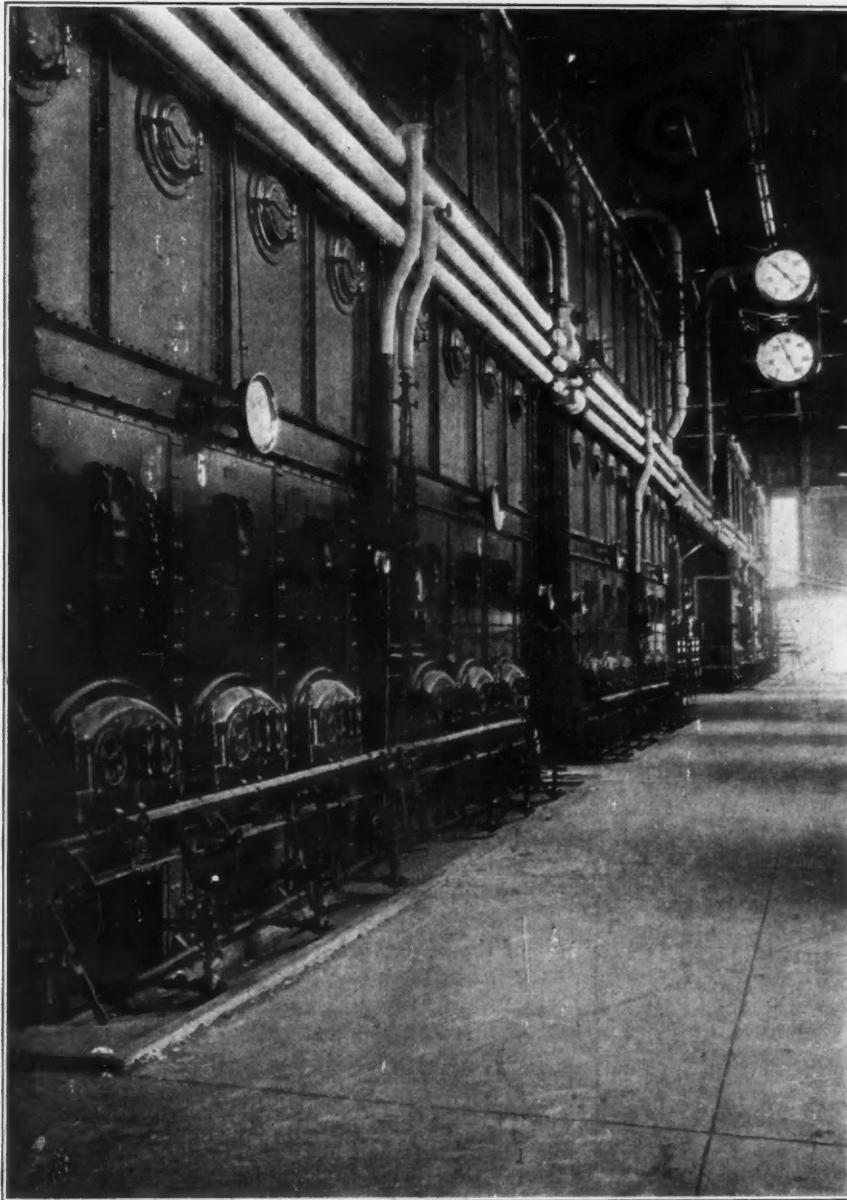


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Largest Circulation of Any Mining and Metal Journal in the World

April 9, 1921



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in the Southwest

Development Methods at Morenci, Arizona—By J. P. Hodgson and P. B. Lord

Tunneling Through Soft Ground—By Robert W. Jones

Recent Metallurgical Practice on the Rand

*Government Officials Prominent in Mining*—Senator Samuel D. Nicholson



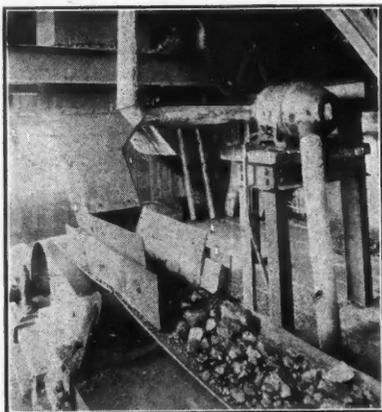
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## Popularizing Science

IN RECENT YEARS the demand on the part of the public for information of a popular character concerning the progress of science has been continually increasing. This demand has even been appreciated by the various Government research bureaus, and efforts have been made to popularize their publications, but thus far with indifferent success. The concise detailed form of the Government scientific report has become almost unintelligible to many of the people whom it was intended to assist.

Although, to some extent, research work for the sake of the discovery of new facts with no regard to their application is subsidized by the Government, the major part of the work is supported because of its practical utility. There is, consequently, an obligation resting upon the workers to have their contributions expressed in the most readable form, although it must be admitted that such obligations are not always accorded due consideration. Little progress has thus far been made in popularizing the Government scientific publications, and quotations of abstruse technical verbiage, meaningless to the ordinary person, are often made in periodicals for the purpose of ridiculing Government research work.

When the scientific investigator has endeavored to write for the layman he has frequently found it difficult to express his ideas accurately without the use of his technical vocabulary, and the defining of all the technical terms has often so seriously encumbered his article as to make it uninteresting to the casual reader. When the "hack writer," after reading a few articles or interviewing some prominent research worker, has tried to inform the public of the new and startling discoveries of science, the results in many cases have been ludicrous. Non-important matters have been mistaken for important ones, facts and theories have been confused, gross exaggerations, due to the too vivid imagination of the writer, and a general lack of proper discrimination have been the rule rather than the exception. Articles by the non-scientific writer are not all bad, and many of the popular descriptions of new researches in the supplements of our Sunday newspapers are of great value, but too frequently they are so misleading as to embarrass the scientific investigator and to seriously discredit him among his fellow workers.

Notwithstanding these difficulties, it is generally recognized that some way must be devised by which the intelligent reading public may become acquainted with the new developments of science. Apparently this must be done by means of articles written as far as possible in non-technical language. If in addition this can be done by the usage of a distinctly literary style, the results will be far-reaching in their effects. It may well be that the time will soon arrive when research workers will be made to feel that the acquisition of a simple readable style is as important as the ability to conduct

research for the purpose of adding to the sum of human knowledge. At least it is to be hoped that some of the most glaring defects of present-day scientific contributions may be overcome.

An interesting example of the work of a distinctly literary man in the field of science is afforded by H. G. Wells in his recently published "Outline of History," in which there is a résumé of the entire field of Historical Geology. In the preface the writer states that "his disqualifications are manifest," but adds that every chapter in the work has been revised by a "more competent person than himself," and whom he seems to have regarded as properly qualified for the task.

Notwithstanding the fact that the work bears evidence of considerable preparation by extensive reading, and that the style is far superior to that of our ordinary books on geology, the result is far from satisfactory, and seems to show the necessity of having our geological literature popularized by geologists rather than by literary people who seek to inform themselves by a short course of intensive reading. The literature of geology is too vast to permit one to master it sufficiently to write such a review as Mr. Wells has prepared without the expenditure of far more time than he evidently had at his disposal.

Admittedly, when an author reviews the history of the world from the beginning of geologic time to the present in two 600-page octavo volumes he is to be excused for dogmatic assertions and the failure to include many of the numerous theories of science, but it is unfortunate when preference is given to discredited or at least unsatisfactory theories. The observant reader must be surprised to learn in Mr. Wells' work that the nebular hypothesis is accepted without question as the correct explanation of the origin of our solar system; that *Eozoon Canadense* "is nothing more than a crystalline marking"; and that the Pleistocene Ice-Age was brought about by the greater ellipticity of the earth's orbit, the change in the obliquity of the equator to the orbit, and the precession of the equinoxes. Other errors have crept in, despite the critical reading of his scientific friends. Nevertheless, we commend Mr. Wells for his courage in undertaking such a monumental task, but in regard to the facts of geologic history we are still waiting for the accurate and popular literary account.

## Standardization

WE HAVE BEEN HEARING a great deal about standardization during the last few years, but the movement has not progressed very far in actual practice. Theoretically, the elimination of a multiplicity of styles and shapes would certainly make for efficiency and economy of production, and we should be that much better off. Are we, however, willing to have ourselves and our business standardized? Any degree of system is easily possible, if we desire it. The fact that there is still an endless variety of all manufactured articles

makes it proper to question whether we want standardization.

Take men's clothing, for example: there are hundreds of patterns, each of which demands separate adjustments of machinery, with waste of time and material. If we could reduce the patterns to twenty, instead of many hundreds, the cloth would be much cheaper, and as good; and clothing would come down. Standardized homes would mean cheaper homes. We should pay less rent. Standardized brands and sizes of groceries would mean that we should get our foods cheaper. In operating mines, reduction of the number of sizes of tracks, locomotives, nuts, bolts, jigs, stamps, and other devices would enable quantity production on the part of the manufacturer; we should mine more cheaply, and the price of metal would come down.

All this means that the average man would make more money—perhaps. What would he do with it—or what would his wife do with it? What does anybody do with money? Those who possess it spend it on a minimum of necessities and a maximum of luxuries. The definition of an acceptable and desirable luxury is that it be *not standardized*—indeed, that it be distinctive and “different.” When your wife buys a dress, or when you buy a suit, she likes to think or you like to think that the cloth is a special weave, and that the modiste or the tailor has secured from France or from England only enough for one dress or one suit. Both she and you are willing to pay for this reactionary feeling against standardization. That is the psychological necessity, as potent in the world as the material need—yes, much more potent. Rare and costly articles, clothes, jewelry, works of art, variety of diversion, of language, of education, are the things for which the real struggles are made. In a prison, or a like institution, one gets real standardization of clothes, food, and life.

In industry also, in machinery, it is a question whether an unnatural urge toward standardization would not mean a loss of flexibility and a decrease of ingenuity and invention. Certainly, we shall have to go slow, if we are not to injure the advantages of individuality. For those who are interested in the advantages gained from standardization we recommend the adoption of the metric system. After that is accomplished, we can decide what to adopt next; but the expectation of universal standardization all at once would appear to be a will-o'-the-wisp.

### Power in the Mining Industry

A RECENT SURVEY of the power situation in the United States showed that 277 mining companies which replied to questionnaires were using as prime movers electric motors developing 204,268 hp., steam engines developing 176,272 hp., internal-combustion engines developing 17,601 hp., and water wheels furnishing the negligible amount of 1,000 hp. The respective percentages were 51.2, 44.2, 4.4, and 0.2. Electric power has demonstrated its superiority despite such handicaps as water shortage and high cost of coal. Mining companies are buying their power when they can, and, in general, increasing power rates have caused no inclination on their part to install their own plants. Apparently there are more believers in electric power than ever before. Bought power has proved itself the most reliable and satisfactory, and, in most cases, just as cheap as or cheaper than any that the consumers could themselves generate.

It is interesting to note the manner in which conditions differ throughout the country. In the copper district of northern Michigan there are no hydro-electric installations, all power, instead, being generated by steam and for the most part by the mining companies themselves. In recent years low-pressure and mixed-pressure steam turbines using exhaust steam from the large steam stamps have come into use. The great quantity of water used in the concentrators makes available an abundance needed for cooling in the condenser equipment. On the Mesabi Range all companies buy power save the Oliver and on the Cuyuna Range about 80 per cent of them. Similarly, in Wisconsin all operators buy, although protesting against a temporary raise in rates.

In southeast Missouri the mining companies have their own plants, using cheap Illinois coal. Here there are no hydro-electric installations. In the Joplin district there is a large power company with two hydro-electric plants and one auxiliary steam plant, and the zinc companies find it cheaper to buy than to generate. In Arkansas the mines provide their own power. In the Black Hills of South Dakota the Homestake company has two hydro-electric installations, and the other companies generate their own power by other means. In the mountains of Colorado power transmitted at high tension has easily proved itself superior where the topography is rugged and the winter severe. At Leadville, electricity is being substituted for steam when operations long suspended are being resumed.

In Utah, Montana, and Idaho the operator finds power conditions much the same, in general buying his power. In Washington the situation is somewhat mixed. Of forty operators all generating their own power seven are using straight electric, ten water, eleven steam, ten gas or distillate, and two crude oil. Here the trend is naturally to hydro-electric installations. In Arizona it is said that the question of operators generating their own power, either individually or on a co-operative basis, is receiving much attention.

Though electrical power has come to stay, it is possible that the use of oil or similar engines for intermittent operations might be found profitable, particularly for coarse crushing. The value of this idea, according to a correspondent, lies in the fact that highest efficiency from the power seller's point of view comes from steady operation and steady demand for power. This is reflected in power rates. Large consumers especially are constantly trying to average up their load, and those who are coarse crushing only part of the time have trouble. On the other hand, small operators are less able to finance the extra cost of oil-engine installation. Power companies might possibly be able to alter their rates so as to make such auxiliary equipment needless.

It seems inevitable that eventually electric power, whether generated by water or by burning coal directly at the mine and transmitted at high tension to all points, will be used by all. The progress report on the Superpower Survey made by the retiring Secretary of the Interior, John Barton Payne, in the latter part of February, indicates what can be done in the Boston-Washington industrial region. The problem of securing a larger supply of cheaper power and of fully using the country's resources, and at the same time conserving its fuel, is one that affects the mining industry, and in its solution the industry will profit.

### The Diesel Engine in the Mining Field

A RECENT SURVEY, in *Power*, of the Diesel engine industry brings out the interesting fact that out of a total of more than 370,000 hp. attributed to Diesel-engine installations in the United States, somewhat over 10 per cent is utilized by mines. For the most part these are situated in the Southwest, where the present prices of fuel oil offer an advantage over the prevailing rates for coal. Another field which shows an increasing utilization of this type of prime movers is that of oil-pipe lines; in fact, compiled figures show that something over 98,000 hp., or nearly 31 per cent, is furnished by the Diesel engine in pumping stations.

There are many arguments for the use of this type, and much of the former prejudice of engineers which was based on the lack of performance of the earlier designs has been overcome. Especially is the Diesel type adapted to the small- or medium-powered central plant. The operating cost per kilowatt is considerably less than that of a steam installation, and the overhead charges, as compared with steam plants, are not excessive.

It is to be expected that petroleum prices will advance with an increased demand and decreased output, but the several predictions as to the ultimate exhaustion of the oil fields are dependent on so many factors that it is safe to assume that in favorable localities the Diesel engine will continue to hold its own on the cost sheet, as compared with the steam plant, for many years.

### Homeopathic Treatment Fails The Copper Producers

ONLY COMPLICATED CALCULATIONS will show whether or not a mining or metallurgical enterprise should be kept in operation when it is losing money. Not only must known factors be considered carefully by competent executives clothed with the responsibility of rendering a decision, but the unknown future of demand and prices must be intelligently prognosticated. Even though many years of loss are in prospect, it may still be advisable to keep a plant running.

For some time, careful students of the metal market have believed that copper production should be curtailed to a much greater extent than has heretofore been considered necessary. Most of these men have no understanding of the difficulties of further curtailment or complete shutdown, and the common idea seems to be that the only important thing to consider is the possibility of the mine filling with water. Deterioration is an unknown factor to which they give little thought, and the economic and social problems which usually worry the management more than any other are not mentioned. But as interpreters of the law of supply and demand, their opinions merit attention, and are no doubt being given proper weight in determining policies of complete cessation of operation.

We are sorry to see conditions in the copper market so bad that practically all of the largest producers have either completely stopped work or are considering taking that step. But it would appear to be for the good of the industry: if production were maintained, even on the curtailed scale of the last few months, it might take years to return to proper copper price levels, for a surplus will be present for a considerable period, owing to the time required for the absorption of the large war and post-war production.

Of the companies which operated up to the close of 1919, a complete cessation of mining and smelting operations is extremely unlikely to be more than temporary. However, resumption cannot be expected as soon as the market begins to improve, for the large unsold production of the last few years must be marketed. There is little cause for hope of a resumption during 1921 by those companies now ceasing operations, in our opinion, but they are entitled to the thanks of the industry as a whole for their martyrdom.

There are two systems of medical practice: allopathy and homeopathy. If we have a fever the allopath endeavors to give us something of a cooling nature which will neutralize the fever. The homeopath, on the other hand, gives us a small dose of medicine which would normally induce a fever. The idea seems to be the same as that which prompts prescribing "a hair of the dog that bit you" for early morning disorders. Copper producers have been taking the homeopathic treatment. It has failed, and now the allopaths are being consulted.

### The Copper Fabricator Disclaims Responsibility for High Prices

THIS WEEK we are including in the communications published under the heading "What Others Think" an anonymous contribution to the discussion of the high prices of copper products. Ordinarily we pay no attention to unsigned communications, but in this instance we believe the letter to be worth printing. We regret that space limitations make it necessary to omit certain relatively unimportant portions.

On reading the first paragraph we had hoped that someone had risen to explain some of the questions which we have asked in previous editorials, but it seems that the writer has sought only to absolve the large copper manufacturing interests from blame for the present condition of the copper market. Nowhere is any reason given or suggested as to why copper screens retail at 15c. per sq.ft., compared with 4c. for iron, to mention only one product. Our questions still remain unanswered.

The reported sale of a piece of sheet copper by a hardware dealer in Houghton at 70c. per lb. while tons of copper were lying on the docks near by which could not be sold at 13c. per lb. is mentioned. Then comes this extraordinary statement: "How anyone can give a transaction of this kind serious consideration as a reflection of existing market conditions is remarkable, to say the least." To us, this seems the crux of the whole matter and of great importance as a condition which limits the use of copper products. If they were cheaper they could better compete with substitutes. At present they are regarded as a luxury.

At no time have we said that the fabricator was to blame for existing high prices. But *someone* between the producer of crude copper and the ultimate consumer is responsible; or if not someone, some condition. Whoever or whatever it is should be eliminated. A proper co-operation between all of the factors in the situation, from the producers to the retail dealers, should solve the problem. The matter should be actively pushed, and not allowed to drift. Later on, when the demand for copper becomes satisfactory, owing to a resumption of industrial activity, there will be less incentive to develop a market. Zinc and nickel are sold as well as bought. Why cannot the same be said for copper?

## WHAT OTHERS THINK

### The Copper Situation as Seen By the Fabricator

(We have received for publication the following contribution on the subject of the copper situation. As it is anonymous, we ordinarily would not give it space; nevertheless, as it presents a vigorous defense of the consumer, it is perhaps not improper to present this side of the question, although we regret that the writer has not supplied us with his identity, which would, in any case, have strengthened his position.—EDITOR.)

At frequent intervals, in various trade journals and newspapers, articles have appeared dwelling upon the unsatisfactory condition of the copper industry. Most of these have read as though they were inspired for the purpose of creating the belief that the consumption of copper has been materially reduced because those concerns who are the largest customers of the copper producers, and who convert the raw copper into commercial shapes, have been and are demanding exorbitant prices for their products.

The largest direct consumers or purchasers of copper from the copper-producing companies are those concerns engaged in the conversion of copper and alloys of copper, such as brass, Muntz metal, nickel-silver, and bronzes, into sheets, plates, rods, bars, wire, tubes, and like forms. Among these may be mentioned the American Brass Co.; Chase Rolling Mills; the Scovill Manufacturing Co.; the Bridgeport Brass Co.; the Standard Underground Cable Co.; Roebling's Sons Co.; Rome Brass & Copper Co., and the Detroit Copper & Brass Rolling Mills. Most of these concerns have large investments and able and valuable organizations. Their very existence depends upon their ability to keep producing a commodity in which copper is essential. Not a single concern of this character is engaged in the manufacture of a substitute or substitutes for items made from copper. Is it reasonable to suppose that all or any of them would deliberately fix prices on their output that would restrict its consumption? Hardly.

Let it first be understood that there is a limit, as to the price, at which articles made from copper or its alloys find a ready market. This fact was either unknown or ignored by the producers of copper and those who fix the prices for copper to the fabricators.

To illustrate: In the matter of plumbing, brass and copper pipe is brought in competition with iron pipe, which under any conditions can be sold for less than brass pipe. It is quite generally known that the life of a brass pipe is much longer than that of an iron pipe, but the item of original investment or cost enters, and where the difference in first cost is comparatively great the iron pipe is almost invariably used.

In roofing and cornice work, copper is brought in direct competition with galvanized iron, tinplate, gravel, and various composition roofings. Copper is undoubtedly superior to anything, but so high a price may be reached that its use is curtailed enormously.

Take the case of household utensils. Copper is brought in competition with tinplate, aluminum, and

so-called agate or granite ware. A copper utensil will last much longer than any other, but how much more will be paid for the copper utensil than for any of the other kinds? It is contended that copper has soared in price to such an extent that its use in household utensils has been curtailed enormously, and this, no doubt, is true.

What is the cause for the so-called exorbitant prices for copper products? From various newspaper articles one would believe that the cause lies in exorbitant prices charged by those concerns that convert the raw copper into the various commercial shapes. In analyzing this particular feature, and using sheet copper as a basis, it will undoubtedly be conceded that the price of sheet copper, fundamentally, lies in the price of raw copper. What relation has the price of sheet copper borne to the price of raw copper? This, perhaps, is best demonstrated by the following tables:

PRICES OF RAW AND SHEET COPPER FOR TEN YEARS  
In Cents per Pound

	Raw Copper		Sheet Copper	
	High	Low	High	Low
1910	13.80	12.20	19.00	16.65
1911	14.25	12.00	19.00	16.00
1912	17.75	13.95	23.00	19.00
1913	17.60	14.12	23.00	19.75
1914	14.87	11.10	20.25	16.50
1915	23.00	12.80	27.50	18.75
1916	36.00	23.00	42.00	29.00
1917	37.00	23.50	42.00	31.50
1918	26.00	23.00	35.25	31.50
1919	23.00	14.75	33.50	22.50
1920	19.02	13.48	29.50	22.50

Although it is true that, fundamentally, the price of sheet copper is governed by the price of raw copper, there also enter into the cost of sheet copper other items, manufacturing costs, which include labor; the cost of fuel, lumber, and supplies of all kinds. It is difficult to secure comparative quotations on these items, but figures obtained from a leading mill are given below, which show the differences prevailing as of July 1, 1914, and Sept. 1, 1920:

COSTS OF LABOR AND SUPPLIES IN 1920 AND 1914

	July 1, 1914	Sept. 1, 1920	Increase, per Cent
Coal, per ton	\$2.20	\$10.80	391
Coke, per ton	4.50	15.75	250
Fuel oil, per bbl.	3.25	11.50	254
Lumber, per 1,000 ft.	19.00	51.00	169
Miscellaneous supplies			123

For the same periods the following advances appear in wage rates:

	Increase, per Cent
Common or general labor	244
Mechanical labor	151
Direct sheet copper-mill labor	261

On Sept. 1, 1920, the price for copper was 18½c., and on Sept. 1, 1920, the published base price for sheet copper was 29½c., a spread of 11c. In February, 1921, leading sellers of copper were quoting 13c. per lb., and the base price of sheet copper was 20½c. per lb., showing a spread of 7½c. per lb., which would indicate that the fabricators, by reducing their spread, were doing what they could to meet the conditions with which they were confronted.

Note that in 1917 the price of raw copper reached

37c. per lb., or, in other words, in three years it had more than tripled in price. To what was this enormous increase due? In these three years the cost of labor to the producers had not tripled, neither had there been such an increase in the cost of fuel or supplies that enter into the copper-mining industry. The Great War started in 1914, and with it came the demand for copper which was absolutely essential in the manufacture of ammunition. It is safe to say that mining companies, finding themselves confronted with a demand unparalleled, lost sight of the normality of the copper industry. They forgot all about the future, or the time when war needs would be over, and simply took all that war necessities made it possible for them to take.

Not only did high prices for copper in 1916 and 1917 lead to the use of substitutes for manufactures of copper, but this was intensified by Government action when fabricators were prohibited from disposing of any of their products unless they were for use in war work. Every order emanating from any source other than Government departments had to be submitted to the Brass Section of the War Industries Board for approval or disapproval, which resulted in many consumers of copper products being denied their requirements, and these consumers at once sought substitutes. Steel, in various shapes, either brass or copper plated, found a market where it was never thought of before, and in many cases steel is so firmly entrenched that it will be very difficult, if possible at all, to dislodge it, as there is hardly a chance that copper or brass articles can be produced at a cost anywhere near the cost of steel.

That the producers of copper should note with alarm the shrinkage in the demand for copper can be easily understood, but it is difficult to understand why, in their efforts to seek the cause, and find, if possible, some remedy, they should lose sight of every other element and factor and attribute all their alleged troubles to their largest customers, whose very existence lies in their consuming the largest amount of copper possible.

No merchandising proposition in the copper industry of recent years has been given more publicity than the alleged sale of a piece of sheet copper by a hardware dealer in Houghton, Mich., at around 70c. per lb., while, it is claimed, tons of copper were lying on the docks within a stone's throw of the hardware store, which mining companies were unable to sell at 13c. per lb. It is cited as a typical case of where, somewhere between the mining company and the ultimate consumer, 57c. per lb. was absorbed. How any one can give a transaction of this kind serious consideration as a reflection of market conditions is remarkable, to say the least.

Fabricators have been charged with unfairness, and of being guilty of a policy that has embarrassed and worked a hardship upon the producers, by reason of their unwillingness to purchase copper in anticipation of possible future requirements, and carry same in their yards or warehouses. It has been pointed out that prior to the war it was the practice of fabricators to carry liberal quantities of copper in stock, but this policy had been discontinued, with the result that producers were compelled to carry millions of pounds which formerly were carried by the fabricators. The answer is a simple one—the fabricators had a better knowledge of the underlying conditions than did the producers. They knew of the enormous quantities of secondary metals that would have to be absorbed; they knew that, on account of high prices, substitutes were being exten-

sively used, and their purchases were being prompted by this knowledge, and still they were criticised for displaying just ordinary business intelligence.

The consumption of copper has decreased, but do not accuse fabricators of "killing the only goose that lays their eggs." The men who dictate the policies of the fabricating companies should be given credit for ordinary business intelligence; their past achievements entitle them to this at least. Instead of spreading broadcast the incident of the hardware dealer who charged 70c. per lb. for perhaps five pounds of sheet copper, as conclusive evidence that some one is charging prices that are to a serious extent curtailing the consumption, and insinuating that the brass and copper mills, which are the producers' largest customers and the natural outlet for perhaps 80 per cent of the copper consumed, are charging prices that result in curtailment of their regular and only business, why do not those men who shape the policies of the mining companies sit in with those who operate the copper mills, and indulge in a heart-to-heart showdown, and in this way find out actual conditions, the causes and remedies, if any? It must be evident that the interests of these two factors, the producer and the fabricator, are almost identical.

There has been under consideration the formation of an organization—a Copper Institute—the membership to be made up of copper producers and copper consumers; in fact, every one directly interested in copper in its various angles. It is believed by those who have given the subject serious consideration, that, by such an organization, if conducted along lines that would bring about active participation of the "big men" of all the elements, much could be accomplished for the good of the copper industry; but if, in an organization of this kind, the "big men," the dictating factors, the men with authority, will only lend their names, and delegate subordinates with no authority, with no knowledge of the needs of the industry, to handle the active work of the organization, it would be a waste of time even to consider it.

The rehabilitation of the copper-producing and copper-fabricating industry is a business proposition pure and simple that can be handled by business men if they will go about it in a businesslike manner. The industry awaits the appearance of a sincere and concrete movement, aiming to a betterment of conditions. The time is ripe. Will those who should be most interested grasp the opportunity?

### A Pronunciation Echo

A user of our Century Dictionary at Palo Alto has lately called our attention to an article in *Engineering and Mining Journal* of Dec. 11, 1920, on page 1115, on the pronunciation of the word "bauxite." We procured a copy today, but find that the article is only one of a number which have dealt with the subject. As we are sending to press some material in which we wish to give the correct pronunciation of the word, we ask if you will let us know the ultimate decision as to the *English* pronunciation. An authority quoted in your Dec. 11 issue says "boxite." Does this mean böke'sit (long o) or bawk'sit? Or is it possible that *bauxite* has become shortened in sound to böx'it (o as in *box, oxen*)?

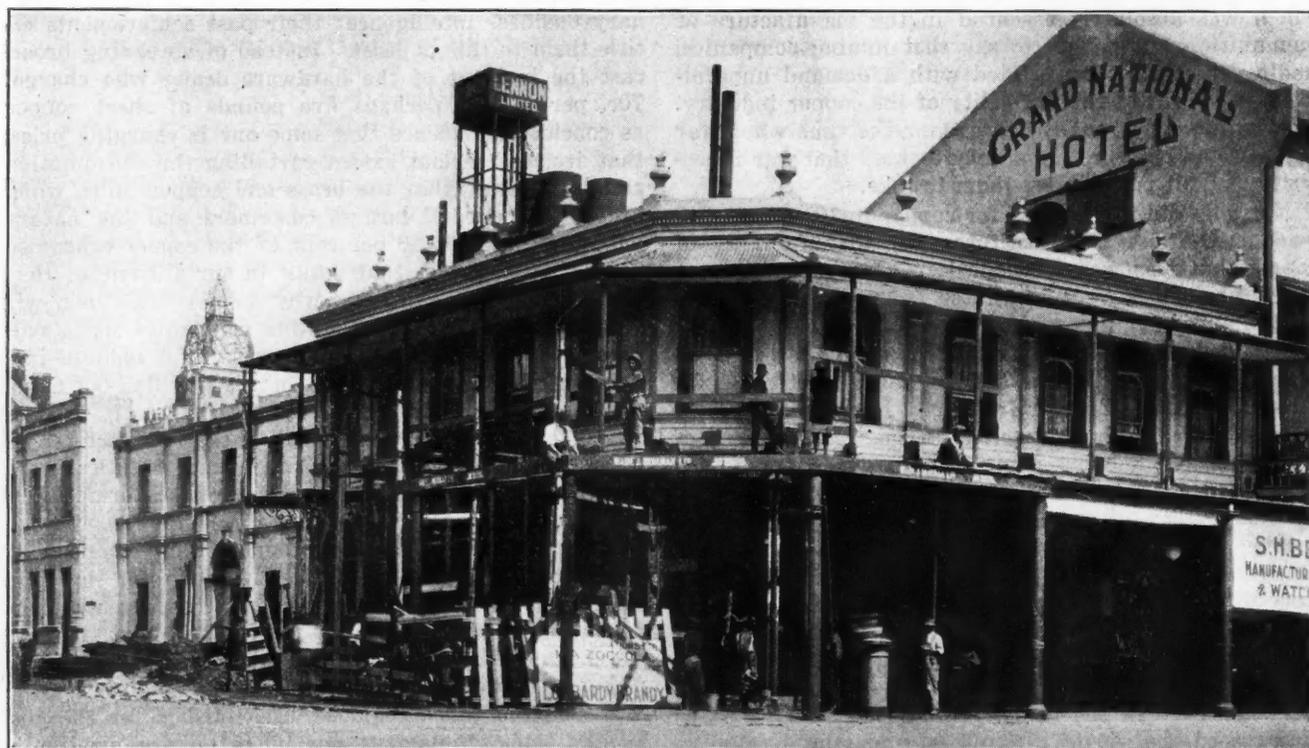
New York.

