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The Case for and Against a Metal Exchange

By Felix Edgar Wormser

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By H. H. Manchester

Ferric Salts as Solvents in Leaching Roasted Copper Ores

By Percy R. Middleton

Antimony in Southwestern Arkansas

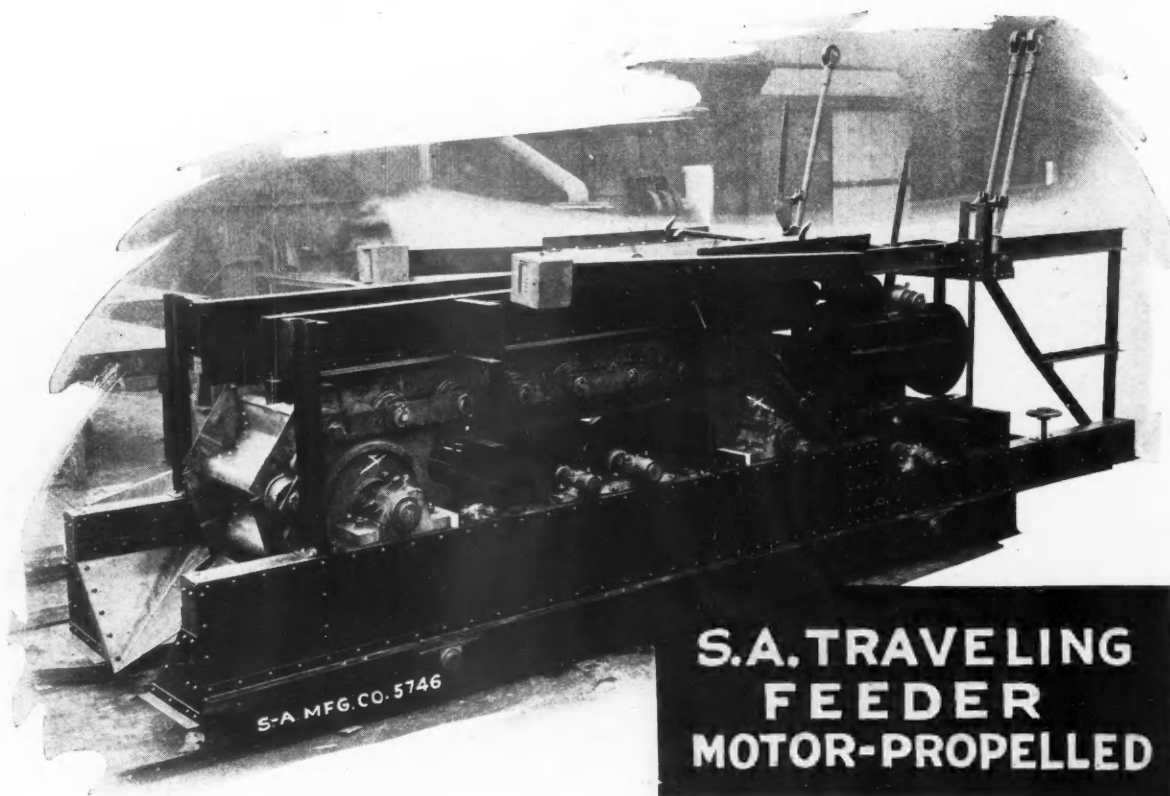
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September 9, 1922



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Number 11

The Problem of a Representative Metal Exchange

MARKETING is not an exact science. Although it is an activity that dates back almost to Adam and has affected the welfare of communities for thousands of years, the best method of buying and selling commodities and transferring them economically from producers to consumers occupies the attention of business men, professors, and even of entire legislatures to this day. This is largely owing to the complexities which various modern agencies, such as the foreign exchange, the telephone, and the railroad, have introduced into the problem of efficient distribution. Theoretical considerations and practice are still the subject of a tremendous amount of attention, and we may safely say that in the marketing of no commodity has a stable and complete standardized basis been reached.

These remarks apply equally to the great non-ferrous metal industries and to the marketing of agricultural products. Many observers of the methods of selling metals in the United States have the honest conviction that improvements can be made, and it has long been the desire of some of them to establish a strong metal exchange in New York, where buying and selling of the metals could take place freely and where the larger producers of the non-ferrous metals would be willing to trade. The fulfillment of this wish has always been thwarted by the attitude of practically all the important metal producers in the United States, who desire to deal directly with consumers, to eliminate the middleman, and to prevent speculation with their product. On the other hand, the advocates of a metal exchange regard free and open trading on a metal exchange as maintaining greater stability in prices, and they advance other reasons for its establishment.

Last winter we were urged by several metal dealers and producers to investigate the possibility of founding a metal exchange more representative of the great metal mining industries than the excellent organization, the New York Metal Exchange—now existing, through which very little business indeed is transacted. The result of this investigation so far as copper, lead, zinc, and tin are concerned is summarized in an article appearing elsewhere in this issue from which it appears that the chances for the establishment of a representative metal exchange are not auspicious. A discussion of a silver exchange will appear subsequently.

The fear behind the producer's attitude toward a metal exchange is doubtless that, in the long run, he would be compelled to pay heavily for the sacrifice made in trading on an exchange; and there is the belief that by selling his own product directly higher prices can be obtained. Some consumers believe that a metal exchange would greatly facilitate marketing, and if it did not lower the cost of their metal purchases would at least give them the assurance of buying at the market level. Until this wide gulf of opinion is bridged we

see little hope for a more active metal exchange. The most important object of marketing any commodity is to transfer the product from producer to consumer in the quickest and cheapest, or most efficient, manner. Will a more active metal exchange perform that function better than the present unorganized system?

Back of the desire to establish a representative American metal exchange is partly the wish to break away from the influence of the important London exchange or to possess one comparable in its position. However, London does not control the American major metal markets, and no exchange is necessary in order to wrest away any fancied laurels of London. Our friends abroad will always be an important factor in the purchase of American metals; but they do not dominate the copper, lead, and zinc markets.

In comparing the work of other commodity exchanges with that of a metal exchange, the peculiar conditions under which each operates must be carefully considered. The impression may be gained that conditions in the stock exchanges parallel those of a metal exchange. They do so to a certain extent only. Each stock of the many listed on the various stock exchanges of the country is a separate problem. It is essential that the unknown purchaser be brought in contact with the unknown seller of stocks, a service that is efficiently performed by the broker. Not so with the metals. Producer and consumer may be easily brought together without the need of any intermediary. Furthermore, the marketing of stocks is not always a means of reaching the "ultimate consumer," an important requisite in trading in the metals. It does not seem probable that a more active metal exchange will be soon established, at any rate one that will receive the help of the chief producers—and without that it will hardly be strong.

Engineering and Mining Journal-Press takes a neutral stand on the issue. Our sole thought has been the welfare of the mining industries we serve. We have been unbiased investigators and reporters of the sentiment of the various market factors. If producers and others had declared outspokenly for an active metal exchange, none would have been more anxious to lend support to it than ourselves. It would have simplified greatly our quotational work and relieved us of a heavy responsibility. That the metal companies have decreed otherwise makes it imperative that *Engineering and Mining Journal-Press* continue to furnish its independent market service. In fact, it is incumbent upon that part of the technical and commercial press serving the metal trades to go to greater lengths in procuring market information. This, however, they cannot do without the hearty co-operation of metal producers and consumers. Reliable market quotations do away with one of the main reasons for an exchange—an accurate index to market conditions.

To the many individuals who so kindly gave us the benefit of their time and thoughts on this interesting and highly important topic we are deeply grateful.

Labor Legislation in Mexico

THE DEFINITION of liberty and personal rights needs ever to be formulated anew as the evolution of our industrial life presents new combinations of circumstances and offers new problems which were absent in the less complicated human organization of the past. Labor problems in the large or national sense were unknown to the founders of the American Republic. A great principle of labor—the greatest of all time—was settled for the world as one of the consequences of the Civil War, when it was finally decreed that under no circumstances should the workman be the property of the directing and wealth-producing enterprisers, or land owners, or capitalists.

