copper.....	Boston.....	16	16	16	
Shannon.....	Boston.....	0.75	0.50	0.75	Nov.'17, Q .25
Shattuck Ariz.....	N. Y.....	4	4	4	Jan.'20, Q .25
South Lake.....	Boston.....	4	4	4	
South Utah.....	Boston.....	3	3	3	Apr.'17, 1.00
Superior Copper.....	Boston.....	1	1	1	
Superior & Boston.....	Boston.....	7	6	7	May '18, I 1.00
Tenn. C. & C.....	N. Y.....	40	35	35	May '13, .10
Tuolumne.....	Boston.....	23	22	23	Nov.'20, Q .50
United Verde Ex.....	Boston Curb	3	3	3	Sept.'18, .25
Utah Consol.....	Boston.....	50	45	50	Dec.'20, Q 1.50
Utah Copper.....	N. Y.....	*95	*85	*90	Dec.'17, .30
Utah M. & T.....	Boston.....	1	1	1	
Victoria.....	Boston.....	*45	*25	*45	Jan.'20, Q .50
Winona.....	Boston.....	9	8	9	
Wolverine.....	Boston.....	9	8	9	
LEAD					
Hecla Mining.....	N. Y. Curb.	3	3	3	Dec.'20, QX .15
St. Joseph Lead.....	N. Y.....	12	11	12	Dec.'20, QX .50
Stewart.....	Boston Curb	6	6	6	Dec.'15, .05
Utah Apex.....	Boston.....	3	2	3	Nov.'20, K .25
ZINC					
Am. Z. L. & S.....	N. Y.....	8	6	7	May '17, 1.00
Am. Z. L. & S. pf.....	N. Y.....	30	28	30	Nov.'20, Q 1.50
Butte C. & Z.....	N. Y.....	4	3	4	Sept.'18, I .50
Butte & Superior.....	N. Y.....	11	8	10	Sept.'17, 1.25
Callahan Z. L.....	N. Y.....	5	4	4	Dec.'20, Q .50
New Jersey Z.....	N. Y. Curb.	130	127	130	Nov.'20, Q 4.00
Success.....	N. Y. Curb.	*3	*1	*3	July '16, .03
Yellow Pine.....	Los Angeles.....	†.....	†.....	†.....	June '20, Q .03

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

Stock	Exch.	High	Low	Last	Last Div.
GOLD					
Alaska Gold.....	N. Y.....	1	1	1	
Alaska Juneau.....	N. Y.....	1	1	1	
Carson Hill.....	N. Y. Curb.	22	22	22	
Cresson Consol. G.....	N. Y. Curb.	1	1	1	June '20, Q .10
Dome Ex.....	Toronto.....	1	1	1	
Dome Mines.....	N. Y.....	10	9	10	Oct.'20, Q .25
Golden Cycle.....	Colo. Sprgs.	†.....	†.....	†.....	Dec.'20, Q .02
Goldfield Con.....	N. Y. Curb.	*6	*4	*5	Dec.'19, .05
Hedley.....	Boston.....	5	4	5	June '19, .10
Hollinger Con.....	Toronto.....	5.55	5.40	5.55	Dec.'20, BM .05
Homestake.....	N. Y.....	50	49	50	Sept.'19, .50
Kirkland Lake.....	Toronto.....	39	39	39	
Lake Shore.....	Toronto.....	1.05	1.05	1.05	Oct.'20, K .02
McIntyre-Porcupine	Toronto.....	1.81	1.76	1.79	Sept.'20, K .05
Porcupine Crown.....	Toronto.....	*17	*17	*17	July '17, .03
Portland.....	Colo. Sprgs.	†.....	†.....	†.....	Oct.'20, Q .01
Reorgan. Booth.....	N. Y. Curb.	*3	*2	*3	May '19, .05
Silver Pick.....	N. Y. Curb.	*4	*3	*4	
Teck Hughes.....	Toronto.....	*10	*10	*10	
Timberline.....	Los Angeles.....	†.....	†.....	†.....	Dec.'19, .02
United Eastern.....	N. Y. Curb.	2	2	2	Oct.'20, Q .15
Vindicator Consol.....	Colo. Sprgs.	†.....	†.....	†.....	Jan.'20, Q .01
West Dome Consol.....	Toronto.....	*8	*7	*8	
White Caps Min.....	N. Y. Curb.	*5	*3	*4	
Yukon Gold.....	Boston Curb	*50	*50	*50	June '18, .02
SILVER					
Arizona Silver.....	Boston Curb	*20	*17	*18	Apr.'20, M .03
Beaver Con.....	Toronto.....	*27	*25	*25	May '20, K .03
Coniagas.....	Toronto.....	2.00	2.00	2.00	Nov.'20, Q .12
Crown Reserve.....	Toronto.....	*16	*15	*16	Jan.'17, .05
Kerr Lake.....	Boston.....	2	2	2	Oct.'20, K .12
La Rose.....	Toronto.....	2	2	2	Apr.'18, .02