THE CENTURY CO.,

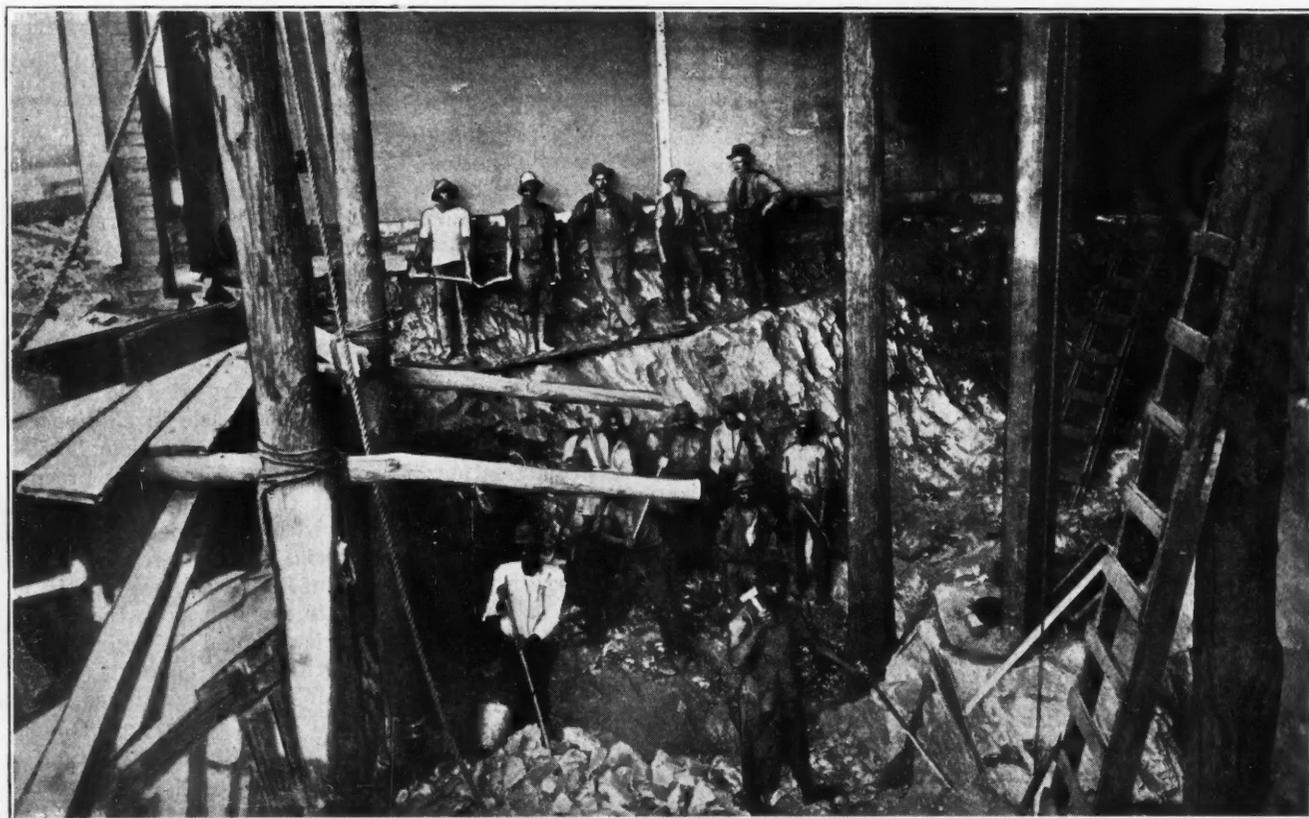
H. G. Emery, Dictionary Department.

In reply to this inquiry we wrote as follows: "The current American pronunciation seems to be practically exclusively böx'ite."—EDITOR.

## Photos From the Transvaal



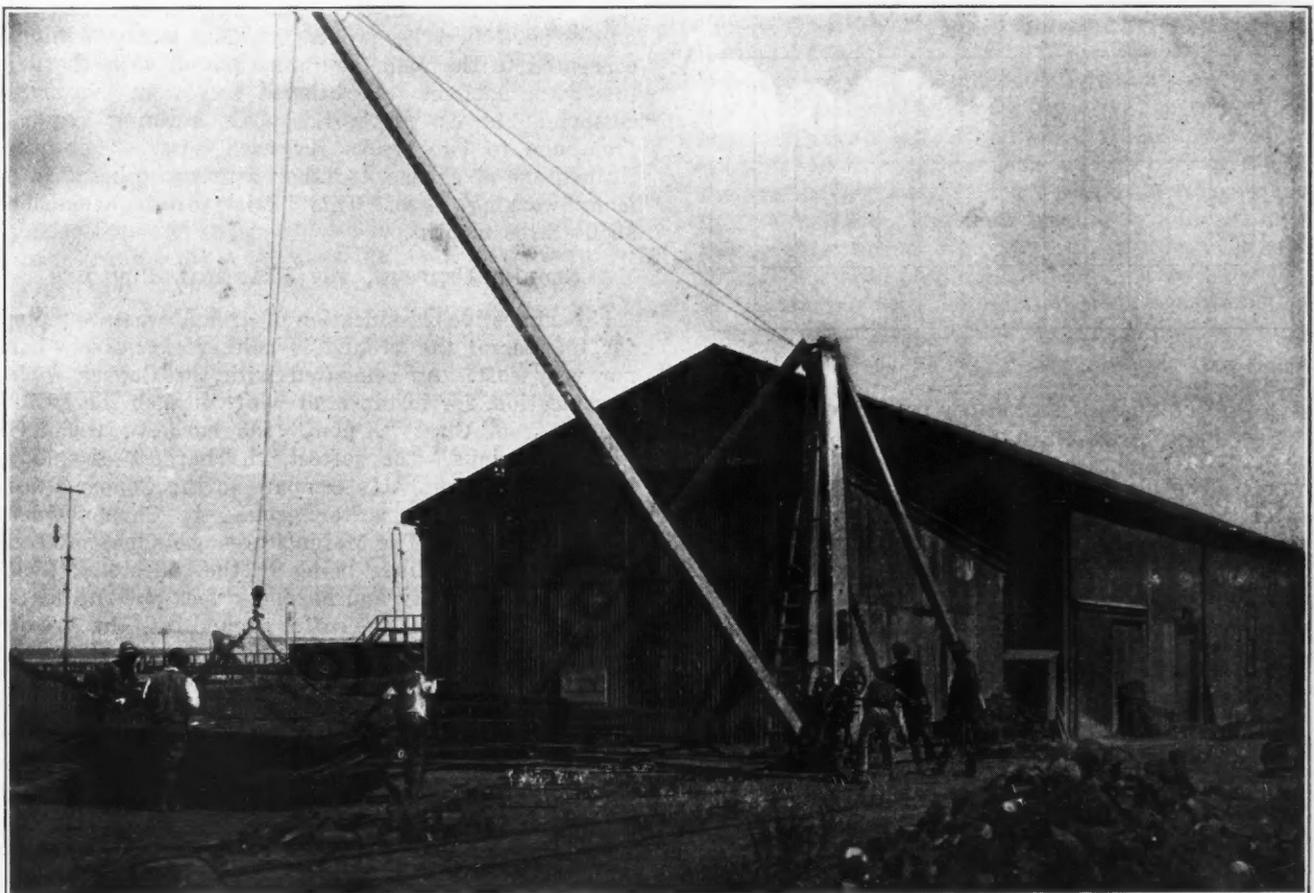
THE GRAND NATIONAL HOTEL, JOHANNESBURG, ON WHICH REPAIRS WERE RECENTLY MADE  
During the work of excavation, what is believed to be a part of the Main Reef was discovered.



DISCOVERY OF THE GOLD REEF WAS MADE IN THIS EXCAVATION



THE 300-STAMP MILL AT SIMMER DEEP, WHICH IS BEING MOVED TO THE MODDERFONTEIN EAST, ON THE WITWATERSRAND



PART OF THE WORK OF MOVING THE STAMP MILL OF THE SIMMER DEEP, LTD., AND JUPITER GOLD MINING CO.

## Development Methods at Morenci Branch Of Phelps Dodge Corporation

Conclusions Reached as the Result of Work Conducted by This Company  
In Carrying on an Intensive Campaign of Operations Show the Advantages  
Of a Bonus System and the Importance of Careful Training for the Men

BY JOSEPH P. HODGSON AND P. B. LORD

Written for *Engineering and Mining Journal*

THE mines, concentrator, and smelter of the Phelps Dodge Corporation at Morenci, Ariz., were operated almost continuously for thirty-eight years until placed upon a non-productive basis on Sept. 15, 1919, at which time an intensive development campaign was initiated. The principal reasons for this step

account of the relatively small amount of development work which had been done for several years prior to the cessation of production, it was necessary carefully to train both bosses and men in approved methods to assure satisfactory results. About 78 per cent of the men employed underground at the property were Mexicans, the rest being Italians and Spaniards. The foremen and bosses were Americans.

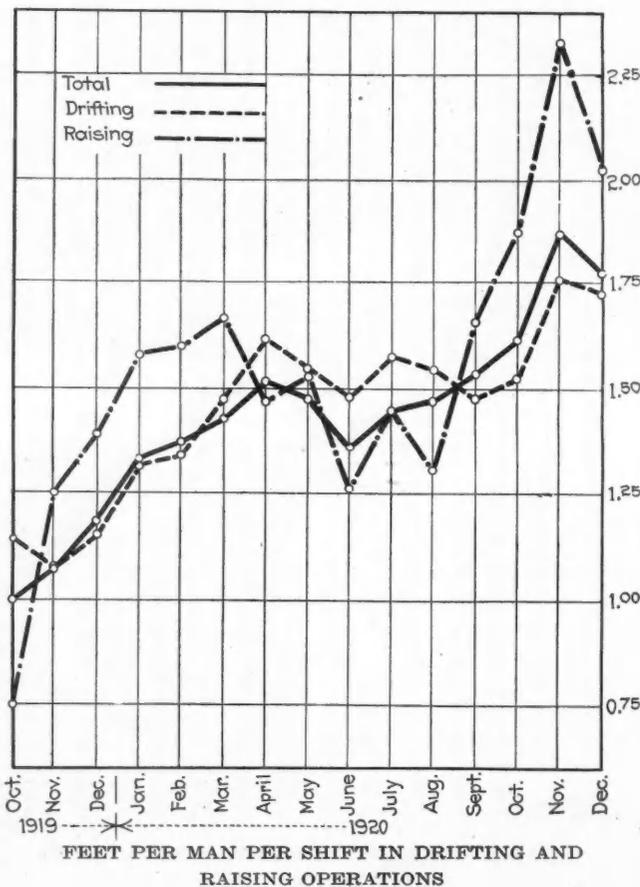
Drilling methods and types of rounds had been extensively studied by the Copper Queen staff during the time Mr. Hodgson was mine superintendent there, and as this work had been continued with great success under the able supervision of Gerald Sherman and Arthur Notman, it was decided to secure one of the best practical drill instructors from the Copper Queen branch of the corporation. Much credit is due to E. E. Burgess, who was loaned by the Copper Queen branch, and also to Foremen Bennetts and Chesterfield, as well as to the shift bosses, for such success as was attained.

It was decided that every shift boss should take training under the drill instructor, for the management felt that to instruct the men intelligently the bosses must first be proficient. The bosses willingly consented to the plan, and were placed with the drill instructor until he was satisfied they were thoroughly competent to do the work. This training required from one to two weeks for each boss. They were trained one at a time, together with two miners, in as many working faces. This initial training consumed about three months.

### GROUND UNIFORM, FOR PRACTICAL PURPOSES

No exhaustive classification of ground was attempted, for in general the ground is neither excessively hard nor very soft. As compared with the Copper Queen classification, for instance, at which branch the ground ranges from Class "A-plus," the hardest ground, to Class "D-minus," the softest, the hardest ground at Morenci would probably compare to the Copper Queen Class "B" and the softer ground to Copper Queen Class "C-minus." The Morenci ores are almost entirely porphyritic, very little being in the limestone; hence the range of density and hardness does not run to the extreme. In general, the softer ground is in the Arizona Central and Colorado mines, and the hardest ground in the Ryerson and Yankie mines.

It was decided that none of the heavier types of drilling machines were necessary for development purpose at Morenci, so those in use were retired. For drives in hard ground it developed that the Waugh Clipper No. 50 was the best, and for medium ground the Ingersoll-Rand Jackhammer B. C. R. W. No. 430 was most satisfactory. These drills, all being of the water type, were mounted when used in hard ground and were



were: The depressed condition of the copper market after the armistice; the interference with the prosecution of necessary development during the years 1915 to 1919 by strikes and scarcity of labor; the necessity of keeping production at a maximum during the war period, thus making it virtually impossible to do enough development work to maintain satisfactory reserves; and the decrease in the copper content, which made it necessary, for the future successful operation of the properties, either to increase largely the reserves of fair-grade ore or to develop a sufficient tonnage of lower-grade ores to warrant the erection of new plants or enlarging existing equipment.

During the period from Oct. 1, 1919, to Dec. 31, 1920, there was driven 69,725 ft., or 13.2 miles, of drifting and raising. It was felt at the outset that on

supported when used in soft ground by a device invented and patented by one of the shift bosses. No dry drills were used in drifting. For raise work, the Waugh No. 73 and the Ingersoll-Rand CC-11 and BC-21, equipped with sprays to allay the dust, were employed.

Hexagon hollow 1/2-in. steel with double-taper bit was used in the drifting machines, and 1-in. grooved solid steel with a similar bit was used by the stoper machines in raises. This simplified the steel problem, as it was necessary to use only two types of steel in the entire operations.

Compressed air for drilling purposes was provided by a 6,400-ft. Nordberg Carels Diesel compressor carrying 98 lb. pressure at the power house, the pressure at the drills varying from 85 to 92 lb., according to the size and friction in the air lines. The powder used was Hercules 1-in. ammonia, 40 per cent and 30 per cent, with some 60 per cent and 40 per cent gelatin in the hard drifts. Consumption of powder varied from 6.1 lb. per foot in November, 1919, the highest, to 4.4 lb. in October, 1920. Tamping, or stemming, consisting of sand in paper cartridge sacks, was used in all headings.

The daily rate for timbermen and mounted machine runners was \$4.98, for miners \$4.79, and for muckers \$4.08, for the period covered in this article.

OPPOSITION TO CONTRACT SYSTEM OVERCOME

About 92.3 per cent of the work was performed on contract and the remainder by company account. The daily rate of wages was guaranteed to the contractors. Labor was very difficult to handle, on account of conditions obtaining at the property after the war, as during that period it had been impossible to enforce discipline, men being very scarce and very independent. Practically all work theretofore had been conducted upon the company-account plan, so that the well-known union opposition to piecework had to be overcome. However, it developed that as the contractors' earnings gradually increased, practically all opposition was withdrawn.

A map was prepared projecting the development work to be done in the different parts of the property, and calculations were made of the speed that should be made monthly in every heading or face, and were noted upon the map. The actual advance made in each face was also placed thereon. If a drift or drifts were behind the schedule, the reason was ascertained if possible. It might be because a strata of ground harder than usual was encountered, or because a miner was not quite up to the average in drilling methods, or, possibly, because the mucking was not being done properly. This map was found very beneficial to the staff, as it was possible to keep a close check upon the advance made, and it assisted, as well, to visualize the work. It was quite surprising how closely the work as predicated upon the map was carried out.

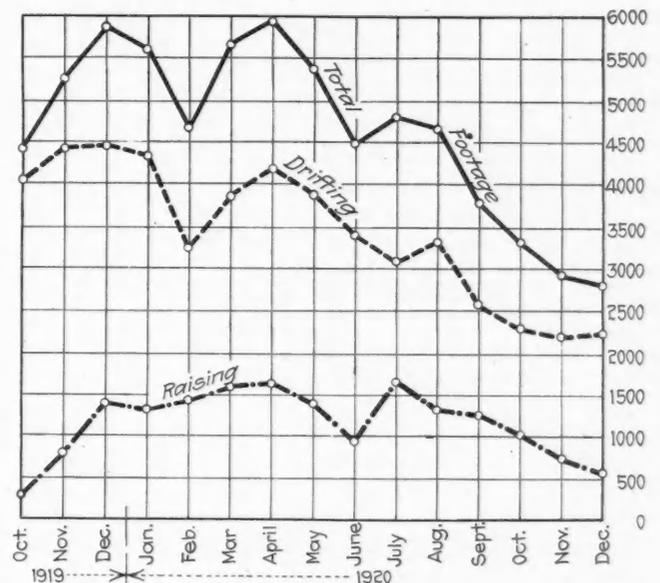
MEETINGS FOR DISCUSSION ADVANTAGEOUS

Weekly meetings of the heads of departments were held, at which discussions or criticisms of the work were invited. Monthly meetings of department heads, engineering department, foremen and bosses, and other operating officials, were also held for the purpose of discussing the different phases of the entire operations. At these gatherings papers bearing upon different parts of the work were read and discussed. The meetings were very helpful, in that every department had an

opportunity to acquire the necessary knowledge of the operations and of its relation to them.

Each face was measured daily, the advance was reported, and daily cost tabulations were made, this information being supplied to the foremen and bosses. This was of great assistance, as it provided them with quick and reliable information, both as to advance and costs.

The standard size of untimbered level drifts was 5 ft. x 7 ft., with the exception of a few haulage drifts 5 1/2 ft. x 8 ft. Stope development drifts in the Arizona Central division were 4 ft. x 6 ft. Raises were driven 6 ft. x 4 ft. over-all with a lagged manway 2 ft. x 4 ft. Stope development raises less than 50 ft. in



FOOTAGE BY MONTHS IN DRIFTING AND RAISING

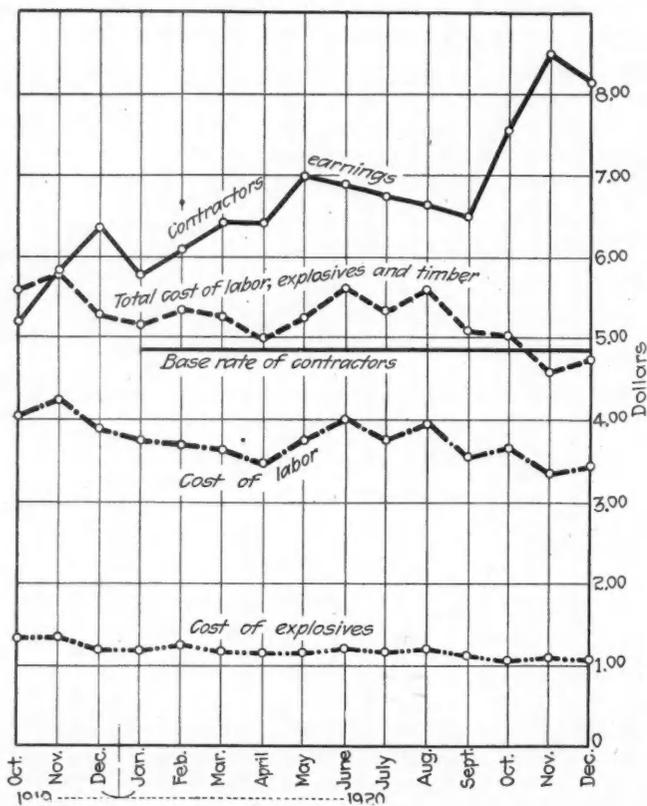
height were 3 ft. in diameter, with no manway, but timbered raises with four-post 5-ft. center sets were provided, with a lagged manway 4 ft. 8 in. x 1 ft. 6 in. Winzing constituted less than 1.5 per cent of the total footage driven, and for that reason is not considered in this article. Timbered headings, both drifts and raises, constituting less than 10 per cent of the total footage, included all drifts timbered within four months of the time driven, the shifts in such operations being charged to the heading and forming a part of the total advance per man-shift for that period.

CONSIDERATION OF BONUS SYSTEM

At the beginning of the development campaign it was deemed advisable to place as much work as possible on a contract or bonus basis. The following factors were considered in formulating a system: First, the necessity and the justice of guaranteeing every man day's pay; second, the temperament of Mexican laborers, which makes them suspicious of any bonus system in which the unit price is constantly varied; third, the advisability of placing the unit price sufficiently low, so that as men increased in proficiency under instruction it would not be necessary for it to be reduced; fourth, the uniform character of ground in a few large sections of the mines, which would necessitate only three or four rates for the same sized headings.

The plan adopted might be called a bonus system as distinguished from the straight contract, as all men were guaranteed day's pay. It was possible to divide

the ground broadly into three classifications as regards hardness, drilling speed, breaking qualities, and other working factors, calling for three different rates, and in general to confine these to separate sections. The price per foot included the cost of explosives, drilling, mucking, and tramming, the latter very seldom exceeding 150 ft. Each heading was regarded as a separate contract. The company deducted from the contractor's settlement the expense of explosives and mucking labor, this latter being figured at day's pay rate for muckers. Settlements were made on engineers' measurements twice a month.



CONTRACTORS' EARNINGS PER SHIFT PER FOOT AND COSTS ON ADVANCE WORK

For the first three or four months the number of faces in which it was necessary to make up day's pay was rather high, but these decreased to a small percentage as the men improved in breaking ground. Only one general cut was made in the first rate established, which was in the Arizona Central division, where experience proved the initial price had been placed too high. It may be stated here that extreme care is necessary in first establishing a rate of a piece of work, as later reductions are highly injurious to the confidence and morale of the men.

It is realized that this system is not perfect, the principal objection being the lack of flexibility which would enable the company to share in the advantages to be gained from improved methods or equipment without lowering the contract rate. In ground which was more changeable from day to day in breaking qualities and other working conditions, it might be necessary to use a bonus system with frequent classification of ground, as at the Copper Queen branch, even though this involves considerable expense. However, it is felt that in general the practice here has proved satisfactory in operation, to both the men and the company.

The accompanying graphs illustrate the total footage, footage by classes, feet per man-shift, cost of labor and explosives of men on advance work, and contractor's earnings for the period under discussion.

The work may be divided into three periods: From Oct. 1, 1919, to May 15, 1920; from May 15, 1920, to Sept. 1, 1920, and from Sept. 1, 1920, to the end of the year.

In the first period the maximum amount of footage was driven each month with the labor available. This included both prospect work and stope development, the latter reaching a maximum in April of 31 per cent of the total. The feet per man shift steadily increased and the cost per foot decreased. The monthly footage and the contractors' earnings increased, except in February, a shorter month, during which it was necessary to break in a larger number of muckers than ordinarily on machines to replace withdrawals from the force.

On May 15, 1920, all men on stope development in the Arizona Central division were transferred to the Ryerson-Yankie division. During June no stope development was done, and only a small amount in July and August. The drifts and raises in the Ryerson-Yankie division were larger than those driven in stope development, and the ground on an average harder, which was reflected in the cost curves, contractors' earnings, and footage per man-shift graphs. Less footage per month was driven during this period.

#### LOW COPPER MARKET FORCED CURTAILMENT LAST FALL

Beginning Sept. 1, 1920, curtailment was deemed advisable, owing to the status of the copper market, so that from this date no new men were hired, and a few were dropped. No stope development was done after Sept. 1. In this period the best results were obtained, due to the greater experience of the men and also to the fact that the men represented the pick of the organization. As a rule, increased earnings by the contractors have meant lower costs per foot to the company, as indicated by the two graphs.

From the experience gained in this work the following conclusions have been drawn:

First—Some form of contract or bonus system which will repay increased individual effort is preferable to day's pay work, both to the employer and employee. Better results are obtained if contracts are given to individuals rather than to a group of men.

Second—Careful instruction and training of men more than repays for itself in the results obtained. Some of the best machine men were developed from surface laborers after several weeks' instruction and a few months' experience underground. This is a factor of increasing importance in the mining industry of the southwest, where skilled underground labor is scarce under normal conditions. It is felt that intensive training will develop better men for stoping work, just as it has for development work.

Third—Daily cost records and progress maps and weekly and monthly conferences of bosses and foremen and department heads are advantageous for co-ordination and a better understanding of the work. That cost records can be carried to extremes in detail and expense consistent with the results obtained from them is conceded and understood, but when not carried to extreme they are of great assistance in indicating the daily progress of the work in hand.

## Recent Metallurgical Practice on the Rand

Less Amenable Ores of the Far East Area Causing Changes in Long-Established Practice—  
So-called "All-Slime" Treatment Under Consideration—Innovations and  
Improvements in Precipitation Methods

Written for *Engineering and Mining Journal*

PRACTICALLY all of the development which is now taking place in the Witwatersrand gold fields, in South Africa, is confined to the Far East section of the Rand, and as the ores of this new area are developed it is becoming evident that the prevailing milling practice so long in vogue is to be subject to modifications which by contrast may appear to metallurgists as radical departures. With few exceptions, there have been practically no changes of note in metallurgical practice on the Rand for the last ten years. An exception may be mentioned in Bosqui's adoption, at the new plant of the New Modderfontein, of direct leaching in the sand collectors without transfer. Although viewed at first with considerable skepticism by other metallurgists, this simplification appears to be operating with entire satisfaction, and is likely to be adopted by other plants to be built in the near future.

### FAR EAST RAND ORES REFRACTORY

The underground development of several large new properties on the Far East Rand is now reaching a point warranting milling equipment, and the design of this equipment for the efficient treatment of these ores has become a vital problem. The ores from this section of the Rand are materially different in character from those appearing in the older mines of the Central and West Rand. The pyrite is more compact and more finely disseminated. Also, there is frequent occurrence of arsenical pyrite, and the presence of nickel has been repeatedly noted. Unquestionably, the ore is of a more refractory nature and not entirely suitable to prevailing metallurgical practice. At the Geduld mine, one of the older properties situated in this area, the ore has always been recognized as presenting metallurgical difficulties, and these have become intensified in the newer properties at Modder East, Springs, West Springs, and to a somewhat less extent in the New State areas. These ores require finer grinding, and the time of contact required for a satisfactory extraction by the cyanide process is considerably prolonged.

It so happens that careful investigation into the possibilities of eliminating, or in a measure eliminating, stamps in favor of ball mills and tube mills is also being made, and, therefore, in deciding upon the new plants which are to be built in the next two or three years, the following problems are presented:

*First*—Somewhat finer crushing in the primary rock breakers, followed by the complete elimination of stamps, or at least by a thorough screening by which only the oversize, which would represent perhaps 25 per cent of the original ore, would be crushed by stamps. In this connection it should be noted that the stamp battery on the Rand at present is really more of the character of a breaking than a crushing device, as most of the batteries are equipped with screens having apertures of from  $\frac{1}{2}$  to  $\frac{3}{4}$  in. Starting with such a feed to the tube mills, it seems only logical that, with certain modifications, it may be possible to grind a product passing a  $1\frac{1}{2}$  to  $1\frac{1}{2}$ -in. ring, and eliminate stamps

entirely. This is the experiment which is now being made on a working scale. The principal modification being tried is to enlarge the aperture in the discharge grates of the tubes, allowing a considerable amount of partially rounded, unground material to leave the mill. This material is screened from the pulp as usual, but, being in much greater quantity, it is sent to rolls, whence it is returned to the original tube mills, thus establishing a closed circuit.

The results of these experiments have been encouraging, and it seems at least possible that by increasing the diameters of the tube mills, or, probably better still, by using primary and secondary grinding units, the former from 8 to 12 ft. in diameter and the latter 5 ft. 6 in. in diameter, the innovation may prove to be an economical method of crushing and grinding these ores. It has the undoubted merit of removing practically all metallic iron from the crushing circuit, provided the mine-run "banket" can be used in both stages for pebbles, as it is now used in the tubes.

*Second*—The percentage of amalgamation from these ores has dropped from the normal of 70 in other portions of the Rand to little better than 35. This automatically increased the cost per ounce of gold recovered, to a point where it becomes a serious question whether amalgamation should not be eliminated entirely. Practically the same plate area and operating crew are required, irrespective of the percentage recovered by amalgamation, and of course the danger of theft and loss in handling amalgam has always been a serious problem on the Rand. The finer grinding which these ores require in any case for cyanide treatment makes it certain that practically all of the free gold would be recovered in the cyanide plant, and more economically than by amalgamation.

*Third*—With the finer crushing it is practicable to leach only about 25 or 30 per cent of the material as sand. This compares with at least twice this percentage in the older plants. Here again the cost of building a complete classification, sand-leaching, and sand-residue-disposal plant for such a small proportion of the total ore renders the cost per ton of sand treated out of all proportion to previous costs. With little additional grinding it is entirely possible to handle the total ore as an "all-slime" product in the settlers or thickeners, agitators and Butters filters, as now used, and it seems probable that this modification could profitably be adopted at these mines. Certainly the cost of the plant would be reduced, and the simplified operation is obvious.

With the elimination of amalgamation, and the adoption of "all-slime" treatment, most of the objections to crushing in cyanide solution are overcome. The point, formerly raised by older metallurgists on the Rand, that crushing in solution would make it difficult to obtain a satisfactory head sample from the batteries, has automatically disappeared, for it is obviously impossible to obtain a reliable head value from stamp batteries crushing through  $\frac{1}{2}$  and  $\frac{3}{4}$ -in. apertures. Also, other

and perfectly reliable methods of determining the value of the ore have now been developed in other mills where ore is crushed in solution. It still, however, remains to be proved whether or not crushing in cyanide solution would entail a higher cyanide consumption due to water-soluble cyanicides in the ore, which are largely removed by crushing in water and neutralized with lime.