But the United States of that period, and previously, was an agricultural nation, with the great majority of its population living on farms. Its labor problems were then simple; and after the abolition of slavery, were subject to the normal laws of supply and demand, with little additional in the way of governing factors or of co-operative organization, either on the part of the farmers or of the farm hands. The farm hand of that day married the farmer's daughter and became the farmer of tomorrow. Moreover, except in the South, the average farmstead in the United States was limited—a one-family affair—so that control over any large acreage was ordinarily lacking, and the law of competitive demand operated as nicely as that of competitive supply.

For this reason the United States never had the agrarian problems which have been at the root of tumultuous upheavals in Russia, in Ireland, and in Mexico, and which caused the French Revolution. We are apparently secure for all foreseeable time from such conditions. But in countries where such conditions have obtained, the feudal system has tended to be transferred from the plantations to the manufacturing industries as the latter developed, and radical reforms have been not only desirable but necessary.

Satisfactory as the condition of industry may have been in many respects in Mexico under the rule of Porfirio Diaz, the status and condition of the farm and even mine laborer was one which no lover of mankind could wish to see perpetuated. The Mexican peon was well named, for on many agricultural estates he lived in a condition of real peonage, eternally in debt to a cunning great land-owner, and therefore always bound to labor for him; and this inborn helplessness, bewilderment, and childlike lack of responsibility persisted in the peon when he was hired as a miner or as a workman in other industrial enterprises. And even many Americans, directing mines, shed immediately, on crossing the Rio Grande, their theories of the equality of mankind, of the right to equal treatment and opportunity, accepted themselves gladly and unexpectedly as belonging to a superior order of beings, and drove their Mexican labor with little or no concern except getting the maximum of work done at a minimum cost. The peon represented exactly to them what the hoists and the pumps did, only the former was more unstable, less fixed and calculable, and therefore more exasperating and fundamentally depraved. Labor was a commodity—an unsatisfactory brand of commodity.

It is therefore in the natural course of social evolution that out of the boiling of the recent Mexican revolutions should come laws designed to fix the status and affect the compensation of labor; and no thoughtful observer will say that some legislation is not desirable.

We need not fear bolshevism in a free and fair country such as the United States, in the main, has ever been; bolshevism is the natural reaction from great repression, which reaction, so far from reaching its theoretical goal of freedom, results in substituting a tyranny of industrial workmen for the oppression of monopolistic owners. The runners-up of red and of black flags are vague in their purposes; they express an emotion rather than an intelligence; and that emotion is profound dissatisfaction, unhappiness, and a reckless desire for a new deal all around. And in Mexico there is no danger of bolshevism, as we get that term from Russia; that period has passed in Mexico's history. The extreme of the reaction is over; and the very fact that organized legislatures are free to make laws like those Chihuahua laws recently discussed by a contributor is the greatest possible assurance against the radicalism run mad which broke loose in Russia; and which eventually bites itself and dies. Movements, nevertheless, even if not so violent, develop in pendulum-like swings; and so it is inevitable that laws designed for the protection and betterment of labor, in Mexico or elsewhere, may overshoot their mark. But when their application proves that they have been too strong for the purpose, that they cripple industry and so fail to improve the condition of those they were intended to aid, the legislatures which have enacted them will be quick to modify them.

Old Mother Hubbard Applied to Mining

ONE OF THE FAVORITE ways for the inexperienced mining man to show his faith in a property is to build a reduction plant, popularly called a mill, before the requisite ore is developed. Sometimes such construction can be laid to dishonesty—to control of a property by irresponsible brokers or financiers who wish to make an impression on a gullible public looking for an "investment" with possibilities of a 25 or 50 per cent return on their money per year. But more often, perhaps, premature mill construction is the result of an unwarranted optimism, of a desire to have some place to treat the ore as it is mined from the grass-roots down. This is especially true where custom milling or smelting plants are not conveniently situated. So sure is the promoter that an orebody will be found that he takes a chance. If the ore is there, he is considered long-headed and his reputation is considerably augmented; if it is not, he had better move at least 5,000 miles away and start afresh.

We were recently led into thinking about this subject by noting the advertisements of the company which is salvaging the Great Western smelter at Mayer, Ariz. A more recent example is furnished by a Canadian company.

For some time the Kirkland Lake district, in Ontario, has been known as the camp without a failure, but the residents no longer dwell on this point. The sore spot can be found about a mile south of the main ore zone, where the Ontario-Kirkland property is situated. Ore, supposedly of good grade, was developed in a gray-wacke schist to a depth of about 450 ft. The property was sampled and the assays were made by a thoroughly reputable company. On the face of the returns, a cyanide plant with a capacity of from 100 to 150 tons was built, and was placed in operation in January of this year. The mill was well designed and constructed, and, so far as we know, worked as nearly perfectly as a new plant could be expected to. The only difficulty

was that the ore, instead of running around \$11, as expected, assayed only \$2 or \$3. In other words it was a miniature Alaska Gold.

Of course, the mill ran only a month or two before the impossibility of continuing operation under the conditions which had arisen was seen. Then came the inevitable reorganization, the property being merged with the adjoining Montreal-Kirkland mine, with the hope that ore of milling grade could be more readily found. Now, with little money available, development work on a very modest scale is being carried on, while the mill stands idle.

Fortunately, there is no hint of dishonesty in the history of the enterprise. Nor can the unfortunate outcome be traced strictly to unfounded optimism. No one seems to know how such a gross error in the estimation of the grade of the ore could be made, but the indications are that it was a result of improper sampling caused by inexperience. Probably not sufficient samples were taken, and what were taken were selected without due regard for actual mining conditions. Or, it is possible that the samples might have been salted by parties unknown to the management. Sampling, and the care of samples, is more of an art than is sometimes realized, and it is well to have important work checked thoroughly.

With the able management which it now apparently has, the Montreal-Ontario has a fighting chance to make good, but certainly not more than that. Meanwhile the mill is rapidly deteriorating, although, as one of our editors who recently visited the property suggested, it might be put to good use treating some of the ore from the Lake Shore mine, which has a mill with a capacity of only about eighty tons. An aerial tram would cost only fifteen or twenty thousand dollars, in all probability, with ten or fifteen cents a ton for operating cost. Possibly some arrangement of this kind can be consummated, to the advantage of every one.

The Radio Crystal Industry

SEVERAL MONTHS AGO, as a result of three or four requests for the names of those who could supply mineral crystals suitable for detectors in radio telephone receiving sets, we published an editorial note that such material was wanted and invited offers. Since that time we have received no more requests for the names of producers, but, on the other hand, forty or fifty persons have told us of sources of supply. Replies to our editorial appeal have come from all over the world—even from points as far away as Australia. One is a company with large stocks of tested crystals which has supplied numerous manufacturers as well as the Bureau of Standards. From this, the replies range down to one from an old prospector who saw some crystals about twenty years ago that he thinks might answer the purpose, and offers to set out in a search for them again if given financial backing.

One correspondent unburdens himself in good, plain, unvarnished American, in this wise:

"There are two bunk ads. in your issue. . . . The second is a fine scheme to get a few cars of radio crystals free. 'Quote ton prices' is bunk, for such mineral is not found in ton lots. Inasmuch as by your editorial a few months since, you practically endorsed those soliciting free samples of galena crystals, I think it is up to the *E. & M. Jour.*, which I have been buying and reading since 1885, to print the facts regarding radio crystals, since a swarm of mysterious outfits is burdening the mails with letters begging

for pound samples, gratis of course, and the producer is being considerably bilked thereby. You are doubtless the ones who can enlighten us benighted ones."

Now, we do not doubt that irresponsible individuals and companies are trying to get what crystals they can obtain free, though not, we are sure, through our columns. On the other hand, it would be unjust to make them pay for samples of no use to them. Some samples have been received in this office that, although they would make wonderful ore, are not of the slightest use for radio purposes. The mineral, as we understand it, must be in the shape of crystals at least a quarter or half inch in cross-section, and must have the physical property of being "live," a property that can be determined only by a test.

The market now seems to be well supplied. Last week we published a list of possible buyers, made up partly from our own knowledge and partly from a bulletin issued by the U. S. Bureau of Standards. It is extremely difficult to separate responsible individuals and companies from fly-by-night concerns, inasmuch as no large capital and but little skill are needed to make a perfectly satisfactory crystal detector. Some high-school boy, working at home at night, may be a perfectly honorable and legitimate consumer of the raw material. As to samples, we would suggest that possible producers send samples of their material to the U. S. Bureau of Standards, Washington, D. C., for an opinion as to their suitability. If the report is satisfactory, no free samples need be sent to others, or, at the most, three or four crystals to indicate their general character. Certainly they need not be furnished by the pound. The price, of course, will have to be determined individually between the buyer and seller. Small tested crystals of galena can be obtained at retail in New York at three for twenty-five cents.