McKinley-Dar.....	Toronto.....	2	2	2	Oct.'20, Q .05
Mining Corp.....	Toronto.....	1.00	1.00	1.00	Sept.'20, Q .12
Nipissing.....	N. Y. Curb.	7	7	7	Oct.'20, QX .50
Ontario Silver.....	N. Y. Curb.	4	4	4	Jan.'19, Q .50
Ophir Silver.....	N. Y. Curb.	1	1	1	Jan.'12, .10
Peterson Lake.....	Toronto.....	9	9	9	Jan.'17, .01
Temiskaming.....	Toronto.....	*25	*25	*25	Jan.'20, K .04
Trethewey.....	Toronto.....	*17	*15	*15	Jan.'19, .05
GOLD AND SILVER					
Atlanta.....	N. Y. Curb.	*1	*1	*1	
Barnes-King.....	Butte.....	1.11	1.11	1.11	Aug.'20, Q .05
Bost. & Mont.....	Boston.....	63	63	63	
Cashboy.....	N. Y. Curb.	*5	*3	*3	
El Salvador.....	N. Y. Curb.	1	1	1	
Jim Butler.....	N. Y. Curb.	*18	*16	*17	Aug.'18, SA .07
Jumbo Extension.....	N. Y. Curb.	*5	*4	*4	June '16, .05
Louisiana Con.....	N. Y. Curb.	1	1	1	
MacNamara M.....	N. Y. Curb.	1	1	1	May '10, .02
Open Mar.....	N. Y. Curb.	†11	†9	†9	Oct.'20, QX .50
Tonopah-Belmont.....	N. Y. Curb.	1	1	1	Oct.'20, Q .05
Tonopah-Divide.....	N. Y. Curb.	1	1	1	
Tonopah Ex.....	N. Y. Curb.	1	1	1	Oct.'20, Q .05
Tonopah Mining.....	N. Y. Curb.	1	1	1	Oct.'20, SA .05
West End Con.....	N. Y. Curb.	1	1	1	Dec.'19, SA .05
SILVER-LEAD					
Caledonia.....	N. Y. Curb.	*17	*15	*16	July '20, M .01
Consol. M. & S.....	Montreal.....	19	16	17	Oct.'20, Q .62
Daly Mining.....	Salt Lake.....	2.00	2.00	2.00	July '20, Q .10
Daly-West.....	Boston.....	3	3	3	Dec.'20, Q .25
Eagle & Blue Bell.....	Boston Curb	2	2	2	Dec.'20, K .25
Electric Point.....	Spokane.....	†.....	†.....	†.....	May '20, SA .03
Fed. M. & S.....	N. Y.....	7	6	7	Jan.'09, 1.50
Florence Silver.....	N. Y.....	22	21	22	Dec.'20, Q 1.75
Grand Central.....	Spokane.....	†.....	†.....	†.....	Apr.'19, .01
Iron Blossom.....	Salt Lake.....	*18	*16	*16	June '20, K .03
Judge M. & S.....	Salt Lake.....	3.00	2.92	2.92	Apr.'20, Q .02
Marsh Mines.....	N. Y. Curb.	*8	*7	*8	Sept.'20, Q .12
Prince Consol.....	N. Y. Curb.	1	1	1	Nov.'17, .02
Rambler-Cariboo.....	Spokane.....	†.....	†.....	†.....	Feb.'17, .01
Rex Con.....	N. Y. Curb.	*5	*3	*4	
South Hecla.....	Salt Lake.....	*65	*65	*65	Sept.'19, K .15
Stand. S. L.....	N. Y. Curb.	†.....	†.....	†.....	Oct.'17, .05
Tamarack-Custer.....	Spokane.....	†.....	†.....	†.....	Dec.'19, K .03
Tintie Standard.....	Salt Lake.....	3.40	3.10	3.32	June '20, Q .10
Wilbert Mining.....	N. Y. Curb.	*2	*2	*2	Nov.'17, .01
NICKEL-COPPER					
Internat'l Nickel.....	N. Y.....	13	12	13	Mar.'19, .50
Internat'l Nickel, pf.....	N. Y.....	78	78	78	Nov.'20, Q 1.50
QUICKSILVER					
New Idria.....	Boston.....	*45	*35	*35	Jan.'19, .25
TUNGSTEN					
Mojave Tungsten.....	Boston Curb	5	5	5	
VANADIUM					
Vanadium Corp.....	N. Y.....	34	28	33	Oct.'20, Q 1.50
ASBESTOS					
Asbestos Corp.....	Montreal.....	82	82	82	Oct.'20, Q 1.50
Asbestos Corp. pf.....	Montreal.....	92	92	92	Oct.'20, Q 1.75
MINING, SMELTING AND REFINING					
Am. S. & R.....	N. Y.....	36	29	36	Dec.'20, Q 1.00
Am. S. & R. pf.....	N. Y.....	76	64	76	Dec.'20, Q 1.75
Am. Sm. pf. A.....	N. Y.....	61	61	61	Oct.'20, Q 1.50
U. S. Sm. R. & M.....	N. Y.....	33	29	33	Oct.'20, Q 1.50
U. S. S. R. & M. pf.....	Boston.....	43	40	43	Oct.'20, Q .87