#### CROWE VACUUM PRECIPITATION PROCESS EFFICIENT

Considering the metallurgy on the Rand as a whole, unquestionably the most important development which has taken place in recent years is the introduction of the Crowe vacuum precipitation process. During 1919 and 1920, careful trials with this process were conducted at the City Deep by a metallurgical committee of the Chamber of Mines, and the results demonstrated clearly that a material saving could be effected in zinc, in cyanide, in labor for clean-up, and in refining, and that the loss of soluble gold in the slime tailings could be materially reduced. In particular these trials demonstrated that the so-called "white precipitate," which has been the chief obstacle to efficient precipitation by zinc shavings on the Rand since the early days of the process, completely disappeared from the boxes even in the coldest weather. In other words, that the presence of this product is due entirely to dissolved oxygen in the solution, and that when this dissolved oxygen is removed by the Crowe process, the "white precipitate" automatically disappears. As the result of these trials the Crowe process is now being installed by a number of plants on the Rand, including City Deep, Van Ryn Estates, Geduld, Modder B, and Brakpan.

Brakpan and Modder B are equipped with the Merrill precipitation process using zinc dust. From results obtained by the Crowe process under similar conditions in other parts of the world, both with the Merrill process and zinc shavings, and from trials at the City Deep, it is now possible to state with certainty that the use of the Crowe process with zinc shavings will reduce the zinc consumption from 30 to 40 per cent, and will reduce the zinc consumption in the Merrill process from 40 to 60 per cent. The consumption of zinc shavings on the Rand varies from 0.12 to 0.26 lb. per ton of ore milled, the higher figure being caused usually by the necessity of removing shavings from the boxes to recover the gold for financial reasons before the full efficiency of the zinc has been obtained.

#### CROWE PROCESS CUTS ZINC PRODUCTION

At the plants on the Rand where the Merrill process is in use, the consumption of zinc dust varies from 0.10 to 0.14 lb. per ton of ore, and there is of course no question of gold tie-up in the Merrill process, as all of the precipitated gold is completely removed at each clean-up. It seems certain that with the Crowe process installed, the consumption of zinc by the Merrill process will be reduced to one-half of the above figures, which in turn will result in raw precipitate from the presses containing from 30 to 40 per cent gold. This product is economically melted direct, after a simple calcining, with the entire elimination of the expensive and troublesome acid treatment which is now universally practiced on the Rand.

Up to the beginning of 1921 the more general use of the Merrill process on the Rand had been hindered by reason of the fact that the slime solutions are extremely low in cyanide and alkali content and that

such solutions without the Crowe process are more effectively precipitated by means of the lead-zinc couple always used in the zinc boxes for this purpose. By removing the dissolved oxygen from cyanide solutions, the precipitation of the metals becomes, within practical limits, independent of both alkalinity and cyanide strength. Thus, it would appear that the only existing objection to the Merrill process in Africa has now been eliminated, and that the other obvious advantages of the process will lead to its adoption at least in many plants to be built. Whether the savings will be sufficient to justify the alteration of existing older plants depends not only upon the process itself, but upon the future price of gold in Africa and upon mining costs as a whole.

#### RAND GOLD BRINGS PREMIUM

In this connection it is interesting to note the effect of increased costs of labor and supplies upon this vitally important gold-producing district. The standard value of an ounce of gold is approximately 86s., and of the forty-two operating mines on the Rand at the end of 1920, only eighteen were producing gold at a cost of less than 86s. per ounce. The costs at the other properties varied from 88s. to as high as 112s. per ounce.

The gold produced from the Rand is mostly sold in the open market in England, and for some time has commanded a premium above the standard price. This premium is a function of the current rate of exchange between England and America, and in February of 1920 gold reached the record price of 127s. per ounce. As the rate of exchange between England and America approaches normal the premium on African gold decreases, and it is, therefore, obvious that unless operating costs, principally labor and supplies, recede at a rate at least equal to the premium decrease, a large number of the mines will either have to suspend operations or operate at a material loss. The relation of these two curves, realization and operating costs, is now the principal topic of interest among the mining and financial men of the Rand.

#### South African Gold Mines Show Gains

Operations of the gold mines of South Africa for December, 1920, show a substantial financial gain over results for 1919, despite the disadvantageous factors resulting from strikes by native laborers, shortage of native workers, increased costs, falling off in grade, and the loss of two days' time through two holidays at the Robinson Deep, according to the report of Transvaal Chamber of Mines for December, 1920.

The total tons milled in 1920 was 24,096,277, against 24,043,638 in 1919. Dividends in 1920 amounted to £8,450,006, against £6,075,765 in 1919.

#### Alaska an Important Copper County

During twenty years of mining, Alaska has produced 545,000,000 lb. of copper, according to the U. S. Geological Survey. The reserve of copper in the deposits so far developed is small, but the evidence of strong copper mineralization in several accessible mining districts and the widespread distribution of copper ores give ample assurance of considerable future production, so that it may be confidently predicted that Alaska's copper industry will grow when transportation has been improved and general industrial conditions have become better.

# Tunneling Through Soft Ground

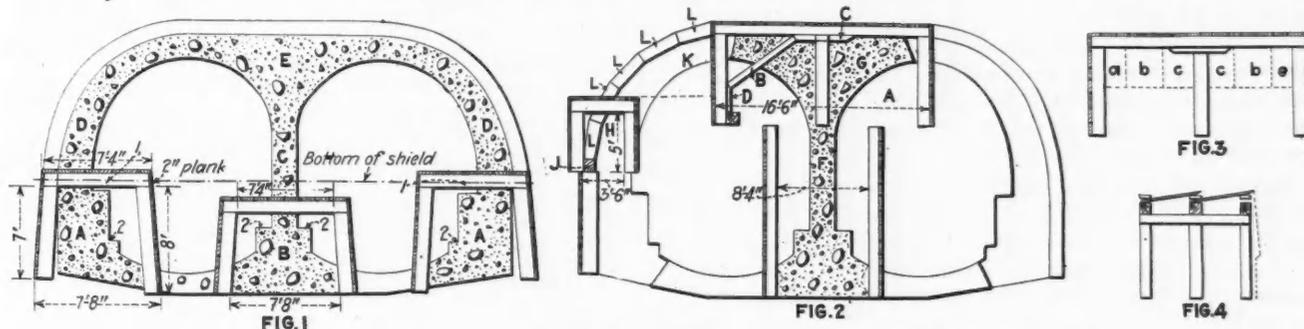
Excavating for Subways Presents Problems Differing From Ordinary Mine Drifting—Two Methods, One Involving the Use of a Metallic Roof Shield and the Other Depending Upon Timbering for Needed Support and Protection, Are Described

BY ROBERT W. JONES

Written for *Engineering and Mining Journal*

**D**URING THE CONSTRUCTION of the New York subways it has been necessary to work under normal air conditions and under abnormal air pressure. The greater part of the work, however, has been carried on under normal air by tunneling, open cut, and cut and cover. These three methods of normal air work entail few conditions that differ from the ordinary rock tunneling as understood by the mining engineer. There are conditions of foundation and street preservation, however, that the average mining engineer does not appreciate, and many times we have heard criti-

was opened in one cut, using horizontal breastboards, and the sides between bents were supported in the same manner. Hay and straw were used as a backing to prevent flowage of sands. The posts and caps of drifts were either 8 in. x 8 in. or 8 in. x 10 in., with bents placed 2 ft. 10 in. center to center. Caps of side drifts were 7 ft. 4 in. and center drift caps were 9 ft. in length. The inner posts of side drifts were cut 8 ft., with the outer posts 7 ft., and the center drift posts were 6 ft. The roof was driven with poling boards, the boards being driven half way, the material exca-



CROSS-SECTIONS OF SUBWAY EXCAVATIONS AND METHOD OF CONCRETING

cisms regarding the rate of progress, and these would indicate that facts concerning the work were not understood. The following short descriptions of methods in driving through unconsolidated materials, under normal air, should be of interest:

The tunnel under discussion was to be carried through a morainal deposit varying from a clean sand to heavy gravel, with pockets of loam and in spots an abundance of boulders up to three and four feet in diameter. Water was encountered in places, but not in quantity. The dry sandy sections were unstable, and the tendency of the ground to run as soon as the support was released was quite evident. The boulder section made dangerous roof conditions. The wet sand and loam would hold up for a time without support and then unexpectedly fall.

The tunnel was opened from two main faces, or rather under two conditions. At one face a metallic roof shield was used and at the other the entire support and protection depended upon timbering. The descriptions simply give the general ideas as laid out in advance of active work and maintained remarkable consistency throughout construction.

The shield-driven tunnel was mainly through material that was of a loamy nature, but which carried an abundance of medium-size gravel. Some distance from the shaft the material changed in character and boulders predominated, the strata being that of a typical water-sorted glacial deposit.

Lateral operations were begun by driving from the bottom of the shaft two side drifts, A, and one center drift, B, as shown in Fig. 1. The face of each drift

was opened in one cut, using horizontal breastboards, and the sides between bents were supported in the same manner. Hay and straw were used as a backing to prevent flowage of sands. The posts and caps of drifts were either 8 in. x 8 in. or 8 in. x 10 in., with bents placed 2 ft. 10 in. center to center. Caps of side drifts were 7 ft. 4 in. and center drift caps were 9 ft. in length. The inner posts of side drifts were cut 8 ft., with the outer posts 7 ft., and the center drift posts were 6 ft. The roof was driven with poling boards, the boards being driven half way, the material exca-

was then erected, and the work carried on as before. Owing to the short distance between bents, there was little difficulty in supporting the sides. Two-inch poling boards were used. On completion of the drifts, forms were erected and the concrete was placed to finished form. The concrete benches of side drifts were prepared to support the bearing surface of the roof shield. The bottom of the cross-piece of the shield passed 2 in. above the top of the side drift posts and approximately 1 ft. above the cap of the center drift. After the shield was in place the entire top heading was removed for a depth of about 32 in. and downward to the bottom of the shield cross-piece. Horizontal breastboards were used when necessary.

Tracks were carried at approximately the elevation of the top of the invert, allowing side-dump cars to be pushed in between the posts of the side and center drifts. The material excavated under the shield in the top heading was passed through the shield cross-piece into the cars. As the top heading was being cleaned up to allow the shield to be pushed ahead, the lower headings between the side and center drifts were removed, using breastboards with straw and hay.

Benches of the side and center drifts were prepared to carry the bearing surface of the erector for the metallic concrete forms. These forms were erected immediately back of the advancing shield, and the entire center wall C, side walls D, and umbrella E were blown in at one operation. There was little danger in the preceding method of excavation, as the face was

the only area exposed, and the finished concrete was carried up close to the shield. As the shield advanced the drift posts were removed, and the invert *F* was advanced in sections. The tunnel was carried forward in a finished condition ready to be turned over for the rails.

The timber-driven tunnel face was carried through flowing sand, sand and loam, and gravel. The main and first point of attack is the top heading *A*, in Fig. 2, with a width of 16 ft. 6 in. and a height of 8 ft. 6 in. If the material was fairly well consolidated, the entire face was taken out in one cut. If not, the face was divided into two equal areas, but carried very close to each other. If it was necessary to remove the face in two cuts, the upper was taken out in five vertical cuts (*a*, *b*, *c*, *d* and as shown in *e*, Fig. 3). Fig. 4 shows a section along the center line of tunnel in the top heading. The center cut (*c*) of the upper cut is made either 4 ft. or 6 ft., depending upon the material. The five cuts were made with breastboards and straw, and the lower part of the face is taken out in one cut. Side and center posts and caps are placed, and the face is ready for another cut. Twenty feet back of the face the center posts are removed, and the braces *B*, top pieces *C*, and uprights *D* are placed in position, taking the pressure on the sill *E* and side posts of the drift. The supports *B* consist of 6-in. iron pipe filled with concrete.

Throughout the distance where the center posts are removed (for a distance of twenty feet), a trench is dug to subgrade, using either vertical sheathing or 8-in. x 8-in. uprights, 5 ft. 4 in. center to center and boarded as side supports. This interval of twenty feet is maintained and the concrete center wall *F* is carried forward to the top of the trench and upward to the cap as a concrete post in place of the original center post. Back of the open trench the pipe braces *B* are then removed and the umbrella *G* is then blown in.

#### DRIVING THE SIDE DRIFTS

Simultaneously with excavation in the main face, the side drifts *H* are carried forward with the face held about 40 ft. back of the main face. In this drift the 12-in. x 12-in. wall plate *J* is laid. These side drifts are driven 3 ft. clear, with inside posts at the top, 3 ft. 6 in. at floor, and 5 ft. high. The two segments *K* are then excavated down to the top of the side drifts, and the arch timbers *L* are placed bearing against the cap of the first excavation and the wall plate in the side drift. The excavation for the segments *K* is carried on in a similar method to the first excavation, using breastboards and straw, with vertical sections varying with the material. Twenty feet back from the face of this excavation it is carried down to the level with the floor of the side drifts. In another twenty feet the cut is carried to the subgrade, side posts are placed, forms are erected, and the side walls concreted.

#### Aluminum Production Increased in 1920

The value of primary aluminum produced in the United States in 1920, according to reports received by the U. S. Geological Survey, was \$41,375,000, as compared with \$38,558,000 in 1919. This increase of approximately 7 per cent shows a return to more normal operations and indicates what may be expected in the future. The market prices throughout the year were nearly constant, ranging from 32 to 33c. per lb.

## Blue-Sky Legislation

Over-Regulation Often Proves as Great a Depressant  
On Mining Industry as Lack of Laws Controlling  
Promotion and Stock Selling

**B**LUE-SKY LEGISLATION was the subject of an interesting paper read by J. P. MacGregor at the recent meeting of the Canadian Institute of Mining and Metallurgy, and the ensuing discussion brought out many reasons why such laws should or should not be enacted. The object, as explained by Mr. MacGregor, was to prevent unfairness, imposition, and fraud on the part of corporations seeking to sell stock. Over-regulation, he pointed out, was as bad as under-regulation, for it would prevent the flotation of legitimate speculative enterprises and discourage the development of prospects. On the other hand, the evils of no regulation were well known; a company could make any statement, regardless of fact, and sell stock where there was no indication whatever of ore.

The consensus of opinion at the meeting seemed to be that such legislation should not go further than compelling a stock-selling company to stick to the facts in its publicity matter. The property should be investigated by government agents, and if not evidently an illegitimate proposition, the company should be given a license to sell stock, to be retained as long as fraud was not practiced on the public. The resources and prospects would be openly known, and intending buyers would understand something of the chance they were taking. At the same time, it would be possible to secure money for the development of the poorer prospects, for the granting of a license would in no way imply that the property had merit—merely that its backers were honest. Facts, not theories or opinions, would be considered.

T. W. Gibson, Deputy Minister of Mines for Ontario, refused to recommend such legislation, and said that he believed a fool would lose his money anyway, intimating that he might as well buy worthless mining stock as real estate in the middle of a swamp. Others disagreed, saying that fraudulent mining promotions made it more difficult to sell legitimate mining stock to careful investors.

#### Mogollon Silver District Productive

The Mogollon district, in New Mexico, is one of the oldest and most productive silver-mining regions of the Southwest, according to the U. S. Geological Survey. The pioneer prospector in this district was James Cooney, an old Indian fighter, who first discovered rich silver-copper ores there in the canyon of a stream that was christened Silver Creek. The region was then inaccessible and was infested by Apaches, so that for the first ten years mining was complicated by Indian warfare. During the last forty years, however, the district has been producing a steady output of metal, chiefly silver, and the estimated value of the total product is more than \$15,000,000.

The region is rugged and mountainous and the nearest railroad station is eighty-five miles away. The rocks are chiefly lavas of various types and are much broken by faults. The mineral-bearing veins, however, are well defined and continuous, the combined workings on one vein aggregating over a mile and a half in length.

## Government Officials Prominent in Mining

### Senator Samuel D. Nicholson

BY PAUL WOOTON

Written for *Engineering and Mining Journal*

IT IS NOT uncommon to find a United States Senator who is a self-made man, but it is uncommon for one who was once an uneducated mine laborer to gain a seat in that body—a position regarded by many as the most desirable within the gift of the people, with the single exception of the Presidency itself. Samuel D. Nicholson, who has just taken his seat as one of Colorado's Senators, forty years ago trudged into Leadville in a snow-storm. He was then twenty-two years old. He had been working in Nebraska on a farm. He heard about the boom in Leadville, and invested his entire capital in making the trip to the Colorado mining camp. In fact, twenty-five cents was all he had left on his arrival. He had no overcoat and possessed only remnants of shoes to withstand the rigors of winter at an altitude of 10,000 ft., but this did not deter him from going immediately to work as a section hand. He admits that it took all of his grit to stay with this job in the open during the long Leadville winter. It was not until spring that an opportunity came for him to secure work in a mine—his objective. His first job was in the Colonel Sellars mine, a property of which he later became an owner.

Mr. Nicholson's term as a mine laborer was not a transitory one. For five years he polished the heads of drills, did mucking and anything else that he could do in his effort to amass enough capital to undertake operation on his own account. The accumulating process was hastened finally by an increase in salary which he was able to demand on the strength of his experience and his ability to act as foreman. It was a lease on the Sellars mine and an adjoining property that gave him the financial foundation to become an operator.

Later Mr. Nicholson organized the Mab Mining Co. Success finally crowned this operation, after he had strained his credit to the limit in an effort to carry forward the work. Afterward he was able to extend his operations until they included a large number of properties in Colorado and in other states. He was prominent among those operators responsible for the

application of concentration methods to Colorado ores. He assisted in the development of the first carbonate of zinc ores found in the Leadville district, and was the discoverer of the zinc ore which bears his name—nicholsonite. Senator Nicholson was born on Prince

Edward Island, at that time a direct dependency of Great Britain. He emigrated to the United States when he was seventeen years old. He took up his residence at Bay City, Mich., where he completed the grammar-school course. That constituted his entire formal education. Nevertheless, the new Colorado Senator has a reputation of being well educated, although self-taught. Mining is at a lower ebb than at any time in his recollection, Senator Nicholson says, and as a consequence he had not been in Washington twenty-four hours until he was urging the utmost haste in adopting some form of legislation which will close American ports to the metals and ores produced abroad with cheap labor. He is an advocate of immediate, stop-gap tariff legislation. He does not believe the country can afford to let an unnecessary day pass without affording the re-



SENATOR SAMUEL D. NICHOLSON

lief which he thinks a protective tariff will give the miners of the United States. He says that metal miners have suffered more than have manufacturers or coal miners, in that they have had no unusual profits to spread over this lean period.

In announcing his candidacy Senator Nicholson said: "Residing in this state since boyhood, I am indebted to Colorado and her people for whatever success I may have enjoyed, and appreciating that fact, and believing I know the needs of both, my life work will be devoted to their interests. Having no college degree, the only diploma which I possess is that of moderate success, awarded me by the University of Experience after many years of honest toil and honorable business enterprise which had its beginning with a miner's pick. My life among you for forty years has been an open book, and upon it and upon the principles here stated, I stand as a candidate, with the assurance that the party nominee, whoever he may be, will receive my cordial and hearty support on election day."

## BY THE WAY

### Just Out of Spite

"Did I ever tell thee, m'son," said Cap'n Dick, "baout tha time Billy Nancarrow wuz drafted? No? Well, I'll tell 'ee. Billy wuzn't drafted for tha h'army—'e wuz too bloody h'ole for that. T'wuz jus' tha h'opposite o' bein' drafted for the h'army an' put to work. 'E wuz drafted from 'is job, an' it 'appened moor'n a score o' years h'ago to tha North Star mine. Those days tha standin' h'orders wuz, 'H'if she don't pay, shut 'er daown,' an' w'en tha super 'ad to make 'er pay month by month 'e 'ad to do a bit o' figgerin' a'tween pay days. So tha custom come o' draftin' h'off part o' tha crew to cut h'expenses naow an' again. 'Owsomeh'ever, t'were usually made fair h'all raoun' by drawin' foorth tha names from a 'at, with married men lef' h'out w'en possible. This 'ere time I speaks o' the boys 'ad been h'expectin' a draf' for moor'n a fortnight, so Billy wuzn't a bit 'mazed w'en Cap'n Joe Trebilcock, makin' 'is las' raoun' for tha day, sez, 'Well, Billy, m'son, there's a bit o' a draf', an' you're h'in it.' Billy goes 'ome to supper an' tol' tha missus 'e'd been caught in the draf'. "'Oo h'else got drafted,' sez she. 'Don't naw yet,' sez Billy, 'but jus' so soon h'as I finish this 'ere bit o' pasty I'll go foorth to taown an' fin' h'out.' 'Baout ten h'o'clock that night Billy comes 'ome, lookin' some wish't an' daown'erted. 'Is misses wuz waitin' h'up for 'im to 'ear 'baout tha draf'. 'Mother,' sez Billy, 'I belong bein' tha 'ol bloody draf'. I don't wish to h'appear spiteful, naow, min' you, but I can't 'elp 'opin' that tha new super, 'oo b'longs commin' foorth next week, will draf' that h'uppity beggar Joe Trebilcock tha firs' b'oodly day h'after 'e do come.'"

### Dreams and Humbugs

The foundation of the fortune finally acquired by the late Jesse Knight, of Utah, came through a property popularly known as the Humbug, and christened the Dream mine. According to Whitney's "History of Utah," Mr. Knight, who was by birth a member of the Church of Latter-Day Saints, had grown careless and forsaken his affiliation with his church. In the fall of 1886 "he was shown in a dream that certain persons, among them a young man he had known from boyhood, had combined to defraud him in a mining deal. The next day, after denouncing them on the mere strength of his dream—which subsequent developments justified—he walked over a mountain to trace the outcroppings of a vein (the Humbug vein) he had previously located. . . . In the midst of his mournful reflections he was astonished to hear a voice speaking to him as from the mid-day heavens," counseling him not only to remain true to the Latter-Day Saints, but to refuse to sell his claims. Mr. Knight and his sons worked intermittently seven years on the Humbug claim.

### Cast Up by the Sea

Beach combers meet with a variety of experiences, but one, recently reported from Velasco, Tex., is exceptional. Fishermen returning from Quintana Beach are said to have reported that thousands of tons of fresh asphalt have been washed up on the coast. Blanket-like strips of twenty-five to fifty feet in length and varying in thickness up to several feet were cast up on

March 20 along several miles of the beach, they report. H. J. Parks, one of the fishermen, experienced difficulty in making his way through the surf and to shore after the first strip of asphalt had bowled him over as he was adjusting his tackle far out in the surf. A kerosene bath was necessary as a result of his encounter with the viscous flotsam. The temperature of the asphalt indicated that its origin was close to the coast, according to the fishermen. As one result of the deposit, the beach for a stretch of approximately ten miles will take on the characteristics of a motor speedway.

### From the German

Oil prospectors should watch the trees. According to a recent writer in the *Stuttgart Neues Tageblatt*, one of the most valuable criteria for the discovery of oil pools is the complexion of the trees of the forest:

Wisber found that all the trees of the little forest of Höpen had a white alkaline efflorescence. Associating this with the existence of salt, he next discovered two extensive salt beds—in Fleested and from Tötensen to Meckelfeld. Since petroleum is always associated with such minerals, he sought farther and found oil seepages which he correlated directly with the gas occurrence at Neuengammer. It is probable that this gas occurrence, discovered ten years ago, has its origin in the Meckelfeld oil deposits, whose oil often seeps to the surface. Tests confirmed the significance of the discovery. According to the view of those who know, it is the best oil thus far discovered in Germany, and when this deposit is worked there will develop in the south of Harburg a great oil industry.

It would evidently pay the divining-rod experts to discard their hazel wands in favor of a strip of red litmus paper, and to wander leisurely through the woods after a rainy season, testing the hydroxyl-ion concentration on the epidermis of any unusually pale confrères of the genus "chestnut."

### The Song of the Drill

BY THOMAS A. DOXEY, JR.

I've taken the rocks as I've found them,  
On top or deep under the ground;  
I've opened the passage for thousands  
To where untold riches were found.  
I'm little and heavy and noisy,  
And I jar 'till I make the brain reel;  
But I point out the way to the ground that will pay,  
And my finger's a finger of steel.

I'm at work away up in the Arctic,  
Where the ice doesn't melt all year 'round,  
And the blood that drops from the finger  
Freezes ere reaching the ground;  
Where the sunlight is fitful and watery  
And the nights are six dark, cold months long;  
The colors and whites of the Far Northern lights  
Have harked to my rattling song.

My work is also in the tropics,  
In lands that are kissed by the sun,  
Where the palm fronds stir in the breezes  
And the coral reefs have to be "run";  
Where the skies are as blue as the sapphire  
And the sands are hot-dazzling white—  
I uncover the ore on island and shore;  
I bring riches up into the light.

My song is a song of achievement;  
I sing from the mountains and plains;  
The air that is breathed by the millions  
Courses like fire through my veins.  
I'm little and heavy and noisy  
But I'm working away with a will.  
Through foul weather or fair—just give me the air—  
And I'll sing you the song of the drill.

## HANDY KNOWLEDGE

### Steps Toward the Elimination of Forced Delays in Copper-Nickel Blast-Furnace Operation

BY E. T. AUSTIN\*

In every smelter, the great factor in making satisfactory progress is that of continuous operation, and consequently a great deal of energy is directed toward cutting down to the minimum all delays or shutdowns. If a furnace or converter is shut down for a few hours it means that just so much less ore or furnace matte, as the case may be, is treated during the period of the shutdown, while operation costs remain practically unchanged. Thus the saving of an hour or even of a few minutes during any forced shutdown is of considerable importance and is directly reflected in the monthly statements.

One of the forced delays in furnace operation has been that of making repairs to the brickwork of the furnace spout. This has necessitated tapping the furnace, tearing out what remained of the old brickwork, and replacing it with new, after which the new brick had to be thoroughly dried before restarting the furnace. This procedure usually took from four to ten or twelve hours, depending on the design of the spout.

The blast furnaces at Coniston have a cast-iron breast-jacket 2 ft. 9 in. by 3 ft. 2 in. by 3 in., in about the middle of which is an opening 6 in. by 7 in., surrounded by a system of 1-in. water-pipes imbedded in the jacket. The jacket fits tight against the brickwork at the end of the furnace crucible, and the opening in the jacket comes in line with the opening through the brickwork of the crucible. Water circulating through the pipes in the jacket keeps the jacket cool around the opening, and thus protects it from being corroded rapidly by the molten matte and slag passing through.

The furnace spout, which is also of cast iron with 1-in. water pipes imbedded in it, is 4 ft. long and U-shaped in cross-section. It is lined with brick and is set tight against the breast-jacket in such a position that the opening in the breast-jacket is about flush with the bottom of the trough of the spout. Wedged-shaped brick is used for lining the bottom of the spout, and from the opening in the breast-jacket the brickwork rises at a slope of about 15 deg. to the end of the spout. This construction provides a trap through which the molten materials pass, at the same time preventing any of the air-blast from escaping.

It has been found necessary to renew the brickwork in the spout at intervals of from four to six weeks, and by the old method this meant tapping the furnace, tearing out the old brickwork and replacing it with new, and then thoroughly drying the new brickwork before putting on the blast again, thus losing from four to six hours. At present the Coniston furnaces are all equipped with a spare spout and trolley, also one two-ton chain-block that is transferred from one

furnace to the other as needed. The trolley travels on the bottom flange of a 10-in. I-beam that is bolted to the cross-girders of the charge-floor on the center-line of the furnace and from the end of the furnace out over the settler. The spare spout is always kept bricked ready for use and well dried. It usually is placed beside the settler until the day before it is needed, then it is picked up by the chain-block and placed on top of the settler. Here it becomes thoroughly warmed before being put in place. When it is decided to change spouts the furnace is tapped; then the old spout is disconnected, raised by the chain-block, pushed back, and set down by the settler. The extra spout is then set in place. After pouring some grout around the joint between the spout and breast-jacket, the blast is put on again, the whole operation taking from twenty to forty minutes. We believe it possible that, with all conditions favorable, the breast opening could be "budded" while the spouts were being changed, and the whole operation accomplished without tapping the furnace.

The settlers are equipped with two separate tap-holes, each of which consists of a magnesite block, 8 in. by 8 in. and from 6 in. to 10 in. long, set in the brickwork of the settler, the outside face of the block being flush with the outside of the brickwork. In the center of each block is a tapered hole, 1½ in. at the outside face. When the block is in place this hole is in line with the opening through the brickwork of the settler. As the matte is tapped, it gradually wears the hole larger, until it becomes difficult to "bud." The second tap hole is then put in use, and the worn one is cooled by means of a jet of air and gradually chipped back. This process of cooling and chipping is slow and must be done carefully. But it may be accomplished successfully, and when completed a new block is placed in position. It is then grouted and is ready to replace the other block when required. In this way any shutdown, with consequent lost time due to draining the settler, is avoided when repairing the tap holes.

These improvements result in increasing the capacity of the furnace, and at the same time they practically eliminate two of the most frequent causes of the forced delays in operating blast furnaces.

### The Cassius Purple Test for Gold

BY JOHN DIXON

Written for *Engineering and Mining Journal*

Although the Cassius purple reaction is being used at many mills for the determination of gold in precipitated cyanide solutions, I have never seen the method published. Perhaps the following description of the determination as used at the Kirkland Lake Gold Mining Co., Ltd., will be interesting:

Take 750 c.c. of solution to be tested in a 1,000 c.c. Erlenmeyer flask (a painted mark on the flask makes it easily measured). Add 20 c.c. saturated cyanide solution and two to four drops of saturated lead acetate solution. Shake well. Add 0.5 gram of zinc dust and shake until the lead sponge is formed, and invert in a

\*A paper read before the Sudbury branch of the Canadian Institute of Mining and Metallurgy, and printed in the *Bulletin* of that institute, for March, 1921.

3-in. porcelain casserole. Let air into the flask until the casserole is half full and allow the sponge to settle out into the casserole. A stand with a rounded hole open at the front makes a convenient holder.

After the sponge has settled, remove the mouth of the flask quickly from the casserole and allow the solution to run to waste. Decant the remainder of the solution from the sponge in the casserole and add 10 c.c. aqua regia (under a hood). Evaporate until a thick brown syrup remains. Add 5 c.c. conc. HCl and evaporate until 5 c.c. remains. Pour into a test tube and cool under the tap. Allow the precipitate of lead chloride to settle and add two to four drops of stannous chloride from a dropper. From the color ring formed, estimate the gold in the sample.

	Per Ton.
Colorless .....	0 cents.
Straw yellow.....	0 to 2 cents.
Light purple .....	.2 to 4 cents.
Dark purple.....	over 6 cents.

The color disappears quickly, but can be brought back again by adding more stannous chloride.

**Reagents:** Aqua regia; 7 parts conc. HNO<sub>3</sub> to 3 parts conc. HCl.

**Stannous chloride:** Make a saturated solution of the c.p. salt in 1 part conc. HCl and 15 parts distilled water. Place a few shavings of metallic tin in the bottle to keep it in stannous form. Not over two weeks' supply of stannous chloride should be prepared at a time, as it deteriorates on standing.