Patents and Publicity

IT IS CONSIDERED in some quarters that a policy of secrecy on the part of individuals and companies operating important processes is desirable, so that pirate "inventors" may not be in a position to take advantage of the chaotic condition of the U. S. Patent Office, by obtaining legal protection on apparatus or processes that they have neither originated nor practiced, but for which no exclusive rights have been asked by others. History shows that this attitude does not pay. A healthy public and professional opinion is the best corrective for such irregularities.

Although secrecy is essential during the initial stages of the development of a process or in the design of an apparatus, it is seldom justified at a later date; it creates suspicion and fosters the idea that unfair action is anticipated.

If the misdemeanors of unscrupulous persons who seek patents for which they have no moral right were subjected to the searchlight of publicity few would force their claims. They would lose professional standing were they to do so.

E. & M. J.-P. Index

THE INDEX for Vol. 113 of the *Engineering and Mining Journal-Press* is now ready for distribution and will be mailed only to those who request it. Those who wish a copy of the Index are requested to send for it promptly. A postcard will do.

DISCUSSION

How Should Depletion and Depreciation Be Charged?

Standardization of Mining Company Reports
Desirable, But Simplification Preferable in
Interest of Stockholder and Investor

THE EDITOR:

Sir—Relative to the articles which appeared in your issues of May 5 and June 10 on the subject of depletion and depreciation, it is of some importance to state that previous to the passage of the federal income and excess profits tax laws, few if any copper-mining companies included or mentioned depletion or depreciation as an additional cost per pound or reported the matter in their annual reports.

The 1921 law re-enacts the provisions of the 1918 law regarding depletion:

“A reasonable allowance for depletion is permitted in the case of those industries with wasting assets because of the exhaustion of minerals, oil, timber, etc. The allowance represents a return of capital. Depletion charges are, therefore, based on the value as at March 1, 1913, of copper-mining companies. To determine the rate of depletion applicable to copper mines, the method most commonly used is by dividing the tonnage of or recoverable pounds of copper contained in the properties into their value as of March 1, 1913. The quantity of recoverable copper in many mines must necessarily be estimated. In securing the requisite data practical difficulties are encountered.”

Two basic or important facts must be established as follows:

- (a) Value of property at March 1, 1913, if acquired prior thereto.
- (b) The number of units of principal product in the property at valuation date.

The depletion unit ($a \div b$) multiplied by the number of units produced during the year gives the depletion deduction for the taxable year.

No further charge for depletion can be made after the reserve for depletion equals the value as shown by the mining property account. The excess is all income and must be so returned. Unless the vein contents are known or proven, a rate established for depletion may be quite erroneous or incorrect at some future year. As property taxes of all kinds are an expense, and as the word expense implies money expended or outlay, is it not proper to include all taxes?

The stockholders should have a clear and concise yearly report showing the correct and actual cost to produce a pound of copper. To illustrate more clearly: In 1917 the Ahmeek Mining Co.'s annual report was as follows:

	Pounds	
Total copper product for the year 1917.....	27,919,812	
Of this there was delivered and billed in 1917.....	19,299,590	
On hand Dec. 31, 1917, not billed of 1917 product.....	8,620,222	
Production and Delivery Costs		
Mining and mine taxes.....	27,919,812 lb. at 7.91 c. per lb.	\$2,208,175.88
Smelting, refining, eastern offices and corporation taxes.....	27,919,812 lb. at 1.14 c. per lb.	317,759.34
Production costs for.....	27,919,812 lb. at 9.05 c. per lb.	\$2,525,935.22

Less copper on hand Dec. 31, 1917.....	8,620,222 lb. at 9.05 c. per lb.	\$779,880.70
Delivered of 1917 product.....	19,299,590 lb. at 9.05 c. per lb.	\$1,746,054.52
Freight, insurance, commissions, etc., on copper delivered.....	19,299,590 lb. at 0.37 c. per lb.	72,256.40
Production and delivery cost of copper delivered.....	19,299,590 lb. at 9.42 c. per lb.	\$1,818,310.92
Received for copper delivered..	19,299,590 lb. at 26.84 c. per lb.	5,180,901.48
Gain on copper delivered.....	19,299,590 lb. at 17.42 c. per lb.	\$3,362,590.56
Miscellaneous income		
Silver sales.....	\$16,171.37	
Balance of interest receipts.....	10,383.99	26,555.36
Gross income from 1917 operations.....		\$3,389,145.92
Depreciation of plant.....	\$210,713.34	
Depletion of mineral deposits.....	422,787.93	
	\$633,501.27	
Less reserves established for same.....	633,501.27	
Dividends declared.....		2,800,000.00
		\$589,145.92
Less: Income tax 1916.....	\$64,875.40	
Income tax 1917.....	\$112,999.28	
Excess profits tax 1917..	869,760.59	1,047,635.27
		\$458,489.35
Increase in capital assets		
Construction in 1917.....	\$231,257.42	
Real estate bought.....	38,173.00	269,430.42
Net decrease in current assets.....		\$727,919.77
Balance of current assets Dec. 31, 1916.....		2,233,363.65
Balance of current assets Dec. 31, 1917.....		\$1,505,443.88

A majority, if not all, of stockholders desire a plain statement of facts; and a report similar, for example, to the following would therefore be preferred:

Mining and mine taxes.....	27,919,812 lb. at 7.91 c. per lb.	\$2,208,175.88
Smelting, refining, eastern offices and corporation taxes.....	27,919,812 lb. at 1.14 c. per lb.	317,759.34
Freight and delivery cost on copper delivered, 19,299,590 lb. sold at 26.84 c. at 0.37 c. per lb.		72,256.40
Ditto on 8,620,222 lb. sold in 1918 at 24.3 c. at 0.49 c. per lb.		42,239.09
		\$2,640,430.71
Income and excess profits taxes for 1917.....		1,452,913.31
		\$4,093,344.02
Construction expense.....	231,257.42	
Real estate bought.....	38,173.00	\$4,362,774.44
Less silver sales.....	\$16,171.37	
Less interest receipts.....	10,383.99	26,555.36
		\$4,336,219.08
19,299,590 lb. copper sold at 26.84 c. per lb....	\$5,180,901.45	
8,620,222 lb. copper sold at 24.3 c. per lb....	2,094,713.95	
	\$7,275,615.40	
Total income.....		7,275,615.40
Total expenditures.....		4,336,219.08
Profit.....		\$2,939,396.32
Less 1916 income tax paid in 1917.....		64,875.40
		\$2,874,520.92

27,919,812 lb. of copper cost 15.17 c. per lb.
27,919,812 lb. of copper sold at an average of 26.06 c. per lb.
Profit per lb. of copper, 10.89 c.
The depletion charge was..... \$422,787.93
The depreciation charge was..... 210,713.34
Or 2.27 c. per lb. \$633,501.27
Based on the federal taxes for 1917 of \$1,452,913.31, the amount per lb. of copper product was 5.2 c.
If depletion and depreciation had been given as a cost and the federal taxes eliminated, the per lb. cost would have been 12.6 c.

It would not seem proper, therefore, in reporting to the stockholders to include both excess profits and income taxes and depletion and depreciation charges. It is confusing to share owners to endeavor to understand the yearly reports of many companies, as one year's reports differ in form and substance from those of a previous year. Depletion charges may be given or shown one year and omitted another.

The lack of uniformity is clearly shown by the fol-

lowing: In 1917 the Utah Copper Co. produced its copper for 10.995c. after crediting precious metals and miscellaneous income excepting Nevada Consolidated Mining Co.'s dividends. Included in the cost was depreciation of plants and equipment and all taxes, including federal. In 1918, 1919, and 1920, the costs were 12.53c., 12.336c. and 13.145c. respectively, but federal, income, and profit taxes were not included.

The Nevada Consolidated Copper Co. in 1917 included depreciation of plants and equipment, and all taxes in its cost of 11.68c. per pound to produce. In 1918 the cost was 15.69c. and included depreciation of plants and equipment and all taxes except federal. In 1919 and 1920 the production costs of 16.14c. and 17.28c., respectively, included depreciation of plants and equipment and all taxes, except federal income and profit taxes.