If a hot plate is not available, a soldering torch furnishes a satisfactory heater if the casserole is set in a hole cut in a piece of asbestos board to prevent the direct flame from striking against the sides of the casserole.

The determination can be made in about fifteen minutes, and if desirable, several samples can be handled at the same time.

### Improvising a Blowpipe and Charcoal

By S. H. HAMILTON

Written for *Engineering and Mining Journal*

A blowpipe may be improvised for mineralogical determinations in the following manner: Break about one inch off the end of an old-fashioned, straight stem, penny clay pipe. Fit a cork or piece of wood into the bowl and bore a hole in this stopper into which the piece broken from the stem will neatly fit. This will make as good a blowpipe with a moisture trap as any scientific tramp could wish.

Likewise, a piece of charcoal neatly shaped may also be readily made as follows: Put some charcoal from a quenched fire in a piece of paper and crush it under the heel. Mix the charcoal dust with a little flour and make it into a stiff dough with water. Mould this into the form desired and bake it in the camp oven. After it is baked, toast it before the fire until it no longer gives off fumes.

### Preventing Vibration of Balances

"To protect our fine chemical balances from the vibrations of our office building we have placed these balances on a heavy slab which is supported by three balls of solid rubber which rest in turn on a strong table top," says Walter C. Durfee in the *Chemist-Analyst*, issued by the J. T. Baker Chemical Co. "The weight of the slab which we use is about 30 lb. and the rubber balls

are about 1½ in. in diameter, such as are used as dog balls. After a time the balls become somewhat flattened, so that there is no danger of the balances rolling off the table. In the beginning, of course, the balls should be fastened in some way, as for example by a short nail from underneath or by saucers. We used for this purpose a packing of cotton between the table and the slab, which we thought was also helpful in damping the vibrations. Before installing this simple device we were unable to use the balances except at night, but have found that the objectionable vibrations are satisfactorily subdued in the way mentioned."

### Comparative Cost of Mine Supplies

The comparative cost of mining supplies in the years 1914, 1917, 1918, 1919, and in April and December, 1920, is given in the following table taken from the *Bulletin of the American Zinc Institute*, Vol. 4, Nos. 1, 2 and 3, p. 14:

COST OF MINE SUPPLIES, BY YEARS

	1914	1917	1918	1919	April, 1920	December, 1920
Coal, mine run.....	\$2.10	\$3.60	\$3.15	\$3.30	\$3.75	\$6.39
Dynamite:						
40 per cent pulp.....	\$11.00	\$18.25	\$19.25	\$19.25	\$17.50	\$18.50
40 per cent gelatine....	\$11.50	\$20.50	\$22.50	\$21.50	\$19.80	\$20.00
80 per cent gelatine....	\$15.50	\$31.75	\$39.50	\$32.50	\$26.25	\$27.75
Fuse, per case, 6,000 ft....	\$7.57	\$14.58	\$14.58	\$16.28	\$18.40	\$18.40
Screen jackets:						
Light, sq.ft.....	\$0.18	\$0.60	\$0.60	\$0.52	\$0.72	\$0.53
Heavy, sq.ft.....	\$0.22	\$0.72	\$0.86	\$0.91	\$1.10	\$0.71
Slotted jig sheets.....	\$0.30	\$0.80	\$0.87	\$0.76	\$0.97	\$0.90
Sheet steel spouting, per joint.....	\$3.00	\$6.00	\$6.00	\$5.00	\$8.20	\$7.00
Elevator cups, per inch.....	\$0.30	\$0.07	\$0.07	\$0.07	\$0.11	\$0.085
Sheet steel, to order, per lb. Elev. bolts, ½ by 1 in., per 100.....	\$0.05	\$0.10	\$0.10	\$0.08	\$0.11	\$0.07
Elev. bolts, ½ by 1 in., per 100.....	\$0.70	\$1.40	\$1.50	\$1.50	\$1.50	\$1.75
Elev. bolts, ¾ by 1½ in., per 100.....	\$1.00	\$2.00	\$2.10	\$1.90	\$2.10	\$2.55
Hard iron, jaws, sheets, and side plates, per lb. Belting, rubber, first quality, per cent.....	\$0.02½	\$0.04½	\$0.04½	\$0.04	\$0.03½	\$0.03½
50-10-5.....	45	30.5	40	40	40	40
Belting, rubber, second quality, per cent.....	60-10	50-5	40-5	45	40-5	40-5
Belting, canvas, per cent.....	70	60	50	DT	50	50
No. 2 carpenter scoops, dia. 75.....	\$5.50	\$11.00	\$11.50	\$11.50	\$11.50	\$11.50
Pipe, black, base, per cent. 75.....	34	27	27	27	33	33
T-rail, No. 8, per ton.....	\$35.00	\$80.00	\$80.00	\$80.00	\$80.00	\$80.00
Track spikes, ¾ by 2½, keg fittings, malleable, off list, per cent.....	\$6.50	\$13.50	\$16.50	\$15.50	\$16.00	\$14.00
Fittings, cast iron, price list, per cent.....	65	45	30	35	List	List
Jenkins brass valves, per cent.....	60	35	List	5	10	10
Lunkenheimer clip gate, per cent.....	50	25	10	15	13	35
Drill steel:						
Solid, per lb.....	\$0.07½	\$0.16	\$0.17	\$0.16	\$0.14	\$0.14
Hollow.....	\$0.10	\$0.23	\$0.23	\$0.22	\$0.20	\$0.20
Rubber, wire-wound air hose, 1-in., per ft.....	\$0.25	\$0.40	\$0.40	\$0.45	\$0.65	\$0.53
Norway iron, per pound.....	\$0.05	\$0.15	\$0.20	(a)	(a)	(a)
Tool steel, per lb.....	\$0.08	\$0.20	\$0.20	(a)	\$0.20	\$0.14
Hammers, No. 8, rock, ea. Machine bolts, off list, per cent.....	\$0.55	\$1.12	\$1.12	.....	\$1.60	\$1.20
Carriage bolts, off list, per cent.....	60	25	30	25	List	10
Carbide, union, per ton.....	\$82.00	\$90.00	\$108.00	\$115.00	\$115.00	\$135.00
Galvanized corrugated iron, No. 28, per square.....	\$3.50	\$7.00	\$8.00	\$7.50	\$8.00	\$8.00
Nails, per keg.....	\$2.35	\$5.25	\$4.70	\$4.75	\$5.50	\$5.80
Drill cable, per lb.....	\$0.18	\$0.37½	\$0.40	\$0.37	\$0.35	\$0.33
Wire cable, per ft., per cent 50-10.....	15-5	List	List	10	List	List
Manila rope, base, per lb.....	\$0.15	\$0.35	\$0.40	\$0.37	\$0.41	\$0.39
Perfection gates, 2-in., per doz.....	\$8.00	\$12.00	\$12.00	\$15.00	\$16.00	\$12.00
Dart unions, per cent.....	60	35	30	30	25	5
Common bar iron, base, per hundredweight.....	\$2.25	\$5.50	\$6.00	\$5.50	\$6.45	\$5.30
Common soft steel, per hundredweight.....	\$2.25	\$5.50	\$6.00	\$5.50	\$6.45	\$5.30
No. 4 babbitt, per lb.....	\$0.08½	\$0.15	\$0.12	\$0.10	\$0.13	\$0.11
Jig wire, per sq.ft.....	\$0.20	\$0.28	\$0.30	\$0.30	\$0.36	\$0.30
Trim pipe wrenches, per cent.....	75	60	50-5	50-10	50	45
Wood pulleys, per cent.....	60-10	50	30	25	10	10
Steel pulleys, per cent.....	40	15	15	15	10	10
White waste, per lb.....	\$0.09	\$0.17	\$0.18	\$0.17	\$0.21	\$0.20
Oils:						
Castor, machine.....	\$0.13½	\$0.23½	\$0.291	.....	\$0.238	\$0.548
Gas engine oil.....	\$0.24	\$0.271	\$0.56	.....	\$0.498	\$0.618
Cylinder oil.....	\$0.27	\$0.35	\$0.50	.....	\$0.748	\$0.868
Red engine oil.....	\$0.14½	\$0.20	\$0.35	.....	\$0.368	\$0.438
Compressor oil.....	\$0.20	\$0.25	\$0.289	.....	\$0.368	\$0.618
Gasoline.....	\$0.11	\$0.20	\$0.225	.....	\$0.280	\$0.286
Coal oil.....	\$0.06	\$0.08	\$0.11	.....	\$0.183	\$0.183

(a) Not on the market.

# THE PETROLEUM INDUSTRY

## Core Drills in the Petroleum Industry

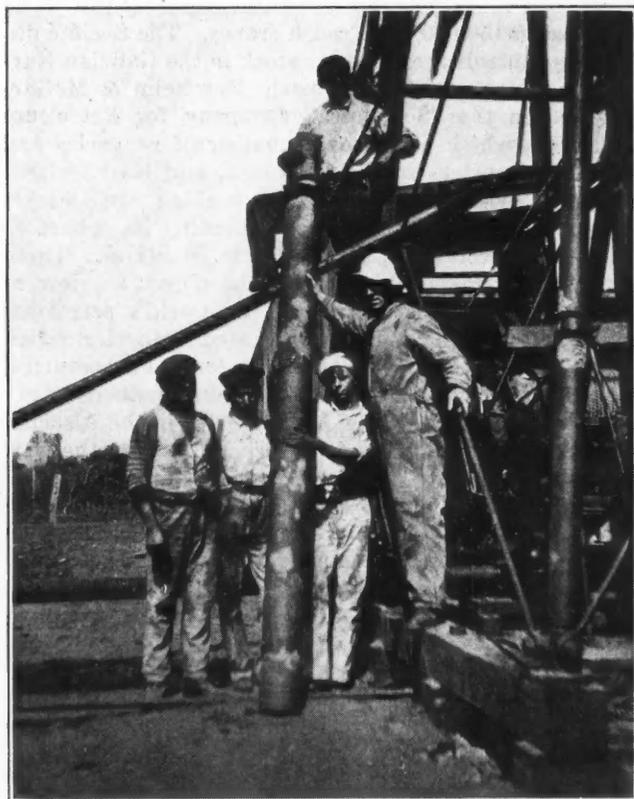
BY HERBERT T. ABRAMS

Written for *Engineering and Mining Journal*

**T**HE ADVANTAGE of prospecting for mineral deposits in advance of actual mining operations is well recognized and universally followed. Several articles have recently appeared in the technical press suggesting that methods similar to those used in determining the depth and extent of ore deposits might be employed for the same purpose in searching for oil.

The time and money expended in unexplored fields, or in partly developed territory, and lost in putting down wells of the ordinary production size, amount to a considerable figure, and it is reasonably certain that if operators in general could be made to realize that there was any practicable method offered for overcoming or reducing their exploration costs, they would not fail to see the advantage of such a preliminary outlay, which would determine, in advance, the underground

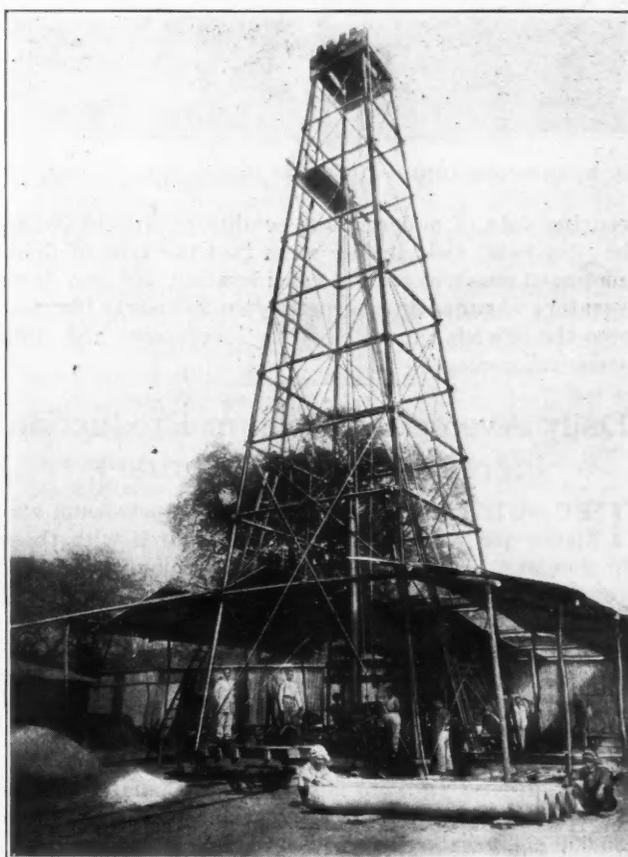
account of the absence of all reference to this class of drills (at least one of which—the “calyx” drill—employs not only the chilled shot method for hard formations, but an auxiliary bit, called the “Davis” cutter, which is a steel bit of special composition with forged teeth for use in soft materials) it would appear that this



ELEVEN-FOOT CORE AT RIO CLARO, BRAZIL

conditions, and make it fairly possible to judge whether or not extensive drilling of deep holes was warranted.

All published articles which have thus far come to my attention suggest that the diamond drill is the only method adapted for prospecting oil fields, and no mention has been made of that class of core drills which employ chilled steel shot (calyxite) as the cutting medium in hard formations instead of diamonds. On



CALYX DRILL AT BROACH, INDIA

type of machine is not generally known among engineers.

The “calyx” drill has several advantages over the diamond drill in the search for oil, in that it not only is capable of furnishing records which are as good as or better than those obtained by the diamond drill, but with a drill of this type it is possible to put down holes of larger diameter at less cost than with the diamond drill. Another reason why the “diamondless” drill should be considered is that no expensive carbons are used or lost in the hole, and no skilled diamond setter is required. Chilled steel shot does the cutting, the cost being negligible, even if some is wasted, and, possessing this advantage over diamonds, it is possible to put down holes of large diameter, which indicates that a larger core can be secured for examination and

test purposes. Furthermore, there is a possibility that a bore of such size as is permissible with a diamondless drill might easily be turned into a production well.

I do not mean to suggest that core drills can be generally used to supplant churn drills, or other commonly accepted types of oil-well drills, but for purposes of



A "BED" OF DRILL CORES AT RIO CLARO, BRAZIL

securing data of underground conditions, and to reduce the "dry hole" risk, it does seem that the type of drills mentioned deserves careful consideration, not only from operators engaged in the petroleum industry, but also from the officials connected with Government and state geological surveys.

### Daily Average Petroleum Production Increases During February

THE OUTSTANDING FACTS of the petroleum statistics for February, 1921, as compared with those for January, according to the U. S. Geological Survey, are that the daily average production of crude oil increased 33,000 bbl. and the daily average of imports decreased 19,000 bbl. The estimated daily average consumption also decreased 196,000 bbl., so that the stocks of crude oil showed the gratifying increase of 7½ million bbl.

Although the daily average rate of production was slightly greater in February than in January, it was 2,000 bbl. less than in December, but was more than 125,000 bbl. greater than in February a year ago. Kansas is credited with an increased daily average production of 12,000 bbl., Oklahoma with 10,000 bbl., and

Wyoming with 6,000 bbl. Smaller gains are reported from Montana, Kentucky, West Virginia, Ohio, Pennsylvania, Indiana, and Colorado. A decrease of 3,500 bbl. in daily production is recorded from Louisiana, and slight decreases are noted for Texas, California, New York, and Tennessee.

The accompanying figures, compiled from company reports, show the quantity of petroleum removed from producing properties. Oil consumed on the leases is not included.

### An International Petroleum Union

#### SPECIAL CORRESPONDENCE

During the last few months negotiations have been carried on between the leading German petroleum companies and the group of French stockholders in control of the larger petroleum enterprises in Poland and the Austrian succession states. These negotiations resulted in the formation at Zurich, on March 1, of the so-called International Petroleum Union, a trust company capitalized at 210,000,000 Swiss francs, in which the Swiss bank takes a leading interest.

The new company has acquired more than 75 per cent of the capital stock of the German Crude Oil Co. of Berlin, which latter company only recently raised its capital to 100,000,000 marks, as well as 75 per cent of the capital of the French Société des Pétroles de Dabrowa, of Paris. The capital of this company is soon to be raised to 150,000,000 French francs. The Société des Pétroles controls the majority stock in the Galician Karpathian Petroleum Co., formerly Bergheim & McGarvey, and in the "Schodnica" Company for Petroleum Industries, which possesses a number of refineries and similar enterprises in West, Central, and East Galicia. The new Swiss trust company is making considerable investments for the purpose of extending its sphere of influence, especially in transatlantic countries. These steps will be taken chiefly with the object in view to securing a larger percentage of the world's petroleum production for the countries interested in the formation of the International Petroleum Union. Furthermore, the company intends to introduce mining methods to obtain crude oil which proved so successful in the Alsacian and Hanoverian oil districts before and during the war. The production of mineral oil from bituminous slate as well as from bituminous coal, as now practiced in certain parts of the Central German lignite district, will also be taken up by the company. It is said that, chiefly for political reasons, neutral Switzerland was selected as headquarters of the company.

#### PETROLEUM PRODUCED IN THE UNITED STATES IN JANUARY, 1921, FEBRUARY, 1921, AND FEBRUARY, 1920

State	January, 1921 (a)		February, 1921		February, 1920	
	Total	Daily Average	Total	Daily Average	Total	Daily Average
California (b)	10,177,000	328,290	9,184,000	328,000	7,974,000	274,966
Central and Northern Texas	6,419,000	207,065	5,773,000	206,179	5,175,000	178,448
Coastal Texas	2,610,000	84,194	2,367,000	84,536	1,565,000	53,966
Oklahoma	8,383,000	270,419	7,855,000	280,536	7,933,000	273,552
Kansas	2,368,000	76,387	2,478,000	88,500	2,983,000	102,862
Northern Louisiana	2,531,000	81,645	2,173,000	77,607	2,560,000	88,275
Coastal Louisiana	156,000	5,032	156,000	5,571	146,000	5,035
Wyoming	1,462,000	47,161	1,497,000	53,464	1,167,000	40,241
Illinois	852,000	27,484	785,000	28,036	831,000	28,655
Kentucky	744,000	24,800	723,000	25,821	582,000	20,069
West Virginia	645,000	20,866	634,000	22,643	613,000	21,138
Central and Northern Ohio	433,000	13,960	427,000	15,250	376,000	12,966
Northwestern Ohio	186,000	6,000	175,000	6,250	146,000	5,034
Pennsylvania	619,500	19,984	602,000	21,500	530,000	18,276
Montana	78,000	2,516	115,000	4,107	7,000	241
Indiana	95,000	3,065	92,000	3,286	68,000	2,345
New York	84,000	2,710	66,000	2,357	58,000	2,000
Colorado	9,000	290	9,000	321	8,000	276
Tennessee	1,500	48	1,000	36	1,000	34
Totals	37,853,000	1,221,064	35,112,000	1,254,000	32,723,000	1,128,379

(a) Revised.

(b) Average of figures reported by Standard Oil Co. and Independent Oil Producers' Agency.

### Federal Reserve Board Comments on Petroleum Situation

In analyzing the March reports of its member banks, the Federal Reserve Board has issued the following statement in regard to the petroleum situation:

"Production of petroleum in general has shown a decrease, following the recent decreases in prices in the industry. February daily average production of crude petroleum in California was 327,864 bbl., as compared with 331,181 bbl. in January, and in District 11 (Dallas) the daily average production was 403,243 bbl., as compared with 411,171 bbl. in January. In contrast with this situation, however, there has been a practically continuous increase in the weekly output in the Kansas-Oklahoma fields since the beginning of the year. The daily average output for the week ended March 11 was 366,500 bbl. in that field, as compared with 334,000 bbl. for the week ending Jan. 7. This occurred despite the noticeable falling off in the completion of new wells and in new production in District 10 (Kansas City), following the break in prices which occurred in the month of February. Many operators in that district are pursuing a policy of confining their development operations to 'offsets,' in view of the present situation in the industry.

"The decreased output shown in District 11 (Dallas) reflects the decrease in drilling operations. Though the falling off in such operations had already begun in January, February completions, amounting to 420 wells, were 147 less than in January, and new production was only half as large. In District 12 (San Francisco) 60 new wells were completed in February, as compared with 64 in January, though the initial new daily production was cut nearly in half. After the drastic price reduction in January and early February, prices subsequently remained unchanged, the prevailing price in central-west and north Texas being \$1.75 per bbl.

"During the first half of March prices held steady at the same figure in the mid-continent field. It is reported, however, that the second week of March brought marked improvement in that field, and every purchasing company in every field in Oklahoma and Kansas, with one exception, was buying crude oil on a 100 per cent basis. It is reported that fuel oil in the district 'is showing an appreciable increase in demand, and refined petroleum is beginning to move in slightly larger quantities and gasoline is fairly steady, though the demand has not come up to seasonal expectation.'"

### Oil Land Boom in Utah

SPECIAL CORRESPONDENCE

The acreage of land in Utah which offers possibilities of producing oil is extensive, there being, according to Government reports, about 2,000,000 acres classified under oil-land withdrawals. The larger part of this land in southeastern Utah is unsurveyed and not yet accessible by railroads. Since the opening of the land to exploitation through the recently enacted leasing law a larger number of oil companies are constantly becoming interested, and more oil-drilling rigs are being sent in. A number of Eastern companies are active in the field, and companies organized by Utah men are also starting work. Recently the Salt Lake City land office has done a business recalling early boom days. At least seven test wells are being driven, and five of these are on land leased from the Federal and state governments. The Ohio Co. has been one of the first in the

field, and is driving three wells, in each case using a standard rig capable of drilling to a depth of 500 ft.—one in the Circle Cliff field, in Garfield County, one in the Cainesville structure, in Wayne County, and one about three miles northwest of Huntington, in Emery County.

The San Rafael section, in Emery and Grand counties, is of interest, and a number of companies are planning or starting work here. It is understood that the Carter Oil Co. intends to operate in this field. Two local companies, made up of Salt Lake men, the Old Emery and the San Rafael Oil Corporation, are reported to have sent down rigs. Mohrland, Price, and Green River are the nearest towns to the San Rafael field, and bridges and roads are being built to make the various parts of the district accessible by automobile and truck.

In the southwestern part of the state is the Virgin oil field, from which a small quantity of oil has been taken from shallow holes. Interest is also being taken in the possibility of finding oil at the northern end of Great Salt Lake near Promontory and Rosel.

### Oil Pipe-Line Bill Pending in Canada

SPECIAL CORRESPONDENCE

As a preliminary step toward the construction of a pipe line to the Fort Norman oil fields a bill to incorporate the Imperial Pipe Line Co. was introduced in the Alberta Legislature. Charles Taylor, manager of the Imperial Oil Co., was one of the incorporators, and the nominal capital was placed at \$10,000. The bill came up in committee on March 13, the company being represented by William McAdam, who stated that the Imperial Oil Co. estimate of the total cost of the work was \$40,000,000. It would require two years' work to construct a 12-in pipe line, or two 6-in. lines to provide for a production of about 30,000 bbl. per day.

Several members of the committee held the view that a provision should be inserted making the line a common carrier, as were the Kansas and Texas pipe lines. Mr. McAdam strongly opposed this proposal, asserting that the Kansas field had been ruined by this measure. It would, he stated, promote indiscriminate drilling and prematurely exhaust the field, and if the company were compelled to provide for the transportation of other companies' products it would render the cost prohibitive. The company would be glad to buy or transport other oil after it had taken care of its own output. The committee agreed to report the bill as it stood and leave the details to be decided at a later stage.

### Imperial Oil Co. To Use Airplanes

SPECIAL CORRESPONDENCE

The Imperial Oil Co.'s all-metal monoplanes have made an initial flight from Peace River to Great Slave Lake and return. The two planes are preparing for their first flight to Fort Norman as soon as weather conditions are favorable, carrying drills and equipment. The company has four California standard drilling rigs on the way, which will be set up adjacent to its present well. A group of Canadian and British syndicates represented by James D. Tait will have three or four drills in operation during the season. The Fort Norman Oil Co., headed by Joseph M. Aitken, brother of Lord Beaverbrook, announces that development will begin on its Fort Norman and Great Slave Lake properties during the summer.

## Book Reviews

**Electrolytic Deposition and Hydrometallurgy of Zinc.** By Oliver C. Ralston. Cloth; 6 x 9; pp. 201. McGraw-Hill Book Co., New York. Price, \$3.

Investigators in the hydrometallurgy and electrolytic deposition of zinc have been particularly fortunate in the liberal attitude of their employers and of their fellow workers in releasing information. Many articles on the subject have appeared, and, with the exception of the Brunner, Mond & Co. plant, in Winnington, Cheshire, England, experimental and commercial works have, we believe, been freely opened to properly accredited visitors. The present book by Mr. Ralston is another step in the progress of the art.

The author has succeeded well in his attempt to cover the subject completely and simply. It is always difficult to write a first book on a given topic, for there is not the usual opportunity to see what some one else has said and try to say it better. The principles are well stated, and their development in experimental plants is described.

Mr. Ralston has evidently capitalized his electrolytic experience at Niagara Falls. Particular attention is rightly given to the matter of solution impurities which have proved such a stumbling block. A chapter is devoted to the economics of zinc hydrometallurgy, and this subject is one to which even more space could well have been devoted. Will it pay to install an electrolytic zinc plant? This is a question destined to be of importance, and although the present state of the art does not allow any very definite or conclusive data to be given, the subject should have more and more attention in later editions. It is regrettable that no word of the work being done with the Tainton-Pring process at Martinez, Cal., is included, as the experiments there being made with high-current densities show much promise.

Prompt publication, of course, is essential in a work of this kind, and in hurrying a book to press some errors can be pardoned. However, we think the author and (though we say it as shouldn't) the publisher should have been a little more careful in correcting some of the obvious typographical and other mistakes which appear. Cobalt, we are ingenuously told, causes "resolution of the cathodes, leaving them looking like they had been shot full of holes"!

E. H. R.

**Gold.** By Benjamin White. Cloth; 5 x 7½ in.; pp. 130. Isaac Pitman & Sons Co., New York. Price, \$1.

A companion volume to "Silver," by the same author, describing the history and romance of gold and "its place in the economy of mankind," Mr. White has attempted to popularize a subject that lends itself to voluminous and

technical description both as to the production of gold and its function as a monetary medium, and technical shortcomings or omissions are excusable. Production of gold from earliest to present times is considered, and the evolution of coinage given in much detail. The importance of the gold standard, gold movements, stocks, the industrial use of gold, and the part the metal played in the Great War are emphasized. To anyone wishing a short but nevertheless "meaty" treatise on the metal the book is excellently adapted, and no doubt many engineers whose efforts are devoted to mining the precious metal will find much information in the book to enlighten them regarding their own part in the economy of the production and use of this fascinating metal.

F. E. W.

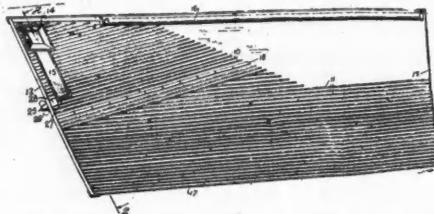
**Quin's Metal Handbook and Statistics, 1921.** By L. H. Quin. Cloth; 6½ x 4½; pp. 309 inc. advt. Published by The Metal Information Bureau, Ltd., 7 East India Avenue, London, E. C. 3, England. Price, 5s.

The 1921 issue of this handy volume of statistical information has just been published. Production, consumption, prices, imports, exports, grades, and other information respecting all of the more important ferrous and non-ferrous metals are given. Data for other countries as well as Great Britain are included.

## Recent Patents

**Drum Filter—No. 1,368,618.** Henry B. Faber, New York, N. Y. A drum filter in an air-tight container, making use of pressure on the outside of the drum, rather than suction within, to de-water the filter cake. Provision for washing the cake is made, and the wash-water may be divided after passing through the filter, if desired, so that the final wash-water may be kept separate from the other. A counter-pressure of air from the inside is used to loosen the cake previous to its discharge.

**Vibrating Sluice Box—Fred Cushman,** Seattle, Wash., assignor of one-half to C. J. Stephanus, Seattle, Wash. Design of a concentrator, embodying a vibrating sluice box suspended over another vibrating receptacle. No. 1,368,901.



**Concentrating Table—J. F. McNeil,** Clifton, Ariz. A table with a new system of riffing, as shown in the illustration. No. 1,368,815.

## Technical Papers

**Phosphate Rock—**"Phosphate Rock in 1919" a separate of *Mineral Resources* containing fifteen pages, has been issued by the U. S. Geological Survey, Washington, D. C., and is obtainable on request. The value of the Florida production was \$7,797,929; that of Tennessee, \$3,414,516; South Carolina, \$308,968; and Idaho, Utah, and Wyoming, \$69,855. Further statistics of domestic production are given, and several pages are devoted to a description of phosphate deposits in Spain, Algeria, Tunis, Morocco, and Nauru and Makatea islands, in the Pacific.

**Seward Peninsula, Alaska—**Mining conditions on the Seward Peninsula in 1919 are discussed in Bulletin 714-F of the U. S. Geological Survey (nine pages, free on request). Underground and open-cut mining have decreased greatly in the last three years, and dredging is the principal activity. Some of the details of the practice and the names of the dredges operating are given. Two dredges were engaged in the recovery of tin.

**Military Mining—**The Engineer School of the U. S. Army, Washington, D. C., has published a thirty-eight-page illustrated bulletin (No. 62) on this subject. The author, A. H. Brooks, was chief geologist of the A. E. F. He emphasizes the principles of mine warfare as developed in the recent conflict rather than the technique of mining. The paper as a whole avoids strictly technical nomenclature, making it all the more valuable to the general reader. Beginning with a historical sketch of military mining, the general features of the art are briefly given. Such matters as terrain, geology, mining tactics, and tools receive extended treatment, copiously illustrated with diagrams. The paper is interesting and valuable to those who wish to be informed regarding mining in other than its peaceful phases.

**Kansas Oil Fields—**The U. S. Geological Survey has published a map of the oil and gas fields of Kansas. This map, which is on a scale of 12 miles to the inch, shows not only economic data of special interest to the oil man, but the township net, county boundaries, railroads, drainage lines and principal towns and cities. The oil fields are outlined in green and the gas fields in red, and scattered occurrences of oil or of gas that are not of sufficient importance to be classified as fields are plainly indicated. The pipe lines are shown in a distinctive color, the locations of refineries are indicated, and the names of the principal fields are given. The map is sold for 50c. a copy, and may be obtained from the Director of the U. S. Geological Survey, Washington, D. C.

# ECHOES FROM THE FRATERNITY

## SOCIETIES, ADDRESSES, AND REPORTS

### Three Power-Test Codes Ready for A. S. M. E. Chicago Meeting

Nineteen power-test codes, constituting what their framers style "a national common law" in the field of power-plant testing, are being framed by 125 leading engineers, scientists, and educators under the auspices of the American Society of Mechanical Engineers. The codes, when completed, will affect a wide range of industrial enterprises, large and small. They will provide courses of procedure by which all forms of devices from an electrical superstation to a boiler feed pump shall be tested to see if they comply with the terms of purchase or if they are operating at the desired efficiency.

In this work, centering at the headquarters of the society in New York, and radiating to practically every important industrial center of the country, nineteen committees are engaged. These committees are supervised by a main committee of twenty-eight, of which Fred R. Low, of New York City, editor of *Power*, is chairman, and Prof. Clifford B. Le Page, of Stevens Institute of Technology, Hoboken, N. J., is secretary. The committeemen represent engineering societies, manufacturers, public service corporations, national, technical and scientific associations, railroads and Government agencies, including the U. S. Bureau of Standards and the U. S. Naval Academy.

The codes, when all are completed, will constitute a revision and enlargement of the power-test codes of the American Society of Mechanical Engineers, issued in 1915. This plan of revision was set in motion in 1918 when the power-test committee of the American Society of Mechanical Engineers was reorganized as a body to draft nineteen new codes for the different classes of apparatus comprised in power-plant equipment.

Three codes will be presented to the American Society of Mechanical Engineers meeting at Chicago, May 23-26, for consideration and adoption. The code which is probably of most general interest is officially known as "Test Code for Reciprocating Steam Engines."

Another forms a preliminary set of rules, and is entitled "General Instructions." This code was prepared by a committee under the chairmanship of William H. Kavanaugh, professor of experimental engineering in the University of Pennsylvania.

The third of the nineteen codes to be formulated is described by the committee as intended primarily for the testing of apparatus heated by steam, such as vacuum pans, or single and multiple-effect evaporators.

The individual committee in charge of a test code first submits a preliminary draft to the secretary of the main committee. This draft is edited and returned to members of the individual committee by the secretary, to whom an edited revision is returned approved. The draft is then put in type, and proofs are distributed to a selected list of from one hundred to two hundred engineers for criticism, after which the individual committee submits the revised code to the main committee. The main committee then returns the code to the individual committee for further revision, and then submits the revised draft of the code to the council, the governing body of the society, and asks permission to print and present it to the society. When the council, consisting of thirty members representing cities East and West, gives leave to print, the code appears in *Mechanical Engineering*, the official journal of the society.

The next step is the submission of the code to the society at a regular meeting where it is either approved and adopted or is returned for further revision. "The purpose of the power-test codes," says an official statement by the society, "is to provide standard directions for conducting and reporting performance tests of power-plant and heat apparatus, such as are most commonly undertaken in commercial work. They are sufficiently comprehensive to apply to tests which determine all the details of the performance, but selected parts of the code may be used for tests of limited scope. They apply, further, to tests which concern the fulfillment of performance guarantees and to acceptance tests.

"The codes are not intended to supply directions for general research or the development of equipment or of processes. It is assumed that the engineer who is concerned with research will proceed as nearly as is practicable in harmony with their requirements, and that in the publication of results he will employ forms of presentation which will be comparable with those of the codes."

### Oil in Utah Discussed

The Utah Society of Engineers recently considered "The Livest Subject in Utah." Three leading papers were presented. Job Winwood, consulting engineer, began the symposium with a discussion, "Federal Requirements for Oil Locations," which was followed by a paper on "Sinking Oil Wells," by B. C. Morrison. "Oil Refining" was discussed by John C. Howard, president of Utah Oil Refining company, and Prof. H. J. Pack, of the University of Utah, spoke on "Oil Geology."

### Carnegie Institute Offers Fellowships in Mining at Pittsburgh

The Co-operative Department of Mining Engineering of the Carnegie Institute of Technology offers two fellowships in Mining Research, and two in teaching and research, in co-operation with the U. S. Bureau of Mines. Fellowships are open to the graduates of universities and technical schools who are properly qualified to undertake research investigations. The value of each fellowship is \$750 per year of ten months. Fellowship holders are required to register as graduate students and become candidates for the degree of master of science unless an equivalent degree has previously been earned. The purpose of these fellowships is to undertake the solution of problems in mining and utilization of fuels which are of special importance to the bituminous coal industry. The following subjects have been suggested for investigation: Acid Mine Waters; Shotfiring; Shooting Coal; Storage of Bituminous Coal; Geology of Coal-Producing Districts in Pennsylvania; Utilization of Fuels; Preparation of Bituminous Coal.

All applicants for appointment to research or teaching fellowships should understand the following conditions governing the appointments: (a) Appointment to the position of research fellow is for a period of ten months beginning July 1, 1921. All of the time of the research fellow is to be devoted to assigned duties in the experiment station of the Bureau of Mines.

(b) Appointment to the position of teaching fellow is for a period of ten months beginning Aug. 1, 1921. Ten hours each week will be devoted to teaching work in mining, and the balance to assigned duties in the experiment station of the Bureau of Mines.

(c) No vacations will be observed.

(d) Any manuscript presenting the result of research shall be published under the joint authorship of that member of the staff of the Bureau of Mines who initiated the investigation and gave it general supervision, as the principal author, and the research or teaching fellow who conducted the investigation as the sub-author.

(e) Fellows are not permitted to accept any kind of employment for pay during their appointment.

Applicants should send a copy of their collegiate records from the registrar's office of the college where they have been or will be graduated. Applications are due not later than June 1, 1921, and should be addressed to Supervisor, Co-operative Department of Mining Engineering, Carnegie Institute of Technology, Pittsburgh, Pa.

## MEN YOU SHOULD KNOW ABOUT

**McMosier Henry**, geologist, of the Phelps Dodge Corporation, is in Morenci, Ariz.

**Colonel Azéma** has been elected president of la Société française de Minéralogie.

**Douglas Lay** has succeeded Paul S. Coudrey as manager of Le Roi No. 2, at Rossland, B. C.

**Horace V. Winchell**, of Minneapolis, was in Tonopah, Nev., on professional business late in March.

**Albert Burch**, mining engineer of San Francisco, was in Tonopah, Nev., recently on professional business.

**H. A. Wheeler**, consulting mining engineer of St. Louis, Mo., was in New York City for a few days last week.

**W. A. Rose**, chief mining engineer for Pickands, Mather & Co., is in Washington, D. C., on business for his company.

**William J. Loring**, of San Francisco, was at Tule Canyon, Nev., recently inspecting the Silver Hills mine in which he is interested.

**C. M. Weld**, consulting mining engineer, has returned to New York City after a professional trip to West Virginia and Kentucky.

**George M. Bevier**, geologist for the Atlantic Oil Producing Co., has moved his headquarters to the company's office at Houston, Texas.

**E. A. Hayes**, president of the Hayes Mining Co., Ironwood, Mich., has been appointed a member of the War Finance Corporation, Washington, D. C.

**O. B. Hopkins** has resigned as petroleum geologist with the U. S. Geological Survey. He will continue his private work for interests in Canada.

**Rufus Mather Bagg**, geologist, formerly with the Maryland and New York state geological surveys, is now with the department of geology of Lawrence College, Appleton, Wis.

**J. M. Price**, assistant superintendent of the Montreal Mining Co., Montreal, Wis., and **V. D. Johnson**, of Ironwood, Mich., recently visited the Mesabi Range on business matters.

**Carl T. Sparks**, mining engineer, attached to the Fairbanks, Alaska, experiment station of the U. S. Bureau of Mines, is returning to Butte, Mont., on urgent private business.

**G. A. Joslin**, managing engineer of the Ramshorn Mines Co., Salt Lake City, Utah, is going to the company's property at Bayshore, Idaho, where he will spend most of the summer.

**A. W. Newberry**, mining engineer, has returned to the United States from Nicaragua, after an absence of four months. He went to Toronto before returning to New York City on April 8.

**Phillipe Zurcher**, a geologist who has devoted much attention to the deposits

and resources of Provence, France, has been elected president of la Société Géologique de France. He succeeds P. Termier in that office.

**Sidney J. Kidder**, general manager for the Mogollon Mines Co., has been appointed by Governor Meacham of New Mexico as one of three commissioners for the new county of Catron, just established from the west end of Socorro County, N. M.

**E. H. Weitzel**, manager of the fuel department of the Colorado Fuel & Iron Co. for the last thirteen years, has been appointed general manager for the company at Pueblo, Col., succeeding the late J. B. McKennan. Mr.



E. H. WEITZEL

Weitzel began his coal-mining experience in the Pittsburgh, Pa., district. In 1903 he was general superintendent of the Empire Coal Co., Bellaire, Ohio, but soon moved to Dawson, N. M., for reasons of health. In 1906 he moved to Trinidad, Col., where he opened an engineering office, and in 1907 entered the employ of the Colorado Fuel & Iron Co. as chief engineer. D. A. Stout succeeds Mr. Weitzel as manager of the fuel department.

**E. W. Shaw**, petroleum geologist, who has been connected with the U. S. Geological Survey for a number of years, resigned recently to take up private consulting work. Mr. Shaw returned from a South American trip last January, and recently executed a commission in South Carolina for the Survey.

**N. H. Darton**, of the U. S. Geological Survey, has gone to Arizona to take charge of the geologic mapping work which is to be done in that state during the next field season. He recently made a geological study of the struc-

ture of the northern Appalachian coal fields in Pennsylvania.

**Frederick B. Hyder**, mining and metallurgical engineer of San Francisco, Cal., has resigned his position with the income-tax unit of the office of the Commissioner of Internal Revenue, and resumed private practice in San Francisco. Mr. Hyder is specializing in valuations of natural resources for Federal tax purposes, and in studies of mineral industries.

**Mining engineers and metallurgists** recently visiting New York City included: **Elwin F. Brown**, general manager, Pewabic Iron Co., Iron Mountain, Mich.; **F. N. Flynn**, of Mexico City, D. F., Mexico, and **Samuel S. Wyer**, consulting engineer of Columbus, Ohio.

## SOCIETY MEETINGS

**Illinois Mining Institute** will hold its spring outing the latter part of May on the Mississippi and Illinois rivers, the boat leaving St. Louis for Peoria on May 26 and returning on May 28. Secretary, **Martin Bolt**, Springfield, Ill.

The **Tulsa, Okla., Section of the American Institute of Mining and Metallurgical Engineers** announces that it meets regularly on the last Friday of each month throughout 1921. **M. M. Valerius** is chairman, and **Jon A. Udden** secretary-treasurer of the section.

The **Iron and Steel Institute** holds its annual meeting on May 5 and 6 at the Institution of Civil Engineers, Great George St., London, S. W. 1. The annual dinner will be held on the evening of May 5, at the Connaught Rooms, Great Queen St., London, W. C. G. C. **Lloyd**, secretary, may be addressed at 28 Victoria St., London, S. W. 1.

## OBITUARY

**A. E. Reynolds**, mining man, rancher, and a trustee of the University of Denver, Col., died of apoplexy at Nashville, Tenn., on March 21. Mr. Reynolds was born Feb. 13, 1840, near Lockport, N. Y., and in the '60s went to Ft. Leavenworth, Kan., where he was an Indian post trader for some years. In 1874 he staked a mining claim near Lake City, Col., but did not settle permanently at Denver until ten years later. From that time on his mining interests expanded. Among his prominent Colorado activities were the Aspen Mining Co. at Creed, the Revenue Mine Co. at Ouray, the Emma mine at Denton, and the May Day, near Durango, Col. The University of Denver elected him to its board of trustees in 1900 and to the executive committee in 1911.

# THE MINING NEWS

## LEADING EVENTS

### Eilers Defeated; Guggenheims Win A. S. & R. Election

682,223 Shares Voted Supporting Management; Opposition Musters Only 202,479

Karl Eilers' efforts to oust the Guggenheims from the control of the American Smelting & Refining Co. were defeated, and the Guggenheim board of directors was elected, at the annual meeting of the company in Jersey City on April 6. A total of 682,223 votes was cast, Mr. Eilers not voting the shares or proxies that he controlled. As the vote cast at the meeting a year ago was 636,284, it was evident that the management of the company had a generous margin. The new board, as elected, is as follows:

Daniel Guggenheim, Simon Guggenheim, G. P. Bartholomew, F. H. Brownell, H. M. Brush, Lyman Candee, member of the New York Board of Underwriters; Merrel P. Callaway, vice-president of the Guaranty Trust Co.; Charles Earl, J. C. Emison, H. A. Guess, Frank W. Hills, E. C. Jameson, president of the Globe & Rutgers Fire Insurance Co.; Benjamin Joy, vice-president of the Bankers Trust Co.; F. J. Leary, vice-president of the Central Union Trust Co.; William Loeb, Jr., W. S. McCormick, president of the McCormick National Bank, Salt Lake City; Willard S. Morse, formerly manager of the company's business in Mexico, now retired; E. L. Newhouse, W. T. Page, H. A. Prosser, F. R. Raiff, C. A. H. de Saullés, E. B. Schley, of Moore & Schley; Wilfred Shore, of the Irving National Bank, representing Amsterdam interests; Roger W. Straus, Frederick T. Walker, of the Royal Bank of Canada; John N. Steele and C. W. Whitley.

It became evident in the course of the meeting that the Guggenheims would be able to elect their ticket, which had been published in the morning papers. President Simon Guggenheim being absent when the hour arrived for calling the meeting to order, F. H. Brownell, a vice-president of the company, took the chair and presided throughout the day. After the presence of a quorum had been determined and the minutes of the preceding meeting read, a motion was made by a Mr. Leary, apparently representing Mr. Eilers, that the meeting be adjourned until the first Wednesday in October and also proposing that the management furnish the Evans committee with all information that it might desire in the course of its proposed investigation. The motion also reiterated, in effect, the charges previously made against the management by Mr. Eilers. This motion was opposed by the chair on the ground that only a motion to adjourn

### WEEKLY RESUMÉ

The Guggenheims elected their board at the A. S. & R. Co.'s annual meeting on April 6. In Manitoba the Flin Flon option has been dropped by the Thompson interests.

Following close upon the news of suspension of operations by many copper producers last week comes the announcement that the Phelps Dodge Corporation will shut down its Copper Queen mine, at Bisbee, and the smelter at Douglas. The Mammoth copper mine at Kennett, Cal., has also suspended. In the Michigan copper country the Copper Range, Mohawk, Wolverine and Quincy companies have announced further wage cuts, as has also the Granby Consolidated, in British Columbia. In Washington the Day interests have closed their Northport smelter, and at Grand Forks, B. C., the Consolidated has shut down its Rock Candy fluor spar mine. The Arizona Copper Co. has deferred its annual meeting until (probably) the end of May. Rumors are afloat of a possible change in control of the Canada Copper Corporation. In Mexico the Torreon smelter has again shut down after exhausting its fuel supply. Judge Johnson, in Salt Lake City, following the Swain report on smelter smoke, has ordered that the Murray plant continue as it has during the last year and that the Midvale plant make certain changes in methods of operation. At Tonopah rumors of possible apex litigation between the Extension and the Cash Boy companies are heard.

In Washington it is said that there is some doubt that H. Foster Bain will be renominated as Director of the U. S. Bureau of Mines.

was in order and that the motion as made was much broader than this. The chair was sustained on this point by a ballot which at once demonstrated that the Guggenheims and their associates would carry the day, Karl Eilers voting only 202,479 shares and receiving negligible support from those present. A new motion to adjourn was promptly defeated.

The polls were opened at 12.35 p. m. to remain open until 4 o'clock. In the meantime, other business being temporarily adjourned, the stockholders repaired to St. Peter's Hall, near by, which was larger and better adapted for discussion than the small board room. The principal feature of the afternoon was a long defence of the Guggenheim management, read by S. R. Guggenheim. The results of the election were later announced at the board room. The entire meeting was uninteresting, as the outcome was apparent at the start.

### Flin Flon Option Dropped by Thompson Interests

Mining Corporation of Canada Said To Be Negotiating Independently To Take Over Property

On account of conditions in the money and metal markets, the William Boyce Thompson interests have dropped the option on the Flin Flon prospect in northern Manitoba, which they purchased early in March, 1920 (see *Engineering and Mining Journal*, March 13, 1920, p. 670). An option held by Hayden, Stone & Co. had previously been dropped in January, 1920, before the Thompson interests acquired theirs.

Colonel Thompson and his associates, including the Mining Corporation of Canada, have expended over \$200,000 on the property, in accordance with the terms of the option which expired with the end of March. It is said that the Mining Corporation is now negotiating independently for an option on the property, on which to date a total of over \$500,000 has been spent.

The Flin Flon deposit has been described in the *Engineering and Mining Journal* of Oct. 25, 1919. It contains 20,000,000 tons of primary sulphides running 1.7 per cent copper, 1.5 oz. silver, and \$1.40 gold. The ore is said also to contain zinc, and the metallurgical problem is reported to be difficult.

### Salt Lake Valley Smelters Get Court Decree

Murray Plant Must Operate as During Past Year—Changes Necessary at Midvale

Judge Tillman A. Johnson, of the United States district court of Utah, following the suit of farmers claiming damage to vegetation from smelters operating in the Salt Lake Valley, and after examination of a report by Dr. Robert Swain, who investigated the matter, has issued a decree permitting the smelters to operate on compliance with certain recommendations outlined by Dr. Swain. The Murray plant of the A. S. & R. Co. is enjoined to continue operation as it has in the past year, while the United States company, operating at Midvale, is required to increase the temperature of its stack gases or to make certain alterations.

### Copper Queen Mine and Douglas Smelter To Shut Down

The Phelps Dodge Corporation has announced that it will shut down the Copper Queen mine at Bisbee and the smelter at Douglas, Ariz., on April 15. The Sacramento Hill project and the construction of the new Copper Queen concentrator will be continued.

### Hecla and Marsh Mines Settle Litigation Amicably

No Further Payment Made—Hecla Gets Release of All Claims—Marsh Lease Cancelled

The Hecla Mining Co., of Wallace, Idaho, has notified its stockholders under date of March 30, 1921, that the negotiations in progress between the Federal Mining & Smelting Co. and Marsh Mines Consolidated for the settlement of the latter's claim against the Hecla have been concluded. The Marsh company has delivered to the Hecla a release of all claims against it and a cancellation of the Marsh lease on the O'Neil, Mono Fraction, and Russell lode mining claims. It is stated that the litigation has been ended without further payment of any other sum than Hecla's obligation to the Federal company, which has been paid in full.

### Tonopah Companies May Undertake Apex Litigation

It is rumored in Tonopah, Nev., that there is a possibility of litigation between the Tonopah Extension Mining Co. and the Cash Boy Mining Co. over the ownership of certain orebodies which the former has followed into Cash Boy ground. It is said that the Cash Boy company has demanded that the Tonopah Extension prove apex rights before extracting further ore. Albert Burch and H. V. Winchell have recently been in Tonopah, though the nature of their business is not known, other than that it is professional.

### Lake Superior Mining Institute To Meet Next August

The Lake Superior Mining Institute will hold a meeting on the Marquette Range next August. It was to have been held in Houghton County, but a change has been made by the institute board because of the depression in the Michigan copper country. A. J. Yungbluth, secretary of the institute, states that this is to be one of the most interesting of the meetings of this body, according to plans now being formulated. No meeting of the institute has been held since the beginning of the late war, and a big attendance is looked for at the coming one. Several interesting side trips are being arranged.

### Compensation Ordered Paid for Death of Miner

The Industrial Commission of Utah has ordered that compensation be paid the minor sisters of Walter Carr, who was killed by drilling into a missed hole at the mine of the Judge Mining & Smelting Co., at Park City, the money to be paid to Mrs. Webb, their mother, who shall file semi-annual affidavits that she has applied all of the compensation under the award to the support and education of the sisters. Payments amount to \$16 a week for 202 weeks.

### Conditions in Cœur d'Alenes Better Than Elsewhere

Less Than Half of Usual Number of Men Employed—Morning and Bunker Hill & Sullivan Will Continue—Hecla To Decide Soon

Since November about 1,300 men have been thrown out of employment in the Cœur d'Alene district, in Idaho, through the suspension of mineral production. The first to shut down was the Callahan Zinc-Lead Co., affecting about 350 men. About Jan. 1 the Gold Hunter followed, affecting about 160 men. Low prices of lead and zinc, high freight rates, and war prices for powder and other mining supplies were the causes of the shutdown in each case. Hope for relief from these onerous conditions did not materialize; in fact, the metal prices further declined, and there has been little relief from war prices for supplies. As a consequence on March 20 the Hercules and the Tamarack & Custer mines, both controlled by the Days, stopped production, resulting in throwing about 700 men out of employment. The only big producing mines now in operation are the Hecla, at Burke; the Morning, at Mullan (owned by the Federal Mining & Smelting Co.), and the Bunker Hill & Sullivan, at Kellogg.

It may be stated authoritatively that the Morning, which is closely affiliated with the American Smelting & Refining Co., and the Bunker Hill & Sullivan, which has its own smelter, will continue in operation, as the smelting companies with which they are connected have ample financial resources to carry an unlimited stock of lead until there is a market for it. What the Hecla will do will probably not be known until after the annual meeting of the company, which will be held in Spokane on April 12. These three companies, including the Bunker Hill smelter, employ in round figures 2,000 men. Small producers and leasing and development operations give employment to 500 men, according to a conservative estimate, making the total number of men employed by the mining industry in the Cœur d'Alene district 2,500, less than half the number employed in normal times. Still this is said to be a better showing than most of the Western mining districts can make.

### Mond Nickel Co. Issues New Securities

The Mond Nickel Co., of Coniston, Ont., in the Sudbury district, has issued £1,300,000 in 8 per cent debentures at 98 in London to provide funds for the further development of its business.

### Granby Cuts Wages Further

Granby Consolidated Mining, Smelting & Power Co. cut wages 25c. more on April 1, making a total cut of \$1 per day since Dec. 31 last. The four furnaces continue to produce 2,000,000 to 3,000,000 lb. of copper monthly.

### The End of the German Steel Trust

Pessimistic Report of Stahlwerksverband for Year July, 1919, to July, 1920, Sketches Conditions in Industry

*From Our Berlin Correspondent*

The Stahlwerksverband, which is the official title of the German Steel Trust, one of the mightiest and most influential institutions of pre-war Germany, has just delivered its death song in the form of the business report, covering the time between July, 1919, and June, 1920, at which time the business activity of the corporation came to an end.

The beginning of the dissolution of the trust dates far back into the early stages of the war, when this powerful structure began tottering on account of the steadily growing tendency of its members to free themselves from all restrictions with regard to production and distribution. The enormous demand for steel products during the war caused the steel trust to be more and more considered as something entirely superfluous, and as a severe handicap to individual progress. It would have fallen into pieces before the war came to an end if the government had not brought influence to bear upon the steel works for the sake of the continuation of the trust. Conditions, however, became critical after the separation of the Luxembourg and Lorraine works. Great difficulty was found to patch up matters from April, 1919, to the end of September, 1919. When, however, at the end of July the Sarre works also left the trust, all hope for a continuation of the trust was abandoned. The government conceived the idea of a new body, which was to take over the functions of the steel trust, under the control of the government, as far as control of prices and distribution was concerned.

This body, the Eisenwirtschaftsbund, or Iron Economy Society, came into life in April, 1920. Strong pressure has been used from the side of the government to keep the steel trust alive until operations of the new society came into swing, in such way that the corporation agreement was compulsorily renewed four times until the 3d of June, 1920, when the activities of the trust were terminated definitely.

The last business report of the trust makes sad reading, and is conspicuous for the absence of optimism. It deals very severely with the official institutions for the control of exports, the export licenses, and the slow red-tape business procedure for obtaining them, which were patiently borne by the foreign buyers only as long as the foreign markets stood in great need of German steel products. Many substantial orders at good prices have been lost on the one hand, while the export offices could not prevent large quantities of steel, specially rolled products, bought at inland prices obviously for inland consumption, from finding

their way across the frontiers through the "Hole in the West," which is the common term used for the territories now occupied, where control of exports is handled indifferently and very leniently. In this way only 11 per cent of the total shipments of 1,278,310 tons could be sold abroad. Even the strong inland demand of that period is not looked upon as a hopeful sign, as it was discovered to be artificial and inflated by speculation.

After delivering a parting shot at the steel trust's successor, the Eisenwirtschaftsbund, which, it is said, in the opinion of the steel industry, is perfectly superfluous and out of place, the report gives vent to rather pessimistic views on the present situation and on the outlook, which is declared to be gloomy. The main danger to the German industry is seen in the growing competition of the foreign rivals, whose situation is steadily improving, while the German industry has not seen its worst time yet. The latter is existing solely on the grace of the low exchange, and is thus controlled by a factor which in itself is uncontrollable.

SHIPMENTS OF GERMAN STEEL PRODUCTS DURING THE INDIVIDUAL MONTHS OF THE BUSINESS YEAR (In Tons)

Month	Semi-Finished Material	Railroad Material	Rolled Products	Total	Decrease Over Previous Period
1919 July.....	42,712	55,491	37,598	135,801	63,181
August.....	34,762	62,008	40,542	137,312	68,626
September.....	58,254	61,147	42,233	161,634	21,960
October.....	26,412	59,632	36,233	122,277	30,892
November.....	19,084	43,122	34,988	97,194	9,106
December.....	18,967	51,666	30,097	100,730	5,067
1920 January.....	12,543	33,412	27,164	73,119	52,242
February.....	19,062	39,830	29,338	88,230	42,990
March.....	22,516	36,563	27,687	86,766	63,150
April.....	21,858	42,581	27,872	92,311	30,088
May.....	17,200	45,164	26,060	88,484	28,204
June.....	21,332	56,198	24,931	102,461	13,274
Total tons.....	314,762	586,814	384,743	1,286,319	410,721

A sudden rise of the exchange, like last year's, would land the German steel industry in a sore predicament.

The shipment of semi-finished products in the period covered by the report was 314,762 tons, as against 439,309 tons in the previous year, or 124,547 tons less. Of these shipments only 12,234 tons, or 3.89 per cent, has been sold on foreign order. The shipment of railroad material was 586,814 tons, which is 229,097 tons less than in the preceding year. On foreign order have been shipped 120,886 tons, or 20.46 per

cent; of rolled shapes, 384,743 tons, or 50,077 tons less than the previous year, was shipped, of which only 12,183 tons, or 3.22 per cent, was sold on foreign order. The shipments of steel bars totaled 279,456 tons. The exports of steel bars could have been much higher, says the report, if the steel works had been free from the fetters of government control, this being the more regrettable, as it evidently has caused the loss of several important markets to foreign competitors. The accompanying table shows the year's shipments.

## NEWS FROM WASHINGTON

By PAUL WOOTON  
Special Correspondent

### Bain's Renomination as Director in Doubt

Position May Go To Pay Political Debt—Fall Said To Be Making Inquiries as to Bain's Experience

Some apprehension is felt at this writing concerning the directorship of the U. S. Bureau of Mines. A report is in circulation to the effect that the position may be filled by a man to whom the administration owes a political debt. Since Dr. H. Foster Bain, the acting director, has been connected with American mining enterprises abroad during the greater part of recent years, and from the fact that he never has been at all active in politics, it is certain that he had no part in the recent Republican success.

There has been much talk about an honest-to-goodness dirt farmer in connection with the selection of the Secretary of Agriculture, and there are some advocating the application of the same principle in the selection of a director for the Bureau of Mines. The fact that the new Secretary of the Interior for many years was engaged in prospecting and has a large acquaintanceship among honest-to-goodness prospectors has given rise to the idea that such procedure would not be unusual.

At the office of Secretary Fall it is stated that there is no ground whatever for the rumor. On the other hand, it is known that the secretary is making some inquiry in regard to Dr.

Bain's practical experience. There is reason to believe, however, that he will follow the precedent of former administrations in continuing in office the heads of technical bureaus, regardless of any political consideration.

Dr. Bain accepted with reluctance the acting directorship of the Bureau of Mines. It meant a considerable financial sacrifice on his part. He was induced to accept the place by the argument that he would be in a position to do great service to the mining industry. He has refused to allow any steps to be taken by his friends toward advancing him for continuation in office. On the other hand, it is known that there is some activity in behalf of aspirants for the place.

### Three Years' Tungsten Supply in Stock Here, Says Hess

More than three years' supply of tungsten ore is being held in stock in this country, in the opinion of Frank L. Hess, tungsten specialist for the U. S. Geological Survey. For this reason, he points out, the production of tungsten concentrates in the United States in 1920 was practically negligible. The only operations conducted during the year were those of the Wolf Tongue Mining Co. and the Vasco Mining Co., of Boulder, Col. The two companies produced in 1920 a tonnage that was equivalent to 216 short tons of ferberite ore, carrying 60 per cent tungsten trioxide.

### Poindexter To Remain Chairman of Senate Committee on Mines

Senator Gives Up Work on Certain Other Committees—Republican Members Named

Senator Poindexter, of Washington, is to continue to head the Committee on Mines and Mining of the Senate. Owing to the fact that the number of Senate committees has been greatly reduced and as there is an unusually large number of Republicans to be considered for committee assignments, objection had been raised to Senator Poindexter's service on a number of important committees. In addition to his chairmanship of the Committee on Mines and Mining he held during the last Congress membership on Interstate Commerce, Naval Affairs, Pensions, Postoffices and Postroads, Public Lands, as well as on minor committees. Final action has been taken on the matter, however, and he is to continue during the next Congress as chairman of the Committee on Mines and Mining, and, in addition, he will hold his membership on the committees of Interstate Commerce, Naval Affairs, and Public Lands.

Republican members of the Senate Committee on Mines and Mining, in addition to the chairman, have been chosen as follows: McCormick, Illinois; Newberry, Michigan; Nicholson, Colorado; Sutherland, West Virginia, and Norbeck, South Dakota. The minority members have not been designated.

### War Mineral Awards

Awards totaling \$25,696.77 were recommended during the week ended March 26 by the War Minerals Relief Commission. In the manganese claim of Thorkildsen & Miller an award of \$17,526.18 was recommended. The claimants had asked for reimbursement to the extent of \$24,248.35. In the case of the Manganese Products Co. an award of \$7,331.19 was recommended. The company had asked for \$98,865.48 to reimburse it for losses sustained in its manganese operations. Introduction of new evidence in the case of Hussey, Beam & McVay resulted in the recommendation of an award of \$645.40. This was 86 per cent of the amount claimed. The claim previously had been disallowed. An additional \$194 was recommended for G. Howard Garrison.