The Chino Copper Co. in 1917 included in its cost per pound of copper produced of 11.39c. depreciation of plants and equipment and part of the federal taxes. In 1918, the same as above excepting that all taxes but federal were included. In 1919 and 1920 the production costs were 15.314c. and 14.40c. respectively, and included as above but excluded both the federal income and profit taxes.

All of the above pertaining to Chino Copper Co. is applicable to the Ray Consolidated Copper Co. for the same years.

Special attention is called to the fact that a depletion charge is not mentioned.

The Inspiration Consolidated Copper Co. in 1920 included a depreciation charge in its cost of copper, but excluded depletion and federal taxes.

In 1917 the Calumet & Hecla Mining Co. and the Ahmeek Mining Co. did not include any production cost for depletion, depreciation or income and excess profits taxes. In 1918 both companies included a charge for depletion and depreciation but not for federal taxes. In 1919 the production cost included a depreciation charge only. In 1920 both depreciation and depletion were included in the costs to produce.

Commenting on the following by McGrath: "As to the depreciation and depletion charges: There is no reason for the apparent misunderstanding of the depletion charge. The depletion charge in mining is the same as the 'cost of goods sold' in merchandising, or 'cost of raw materials used' in manufacturing. In merchandising, the 'cost of goods sold' can be accurately ascertained as a rule, but there is some difficulty in determining the exact depletion charge in mining, although in case of a proven mine of large tonnage it is much simpler than some believe"—the "cost of goods sold" is positively known, but as before stated, to determine correctly what the correct depletion charge should be is in many cases impossible. Supposing a mine should charge \$50,000,000 during a term of years and ultimately the results of mining operations should prove that one-half or one-third or even one and a half times the amount would have been correct, we can readily see that all previous cost accounts would therefore have been erroneous.

As to standardizing mining companies' reports, it is certainly desirable, but simplification is preferable. How many stockholders are competent to decide correctly after examining the majority of coppermining companies' reports the exact cost of a pound of copper or the actual profits?

Houghton, Mich.

J. H. VIVIAN.

Assaying Without Chemicals

THE EDITOR:

Sir—Your editorial on "Assaying Without Chemicals," in the issue of May 27, 1922, surprised me by the idea it gave that the specific gravity method of determination of minerals and rocks, natural and artificial, was not very widely used by engineers. For some years my field kit has not only included a small blow-pipe outfit, but I have always carried as well a Walker's specific gravity balance, a reliable and effective instrument, which can be packed in small space and will stand rough work. With the blowpipe any doubtful mineral in a specimen may be determined, and if the specimen be of "ore," a specific gravity determination gives, in a few minutes, a good idea of the proportion of the economic mineral present.

For rock determinations in the field, the balance is especially useful, although allowance must be made for porosity when dealing with such rocks as sandstone, chalk, and limestone; the factor should be in the mind of the worker even if he does not introduce a figure for it in his calculations. For instance, working on a series of ferro-magnesian limestones, and allowing the error for porosity to remain constant, much useful knowledge concerning the varying proportions of siderite, ankerite, dolomite, and calcite can be obtained in the field by the use of Walker's balance.

Peters, in his "Principles of Copper-Smelting" (pp. 413) gives the percentages of four mattes with their respective specific gravities, but to use the specific gravity method for the "assay" of a matte, care would be necessary to see that no metallic copper were present in the specimen. A method I have used occasionally for determining the proportion of metallic copper in a matte in which it obviously has been present, has been to extract a small pure chip, determine its specific gravity by means of a chemical balance and burette, and then make the determination of the large specimen on Walker's balance; the difference I have accepted as being due to metallic copper.

R. MURRAY HUGHES.

Sable Antelope Mine, Northern Rhodesia.

Science and Religion

THE EDITOR:

Sir—The editorial in the July 1 issue and the discussion in the July 15 issue regarding the conflict between science and religion are worthy of further discussion. In order to discuss this subject clearly it is necessary to define the terms involved:

Science is exact knowledge of the facts of Nature, classified and systematized.

Truth is the established relation which the facts of nature sustain to each other and to the individual intelligence or soul of man.

Philosophy is the conclusions which men in their search for knowledge of truth have drawn from the facts of science.

Religion is the application of the facts of science and the conclusions of philosophy to individual life and conduct.

It will now be apparent that science, philosophy, and religion are in no sense conflicting schools. They do not antagonize each other in their essential nature. On the contrary, they are, in truth, concomitant factors in the same great problem of individual life, and truth is the vital element which relates them all.

Ignorance is the root of all social evil, and partial knowledge is the basis of intellectual controversy.

True religion does not protest against the facts set forth by Darwinism. It is the appalling theories which accompany those facts that shock the spiritual intelligence of the world. Science often makes the mistake of not distinguishing between scientific fact and pure theory. This often causes theories to be accepted as facts, or facts to be repudiated by the public.

According to the Darwinian theory, the fundamental struggle of sentient life is the struggle for physical nutrition and nature is universally hostile to the life it generates. All living organisms, together with intelligence and love, are expressions of physical laws and forces.

Darwinism discovers no higher purpose in individual life than a contribution to species. It offers no other reward for conformity to natural law than survival of the "physically fittest." It sets no higher ideal before human intelligence than a healthy body and material comfort. To the aspiring soul of man it promises nothing better than total extinction when its contribution to species is accomplished.

Against this unwarranted and demoralizing doctrine intelligence rebels. It refuses to accept as final those assumptions which degrade life and life's purposes to the level of physical functions and appetites.

The affect of Darwinism upon the uninformed mind is universally the same. It leaves the individual reader profoundly impressed with the utter insignificance of individual life, aspiration, and effort. On the other hand, it advances species to formidable proportions. Nature appears an insatiable monster engaged in grinding out species at the expense of every individual. There are no forces but mechanical ones. No principles except compulsory ones. No environment that is not hostile. There are no processes except those of battle and competition. There are no motives except selfish ones. There are no rewards for intelligence except physical and material benefits. There is no future for the individual intelligence except as he physically contributes to species. German Kultur is an example which plainly illustrates the effect of such teachings.

If evolution really meant the survival of the physically strongest, mastodons would occupy the place of mosquitoes and the strong rapacious animals would have rendered human life an impossibility. If Nature were hostile to life, this planet would not have progressed from its original state of non-life to this prodigious multiplication of life.

A problem cannot be correctly or completely solved until all the facts are considered. Science cannot correctly or fully solve the problems of Nature until all the facts of nature, physical, spiritual, and psychical, are considered.

Physical science, throughout its entire investigations, strangely overlooks the most marvelous fact of Nature,—namely, the omnipresence of intelligence. This oversight includes the individualized intelligence, as well as the general intelligence of Nature.

There is, therefore, a science which enjoys a broader acquaintance with Nature than physical science, and a religion which enjoys a broader acquaintance with Nature than that gained by intuition.

It is just as impossible to teach the spiritual facts of Nature by intuition or by faith as it would be to teach mathematics by intuition or faith. The practical and rational mind of modern humanity, is trained to

believe what it perceives through its five physical senses, and has encountered many perplexities in its attempts to follow and assimilate a poetic and symbolical religion of a remote time, people, language, and development.

Most of our ideas concerning religion are opinions and beliefs. Opinions and beliefs come to us easily. Actual knowledge comes to us as the result of labor and personal effort. A mere opinion or belief may rest upon very slight evidence or on none at all.

With the most of us at the present time our actual knowledge concerning physical Nature is much more complete than our actual knowledge concerning spiritual Nature. Hence, the importance of gaining scientific knowledge of the spiritual facts of Nature.

The above statements are mainly extracts from the "Harmonic Series" which explains a science much broader and a religion more scientific than that usually taught and explains evolution from a much higher standpoint than that of the purely physical scientist.

Mineral Las Dos Estrellas,
Michoacan, Mexico.

A READER.

The Prospector's Candid Opinion

THE EDITOR:

Sir—Referring to your get-together spirit, which you speak of in your issue of July 8, if it is your wish to let the prospector in and help carry up the rear, I will say that if the Editor and a dozen more combined will send me an armful of questions written in good old U. S. A. language, I will try and give them some "dope" on hunting orebodies and prospecting, after following the work twenty-seven years from the Dark Continent to the Arctic and back. I might be able to help some.