### Flotation Work at Platteville Successful

Information has reached the Bureau of Mines to the effect that it seems certain that Bureau of Mines engineers have assisted importantly in solving the fundamentals of the Wisconsin problem in the treatment of mill sands and slimes. The work has been handled by Messrs. Coghill and Anderson, of the bureau's staff, who had under their charge the flotation experiment work at Platteville, Wis.

To formulate plans for the work of the Alaska mining experiment station George S. Rice, the chief mining engineer of the Bureau of Mines, and Dorsey A. Lyon, its supervisor of stations, are planning to visit Alaska this summer.

### Missouri Appropriates \$150,000 for Rolla Station

The Missouri Legislature has appropriated \$100,000 for the building which the state will erect to accommodate the experiment station of the Bureau of Mines at Rolla. In addition \$50,000 was appropriated for Missouri's share of the co-operative work to be done at the station.

### Harding To Present Radium Gift to Mme. Curie

Plans have been completed for President Harding to present to Mme. Curie the gram of radium which is being given to her by the women of America. The presentation will be made at the White House on May 20. Mme. Curie will sail from France on April 20.

## NEWS BY MINING DISTRICTS

### Special London Letter

**Modderfontein "B" Cuts Main Reef Leader in Southwest Shaft—Modderfontein East Seeking Funds for Milling and Development Scheme—Cam & Motor's February Run**

BY W. A. DOMAN

London, March 22.—Two Far Eastern Rand gold-mining companies come into the limelight this week—the Modderfontein "B" and the Modderfontein East. The former has intersected the main reef leader in the southwest shaft at a depth of 1,488 ft., and the average reef width of eight sections taken round the shaft is 13.9 in., and the average value 29.1 dwt. This gives 405 in.-dwt., not quite up to the average of the ore reserves; but certainly good. As the New Modderfontein, Modderfontein Deep, and the Government Gold Mining Areas are on the western and southern boundaries, and contain ore with high gold values, the prospect of the Modderfontein "B" proving equally successful in this portion of its property is regarded as bright. The South Eastern shaft was not so fortunate, for the reef where struck was of an unprofitable character. The mine, considered not so many years ago as almost a "dud," has proved one of the best in the district.

The Modderfontein East had in mind a more extensive development and milling scheme, for which additional funds are required. At present the ore is treated at the Apex mill. Some weeks ago, in connection with its extended program, the Jupiter reduction plant was acquired for about \$110,000, a good bargain for both parties, seeing that on account of expenditure exceeding revenue the Jupiter had closed down and that the Modderfontein East could not elsewhere have secured a suitable plant

at such a reasonable figure. The total expenditure of the latter company on its scheme will run into approximately \$350,000. In any case, owing to high labor costs, the dismantling of the Jupiter plant and its re-erection at the Modderfontein East could not be accomplished in a hurry, and it now seems that the transfer will be delayed for some time, as insufficient funds are available for capital requirements. It was hoped that options over 373,000 shares at 22/6 per share would be exercised, but there is little prospect of this happening. Besides, the debenture issue of \$500,000 falls due for repayment at the end of July. As the money market is in no mood to put up funds for Kafirs, a scheme is being devised for meeting the situation. There can be no doubt that the debentures will be redeemed at due date, but the program of expansion cannot yet be executed. Pending satisfactory arrangements, operations will be continued on the present scale at the Apex plant. Recent developments have disclosed ore of a lower grade, but the reserves amount to 1,750,000 tons, of an average value of 7.75 dwt. over 55.3 in.

The strike of white miners in Rhodesia does not yet appear to be settled. According to some of the mining companies, the men had accepted the owners' terms unconditionally, but another message says that negotiations are still proceeding. At the Rhodesia Broken Hill mines, which, by the way, produced lead at a lower cost than anywhere else in the world, the men are totally unaffected. Possibly this may be explained by the fact that these properties are much further north, and that the men are well provided for in the way of housing and recreation.

Having remodeled its reduction plant, the Cam & Motor company, operating in Rhodesia, has announced the result of

the February run. The ore milled, 8,200 tons, had a screen value of 44/-, and gold contents of £18,040, at presumably standard price. Concentrates obtained were 989 tons, or 12 per cent of the original, the value per ton being £10 9s. 6d., and the total value £10,360. The value per cent of the original is thus 57.5. It is stated in a later message that the residue of first tanks concentrates treated indicates 90 per cent extraction. Costs for the month exceed the value obtained.

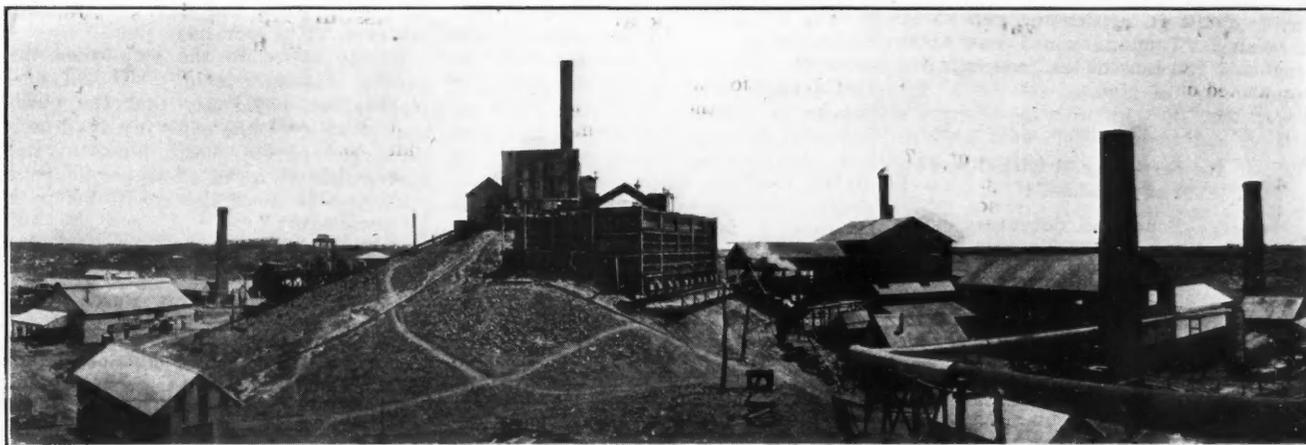
### AUSTRALIA

#### Queensland

**Proposed Process for Treating Mount Elliott Low-Grade Ores Would Net £2,000,000**

Brisbane, Feb. 21.—The annual report of Mount Elliott, Ltd. (Cloncurry), as submitted to a meeting of shareholders in London in December last, reached Queensland in January. During the twelve months covered by the report the smelters of the company remained idle, development was cut down to the most narrow limits, and the loss on the year's operations was £8,940. The failure, already reported, to obtain fresh capital in America is referred to in the report. The very life of the company is described as being dependent upon a railway being constructed to Mount Oxide. This it can obtain only if fresh capital is subscribed, and the directors have under consideration a scheme for the reconstruction of the company with this purpose in view.

Three estimates are given of the ore reserves of Mount Oxide copper mine—those of Edwin S. Berry, of Messrs. Yeatman & Berry, who was sent to Cloncurry on behalf of capitalists in New York to report on the company's mines; the chief govern-



PLANT OF MOUNT ELLIOTT, LTD. (COPPER), CLONCURRY DISTRICT, QUEENSLAND, AUSTRALIA

ment geologist of Queensland, B. Dunstan, and W. H. Corbould, consulting engineer of the company. Mr. Berry's estimate is 100,300 tons of 14.3 per cent ore and 83,300 tons of 10.5 per cent; Mr. Dunstan's is 200,000 tons, having a general average of 12½ per cent down to the 300 level, with evidently an immense deposit in the southern workings containing an average of 4 per cent; and Mr. Corbould's is 300,000 tons of an average grade of 10 per cent. This mine is regarded as one of the richest of its kind for its size in the world.

Mr. Corbould has submitted to the directors a process of his own for the treatment of the low-grade ores of the company's mines, and states that with his proposed treatment plant the profit to be derived from all the ore disclosed to date in the company's group of mines would amount to not less than £2,000,000. Under this treatment he believes that copper can be produced and shipped at port for £50 per ton.

#### Tasmania

##### Mount Bischoff Tin's Profits Dropped in Second Half of 1920

Waratah—The average price received for tin by the Mount Bischoff Tin Mining Co., of Tasmania, during the latter half of 1920, was £253 3s. 6d. per ton, as compared with £342 13s. for the previous six months. It is not surprising, therefore, that the margin of profit on the term's work was small—£3,414. In addition, £416 in interest was received, and £74,236 brought forward from previous account, making the available total £78,066.

#### New South Wales

##### Will Sell Great Cobar Copper Property

Cobar—The Great Cobar copper mine, New South Wales, is to be offered for sale at an early date. Once an important mining center, the Great Cobar went into the hands of a receiver in 1916, but a reconstruction scheme was formulated to obviate the need for selling during the war. The sum required was £100,000, and to keep the enterprise from failing the New South Wales government underwrote £40,000 of the receiver's certificate. The works were

reopened, and operations were so successful that the government received its capital back, with interest and a profit of over £25,000. Labor difficulties and the weak metal market have now, however, caused the present owners to decide that they will not resume operations, and the mines, machinery, rights, stores, rolling stock, and general equipment are to be offered for sale by tender.

#### Victoria

##### Bendigo Amalgamated Shareholders May Object To Erection of Rubber Works

Bendigo—The profit made by Bendigo Amalgamated Goldfields during the latter half of 1920 was £70,504, after providing £20,000 for depreciation and other contingencies. The gold recovered from 50,692 tons of ore milled totaled 32,507 oz., worth at the standard price £129,387, to which must be added £65,092 received in premiums from the Gold Producers' Association. The company has £150,000 in hand and purposes establishing rubber works at Bendigo. A. H. P. Moline, general manager, is visiting England and America in connection with the purchase of plant and machinery for the undertaking. There is likely to be some objection on the part of shareholders to the directors' proposals.

#### SOUTH AFRICA

##### Transvaal

##### Messina Company To Make Blister From Matte in Reverberatory

Messina—The Messina Development Co. is planning to start up a small reverberatory plant for refining copper. It is intended not only to refine blister copper by blowing in a reverberatory furnace in the usual way but also to bring high-grade matte to blister copper by blowing in another reverberatory. The customary converter has not been installed for this work because the tonnage to be handled is very small and the grade of matte made is from 60 to 65 per cent copper, owing to the fact that the ore is mostly bornite. The company had expected to begin work on its new plant in March but the start of operations has been postponed.

#### CANADA

##### British Columbia

##### Consolidated Closes Rock Candy Fluorspar Mine—Rumored Canada Copper May Change Hands

Nelson—Because of the impossibility of reducing wages in the mines of the Crow's Nest Pass district at the present time there is no likelihood of effecting a reduction in coal and coke prices, according to G. D. Robertson, Dominion Minister of Labor. Following a conference with the Western Coal Operators, Mr. Robertson informed F. A. Starkey, commissioner of the Associated Boards of Trade of eastern British Columbia, that there is very little profit made by Crow's Nest operators in coal production under existing conditions and that coke production is effected at a loss of about 60c. per ton.

Grand Forks—Consolidated Mining & Smelting Co.'s Rock Candy fluorspar mine, on the north fork of Kettle River, closed down April 1 because of lessened demand for output in steel operations at Gary, Ind. It is anticipated that the suspension will not last long.

Princeton—Rumors are persistent as to a possibility of change of ownership of the Canada Copper property at Copper Mountain, and of the concentrator at Allenby. If a change is made it will probably result in outright control by Consolidated Mining & Smelting Co., which has apparently had some understanding with the Canada Copper Corporation for some time. The West Kootenay Light & Power Co., a Consolidated subsidiary, has spent large sums in construction of a long distance transmission line to the district, and the Kettle Valley Ry., a Canadian Pacific subsidiary, incurred heavy expenses in building a spur line to the Canada Copper holdings, with a view to furnishing transportation. The control of the Consolidated is known to be vested in the Canadian Pacific.

Three Forks—The report of the Rambler-Cariboo Mines, Ltd., covering the past year, indicates but little development or production for 1920, owing to labor troubles and water shortage. Underground development con-

sisted of 404 ft. of drifting and 85 ft. of raising. Tonnage mined was 4,000, producing 220 tons of lead concentrates and 250 tons of zinc.

#### Ontario

##### Plan of Reorganizing British America Nickel Indorsed

**Sudbury**—Bond and debenture holders at meetings held in Toronto March 31 indorsed the proposed plans for the financial reorganization of the British America Nickel Corporation by the issue of \$24,500,000 in income bonds of three classes.

**Porcupine**—Plans for house construction for the accommodation of their employees have been adopted by the Hollinger Consolidated and the McIntyre. The former company will build upward of 100 houses in Timmins, and the McIntyre will put up thirty or more on the north side of Pearl Lake.

The Allied Porcupine Gold Mines, Ltd., has been incorporated, capitalized at \$5,000,000, to operate the La Palm and Three Nations properties in Whitney township. It is understood that the Jermy Veteran claim will also be included in the merger, giving the company control of over one square mile of territory in the northeastern part of Whitney township.

The Premier Paymaster, southwest of the Dome, has been reopened. Diamond drilling is being done to prove the extension eastward of a large ore-body met on the 200 level.

The directors of the Porcupine Keora propose to sell two of its claims to a new company. The proposition was submitted to the shareholders on April 4.

**Kirkland Lake**—The Lake Shore during February produced \$24,068 from the treatment of 1,458 tons of ore, the average recovery being \$16.44 per ton. The mill ran 83 per cent of possible running time.

**West Shining Tree**—George R. Rogers, president of the Wasapika Consolidated, announces that arrangements have been made for the erection of a mill, the first unit of which will be of 100 tons daily capacity.

#### Quebec

**Black Lake**—The shareholders of the Black Lake Asbestos & Chrome Co. have decided to move the head office from Toronto to Montreal in view of the recent change in the control.

#### MEXICO

##### Coahuila

##### Torreón Smelter Shuts Down Once More Owing to Lack of Fuel

**Torreón**—The smelting plant of the Cia. Minerales y Metales at Torreón closed down last week, having exhausted its fuel supply. The railroads are unable to bring in sufficient coal and coke, owing to the general strike of employees. Several thousand Mexican laborers are thrown out of employment.

At Dinamita, about twenty-five miles west of Torreón, is the only dynamite

factory in Mexico which has been furnishing explosives to the mines of the republic. Since the establishment of this factory prior to the revolution it has been protected by a high tariff on imported dynamite. According to a new law published in the official paper on March 14 these duties have been suspended, and the factory at Dinamita is threatening to close down, its owners declaring they cannot compete with the foreign factories in price.

#### Sonora

**Cananea**—Development work continues at the property of the Calumet & Sonora. Ore has been cut on the 900 level of the Chivera shaft. The finishing touches are being put on the reconstructed mill. The power plant has not yet been put into operation, owing to difficulties met in getting the new turbine generator started.

The Cananea Consolidated Copper Co. has a few repair men at work in the mines and also a few men doing various painting jobs at the smelter.

#### Chihuahua

The Cia. Explotadora de Santa Marta was recently incorporated, with 5,000 shares and capital stock paid up. It will reopen and operate the Santa Marta property, in the Barranca del Cobre in southwestern Chihuahua, about 45 miles from Creel, on the Kansas City & Orient R.R. About 150 acres are included in the holdings. Some ore had been shipped to the El Paso smelter prior to 1914. Dr. C. S. Bungart, of Fort Smith, Ark., is president; Dr. I. J. Bush, of El Paso, vice-president; H. W. Foster, secretary-treasurer, and T. W. Foster, manager.

#### MICHIGAN

##### The Copper Country

##### Copper Range, Mowhawk and Wolverine and Quincy Cut Wages—C. & H. and Subsidiaries Shut Down

The Copper Range group of mines has announced a reduction in all wages and salaries effective April 1. Under the new schedule the wages of miners will be \$3.50 per day and trammers and other labor \$3 per day. Quincy also cut wages on April 2.

The management of the Calumet & Hecla and subsidiaries has announced that all their properties will cease production for an indefinite period beginning April 1. This means the shutting down of the Calumet & Hecla Mining Co., the Ahmeek Mining Co., and the Isle Royale Copper Co., these being the only mines of this group operating since last November. This action is necessitated by the condition of the copper market and is in line with the policy of other large copper producers throughout the country.

Theodore Dengler, general manager of the Mohawk Mining Co. and Wolverine Copper Mining Co., has announced a general reduction of wages and salaries of all employees, taking effect April 1. The new schedule will be as follows: Miners, \$3 per day;

trammers, \$2.75 per day, and surface laborers, \$2.25 per day.

In his notice to the employees the general manager said: "To all employees we would say that the question of whether the company shall continue to operate these mines or not during this low price of copper depends upon you to meet the conditions with all your effort."

#### Menominee Range

##### Chapin Mine Cuts Force

**Iron Mountain**—The Chapin mine has let out about ninety men, this being the first reduction of forces at any of the Oliver Iron Mining Co.'s properties on the Menominee Range. The stockpile ground at the Chapin is about filled to its capacity and shipments will have to be made to permit much more stocking.

#### Marquette Range

##### Republic Company Closes Hartford Mine

**Ishpeming**—The Republic Iron & Steel Co. has closed its Hartford mine that had been operating only one shift, thus letting out about eighty men. The company has closed several other properties in its Lake Superior list.

#### MINNESOTA

##### Mesabi Range

**Duluth**—Referring to an item printed on p. 443 of *Engineering and Mining Journal* of March 5, George H. Crosby writes: "The *Engineering and Mining Journal* was in error when it involved me in the suit versus the Inland Steel Co. for improper operation of certain mining leases. There is no misunderstanding of any kind between myself and the Inland Steel Co., either personal or as agent for some one else."

#### ALABAMA

##### Gulf States Steel May Put Surplus Ore From Shannon Slope on Market—Furnaces Seek Lower Freight on Raw Material

**Birmingham**—Having completed its development work and being prepared to produce 2,000 to 2,500 tons of self-fluxing ore daily the Gulf States Steel Co. may offer ore on the open market, the supply which will come from the deep-mining slope at Shannon, eight miles south of Birmingham, being greater than the company needs. The mine is down 2,772 ft. from the surface and the slope is completely concreted.

The Woodward Iron Co. has already sunk a shaft to deep ore on some of its property and is prepared to begin the mining on a large scale. When the pig iron market shall have improved so as to warrant the resumption of operations at the several furnaces of the Woodward Co. the new mine will be drawn upon, though the older mining properties will supply ore for many years to come. Developments are under way south of Shannon with prospect of other deep-mining projects being

entered upon. Negotiations are under way with property owners in the lower part of Jefferson County looking to the development of the property. The belief is expressed that when the pig iron market returns to activity there will be much ore in demand. Two or three of the more active companies of this district have considerable ore stacked up already, while a fourth one has a good start on surplus ore and will be ready to increase the pig iron make on very short notice.

The Alabama company is preparing to test the Hammond ore field on Shinnbone Ridge, opposite its furnace plant site in North Gadsden, Etowah County. It is said that there is little doubt that the vein worked for 40 years on adjoining property will be found to exist on the Hammond tract.

Independent ore companies, now shut down because of no demand, are taking the opportunity to install improvements. The pig iron make in this district is very low, three independent companies each having a furnace going; namely, the Woodward Iron Co., the Alabama Co. and the Sloss-Sheffield Steel & Iron Co. The Tennessee Coal, Iron & Railroad Co. has five furnaces on basic iron, one on ferro-manganese and one on foundry iron.

Furnace companies in the Birmingham district are appealing to the Public Utilities Commission of Alabama for a reduction in freight rates on raw material from the mines and quarries to the furnaces. A few years ago the railroads handled the material for practically nothing to assist the iron manufacturing companies, but now it is proposed to make a material charge.

#### ARIZONA

**Arizona Copper Co. Defers Annual Meeting—Asbestos Deposits Open to Location April 15**

**Clifton**—The Arizona Copper Co. has deferred its annual meeting owing to the difficulty experienced in adjusting questions in connection with taxation upon which the company's secretary is now engaged in Washington. The board hopes that the report can be issued and the meeting held about the end of May.

**Douglas**—At a recent meeting in this city of the stockholders of El Tigre Mining Co., Charles M. Bush, of Kansas City, was elected a director, being retained in a place to which he had been temporarily chosen last fall after the death of his predecessor, O. V. Dodge, of Kansas City. The other directors were re-elected and L. R. Budrow, of Douglas, remains as manager. The statement was made by a director that no shut-down is contemplated, as producing costs have been reduced materially, though freight rates remain a serious burden.

**Bisbee**—The Boras Leasing Co. has started a raise on its 700 level to come up under the oxide orebody on the 600 level. Drifting continues on the 700 level to get under the sulphide stope on the 600 level.

The Night Hawk Leasing Co. has been shut down temporarily owing to an accident to the hoisting equipment.

**Patagonia**—Prospecting and development work has been resumed at the Flux mine.

**Chloride** — The Dardanelles Mining Co. shipped its eighth car of high-grade silver ore March 19. The north and south drifts are advancing steadily and both are opening up promising ore.

The White Hills property, twenty miles northwest of Chloride, has been taken over by Senator Keller and associates. The first work is being done by lessees, of which three groups are working.

**Globe**—Something of a rush is expected April 15 into the Apache reservation, east and north of Globe, that date having been set by the Indian Bureau for the opening for location of a number of known deposits of asbestos. The Indian agent has issued warning that any persons who try to evade the terms of the opening notice will be dealt with severely and will be considered as trespassers.

#### COLORADO

**Sunnyside M. & M. Co. Cuts Promising Vein Below 200 Level**

**Eureka**—In sinking the Washington shaft of the Sunnyside Mining & Milling Co. a promising vein of lead, zinc and copper ore has been opened below the 200 level. A crosscut indicates a width of over 40 ft. and assays run up to \$100 a ton. Contracts have been let for 700 ft. of drifting on the vein and a 500-ft. tunnel into the Brennem claim which adjoins the Washington. The Washington shaft will be sunk another 100 ft. The new vein is in virgin ground and is considered very encouraging. The company is laying plans for resumption of active mining operations on a larger scale.

**Denver** — The Colorado Fuel & Iron Co. at its annual meeting of stockholders elected the following: J. F. Welborn, Denver, president; S. J. Murphy, New York, vice-president; Fred Farrar, Denver, general counsel and executive assistant to the president; Wendell Stephens, Denver, attorney; S. G. Pierson, Denver, vice-president and treasurer; A. H. Lichty, Denver, vice-president in charge of industrial relations; E. S. Cowdrick, Denver, assistant to vice-president; E. H. Weitzel, Pueblo, general manager.

#### NEVADA

**Ore Shoot Recently Cut on 1,000 Level of Tonopah Divide Becomes Low Grade**

**Tonopah**—The gross value of gold and silver bullion shipped from the mills of this district, and representing results of two weeks' operations, totaled about \$300,000. The McCane shaft of the Tonopah Extension has reached a depth of 1,646 ft., good progress being made. On the 1,881 level from the Victor shaft, which is the

deepest working in the Tonopah district, three faces are being pushed, all of which are in Extension breccia, which is the ore-bearing formation in this portion of the district. In the West End mine development has been started from the 960 level of the West End shaft and from the 1,100 level of the Ohio shaft. Both workings are in favorable formation.

**Divide**—In the Tonopah-Divide mine some encouraging but erratic values have been cut in the southeast drift on the 800 level. On the 1,000 level the oreshoot entered about three weeks ago has become low grade. Crosscutting and drifting is being done to prospect the vein thoroughly, experience on the upper levels having proved that parallel lenses of ore can occur where the vein is wide, and conditions are favorable on this level, as the vein is very wide. The ore on this level was sulphide in character but not so hard and siliceous as on the level above.

The Tonopah Dividend is crosscutting to the vein on the 200 level and drifting on the 400 level. This is the same vein that the Divide Extension is working on, and in which this company has proved one oreshoot to have a length of at least 150 ft. and to contain high-grade ore, assays up to \$1,000 across a width of 4 ft. having been obtained.

**Tule Canyon**—The Silver Hills Mining Co. reports that the oreshoot recently cut in the drift on the 200 level is holding out well, the face of the drift now showing 5 ft. of \$80 ore, with face samples at least as good for several days. The face is approaching the projected position of rich orebodies which were formerly worked on the upper levels.

**Spanish Belt**—The 50-ton plant of the Consolidated Spanish Belt Mining Co. is to be completed in the near future. This mine has been under development for several years by this company and there is a considerable tonnage of milling ore in sight, with some narrow veins of high-grade assaying up to \$500 per ton, which have recently been discovered in virgin ground.

**Pioneer**—The Mayflower mill is operating successfully on limited tonnage which will soon be increased to about 30 tons per day. The grade of ore is about \$15 per ton and the extraction about 70 per cent by amalgamation and concentration.

**Pioche** — Ore shipments from the Pioche district for the week ended March 24 totaled 1,220 tons. Shippers were: Virginia Louise, 805 tons; Bristol, 320, and Black Metals, 95.

Operations at the Prince Consolidated mine are proceeding satisfactorily and shaft sinking has been started. A Snow horizontal duplex station pump, having a capacity of 175 gallons per minute, is being installed in No. 2 pump station. Within sixty days the lower proven ore beds should be reached and the long deferred expectations of the Prince Consolidated may be realized.

**Silver Horn**—The Silver Dale Mining Co., which is operating and mining high-grade silver ore, recently cut ore running over 400 oz. per ton. Material and supplies for the new Silver Dale camp are being freighted to Silver Horn as fast as teams and railroad can get them there.

The Silver Horn company has increased its working force by five men and is again building additional bunk houses. This company reports that it will soon put on more men and work a second shift. The company's mine development program entails some deeper development, and the present work will open up the vein at a depth of about 150 ft.

The townsite of Silver Horn has been established on patented ground joining the Silver Horn Mining Co.'s property, and recently a number of lots have changed hands. Arrangements have been made with the Silver Horn company whereby water will be supplied to the new town.

#### CALIFORNIA

##### Nevada Progressive Plans To Build 150-Ton Cyanide Mill—Central Eureka To Install Hoist and Steel Headframe

**San Francisco**—F. B. Farish, Edwin Higgins and Roy H. Elliott, of the Metals Exploration Co., recently visited Grass Valley to inspect operations at the Idaho Maryland, which has been reopened under the superintendence of John A. Fulton.

D. C. Jackling and others interested have recently visited the Bully Hill mines at Winthrop, Shasta County, where a metallurgical plant for treating zinc ores is being installed by the Shasta Zinc & Copper Co.

**Sweetwater**—The Nevada Progressive Gold Mining Co., owned by Chicago interests, is planning to construct a 150-ton cyanide mill at the Silverado and Kentucky mines. The Bodie power plant on Green Creek has been acquired and a twenty-five-mile power line is to be constructed to the Silverado mine.

**Kennett**—The Mammoth copper mine has closed down indefinitely.

**Sutter Creek**—Plans for installing a hoist and steel headframe are under consideration by the Central Eureka Mining Co. to replace the present equipment. The shaft will be straightened and repaired so that larger skips can be used. Good headway in diamond drilling is reported from the Old Eureka.

**Jackson**—Unwatering operations are still in progress at both the Argonaut and Kennedy mines.

**Browns Valley**—Seattle interests are said to have taken an option on the old Smethurst mine in Yuba County and are planning to reopen it.

**Placerville**—The Grit Mining Co. has purchased a mill compressor and accessory equipment, and it is said that construction will begin at once. Lode properties in the Spanish Dry Diggings near Greenwood are being developed.

#### IDAHO

##### Cœur d'Alene District

##### Extension of Success Vein Found—Rich Ore Shoot Cut in Alhambra

**Wallace**—The western extension of Success vein has been found on adjoining ground by the Belle of the West Mining Co., of which George R. Trask, mining engineer, is president and manager. The vein is 20 ft. wide and along the hanging wall there is 5 ft. showing stringers and bunches of lead-silver ore with considerable chalcopryrite. There is a good showing of ore in the upper tunnel about 150 ft. east and commercial ore is looked for when the drift reaches a point under it. The company is being financed by certain New York interests.

A letter from Donald A. Callahan, president of the Chicago-Boston Mining Co., to the stockholders, explaining the necessity for the recent assessment of 2c. per share, says that when the Interstate-Callahan, now the Callahan Zinc-Lead Co., took over control of the Chicago-Boston the first-named company loaned the latter \$100,000 for development purposes. This fund has now been exhausted and the Callahan company is not in position to make further advances. Therefore, Mr. Callahan says, it became necessary to levy an assessment to provide funds for further development. Of the sum loaned by the Callahan company \$25,000 was paid for two additional claims, \$3,336 was advanced to the Kill Buck Mining Co., and \$68,935 expended in construction, equipment and development work. A report from C. W. Newton, mine manager, says that good bodies of lead-silver ore have been opened on the 100 and 200 shaft levels, and that on the 400, the next level, the vein is "from 10 to 15 ft. in width, well defined, showing seams of ore running high in silver, and in places widening to 2 ft. of high-grade milling ore."

**Kellogg**—An important strike is reported on the Alhambra, which is being developed by the Bunker Hill & Sullivan company. The property is situated at the head of Elk Creek and joins the Bunker Hill group on the east. It is stated that a crosscut has intersected an ore shoot 4 ft. wide, carrying lead-silver and gray copper and running high in silver. The ore shoot had been located by diamond drilling.

#### SOUTH DAKOTA

##### Eagle Bird Starts 1,500-Ft. Tunnel—Homestake Completes Installing Ellison Hoist

**Deadwood**—The Eagle Bird Mining Co. has let a contract for driving a 1,500-ft. tunnel and the work has been started. The power line has been extended from the Two Johns mine, 1½ miles away, and an Ingersoll-Rand compressor installed. The property is situated on Squaw Creek below the Trojan mill and the present work is the start of active development of this ground. The tunnel will be driven on creek level and will give a depth of 400

ft. from the outcrop of the ore at the surface.

**Lead**—Installation of the electric hoist at the Ellison shaft is about completed. Excavations for skip pockets and underground crushers are now being made and the new equipment will be in use some time this year. The crusher stations and loading pockets will be below the 800, 1,400 and 2,000 levels and the ore will be broken to about 4½-in. size before it is delivered to the skips. The arrangement for loading skips will be the same as that now in use at the B & M shaft. Seventon skips will be used and the new hoist will have a capacity of 4,000 tons in fifteen hours from a depth of 2,300 ft.

#### Chronology of Mining

##### March, 1921

**March 1**—Consolidated Mayflower mill at Pioneer, Nev., resumed operations.—Davidson Consolidated mine, Porcupine, Ont., reopened.

**March 2**—Black Lake Asbestos & Chrome Co., Ltd., passed under control of J. A. Jacobs, Montreal.

**March 3**—All explosives licenses cancelled by Federal government and a new act superseded war-time regulations.

**March 6**—San Rafael mill at Pachuca, Hidalgo, Mexico, burned down.

**March 15**—A. S. & R. smelter at Murray, Utah, and U. S. Smelting, Refining & Mining Co.'s plant at Midvale reduced day wages 25c. for unskilled and 50c. for skilled labor.

**March 20**—Howe Sound Mining & Milling Co.'s plant at Britannia Beach, B. C., burned down.—Hercules and Tamarack & Custer mines in Idaho closed down.

**March 21**—Union Sulphur Co. filed suit against Texas Gulf Sulphur Co. for \$6,678,000, alleging illegal extraction of sulphur from its holdings by defendant.

**March 23**—Thomas Park brought suit for \$1,250,000 against Richard V. Dey, of San Francisco, in Supreme Court at New York, the purchase of Grand Reef Mines, in Graham County, Ariz., being involved.

**March 26**—William H. Taft consented to conduct investigation into affairs of American Smelting & Refining Co. upon invitation by company management, as result of charges made by Karl Eilers.

**March 28**—United Eastern Mining Co., of Oatman, Ariz., given decision in apex suit brought against it by Tom Reed Gold Mines Co.—North Butte Mining Co., Butte, Mont., suspended production.

**March 29**—Anaconda, Utah, Ray Consolidated, Chino and Nevada Consolidated announced immediate and complete shutdown for indefinite period. Old Dominion and Burro Mountain Branch of Phelps Dodge Corporation had previously taken similar action.

**March 31**—Magma Copper Co., Superior, Ariz., closed down.

# THE MARKET REPORT

## Daily Prices of Metals

Month	Copper, N. Y. net refinery <sup>a</sup> Electrolytic	Tin		Lead		Zinc
		99 Per Cent	Straits	N. Y.	St. L.	St. L.
31	12.50	27.75	29.00	4.25@4.40	4.25	4.65
Apr. 1	12.50	27.75	29.00	4.25@4.35	4.25	4.65
2	12.50	27.75	29.00	4.25@4.35	4.25	4.65
4	12.50	27.50	28.75	4.25@4.35	4.25	4.65
5	12.50	27.50	28.75	4.25@4.35	4.25	4.65
6	12.50	28.00	29.50	4.25@4.35	4.25	4.65

<sup>a</sup>These prices correspond to the following quotations for copper, "delivered": 12.75c. for the week.

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 March

Copper:	
New York Electrolytic.....	11.976
London Standard .....	67.565
London Electrolytic .....	71.190
Lead:	
New York .....	4.084
St. Louis .....	4.000
London .....	18.911
Silver:	
New York, foreign.....	56.023
New York, domestic.....	99.500
London .....	32.479
Sterling Exchange .....	389.806
Zinc:	
St. Louis .....	4.737
London .....	25.077
Tin:	
99 per cent .....	27.296
Straits .....	28.806
London .....	156.024
Antimony .....	5.282
Quicksilver .....	46.796
Platinum .....	72.463

## London

Month	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3 M	Spot	3 M	Spot	3 M
	Spot	3 M							
31	70	69½	72½	158½	162	20	20½	24½	25½
Apr. 1	69	68¾	72½	157½	160¾	19¾	20¾	24½	25½
2	...	...	...	...	...	...	...	...	...
4	68	67½	72½	154	157	19¾	19¾	24	25½
5	68¾	68	71½	152½	156½	19¾	19¾	24½	25½
6	68¾	68½	71½	154½	157¾	20	20½	24½	24½

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

Mar.	Sterling Exchange	Silver			Apr.	Sterling Exchange	Silver		
		New York, Domestic Origin	New York, Foreign Origin	London			New York, Domestic Origin	New York, Foreign Origin	London
31	391½	99½	57½	33½	4	390	99½	57	33½
Apr. 1	391	99½	56½	32½	5	390	99½	56½	33
2	390½	99½	56½	32½	6	391	99½	57½	33½

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, April 6, 1921

Conditions have been very dull indeed during the last week, and prices are substantially unchanged. The undertone is firm, despite meager sales. Curtailments continue, and it is understood that the Broken Hills works, in Australia, will close down entirely until more prosperous times.

Transatlantic freight rates have been raised considerably. The French line was largely responsible for the recent cut, and at one time rates as low as \$3 per long ton were quoted from Baltimore. This line has now joined the Conference, however, and will hereafter abide by the rates set by that body. From New York to Germany the new

rate is \$8.80 per long ton; to French, Dutch, and Belgian ports, \$8; and to English ports, \$11, as before.

### Copper

Producers did a fairly satisfactory business in the closing days of last week at 12.75c. delivered, for April shipment. Since Monday, however, the demand has died away, and only a few small domestic sales are reported. Several sellers are willing to accept 12.75c. for April or May, and even slightly under this figure has been rumored. The large producers as a rule cling to the 13c. price set some time ago. Copper for June could probably be obtained for 12.875c. and for July at 13c., but producers are not anxious to go so far into the future.

Demand from Europe, chiefly by Germany and France, continued fairly good throughout the week, practically all of the business being done through the Copper Export Association at the reported price of 12.75c., c.i.f.

### Lead

On Thursday, March 31, the American Smelting & Refining Co. increased its price of lead, New York and St. Louis, from 4.10c. to 4.25c. This was more nearly in accord with the outside market.

The situation in lead has been rather peculiar. One producing interest has been willing to sell for April, and in some cases even for early May, at 4.25c. New York, whereas other producers and agencies have been quoting 4.375@4.50c., and even up to 4.625c. Some business was done as high as 4.35c., but those who were asking the higher figures sold practically nothing except small lots to those who were out of touch with conditions. A large tonnage for these times, however, was sold at 4.25c. An encouraging feature is that the demand was well distributed among the various classes of consumers. The premium on chemical lead is decreasing, not more than 15 points now being asked by any producer. Demand is slack. Lead for future delivery is scarce and would be difficult to obtain under 4.40@4.50c.

### Zinc

The market remains unchanged at 4.65c., St. Louis. Producers generally report a lack of interest in the trade, and sales are confined to small lots, mainly for galvanizing purposes. Brass manufacturers are almost entirely out of the market, as much scrap material suitable for their purposes continues

to be offered. Brass Special was sold last week in small amounts, a few car-load lots, at 4.75c., East St. Louis. High-grade zinc can be obtained for 7c., but this price has been shaded. Zinc producers are relying strongly upon the early passage of a higher tariff to help them out of their difficulties.

### Tin

Tin has been as inactive as usual, though a little spurt took place yesterday afternoon. Electrolytic sales have been small, at about the same price as Straits.

Straits tin for future delivery: March 31st, 29@29.50c.; April 1st, 29@29.50c.; 2d, 29@29.50c.; 4th, 29@29.25c.; 5th, 28.75@29c.; 6th, 29.25@29.75c.

Arrivals of tin, in long tons: March 28th, China, 5; 29th, Singapore, 25. Total for March, 1,613.

### Silver

The silver market has continued dull, with lower tendency in London. There has been no China demand, and Indian orders are the only support of the market. Demand for domestic consumption continues limited. Foreign supplies, however, are small, owing to curtailment of production by closing down of mines in Mexico and Canada.

Mexican Dollars—March 31st, 43½; April 1st, 43; 2d, 43; 4th, 43½; 5th, 43½; 6th, 44½.

### Gold

Gold in London: March 31st, 104s. 9d.; April 1st, 104s. 10d.; 4th, 105s.; 5th, 105s. 5d.; 6th, 104s. 11d.

Gold is pouring into the United States from all over the world, and it is estimated that \$150,000,000 has been received so far this year. The Federal Reserve Board states that approximately \$53,000,000 has come from England; \$44,000,000 from France; \$22,000,000 from Asia; \$10,000,000 from Canada; \$8,000,000 from Sweden; \$5,000,000 from The Netherlands; and \$5,000,000 from South America. The only considerable export of gold has been \$3,000,000 to Cuba.

### Foreign Exchange

On Tuesday, April 5, francs were 7.025c.; lire, 4.17c.; and marks, 1.63c. New York funds in Montreal have declined considerably, and were quoted at 11½ per cent premium.

### Other Metals

Aluminum—List prices of 28@28.5c. are nominal. Outside market, 22@23c. per lb.; 22½c. for imports, duty paid.

Antimony—Chinese and Japanese brands, 5½@5¾c.; market dull. W.C.C. brand, 5¾@6c. per lb. Cookson's "C" grade, spot, 9¾c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb. Demand light, with heavy supplies available.

White antimony oxide, Chinese, guaranteed 99 per cent Sb<sub>2</sub>O<sub>3</sub>, wholesale lots, 6½@7c.

Bismuth—\$1.50@1.65 per lb., 500-lb. lots.

Cadmium—Nominal, \$1@1.10 per lb., in 1,000-lb. lots. Price reduced as a reflection of London drop. Smaller quantities, \$1.10@1.25 per lb.

Cobalt—Metal, \$4 per lb.; black oxide, \$3@3.10 per lb. in bbls.; sulphate, \$1.35 per lb. in bbls.

Iridium—Nominal, \$250@300 per oz.

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

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 38@40c.

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

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

Palladium—\$65@70 per oz.

Platinum—\$72@74 per oz. Market a little softer.

Quicksilver—Nominally, \$45@47 per 75-lb. flask. San Francisco wires, \$45.50.

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 Cr<sub>2</sub>O<sub>3</sub>, foreign ore with a maximum of 6 per cent silica, 45@50c. per long ton unit, f.o.b. Atlantic ports.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, \$7.45; Mesabi bessemer, 55 per cent iron, \$7.20; Old Range non-bessemer, 51½ per cent iron, \$6.70; Mesabi non-bessemer, 51½ per cent iron, \$6.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, \$5.80; old bed concentrates, 63 per cent, \$6.70; Harmony, cobbled, 63 per cent, \$6.70; new bed low phosphorus, 65 per cent, \$9.50.

Manganese Ore—30c. per unit, seaport; chemical ore (MnO<sub>2</sub>) \$60 per gross ton, lump; \$70@75 per net ton, powdered. Market dull.

Molybdenum Ore—85 per cent MoS<sub>2</sub>, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

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

Tungsten Ore—Scheelite or wolframite, 60 per cent WO<sub>3</sub> and over, per unit of WO<sub>3</sub>, \$3@3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U<sub>3</sub>O<sub>8</sub> and 5 per cent V<sub>2</sub>O<sub>5</sub>, sells for \$1.50 per lb. of U<sub>3</sub>O<sub>8</sub> and 75c. per lb. of V<sub>2</sub>O<sub>5</sub>; ore containing 2

\*Furnished by Foote Mineral Co., Philadelphia, Pa.

per cent U<sub>3</sub>O<sub>8</sub> and 5 per cent V<sub>2</sub>O<sub>5</sub>, sells for \$2.25 and 75c. per lb., respectively; higher U<sub>3</sub>O<sub>8</sub> and V<sub>2</sub>O<sub>5</sub> content commands proportionately higher prices.

Vanadium Ore—\$1.50 per lb. of V<sub>2</sub>O<sub>5</sub>, (guaranteed minimum of 18 per cent V<sub>2</sub>O<sub>5</sub>), New York.

Zircon—Washed, iron free, 3c. 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., April 2—Zinc blende, per ton, high, \$24.90; basis 60 per cent zinc, premium, \$22.50; Prime Western, \$22.50; fines and slimes, \$21@18. Average settling price, all grades of zinc, \$23.83.

Lead, high, \$44.10; basis 80 per cent lead, \$42.50; average settling price, all grades of lead, \$42.68 per ton.

Shipments for the week: Blende, 6,572; lead, 1,340 tons. Value, all ores the week, \$189,990.

Though there is an unusually large reserve stock of zinc ores in bins throughout the district, buyers can secure but a limited tonnage of current offerings, the owners of reserve ore apparently being able to hold it indefinitely. The purchase this week was around 2,500 tons less than the output, yet most buyers were short on orders at the week-end. An advance of \$2.50 per ton for lead was made this week to encourage an increased production.

Platteville, Wis., April 2—No market for zinc or lead. Shipments for the week: Blende, 7,450 tons. Shipments for the year: Blende, 10,315; lead, 5,550 tons. Shipped during the week to separator plants, 576 tons blende.

### Non-Metallic Minerals

Asbestos—Crude, No. 1, \$2,000@ \$3,000; 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. South Carolina points. Foreign barytes, prime white material, \$25 per net ton f.o.b. Atlantic seaports. Western grades are \$24.50. Crude quoted \$7 per long ton, f.o.b. Cartersville, Ga. Small lots as low as \$5.

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

China Clay (Kaolin)—Crude, \$8@ \$10; washed, \$10@12; powdered, \$15@ \$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, \$15@ \$20, f.o.b. Virginia points. Domestic lump, \$10@20; powdered, \$25@30; imported lump, \$15@25, f.o.b. American ports; powdered, \$35@45, 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, \$20 per ton, f.o.b. Illinois mines, and \$20, f.o.b. Kentucky; ground, suitable for acid, chemical or enameling purposes, \$60; lump, \$17.50, f.o.b. Heathden, 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. mines. California grades, Floridon, \$43 per ton; Medina, \$39. Local grades, \$15@\$25, f.o.b. mines. Large oil companies use Floridon grade.

**Graphite**—Ceylon lump, first quality, 8@9c. per lb.; chip, 7c.; dust, 5½c. No. 1 flake, 7c.; high-grade amorphous crude, 3c.

**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**—Crushed, New York State shipping points, ¾ in. size, \$1.40@\$2 per net ton; 1½ in., \$1.50@\$2. Prices for other sizes practically the same. Agricultural limestone, \$2.50@\$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

**Magnesite, Calcined**—High-grade caustic calcined, lump form, \$30@\$35 per ton, carload lots, f.o.b. California points. In Chicago district, \$57.70; Atlantic seaboard, \$60.

**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, 35c.; No. 5, \$1.20; No. 4, \$2.50@\$3; No. 3, \$3.50@\$4; No. 2, \$4.50@\$6; No. 1, \$5.50@\$6.50. Clear block: No. 6, 50c.; No. 5, \$1.75; No. 4, \$3.25; No. 3, \$5; No. 2, \$6.50; No. 1, \$8; A1, \$6.50@\$8.50; extra large, \$25; ground, wallpaper grade, \$90@\$160 per ton (depending upon quantity); all f.o.b. New York.

**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, \$12.50; 75 per cent, \$11.50; 75@74 per cent, \$11; 70 per cent, \$7.35; 68 per cent, \$6.85; 68@66 per cent, \$6.60.

**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, 16c., c.i.f. Atlantic seaport; furnace size,

16½c.; Spanish lump, 14@15c.; 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.

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

**Talc**—Paper making, \$11@\$20 per ton; roofing grades, \$8.50@\$13; rubber grades, \$11@\$18; all f.o.b. Vermont. California talc, \$18@\$40, talcum powder grade. Southern talc, powdered, carload lots, \$10@\$14 per ton; less than carload, \$25, f.o.b. cars. Imported, \$35@\$40; Canadian, \$20@\$40 per ton.

### Mineral Products

**Arsenic**—White arsenic, 8@9c. per lb. in carload lots.

**Sodium Nitrate**—\$2.60 @ \$2.75 per cwt. ex vessel, Atlantic ports. Market quiet.

**Sodium Sulphate**—For 95 per cent material, \$20 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract; \$32@\$33 per ton, New York.

**Potassium Sulphate**—Domestic, \$215 @ \$220 per net ton, basis 90 per cent, f.o.b. New York.

### Ferro Alloys

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

**Ferrocerium**—Per lb., \$12@\$15.

**Ferrocromium**—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 15c. per lb. of chromium contained; 4 to 6 per cent carbon, 16@17c., f.o.b. works.

**Ferromanganese**—Domestic 76 to 80 per cent, \$90@\$95, f.o.b. furnace; resale, \$90, delivered; English, \$90@\$95, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, \$32, f.o.b. furnace.

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

**Ferrosilicon**—For 10 to 15 per cent, per gross ton, f.o.b. works, \$50@\$55; 50 per cent, \$85@\$90; 75 per cent, \$145@\$150.

**Ferrotungsten**—Domestic, 70 to 80 per cent W, 54@58c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c. duty paid f.o.b. Atlantic ports.

**Ferro-uranium**—35 to 50 per cent U, \$6 per lb. of U contained, f.o.b. works.

**Ferrovandium**—Basis 30 to 40 per cent, \$5 per lb. of V contained, plus 75c. @ \$2 differentials and according to silicon content, f.o.b. works.

### Metal Products

**Copper Sheets**—Current New York list price, 20@20½c. per lb.; wire, 15c.

**Lead Sheets**—Full lead sheets, 7½c.; cut lead sheets, 7¾c. in quantity, mill lots.

**Nickel Silver**—33½c. per lb. for 18 per cent nickel.

**Yellow Metal**—Dimension sheets—18½c.; sheathing, 17½c.; rods, ¾ to 3 in., 15½c.

**Zinc Sheets**—\$11 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 10c. per lb.

### Refractories

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

**Chrome Cement**—40@45 per cent Cr<sub>2</sub>O<sub>3</sub>, \$45@\$50 per net ton, and \$55 in sacks, carload lots, f.o.b. eastern shipping points.

**Chrome Brick**—Straights, \$80 per net ton, shipping point; arches, keys, wedges, \$85; splits, soaps, \$100.

**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, \$90 @\$100 per net ton; 9-in. arches, wedges and keys, \$105; soaps and splits, \$120.

**Silica Brick**—9-in., per 1,000: \$45@\$55 in carload lots, f.o.b. shipping points.

### The Iron Trade

Pittsburgh, April 5, 1921

Demand for steel products is more widespread, but the tonnages called for are small, most of the business being in single carload lots.

Production by the Steel Corporation has been holding up lately better than was expected, after the sharp decline from the middle of January to the forepart of March. The Corporation's ingot production last week was 45 per cent of capacity. Independent production is still estimated at about 20 per cent, but there are many changes at individual plants.

Bars, shapes, and plates have been unchanged in the independent market for several weeks, at 2c. for bars and 2.10c. for shapes and plates, for the usual run of orders. Sheets are lower this week, at 3.75c. for black and 4.80c. for galvanized, in carloads with desirable specifications, or \$2 a ton decline in black and \$3 or \$4 in galvanized in a week or ten days.

The Steel Corporation maintains its prices, and trade is so dull that there is only mild interest in the question when and by how much the Corporation will reduce its quotations, which are still those of the Industrial Board schedule of March 21, 1919.

**Pig Iron**—The market remains inactive, and is quotable at \$25 for bessemer, malleable, and foundry, and \$23 for basic, at Valley furnaces. W. P. Snyder & Co.'s computed averages for March are \$26.20 for bessemer and \$24.50 for basic, at Valley furnaces. The average quotation on foundry iron was \$25.89, Valley.

### Coke

**Connellsville**—Furnace, \$4.75@\$5.25; foundry, \$5.50@\$6.50.

<sup>1</sup>Footnote Mineral Co., Philadelphia, Pa.

## COMPANY REPORTS

### Eagle & Blue Bell Mining Co. Increases Net Gain

Lead; Utah

The annual report of operation of the Eagle & Blue Bell Mining Co. for 1920 states that mining operations show a net gain of \$254,872.23, and, with interest of \$10,236.69 received, make a total net gain of \$265,108.92, an increase of \$162,583.97 over the previous year. Production amounted to 3,178.5 oz. gold; 528,306 oz. silver; 5,408,375 lb. lead, and 1,095 lb. copper, from 26,641.1 dry tons of ore. Smelter returns totaled \$544,568.59. Operating statement follows:

Gross earnings.....	\$544,568.59	
Revenue from rents, etc.....	1,097.25	
<b>Total .....</b>	<b>\$545,665.84</b>	
Operating expenses		
Mining .....	\$168,748.53	
Management .....	35,042.08	
Insurance, taxes .....	36,194.66	
Mine development .....	50,808.34	290,488.91
<b>Net operating gain.....</b>	<b>\$254,872.23</b>	

#### Profit and Loss Account

Debits		Credits	
Depreciation .....	\$ 8,171.57	Net operating gain .....	\$254,872.23
Depletion .....	82,401.98	Interest .....	10,236.69
Balance to surplus .....	174,535.37		
	<b>\$265,108.92</b>		<b>\$265,108.92</b>
Earned surplus balance, Dec. 31, 1919.....	\$ 31,193.49		
Balance to surplus .....	174,535.37		
			<b>\$205,728.86</b>
Less dividends paid in 1920.....			178,629.20
			<b>\$ 27,099.66</b>

Three dividends were paid during the year, two of 10c. each per share, paid from net earnings, and one of 15c., paid from reserve for depletion—a total of \$312,601.10.

### Barnes-King Development Co. Retrenching

Gold; Montana

A report covering the operations of the Barnes-King Development Co. for 1920 states that the Piegan-Gloster and North Moccasin mines were closed down during the year in June and September, respectively. The Shannon mine was worked continuously throughout the year, giving a profit of \$52,337.33. The company's net profit for the year was, however, considerably reduced by reason of the losses incurred at the North Moccasin and Piegan-Gloster properties, and also because of general unsatisfactory operating conditions due to continued high prices of labor and supplies. The company paid three dividends, at the rate of 5c. per share each, totaling \$60,000, and making total dividend disbursements of \$440,000 to date. A general profit-and-loss account follows:

Property Operations			
Profit on operation of Shannon property.....	\$52,337.33		
Profit on operation of Kendall property.....	2,009.69		
<b>Total property net earnings.....</b>		<b>\$54,347.02</b>	
Loss on operation of North Moccasin property.....	\$32,693.11		
Less royalties received.....	\$4,236.23		
Profit on sale of supplies.....	270.08	4,506.31	\$28,186.80
Loss on operation of Piegan-Gloster property.....	\$10,840.22		
Less profit on sale of supplies.....	6.17	10,834.05	
<b>Total property net losses.....</b>		<b>39,020.85</b>	
<b>Net earnings from property operations.....</b>		<b>\$15,326.17</b>	
Miscellaneous income.....		3,175.59	
<b>Total earnings.....</b>		<b>\$18,501.76</b>	
Expenses			
Development of Black Hawk option.....	\$2,872.15		
Development of Betsy Baker option.....	1,689.61	\$4,561.76	
Examination of new properties.....	5,035.41		
Taxes paid.....	4,781.60		
Extraordinary expenses.....	1,383.60		
<b>Total expense.....</b>		<b>15,762.37</b>	
<b>Net profit for year 1920.....</b>		<b>\$2,739.39</b>	

### Lake Shore Mines, Ltd., Reports Profit

Gold, Silver; Ontario

A report of operations of the Lake Shore Mines, Ltd., for the year ended Nov. 30, 1920, states that bullion valued at \$483,701.93 was produced from 18,889 tons of ore milled. Profit and loss account for the year follows:

Income	
Bullion production.....	\$483,701.93
Exchange on bullion sales.....	41,576.45
Interest on victory bonds.....	2,750.00
<b>Total .....</b>	<b>\$528,028.38</b>
Expenses	
Operating expense.....	\$236,792.62
Administration expense.....	16,438.73
Depreciation of buildings and equipment .....	29,779.44
Exchange on dividend cheques.....	10,025.00
	<b>293,035.79</b>
<b>Profit before providing for exhaustion or Dominion taxes .....</b>	<b>\$234,992.59</b>
Provision for exhaustion.....	\$120,000.00
Provision for Dominion war taxes.....	10,000.00
	<b>130,000.00</b>
<b>Net profit.....</b>	<b>\$104,992.59</b>

Dividends amounting to \$80,000 were paid during the year. Debit balance on Dec. 1, 1919, was \$47,010.13; on Nov. 30, 1920, \$22,017.54.

### Ahmeek Sells Copper at Profit

Copper; Michigan

The annual report of operations of the Ahmeek Mining Co. for 1920 states that 20,489,438 lb. of copper was produced, at a cost of 16.08c. per lb.; 9,929,782 lb. was on hand January, 1920, valued at 17.32c.; 12,856,495 lb., valued at 17.04c., was delivered during 1920 at 18.60c., and 17,562,725 lb. was on hand Dec. 31, 1920, valued at 13c. Earnings statement follows:

Received for copper, delivered (18.60c.).....	\$2,391,358.40
Cost of copper, delivered (17.60c.).....	2,262,191.54
Gain on copper delivered.....	\$129,166.86
Loss by reduction of copper on hand to market value..	540,667.38
<b>Balance .....</b>	<b>\$411,500.52</b>
Miscellaneous receipts .....	30,463.48
<b>Net loss .....</b>	<b>\$381,037.04</b>
Dividends paid, \$300,000; additional taxes, \$60,822.31	360,822.31
<b>Total .....</b>	<b>\$741,919.35</b>
Increase in reserves (amortization).....	911,434.80
<b>Increase in balance of current assets.....</b>	<b>\$169,515.45</b>
Balance of current assets, 1919, adjusted.....	3,065,773.38
<b>Balance of current assets, Dec. 31, 1920.....</b>	<b>\$3,235,288.83</b>

### Victoria Copper Mining Co.'s Production Unsold

Copper; Michigan

A report of operations of the Victoria Copper Mining Co. for the calendar year 1920 states that the production of refined copper for the year is estimated at 1,600,829 lb., valued at \$137,907.77. The copper carried over from the previous year was 1,097,566 lb., a total of 2,158,395 lb., of which 977,440 lb. was sold at an average price of 18.163c., leaving a balance on hand of 1,180,955 lb. as a stock still to be marketed.

The total cost of the year's production is estimated at \$263,877.06, and returns amounted to \$147,123.24, leaving a loss of \$116,753.82. Total expenditures were \$305,540.68, and balance of expenditures over receipts was \$158,417.44. Surplus from previous year was \$262,384.66, leaving a balance of \$103,967.22.

The tenor of ore on the lower levels has increased.

# METAL STATISTICS

## Monthly Average Prices of Metals

	New York		London		Sterling Exchange	
	1920	1921	1920	1921	1920	1921
January	132.827	65.950	79.846	39.985	367.082	372.650
February	131.295	59.233	85.005	34.745	337.466	385.932
March	125.551	56.023	74.194	32.479	370.870	381.806
April	119.779	68.848	68.848	392.438	392.438	392.438
May	102.585	60.010	60.010	383.360	383.360	383.360
June	90.957	51.096	51.096	393.663	393.663	393.663
July	91.971	53.736	53.736	385.538	385.538	385.538
August	96.168	59.875	59.875	360.404	360.404	360.404
September	93.675	59.476	59.476	350.370	350.370	350.370
October	83.480	54.197	54.197	346.460	346.460	346.460
November	77.734	50.952	50.952	342.333	342.333	342.333
December	64.774	41.845	41.845	348.101	348.101	348.101
Year	100.900	61.590	61.590	364.840	364.840	364.840

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

### Copper

	New York Electrolytic		Standard		London Electrolytic	
	1920	1921	1920	1921	1920	1921
January	18.918	12.597	118.095	70.964	123.238	79.119
February	18.569	12.556	120.188	70.925	126.950	75.925
March	18.331	11.976	109.533	67.565	118.348	71.190
April	18.660	103.025	103.025	111.500	111.500	111.500
May	18.484	96.750	96.750	109.200	109.200	109.200
June	18.065	87.864	87.864	101.909	101.909	101.909
July	18.576	90.148	90.148	106.455	106.455	106.455
August	18.346	93.935	93.935	111.143	111.143	111.143
September	18.144	96.381	96.381	111.905	111.905	111.905
October	15.934	93.327	93.327	104.905	104.905	104.905
November	14.257	84.807	84.807	94.614	94.614	94.614
December	13.188	75.702	75.702	85.905	85.905	85.905
Year	17.456	97.480	97.480	108.839	108.839	108.839

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

### Lead

	New York		St. Louis		London	
	1920	1921	1920	1921	1920	1921
January	8.561	4.821	8.300	4.747	47.095	23.367
February	8.814	4.373	8.601	4.228	50.256	20.650
March	9.145	4.084	8.894	4.000	46.054	18.911
April	8.902	8.352	8.618	39.225	39.225	39.225
May	8.576	8.352	8.352	38.488	38.488	38.488
June	8.323	8.169	8.169	34.330	34.330	34.330
July	8.338	8.283	8.283	34.960	34.960	34.960
August	8.687	8.725	8.725	36.304	36.304	36.304
September	8.177	8.160	8.160	35.452	35.452	35.452
October	7.070	7.018	7.018	35.238	35.238	35.238
November	6.159	6.127	6.127	32.489	32.489	32.489
December	4.727	4.717	4.717	24.089	24.089	24.089
Year	7.957	7.830	7.830	37.832	37.832	37.832

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

### Tin

	New York 99%		Straits		London	
	1920	1921	1920	1921	1920	1921
January	61.596	36.000	36.000	376.512	190.464	190.464
February	58.466	28.534	28.534	395.750	166.250	166.250
March	61.037	27.296	27.296	369.489	156.024	156.024
April	61.120	62.115	62.115	345.450	345.450	345.450
May	53.230	55.100	55.100	294.813	294.813	294.813
June	46.125	48.327	48.327	250.614	250.614	250.614
July	45.798	49.154	49.154	261.886	261.886	261.886
August	43.856	47.620	47.620	274.048	274.048	274.048
September	41.940	44.465	44.465	270.120	270.120	270.120
October	39.310	40.555	40.555	258.190	258.190	258.190
November	35.667	36.854	36.854	241.080	241.080	241.080
December	31.135	34.058	34.058	212.440	212.440	212.440
Year	48.273	49.101	49.101	295.866	295.866	295.866

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

### Zinc

	St. Louis		London	
	1920	1921	1920	1921
January	9.133	5.413	58.643	25.262
February	8.708	4.928	61.338	24.850
March	8.531	4.737	53.467	25.077
April	8.184	47.388	47.388	47.388
May	7.588	45.088	45.088	45.088
June	7.465	41.193	41.193	41.193
July	7.720	41.886	41.886	41.886
August	7.835	39.690	39.690	39.690
September	7.661	39.756	39.756	39.756
October	7.150	35.028	35.028	35.028
November	6.247	27.762	27.762	27.762
December	5.824	27.762	27.762	27.762
Year	7.671	44.372	44.372	44.372

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

## Antimony, Quicksilver and Platinum

	Antimony (a)		Quicksilver (b)		Platinum (c)	
	New York 1920	New York 1921	New York 1920	New York 1921	New York 1920	New York 1921
January	10.577	5.258	90.192	48.440	154.23	73.400
February	11.588	5.250	84.432	49.545	151.59	70.227
March	11.056	5.282	92.611	46.796	138.56	72.463
April	10.500	102.192	102.192	127.04	127.04	127.04
May	9.655	89.560	89.560	97.50	97.50	97.50
June	8.289	90.154	90.154	85.19	85.19	85.19
July	7.500	90.333	90.333	83.94	83.94	83.94
August	7.177	83.806	83.806	111.44	111.44	111.44
September	7.113	75.000	75.000	115.20	115.20	115.20
October	6.723	67.200	67.200	101.70	101.70	101.70
November	6.109	58.417	58.417	84.75	84.75	84.75
December	5.534	49.577	49.577	79.62	79.62	79.62
Year	8.485	81.123	81.123	110.90	110.90	110.90

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

## Pig Iron, Pittsburgh

	Bessemer		Basic		No. 2 Foundry	
	1920	1921	1920	1921	1920	1921
January	\$40.47	33.96	\$39.88	31.96	\$39.86	33.88
February	42.95	28.96	42.61	26.96	43.40	30.25
March	43.40	28.16	42.90	26.46	43.40	27.85
April	43.72	44.22	44.22	43.90	43.90	43.90
May	44.00	44.88	44.88	45.36	45.36	45.36
June	44.89	45.41	45.41	46.40	46.40	46.40
July	47.21	47.42	47.42	46.56	46.56	46.56
August	48.90	49.88	49.88	49.35	49.35	49.35
September	50.46	50.46	50.46	51.96	51.96	51.96
October	49.21	44.38	44.38	48.58	48.58	48.58
November	41.26	39.20	39.20	42.61	42.61	42.61
December	36.96	34.90	34.90	37.73	37.73	37.73
Year	44.45	43.85	43.85	44.93	44.93	44.93

1 1/2 dollars per long ton.