The articles I read in most cases sound like ancient history—same old warp. We prospectors, whose teachers have been the burros, hills, and rocks, have a very limited amount of the English words to juggle with. Don't think we do not value mining engineers. No sir. We've got to have them. To the ones that fight snowballs in winter and mosquitoes in summer, building railroads to reach the mining countries; to the ones that show us how to sink shafts 7,000 and 8,000 ft. deep, fighting heat, water, and caving ground; the ones that put dredges in distant places and drag lines on the ocean bottom to get the metal that makes a golden noise in your pocket; these are the engineers we doff our hats to. If we did not have men to figure ways and means to mill and smelt our rock we would never get a fair shot at the values in the ore. Also to the engineers that will put hobbles on the great Colorado River, that will give us cheap electric power to work our low-grade ores in the Southwest. These are the ones that build up and do not *destroy* the hardest game, but the most profitable—mining and prospecting. Yes sir. These men are always welcome to our bean pot. But take these mine doctors, crooked mine stock surgeons, and these black-jack mine promoters: it is because of their activities that the advance guard—the prospector—is disappearing.

I don't blame some of the public that believe old Mark Twain when he said the definition of a prospect was a hole in the ground with a damn liar standing on the dump.

Kingman, Ariz.

E. B. FOSTER.

An Illustrated History of Mining and Metallurgy—II*

Methods of Pumping Said to Have Been First Developed When Romans Conquered Carthage—This Period Also Marks First Reference to Contract Work—Pliny Wrote Fully Concerning Methods of Mining Gold in First Century

BY H. H. MANCHESTER

GREEK RELICS of copper, gold, and silver may be traced back to the prehistoric period, but illustrations and accounts of actual mining do not begin until a later date.

One of the earliest and certainly one of the most interesting Greek pictures of mining is a scene in colors on an archaic Corinthian pinax, which may be dated about 600 B.C. This depicts an excavation about eight feet in depth and about the same in width. A miner is attacking one side with a pickaxe, while a boy is gathering up the lumps dislodged and handing them to a woman who is kneeling over the top of the excavation. This may well portray mining by a family at a time when the mines in Greece were still so undeveloped as to require only the simplest operations. One noteworthy detail is a good-sized lamp which is hung above the working place and furnishes light in addition to that from the opening to the sky.

In the early period, the mines which are mentioned are described as exceedingly rich, but probably only the most readily extracted richer ore was taken out. Herodotus, who wrote about 500 B. C., stated that in



Supports in a gallery in Laurion.

Siphnos, "there were mines of gold and silver of so rich a yield, that from a tenth of the ores, the Siphnians furnished out a treasury at Delphi, which was on a par with the grandest there. What the mines yielded was divided year by year among the citizens."

Xenophon wrote that the mines of Laurion had been worked from time immemorial. In a treatise on the revenues, he discloses several facts as to the method of working mines which are of interest. "It is an old story," he declares, "how formerly Nicias owned a thousand men in the silver mines, whom he let out to Sosias, a Thracian. Sosias was to pay him a net obol (3c.) a day, without charge or deduction for every slave of the thousand, and keep up that number continuously. So also Hipponicus let out 600 slaves which brought him a net mina (\$20) a day." Thus it appears that from a very early period the mines at Laurion were worked by slave labor.

Modern excavations at Laurion have revealed narrow galleries winding into chambers which are in part supported by pillars of stone which has either been



An ancient Greek miner and his ax-like pick

left standing or put together for the purpose. A small, partly destroyed furnace has also been discovered, which, it is thought, was used in freeing the silver from the lead.

Much richer than the mines of Laurion were those of Spain. According to Diodorus Siculus, the Pyrenees Mountains were so called because at one time in the distant past they had taken fire, and continued burning for a long time. This had melted so much silver that the metal had flowed down in streams. Since the use of this was unknown to the inhabitants, the Phoenicians had obtained it for mere trifles, and after loading their ships as full as possible, they had even cut the lead weights from their anchors and substituted silver.

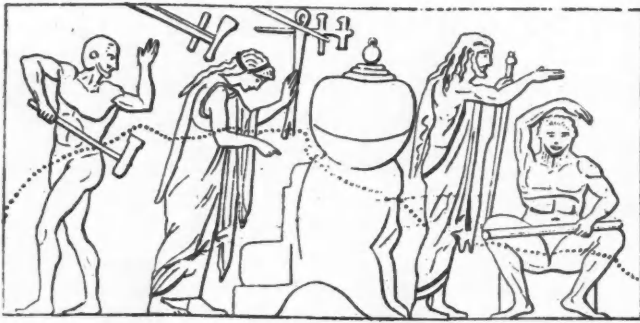
At first anybody might collect the precious metals, and even common laborers in silver mines earned good wages.

After the Carthaginians conquered the country, they made a search for the precious ores, and opened up so many mines that but few new ones were discovered afterward. It was the silver and gold from these mines



A primitive Greek mine. From an archaic Corinthian plate. Note the lamp

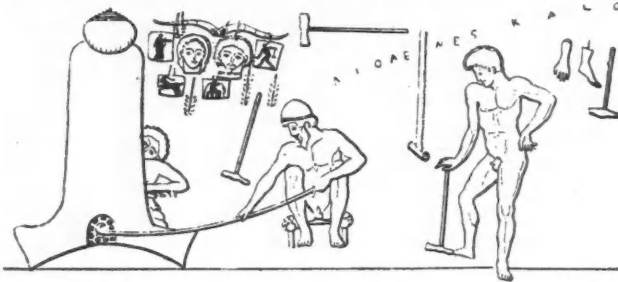
*The second of a series of articles, the first of which appeared in the Sept. 2 issue.



The Greek stack furnace with a kettle or crucible on top.

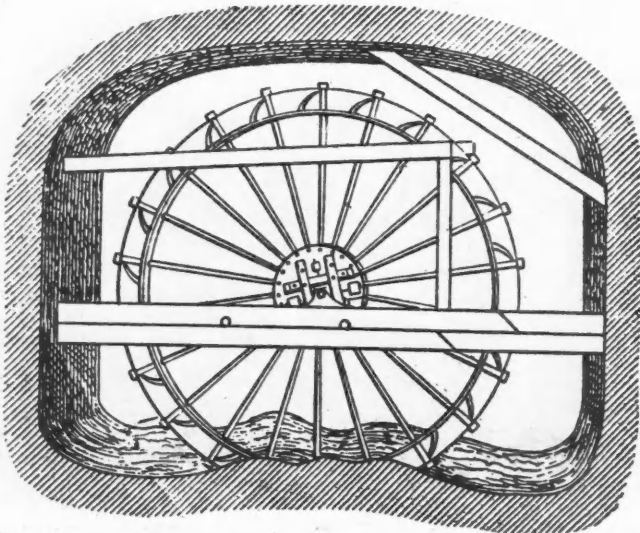
which they used to pay the mercenary troops that formed so large a part of the Carthaginian armies.

When the Romans conquered Carthage and took possession of Spain they developed the slave and contract system of working the mines. The slaves followed the veins from where they cropped out at the surface far into the mountains. By this time mining engineering was beginning to be developed. This is illustrated by Diodorus' description of their method of overcom-



The stack furnace in a statue maker's place. Note the workmen behind the furnace blowing the bellows.

ing underground streams: "Sometimes at a great depth under the ground they meet with rivers, but by art check the violence of their current; for by cutting trenches under the ground they divert the stream . . . and skilfully pump out the flood with machines called Egyptian screws, invented by Archimedes, the Syracusan, when he was in Egypt. . . . For this engine is so ingeniously contrived that a vast quantity of water is cast out with little labor, and the whole

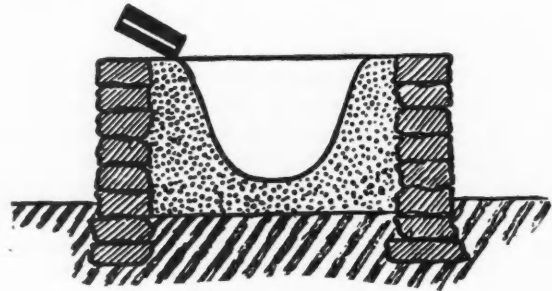


The wheel used for raising water. From remains in S1 a in

flux thrown up from the very bottom of the mine to the surface of the earth."

As under the earlier rulers, the slaves seem to have been worked in the mines without mercy and until they died at their tasks.

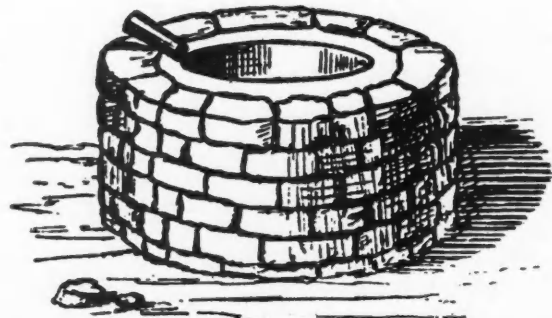
In Spain, likewise, according to Diodorus, was found tin. It was common above Lusitania, in the islands opposite Iberia, and much was also transported from Britain into Gaul, the merchants carrying it on horseback to Marseilles.



Section.



Plan.



A Greek smelting furnace. Reconstructed from remains in Laurion.

By 30 A.D., according to Strabo, the mines of Laurion were exhausted, but the workmen were still obtaining silver there by committing the old refuse and scoria to the furnace, for the former laborers had carried on the process very unskilfully.

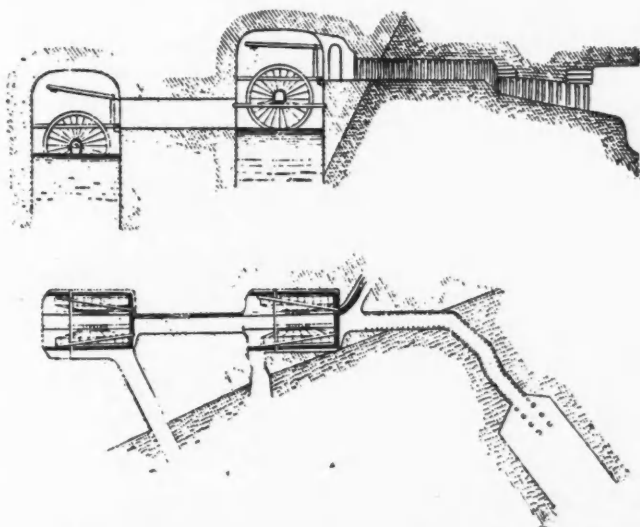
By the first century A. D. mining engineering had become a very practical science among the Romans. Pliny, the Roman scientist, gives a description of the methods of mining gold then employed, and although it is too long to be quoted, the most important points must be noted. Gold was then procured in three ways, the first of which, Pliny considers, was in the form of dust

found in running streams, such as the Tagus in Spain, the Padus in Italy, and the Hebrus in Thrace. The second method was by sinking shafts. The persons in search of gold looked for indications on the surface. When found they washed this earth, or segutilum, as it was called, and from the results conjectured the richness of the vein. Sometimes the gold was found on the surface, as when in the reign of Nero such a vein was discovered in Dalmatia which yielded 50 lb. of gold a day. But the prospectors were seldom so lucky.



A Roman subterranean machine cutting out rock.

The gold ore mined by means of shafts was known as "canalicium." In the galleries the earth was kept from falling by wooden pillars. The method of obtaining silver and gold from the ore is described by Pliny



Roman machines for removing water from mines. From remains in Spain.

as follows: "The material extracted is first broken up and then washed. After this it is subjected to the action of fire, and then ground to a fine powder. . . . The silver which becomes disengaged in the furnace is given the name of sudor. . . . In the case of gold the scoria is broken up a second time and melted over again. The crucibles used for this purpose are made of white earth similar to potter's clay, there

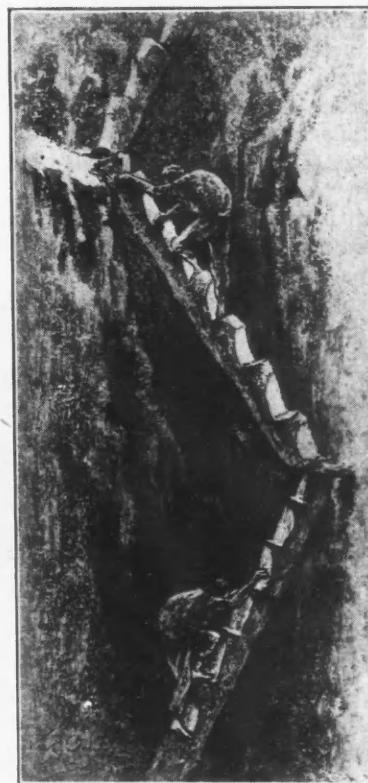
being no other substance capable of withstanding the strong draft, the action of the fire, and the intense heat of the molten metal."

The third method involved the actual tearing down of a mountain, and Pliny says surpassed the labors of the giants. Galleries were driven to great distances, and mountains were hollowed out by the light of torches, the duration of which set the hours for work, the workmen never seeing the light of day for months at a time. Occasionally the earth caved in and crushed the workmen, for which reason arches were left at intervals to support the mountain above, says Pliny.

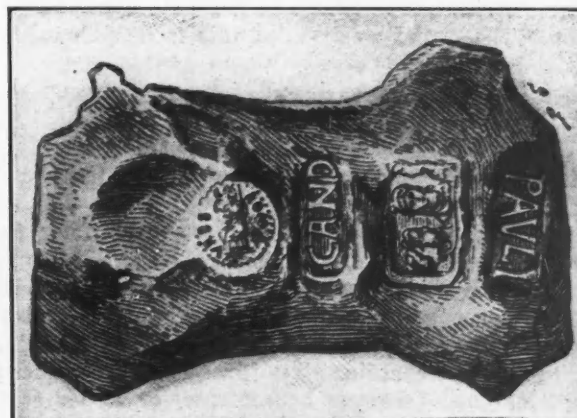
Sometimes barriers of quartz were encountered, which were broken up by fire and vinegar, or more often, as this filled the galleries with smoke, by means of bruising machines shod with pieces of iron weighing 150 lb. each. The fragments were passed out by long lines of workmen, each handing pieces on to his neighbor in the dark. Where the quartz appeared too thick, the miners traced along the side of it and flanked it.

Even more obstinate than the quartz was considered the potter's clay mixed with gravel, which was called "gangadia." When the excavating was completed the workers cut away the wooden pillars, beginning with the inmost, which supported the roof, until the mountain at length caved in, hurling its débris to a distance with a crash, which Pliny says it is impossible for the imagination to conceive.

Washing the débris for the gold required fully as



Rude ladders cut from tree trunks. From remains in a Phoenician mine in Spain.



A stamped silver ingot.

much labor and greater expense. Streams were conducted from still more elevated heights, at a distance in many cases of 100 miles. The fall was kept steep in order to preserve the power of the flow. Sometimes valleys had to be crossed by aqueducts, or obstinate rocks hewed away to make room for troughs of wood. In places this had to be done by workmen suspended with ropes. Care had to be taken to carry the water only over beds of quartz or pebbles to avoid mud.

At the head of the fall at the very brow of the mountain reservoirs were constructed about 200 ft. square and 10 ft. deep. Usually five sluices 3 ft.

square were added, down which, as soon as the flood gates were opened, the water would rush in torrents. Below, on the level ground, trenches were built to carry the water. In them was placed ulex, a plant somewhat like rosemary, rough and prickly, for arresting any piece of gold that might be carried along. Thus the water in the reservoir was made to wash the débris of the mountain and leave the gold in the trenches. Pliny declared that so many hills were thus washed away and carried to the sea that the shores of Spain were noticeably extended.

To be continued.



A gold ingot with various stamps

Cyanidation of Coarse and Fine Concentrates

BY CHARLES FLURY

My experiences in the treatment of mixed gold-silver concentrates resulting from a Wilfley-table and canvas-concentration plant may be of interest to others. An attempt to leach unconcentrated slime and sand, prior to the installation of the concentration plant, gave unsatisfactory results. The slime agglomerated, and the solution could not penetrate; consequently the extraction was poor. The canvas concentrate behaved differently. A lump, when immersed in water, disintegrates readily and forms a pulp. During concentration a large amount of clay that would act as a binder is removed. Successful percolation is then possible.