## Monthly Crude Copper Production

	1920		1921	
	November	December	January	February
Alaska shipments	12,802,696	6,631,700	5,241,634	5,482,962
Arizona Copper	2,800,000	2,650,000	2,300,000	2,000,000
Calumet & Arizona	3,486,000	3,300,000	2,438,000	3,330,000
Con. Ariz. Smelting	750,000	476,000	476,000	476,000
Inspiration	5,350,000	5,000,000	5,000,000	4,500,000
Magma	671,752	600,000	600,000	600,000
Miami	4,505,232	4,373,123	4,439,000	4,200,101
New Cornelia	2,670,000	2,688,456	2,170,000	1,975,918
Old Dominion	2,563,000	2,655,000	2,822,000	1,882,000
Phelps Dodge	5,492,000	5,850,000	6,339,000	5,712,000
Shattuck Arizona	6,063	6,063	6,063	6,063
Ray	3,975,000	2,975,000	2,983,000	2,976,000
United Verde	4,030,000	3,260,000	3,500,000	3,450,000
United Verde Extension	2,642,812	3,204,258	3,219,912	3,349,942
Calumet & Hecla	7,326,763	7,507,712	7,234,300	7,395,084
Other Lake Superior	6,000,000	6,000,000	6,000,000	5,000,000
Anaconda	11,100,000	10,500,000	9,700,000	9,000,000
East Butte	1,658,860	1,538,760	1,600,000	1,500,000
Nevada Cons.	3,950,000	3,000,000	3,000,000	3,000,000
Chino	4,000,000	2,999,000	2,999,751	2,978,934
Utah Copper	9,120,000	7,500,000	7,500,000	7,500,000
Eastern Smelters	1,600,000	1,600,000	1,500,000	1,500,000
Others, estimated	10,200,000	11,400,000	10,000,000	9,300,000
Total United States	106,700,178	95,709,009	90,586,597	86,632,941
Imports: Ore and concentrates, etc.	7,143,610	6,331,559	8,749,861	9,837,491
Imports in blister, etc.	31,148,088	34,619,919	23,340,358	20,168,019
Grand total	145,291,876	136,660,487	122,776,816	116,638,459
British Columbia:				
Granby Cons.	2,465,585	2,665,018	2,530,038	2,530,038
Mexico:				
Boleo	771,680	1,014,160	969,920	813,650
Cananea	3,500,000	3,700,000	2,530,038	2,530,038
Phelps Dodge Mexican properties	2,666,000	2,468,000	2,362,000	1,870,000
Other foreign:				
Cerro de Pasco	3,612,000	4,258,000	4,086,000	4,174,000
Chile	8,859,984	8,859,984	8,859,984	8,859,984
Katanga	3,174,624	2,970,135	2,912,805	2,912,805
Backus & Johnston	1,548,000	1,604,000	1,760,000	1,306,000

## Comparative Annual Copper Production

	1919	1920	1921
January	135,733,511	121,903,744	90,586,597
February	111,649,512	117,450,000	86,632,941
March	102,040,460	120,309,516	120,309,516
April	98,808,998	116,078,871	116,078,871
May	92,652,975	114,964,207	114,964,207
June	95,856,570	116,107,856	116,107,856
July	100,369,247	109,729,510	109,729,510
August	107,994,040	116,460,654	116,460,654
September	108,703,075 (a)	104,919,262	104,919,262
October	115,143,143 (a)	105,231,571	105,231,571
November	117,289,735	106,700,178	106,700,178
December	102,997,633	95,709,009	95,709,009

(a) Revised

# MINING STOCKS

Week Ended April 2, 1921

Stock	Exch.	High	Low	Last	Last Div.
<b>COPPER</b>					
Adventure.....	Boston	*60	*50	*50	
Ahmeek.....	Boston	46	44	44	Sept. '20, Q \$0.50
Alaska-Br. Col.	N. Y. Curb	19	18	18	Mar. '19 1.00
Allouez.....	Boston	38	35	35	Nov. '20, Q 1.00
Anaconda.....	New York	21	21	21	
Arctadian Consol.	Boston	7	7	7	Oct. '18, .50
Ariz. Com'l.....	Boston	8	8	8	Sept. '19, Q .25
Big Ledge.....	N. Y. Curb	45	42	43	Mar. '21, Q .50
Bingham Mines.....	Boston	220	212	213	June '20, Q 5.00
Calumet & Arizona.	Boston	8	8	8	Dec. '18, SA 1.00
Calumet & Hecla.....	N. Y. Curb	25	25	25	Mar. '21, Q .50
Canada Copper.....	Boston	10	9	9	Sept. '20, Q .37
Centennial.....	New York	*24	*22	*22	
Cerro de Pasco.....	Salt Lake	32	29	30	Sept. '20, Q .50
Chile Copper.....	N. Y. Curb	*34	*26	*32	
Chino.....	Boston	5	5	5	Mar. '20, Q .25
Columbus Rexall.....	Boston	8	7	7	Dec. '19, A .50
Con. Arizona.....	Boston Curb	*79	*70	*79	Feb. '19, SA .15
Con. Copper M.....	Boston	1	1	1	
Copper Range.....	N. Y. Curb	18	18	18	May '19, Q 1.25
Crystal Copper (new)	New York	20	20	20	Nov. '20, Q .50
Davis-Daly.....	New York	2	2	2	Jan. '21, Q .05
East Butte.....	N. Y. Curb	2	2	2	Jan. '21, Q .05
First National.....	Boston	32	30	30	Oct. '20, Q 1.00
Franklin.....	Boston Curb	17	17	17	Sept. '20, K .25
Gadsden Copper.....	Boston	17	17	17	Sept. '19, SA .50
Granby Consol.....	New York	17	17	17	Dec. '20, Q .50
Greene-Cananea.....	Boston	1	1	1	
Hancock.....	N. Y. Curb	2	2	2	Jan. '21, Q .05
Howe Sound.....	N. Y. Curb	32	30	30	Oct. '20, Q 1.00
Inspiration Consol.....	New York	6	6	6	Sept. '20, K .25
Iron Cap.....	Boston Curb	17	17	17	Sept. '19, SA .50
Ile Royale.....	Boston	17	17	17	Dec. '20, Q .50
Kennecott.....	New York	17	17	17	Dec. '20, Q .50
Keweenaw.....	Boston	1	1	1	
Lake Copper.....	Boston	2	2	2	
La Salle.....	Boston	2	1	1	
Magma Chief.....	N. Y. Curb	18	17	18	Jan. '19, Q .50
Magma Copper.....	N. Y. Curb	*10	*10	*10	
Majestic.....	Boston Curb	*95	*75	*90	Nov. '17, Q 1.00
Mason Valley.....	Boston	3	3	3	
Mass Consolidated.....	Boston	17	17	17	Feb. '21, Q .50
Mayflower-Old Col.	Boston	3	3	3	
Miami Copper.....	New York	46	44	44	Nov. '20, Q 1.00
Michigan.....	Boston	5	4	4	
Mohawk.....	N. Y. Curb	9	9	9	Sept. '20, Q .25
Mether Lode (new).....	N. Y. Curb	14	12	13	Aug. '20, K .25
Nevada Consol.....	New York	8	8	8	Oct. '18, Q .25
New Baltic.....	Boston Curb	17	17	17	Dec. '18, Q 1.00
New Cornelia.....	Boston	24	23	23	June '20, Q .50
Nixon Nevada.....	N. Y. Curb	1160	1125	1125	Apr. '21, Q 1.00
North Butte.....	Boston	37	36	37	Mar. '20, Q 1.00
North Lake.....	Boston	12	11	11	Dec. '20, Q .25
Ohio Copper.....	N. Y. Curb	*37	*37	*37	
Old Dominion.....	Boston	31	30	30	June '20, K 2.00
Oceola.....	Boston	1	1	1	Nov. '17, Q .25
Phelps Dodge.....	Open Mar.	6	5	6	Jan. '20, Q .25
Quincy.....	Boston	3	3	3	Apr. '17, 1.00
Ray Consolidated.....	New York	8	7	7	May '18, I 1.00
Ray Hercules.....	Boston Curb	*45	*41	*45	May '13, .10
St. Mary's Min. Ld.	Boston	24	22	23	Feb. '21, Q .50
Sensac Copper.....	Boston	47	45	46	Mar. '21, Q 1.00
Shannon.....	Boston	1	1	1	Dec. '17, .30
Shattuck Arizona.....	New York	1	1	1	
South Lake.....	Boston	1	1	1	
Superior Copper.....	Boston	1	1	1	
Superior & Boston.....	Boston	1	1	1	
Tenn. C. & C. etc.....	New York	8	7	7	May '18, I 1.00
Teulimne.....	Boston	*48	*41	*45	May '13, .10
United Verde Ex.....	Boston Curb	24	22	23	Feb. '21, Q .50
Utah Consol.....	Boston	47	45	46	Mar. '21, Q 1.00
Utah Copper.....	New York	1	1	1	Dec. '17, .30
Utah M. & T.....	Boston	1	1	1	
Victoria.....	Boston	1	1	1	
Winona.....	Boston	*40	*40	*40	
Wolverine.....	Boston	11	11	11	

<b>NICKEL-COPPER</b>					
Internat. Nickel.....	New York	14	14	14	Mar. '19 .50
Internat. Nickel, pf.	New York	80		80	Feb. '21, Q 1.50
<b>LEAD</b>					
National Lead.....	New York	72	71	71	Mar. '21, Q 1.50
National Lead, pf.	New York	102		102	Mar. '21, Q 1.75
St. Joseph Lead.....	New York	12	12	12	Mar. '21, Q .25
Stewart Mining.....	Boston Curb			*6	Dec. '15, .05
<b>ZINC</b>					
Am. Z. L. & S.....	New York	8	8	8	May '20, 1.00
Am. Z. L. & S, pf.	New York	27	27	27	Nov. '20, Q 1.50
Butte C. & Z.....	New York	4	4	4	June '18, .50
Butte & Superior.....	New York	11	11	11	Sept. '20, 1.25
Callahan Zn-Ld.....	New York	5	4	5	Dec. '20, Q .50
New Jersey Zn.....	N. Y. Curb	139	135	137	Feb. '21, Q 2.60
Succan.....	N. Y. Curb	*4	*2	*3	July '16, .03
Yellow Pine.....	Los Angeles			*50	Sept. '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.
<b>GOLD</b>					
Alaska Gold.....	New York	1	1	1	
Alaska Juneau.....	New York	1	1	1	
Carson Hill.....	N. Y. Curb	22		22	June '20, Q \$0.10
Cresson Consol. G.....	N. Y. Curb	*60	*60	*60	
Dome Extension.....	Toronto	16	16	16	Jan. '21, Q .25
Dome Mines.....	New York	*65	*64	*65	Dec. '20, Q .02
Golden Cycle.....	Colo. Sprgs.	*8	*6	*6	Dec. '19, .05
Goldfield Consol.....	N. Y. Curb	7	00	6	89
Hollinger Consol.....	Toronto	60	59	60	99
Home-take Mining.....	New York	*49	*49	*49	Sept. '19, .50
Kirkland Lake.....	Toronto	1	15	1	15
Lake Shore.....	Toronto	1	98	1	95
McIntyre-Porcupine	Toronto	*20	*20	*20	July '17, .03
Porcupine Crown.....	Toronto	*45	*45	*45	Oct. '20, Q .01
Portland.....	Colo. Sprgs.	*5	*3	*4	May '21, Q .05
Reorgan. Booth.....	N. Y. Curb			*5	
Silver Pick.....	N. Y. Curb			*10	
Teck Hughes.....	Toronto	1	24	1	07
Tom Reed.....	Los Angeles	3	2	2	1
United Eastern.....	N. Y. Curb	*20	*17	*19	Dec. '19, .02
Vindicator Consol.....	Colo. Sprgs.	*6	*6	*6	Jan. '21, Q .15
West Dome Consol.....	Toronto	*8	*6	*7	Jan. '20, Q .01
White Caps Mining.....	N. Y. Curb				
Yukon Gold.....	N. Y. Curb				June '18, .02

<b>SILVER</b>					
Arizona Silver.....	Boston Curb	*23	*14	*21	Apr. '20, M .03
Batopilas Mining.....	New York			1	Dec. '07, I .12
Beaver Consol.....	Toronto	*36	*36	*36	Nov. '20, K .03
Coniagas.....	Toronto			2	00
Crown Reserve.....	Toronto			*16	Jan. '17, .05
Kerr Lake.....	Boston	2	2	2	Jan. '21, Q .12
La Rose.....	Toronto			*22	Apr. '18, .02
McKinley-Dar-Sav.....	Toronto	*20	*20	*20	Oct. '20, Q .03
Mining Corp. Can.....	Toronto			1	00
Nipissing.....	N. Y. Curb	8	7	7	Jan. '21, QX .50
Ontario Silver.....	New York			4	Jan. '19, Q .50
Ophir Silver.....	N. Y. Curb	1	1	1	Jan. '12, .10
Peterson Lake.....	Toronto			*7	Jan. '17, .01
Temiskaming.....	Toronto	*25	*25	*25	Jan. '20, K .04
Trethewey.....	Toronto	*14	*14	*14	Jan. '19, .05

<b>GOLD AND SILVER</b>					
Atlanta.....	N. Y. Curb	*2	*1	*1	
Barnes-King.....	Butte	1	1	1	Aug. '20, Q .05
Boston & Montana.....	N. Y. Curb	*70	*61	*63	
Cashboy.....	N. Y. Curb	*8	*6	*7	
El Salvador.....	N. Y. Curb			1	
Jim Butler.....	N. Y. Curb	*14	*12	*13	Aug. '18, SA .07
Jumbo Extension.....	N. Y. Curb	*9	*7	*8	June '16, .05
Louisiana Con.....	N. Y. Curb			1	
MacNamara M. & M.	N. Y. Curb	*16	*13	*14	May '10, .02
N. Y. Hond. Rosar.....	Open Mar.	10	9	9	Jan. '21, Q .30
Tonopah-Belmont.....	N. Y. Curb	1	1	1	Apr. '21, Q .05
Tonopah-Divide.....	N. Y. Curb	1	1	1	
Tonopah-Extension.....	N. Y. Curb	1	1	1	Apr. '21, Q .05
Tonopah Mining.....	N. Y. Curb	1	1	1	Oct. '20, SA .05
West End Consol.....	N. Y. Curb	1	1	1	Dec. '19, SA .05

<b>SILVER-LEAD</b>					
Caledonia.....	N. Y. Curb	*12	*10	*11	Jan. '21, M .01
Cardiff M. & M.....	Salt Lake	1	1	1	Dec. '20, .15
Chief Consolidated.....	Boston Curb			2	Feb. '21, Q .05
Consol. M. & S.....	Montreal	18	16	16	Oct. '20, Q .62
Daly Mining.....	Salt Lake			2	50
Daly-West.....	Boston			3	Dec. '20, Q .25
Eagle & Blue Bell.....	Boston Curb			2	Dec. '20, K .25
Electric Point.....	Spokane	*7	*7	*7	May '20, SA .03
Federal M. & S.....	New York	6	6	6	Jan. '09, 1.50
Federal M. & S, pf.	New York	24	23	23	Mar. '21, Q 1.00
Florence Silver.....	Spokane	*17	*16	*16	Apr. '19, .01
Grand Central.....	Salt Lake			*37	June '20, K .03
Hecla Mining.....	N. Y. Curb	4	3	3	Mar. '21, Q .15
Iron Blossom.....	N. Y. Curb			*18	Apr. '20, Q .02
Judge M. & S.....	Salt Lake			3	00
Marsh Mines.....	N. Y. Curb	*8	*6	*6	Nov. '17, .02
Prince Consol.....	N. Y. Curb			*6	Feb. '19, .01
Rambler-Cariboo.....	Spokane	*6	*6	*6	
Rex Consol.....	N. Y. Curb	*8	*7	*8	
South Hecla.....	Salt Lake	1	1	1	Sept. '19, K .15
Standard Silver-Ld.....	N. Y. Curb				Oct. '17, .05
Tamarack-Custer.....	Spokane	1	1	1	Jan. '21, K .04
Tintic Standard.....	Salt Lake	3	2	2	June '20, Q .10
Utah Apex.....	Boston	2	2	2	Nov. '20, K .25
Wilbert Mining.....	N. Y. Curb	*4	*3	*4	Nov. '17, .01

<b>QUICKSILVER</b>					
New Idria.....	Boston			*95	Jan. '19, .25

<b>VANADIUM</b>					
Vanadium Corp.....	New York	31	28	28	Jan. '21, Q 1.00

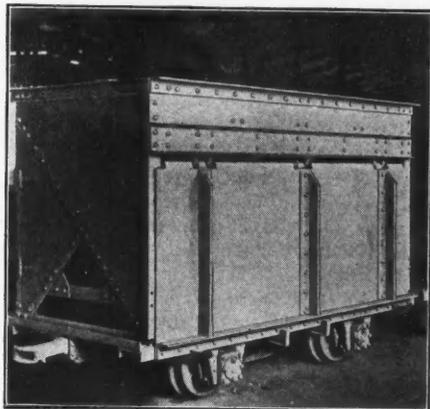
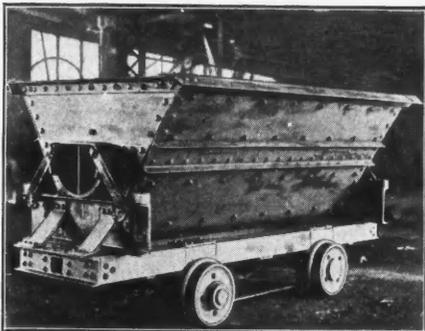
<b>ASBESTOS</b>					
Asbestos Corp.....	Montreal	76	73	73	Jan. '21, QX 3.50
Asbestos Corp, pf.....	Montreal	90	89	89	Jan. '21, QX 3.75

<b>MINING, SMELTING AND REFINING</b>					
Amer. Sm. & Ref.....	New York	37	34	36	Mar. '21, Q 1.00
Amer. Sm. & Ref. pf.	New York	73	68	68	Mar. '21, Q 1.75
Am. Sm. pf. A.....	New York	64	64	64	Apr. '21, Q 1.50
U. S. Sm. R. & M.....	New York	29	26	26	Jan. '21, Q .50
U.S. Sm. R. & M. pf.....	Boston	42	41	42	Jan. '21, Q .87

INDUSTRIAL NOTES

Recent Types of Ore Cars

Two types of ore cars recently built by the Lake Shore Engine Works, Marquette, Mich., are meeting with some success in the Northwest. The upper figure reproduces one of a number of steel rocker-dump cars shipped to the Richmond Iron Co. They are of 80 cu.ft. capacity, steel lined, with wood filling, and are arranged to take M.C.B. automatic car couplers. The wheels are of chilled Lake Superior charcoal iron,



ROCKER DUMP (ABOVE) AND MOTOR-DRIVEN LARRY (BELOW) ORE CARS OF LAKE SHORE ENGINE WORKS

16 in. in diameter and adjusted to 36 in. gage track.

The larry car shown in the lower cut is one of three 90 cu.ft. capacity, motor-driven, remote-control ore cars furnished to a firm in Nashauk, Minn. These cars are driven by 20 hp. motors (alternating current), acting on a worm drive inclosed in an oil-tight housing. Besides the automatic drive, there is an automatic trip device for the door.

How a Capillary Oiler Works

The action of the capillary oiler with hangers and pillow blocks is one of the simplest processes for perfect and reliable lubrication ever known, but the average millwright or mechanic is often at a loss to clearly explain just how it occurs. The Dodge Manufacturing Co., Mishawaka, Ind., was the first manufac-

turer and original patentee of the capillary oiler, and for the last thirty years has sold hundreds of thousands of these oilers. This organization has worked out a clear explanation of how it has employed a primal law of nature to work out a lubrication problem.



FIG. 1. OIL RISING BETWEEN CONVERGING SURFACES

The following simple test can be carried out by any one interested with simple apparatus: A tray is filled with lubricating oil in which are placed two upright glass plates, standing parallel, but not touching. The oil will be seen to rise between the plates to a height above the surface of the oil in the tray, depending on the interval between the plates. If the plates are made to touch at their right hand edges only, as in Fig. 1, note that the oil rises to

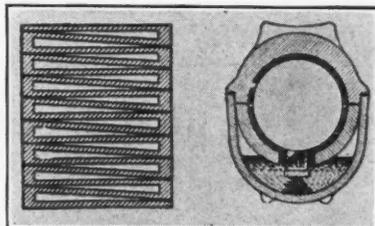


FIG. 2. SET OF CONVERGING PLANES IN DODGE OILER, AT LEFT

the top of the plates at the line of contact. These plates are then exactly in the same relative positions as the surfaces of the Dodge capillary bearing.

In Fig. 1, a strip of glass has been laid across the top of the two plates, representing the relative position of the shaft in a bearing lubricated by a capillary oiler. It will be noted that the increased rise of oil partly covers the top plate. Oil evidences the same

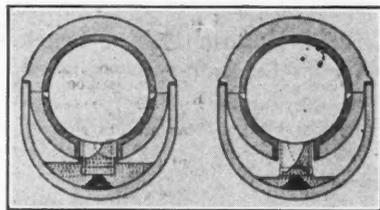


FIG. 3. DODGE CAPILLARY OILER IN USE

tendency to cling to the shaft in a bearing.

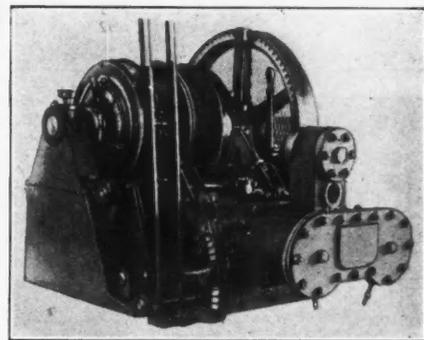
Figs. 2 and 3 are self-explanatory and show how the Dodge capillary oiler acts on the same principles involved in the first four illustrations.

All in all, the capillary oiler has the following advantages: It provides a definite and positive form of dependable lubrication that is bound to work just

as long as the law of capillary attraction works. It is a non-agitating oiler, and as the oil always remains quiet in the reservoir, all sediment settles. Thus a constant flow of clean and pure oil reaches the bearing surface of the shaft. It has the further advantage of not requiring attention oftener than once every six months. At the end of this period, all oil should be drained off, the shaft cleaned, and new oil placed in the reservoir.

A New Air-Operated Scraper Hoist

A new air-operated scraper hoist has been designed by the Lake Shore Engine Works of Marquette, Mich. This machine is compact and powerful and embodies all of the essentials of an underground hoist for use in the modern scraper system. The following is a general description: 6 in. x 9 in. double cylinders with reversing throttle; two drums, 14 in. diameter and 5 1/2 in. face, with flanges 22 in. in diameter; multiple disk friction clutches; rope spool on crank shaft; capacity of drums,



AIR-OPERATED SCRAPER HOIST DESIGNED BY LAKE SHORE ENGINE WORKS

300 ft. of 1/2 in. rope; rope speed, 200 ft. per minute; capacity, 3,500 ft. rope pull at 80 ft. air pressure. Over-all dimensions are as follows: Length, 5 ft. 3 in.; width, 3 ft. 6 in.; height, 3 ft. 6 in. The weight is 3,500 lb.

New Explosive Cannot Freeze

The Atlas Powder Co., Philadelphia, Pa., has produced a non-freezing explosive, the qualities of which will be appreciated by all blasting operators and especially by those who do cold-weather blasting.

The qualifications of this Atlas non-freezing explosive may be stated as follows: Five grades, one for every blasting requirement; cannot freeze at any temperature; withstands the heat of summer; its stability avoids premature explosions (nothing weaker than a No. 6 blasting cap should be used to detonate it); will not cause headaches to those who use and handle it, and is made in all standard sizes of cartridges.

The Lufkin Rule Co. is marketing a new 6-ft. "Lufkin Boxwood Extension Rule," designed for taking inside measurements of openings.

### Highways Transport Bound Up in Motor Traffic

Lee L. Robinson, closing his story "Highways Transport" in *Sinclair's Magazine* for November, makes the following citations concerning the future of the motor truck in the United States:

Charles Chapin, first chairman of the reorganized Highways Transport Committee, Committee of National Defense, said: "The war pointed out that our highways could greatly supplement all

mittee of National Defense, said in part: "At some stage substantially all rail-transported product is moved over the highways, and there are millions of tons of highway-transported product that never reach the rails. . . . I firmly believe that the development of road construction and the use of the motor truck is the next great industrial development to take place in this country, and if intelligently considered and wisely applied, will open up sources of immeasurable national wealth and contribute to the welfare and comfort



FWD TRUCK HAULS CRESSON CONSOLIDATED MEN TO AND FROM WORK

other forms of transportation. . . . Today it is our duty to develop broadly this mighty new form of transportation, properly co-ordinate it with others, safely guide it through these early stages of growth, and make it responsible for opening up every nook and corner of our land."

John J. Esch, of Wisconsin, chairman of the House Committee on Interstate and Foreign Commerce, suggested that "Motor truck routes might be treated, when established and when the population and volume of traffic warrant, just as feeders or short-line railroads are treated, giving the motor-truck line a division of the through rate, also applying the through bill of lading to traffic originating on the motor-truck route to be transported by trunk line to destination or applying it in reverse order on traffic originating on trunk lines to be delivered to destination on the motor truck line."

John S. Cravens, who succeeded Mr. Chapin as chairman of the reorganized Highways Transport Committee, Com-

of our people to a degree that has rarely if ever been equalled by any one method."

### Track-Running Motor Truck Serves Cresson Consolidated

The adaptability of the motor truck to operate on railroad tracks has made the four-mile ride of thirty-five men employed by the Cresson Consolidated Mining Co. to and from the mines as comfortable as riding in a Pullman. The motor truck, a three-ton FWD, made by the Four Wheel Drive Auto Co., Clintonville, Wis., which formerly was run over rough roads, has been equipped with flanged wheels and is now carrying its passengers in real comfort over the smooth steel rails that lead to the mines. Note that the crossways seats permit the passengers to face the driver, and that heavy curtains screen against sun and wind. Even the driver has protection from the elements in an all-weather cab.

### TRADE CATALOGS

**Hoists**—The Wright Manufacturing Co., Lisbon, Ohio, manufacturer of high-speed hoists, screw and differential blocks, and steel trolleys, have issued an attractive new catalog descriptive of their line. It contains much data of use to those interested in hoists, and a portion of the catalog is devoted to a discussion of the various types of hoists and the field of usefulness of each.

**Elevators and Conveyors**—The Dodge Sales and Engineering Co., Mishawaka, Ind., announces the publication of a 6 x 9-in. catalog of 160 pages on Dodge standardized elevators and conveyors. The catalog is one of the most comprehensive the company has ever issued. It covers thoroughly the uses of the equipment with which it is concerned and may be said almost to constitute a textbook on the subjects treated. The tables of data included in the catalog represents much work on the part of the company.

**Air Conveying**—The Dust Recovering & Conveying Co., Cleveland, Ohio, recently distributed its bulletin No. 501, which discusses pneumatic conveying as accomplished by the company's devices. The flexibility of installation and of combination make them suited for a considerable range of purposes, such as sorting blast sand, cleaning grain, collecting atomized metallic lead, cement, carbon dust, and the like.

**Diesel Engines**—Nordberg Manufacturing Co., Milwaukee, Wis., discusses and illustrates in its bulletin No. 31, the advantages of the Diesel engine for most localities needing engine power, and the peculiar features of the company's engines.

**Rock Drills**—In an earlier issue reference was made to a catalog, prepared by the Denver Rock Drill Manufacturing Co., "Waugh 90 Drills." Through an oversight only one type, the "90" was mentioned, whereas three types are described in the pamphlet. The "90" is designed for and specially adapted to coal and iron mining, and, generally, drilling in the softer formations where a powerful, positive rotation is required. The "90" can also be successfully applied to block-holding, hitch-cutting, trimming, or drilling in any character of rock, but is not so well adapted, generally, to constant hard-rock drilling as some other types of Waugh drills specially designed for that purpose. The "93" is designed for drilling in rock, and will give a good account of itself in any formation. It can be operated either "wet" or "dry" and is consequently adapted to any sort of situation, above or below ground. The "95" is identical with the "93," except that it is designed for "dry" drilling only, and is, therefore, especially adapted to work above ground.