The sand concentrate is produced at the rate of fifty metric tons per day; it averages \$23 per ton. The screen analysis is as follows:

	Weight, Per Cent	Value per Metric Ton
+ 1.00 mm.....	8.80	\$18.32
+ 0.50 mm.....	23.4	26.88
+ 0.25 mm.....	9.3	24.38
+ 0.10 mm.....	22.58	17.40
- 0.10 mm.....	35.85	21.93
Total and average.....	99.93	\$23.00

The slime concentrate contains approximately one part of sulphides to three parts of gangue. An average of four metric tons is produced per day, assaying \$37 per ton. The screen analysis of this is as follows:

	Weight, Per Cent	Value per Metric Ton
+ 1.00 mm.....	0.00	.....
+ 0.50 mm.....	0.15	.....
+ 0.25 mm.....	0.45	.....
+ 0.10 mm.....	3.22	\$13.25
- 0.10 mm.....	96.10	27.15
Total and average.....	99.92	\$27.00

This concentrate is stored on a cement platform for twenty-four hours, then sampled and weighed and shipped to the storage room. There it is mixed with the sand concentrate. A second mixing takes place during shipment to the leaching plant; a third during charging. A vat contains sixty-three metric tons, with about five tons of canvas concentrate, or 8 per cent. The average value per ton of the mixture is \$24. Screen analysis of mixed concentrates is as follows:

	Weight, Per Cent	Value per Metric Ton
+ 1.00 mm.....	8.72	\$20.50
+ 0.50 mm.....	21.48	24.25
+ 0.25 mm.....	6.63	24.30
+ 0.10 mm.....	24.12	22.00
- 0.10 mm.....	39.05	25.75
Total and average.....	100.00	\$24.00

Cyanidation is now applied in the following manner: During charging, 1.74 kg. of lime per metric ton of concentrate is mixed with the pulp, giving a protective alkalinity of 0.03 per cent (CaO). While eight tons of working solution (0.03 per cent CaO and 0.20 per cent KCN) is being pumped into the vat, 40 kg. of potassium cyanide is added, bringing the working strength up to 0.7 per cent (KCN). Contact is maintained for twenty-four hours.

After percolation, the ordinary working solution is used for three days. On the fifth day the charge is transferred into another vat. The whole treatment cycle consists of six transfers. The total time of treatment is twenty-four days. After each transfer, the first solution applied is strengthened by the addition of 3 kg. of cyanide. Before discharging the residues, three tons of water is added.

The characteristic features of this treatment are the number of transfers and the relatively strong solutions applied. The residues average \$2.90 per ton, the screening analysis of these being as follows:

	Weight, Per Cent	Value per Metric Ton
+ 1.00 mm.....	8.30	\$4.70
+ 0.50 mm.....	21.30	4.00
+ 0.25 mm.....	6.70	2.65
+ 0.10 mm.....	22.80	2.40
- 0.10 mm.....	40.80	2.40
Total and average.....	99.90	\$2.90

Extraction according to size is as follows:

	Feed, per Metric Ton	Residue, per Metric Ton	Extraction, Per Cent
+ 1.00 mm.....	\$20.50	\$4.70	77.07
+ 0.50 mm.....	24.25	4.00	83.56
+ 0.25 mm.....	24.30	2.65	89.10
+ 0.10 mm.....	22.00	2.40	89.09
- 0.10 mm.....	25.75	2.40	90.70
Averages.....	\$24.00	\$2.90	87.00

When the concentrates are mixed in the proper proportions, a good leaching product may be obtained; but it is necessary to adjust the output of the sand-concentration plant in the proper ratio to that of the slime tables.

Ferric Salts as Solvents in the Leaching of Roasted Copper Ores

Their Use, Heretofore Objectionable Because Basic Iron Salts Clogged the Tanks and Filters, Now Made Possible by the Removal of Colloidal Matter by a Dorr Bowl-Classifier or Hydro-Separator—Regeneration of Solvent a Necessity for Economical Operation

BY PERCY R. MIDDLETON

IN A PREVIOUS ARTICLE I gave an account of roasting experiments on a semi-oxidized copper ore.¹ These experiments showed that it is possible to roast either a sulphide or semi-oxidized ore and produce a calcine containing a large percentage of the copper content in the form of either acid- or water-soluble salts, the percentage of the latter being governed by the amount of sulphur in the original ore. In places where cheap power is available, the leaching of calcine with sulphuric acid, and the electrolysis of the leach solutions with the regeneration of acid, would probably be the most advantageous method of treatment. When the character of the original ore is such that a calcine may be produced in which the greater part of the copper is in the water-soluble form, sulphuric-acid leaching may be applied, together with precipitation on scrap or sponge iron. However, in some cases the acid consumption may be so high that unless it is possible to use electro-deposition, the cost of the solvent would make the process too expensive for commercial operation. As cheap power is available in few places, the acid consumption is one of the most important factors in the treatment of calcine with sulphuric acid, and may mean either the success or failure of the process. In view of this fact, I think that the use of solvents other than sulphuric acid should offer great possibilities.

Numerous processes have been suggested for the leaching of copper ores, the principal variation being in the solvent employed. The leaching of oxidized ores by sulphuric acid, together with the electrolysis of the leach solutions, is in successful operation at both Ajo and Chuquicamata, ammonia leaching is giving satisfactory results on sand tailing at Kennecott and Calumet & Hecla, the roasting and leaching of low-grade material is being successfully carried out at the tailing treatment plant of the Anaconda company, and heap leaching, in which the principal solvent is ferric sulphate, is still in use at Rio Tinto. With the exception of a few instances in which chloridizing roasting is employed, all other processes have been abandoned.

NEW MACHINERY ELIMINATES OLD DIFFICULTIES

On reading the available literature on the older processes of copper leaching, it seems that failure was due principally to two causes—namely, mechanical difficulties in handling both pulp and solutions, and the presence of sulphide or insoluble copper in the ore. In view of the progress that has been made in the design of leaching apparatus and accessories, it is reasonable to suppose that a great many of the mechanical difficulties could be eliminated by the use of modern appliances. In support of this statement I call attention to the development of the cyanide process of gold extraction, in which modern apparatus has made possible the

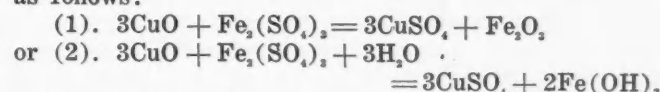
profitable treatment of ores that were regarded, a few years ago, as not amenable to the process. As the second great trouble was the presence of sulphide or insoluble copper in the ore, no great difficulty should be experienced in the application of some of these older processes, under modern conditions, to a calcine containing from 70 to 85 per cent of the copper content in the form of the sulphate, and the remainder as oxide of copper.

The early followers of sulphuric-acid leaching have seen the realization of their dreams in three large plants that were placed in operation after experimental work had shown that the difficulties experienced by earlier operators could be overcome successfully. In few cases has a process been satisfactory in its original form, and it is usually necessary to make many modifications before the desired results are obtained. It is the object of this article to show the possibilities of the ferric salts as solvents in the leaching of the product from a sulphatizing roast.

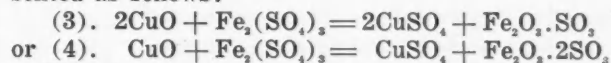
THE CHEMISTRY OF REACTIONS WITH FERRIC SALTS

Before taking up the practical side I will deal with the chemical reactions which take place between the sulphates and chlorides of iron and the oxides of copper.

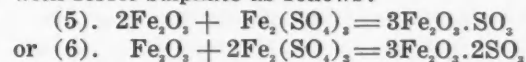
Ferric Sulphate and Cupric Oxide.—The only way ferric sulphate can dissolve cupric oxide is by an exchange of SO_4 for the oxygen combined with the copper. If ferric sulphate loses all its SO_4 , the equation will be as follows:



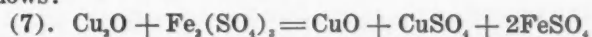
If a partial exchange takes place, it may be represented as follows:



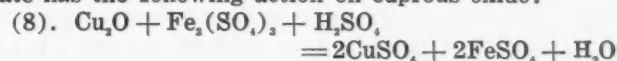
The ferric oxide formed in equation (1) may react with ferric sulphate as follows:



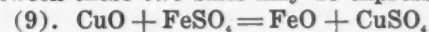
Ferric Sulphate and Cuprous Oxide.—To dissolve cuprous oxide, ferric sulphate must first oxidize it as follows:



Then the cupric oxide formed will be dissolved by an excess of ferric sulphate or by the ferrous sulphate formed in the above reaction in accordance with equation (9). In the presence of sulphuric acid, ferric sulphate has the following action on cuprous oxide:



Ferrous Sulphate and Cupric Oxide.—The reaction between these two salts may be expressed as follows:



Ferrous Sulphate and Cuprous Oxide.—No reaction.

¹E. & M. J.-P., April 15, 1922, p. 629.

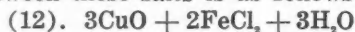
Ferric Chloride and Cupric Oxide.—Ferric chloride dissolves cupric oxide in accordance with the following equation:



or (11). $3\text{CuO} + 2\text{FeCl}_3 + 3\text{H}_2\text{O}$



Ferrous Chloride and Cupric Oxide.—The reaction between these salts is as follows:



The cuprous chloride formed in the above reaction, being insoluble in water, will be precipitated unless an excess of metal chlorides is present.

Though the above equations represent the actual dissolving of the copper compound, numerous basic salts of iron are also formed, depending on the conditions under which the reactions take place. The formation of these basic salts and also the precipitation of the iron oxides has been a great difficulty in the application of leaching methods in which iron salts are used as solvents. The general practice was to leach by percolation, and the colloidal iron oxides, together with the basic salts, clogged the charge and made both leaching and washing almost impossible; however, this difficulty may be eliminated by making a separation of the colloidal matter in either a Dorr bowl-classifier or a hydro-separator. Owing to the small percentage of colloids, it is possible to treat this material by either filter pressing or a standard vacuum filter, without greatly increasing the total cost per ton of original ore. This method of treatment is now standard practice in several cyanide plants, and results are most satisfactory.

POSSIBILITIES OF REGENERATION OF SOLVENT ATTRACTIVE

One of the most important requirements of any leaching process is the regeneration of the solvent or at least the production of a base from which the solvent can be cheaply produced. The use of soluble iron salts as lixiviants, in conjunction with precipitation on iron, offers great possibilities in this direction. The precipitation of copper from sulphate solutions by iron is in accordance with the equation $\text{CuSO}_4 + \text{Fe} = \text{FeSO}_4 + \text{Cu}$. The neutral solution of ferrous sulphate produced in this reaction may be oxidized to ferric sulphate as follows: $4\text{FeSO}_4 + \text{O}_2 = \text{Fe}_2(\text{SO}_4)_3 + \text{Fe}_2\text{O}_3 \cdot \text{SO}_3$. In this operation 50 per cent of the iron is precipitated as a basic salt. If the solution is made acid before oxidation, this basic salt is not formed and the reaction may be represented: $2\text{FeSO}_4 + \text{H}_2\text{SO}_4 + \text{O} = \text{Fe}_2(\text{SO}_4)_3 + \text{H}_2\text{O}$.

The addition of acid to the solution before oxidation makes the process virtually one of acid leaching, however. The above equation calls for only 0.245 lb. of sulphuric acid per pound of ferric sulphate produced, and as one pound of copper, in the form of copper oxide, consumes 2.1 lb. of ferric sulphate, the acid required in the process is equal to 0.514 lb. of sulphuric acid per pound of copper dissolved. This is much below the average consumption in straight acid leaching. In treating calcine from a sulphatizing roast, the loss of iron in the oxidation of the neutral solution from iron precipitation would not be of any consequence, because the roast can be regulated to produce a calcine containing sufficient ferrous sulphate to compensate this loss of iron.

Efforts to oxidize ferrous sulphate by blowing hot air through the solution have not been very successful, but after numerous experiments I found that satisfac-

tory results can be obtained by introducing the air into the solution in tanks fitted with porous bottoms similar in construction to the porous bricks sometimes used in the Callow flotation machine.

Extensive experiments with ferric sulphate were conducted at Cananea² on an ore containing both sulphide and oxide. A 96 per cent extraction was made on a ten-ton lot of Cobre Grande ore containing 3 per cent copper. It was found that ferric sulphate made a practically complete extraction of the oxide and carbonate of copper, but the action on the sulphide was slow. The principal difficulty encountered was the regeneration of the solvent. Experiments along the lines of the Siemens-Halske process, in which the solvent is ferric sulphate, were conducted at Ray, Arizona.³ One ton of 2.5 per cent copper ore was treated and showed an extraction of 80 per cent.

EXPERIMENTS WITH FERRIC CHLORIDE

Ferric chloride is the most active solvent of the iron salts, and has been the subject of considerable experimentation, but the precipitation of ferric hydrate, as shown in equation (11), has caused considerable trouble in the leaching operation. The regeneration of ferric chloride from spent solutions can be effected readily by chlorine: $\text{FeCl}_2 + \text{Cl} = \text{FeCl}_3$, 0.218 lb. of chlorine being required to produce 1 lb. of ferric chloride. In the dissolving of cupric oxide in accordance with equation (11), 1.7 lb. of ferric chloride is required to dissolve 1 lb. of copper and 0.37 lb. of chlorine is required to produce 1.7 lb. of ferric chloride; in other words, the chlorine required for the regeneration of ferric chloride is equal to 0.37 lb. chlorine per pound of copper. The Nelson electrolytic chlorine cell is guaranteed to yield 0.625 lb. of chlorine per kw.-hr.; therefore, the power requirement for the regeneration of ferric chloride is equal to 0.59 kw.-hr. per pound of copper present in the ore as cupric oxide.

Ferric chloride, together with metallic iron, may be produced by the electrolysis of a solution of ferrous chloride, according to the following equation: $3\text{FeCl}_2 + \text{electric current} = 2\text{FeCl}_3 + \text{Fe}$. In this reaction 1 lb. of ferric chloride and 0.165 lb. of metallic iron are produced from 1.17 lb. of ferrous chloride. Operating at 100 per cent efficiency, 431 ampere-hours will yield 1 lb. of iron and 6.06 lb. of ferric chloride. Ferric chloride can also be regenerated by direct oxidation with air: $6\text{FeCl}_2 + 3\text{O} = 4\text{FeCl}_3 + \text{Fe}_2\text{O}_3$. In this reaction one-third of the iron is precipitated as ferric oxide.

Leaching with ferric chloride was tried out on both raw and roasted ore at Rio Tinto.⁴ The raw ore was crushed to half inch and mixed with 0.5 per cent by weight of sodium chloride and 0.5 per cent of ferrous sulphate. Large heaps were built and treated with ferric-chloride solution. The copper was precipitated on pig iron and the ferric chloride regenerated in scrubbing towers by chlorine made by heating ferrous sulphate and sodium chloride. An extraction of 50 per cent was made in four months and 80 per cent in two years. Large-scale experiments were conducted on an oxidized ore by the Walker River Copper Co., at Yerington, Nev.⁵ The ore was crushed to 20 mesh and agitated for seven hours with a ferric-chloride solution, in Dorr agitators; the pulp was then treated in tanks

²W. L. Austin, "Mines and Methods," September, 1910.

³W. L. Austin, "Mines and Methods," October, 1910.

⁴Annales des Mines. Vol. XCVI. "Notes Sur le Rio Tinto." M. E. Cumenge.

⁵M. & S. P., Vol. 118, p. 669. R. W. Perry.

fitted with filter bottoms, but percolation was slow, on account of the precipitated ferric hydrate. The solvent was regenerated by the electrolysis of the spent solution from scrap-iron precipitation, and the iron produced in this operation was used in the precipitation of the copper. Percolation tests on 10 kg. samples of this ore showed extractions around 85 per cent, with a consumption of from 8 to 12 lb. of ferric chloride per ton of ore. The cupric chloride formed by the action of ferric chloride on cupric oxide is also a solvent of both sulphide and oxide of copper, the reaction in the latter case being: $CuCl_2 + CuO = Cu_2Cl_2 + O$. The cuprous chloride thus formed will be precipitated unless an excess of a metallic chloride is present in the solution. The Hoepfner process depends on the above reaction and was the subject of experimentation at Miami, Ariz., in the treatment of Keystone ore.⁶

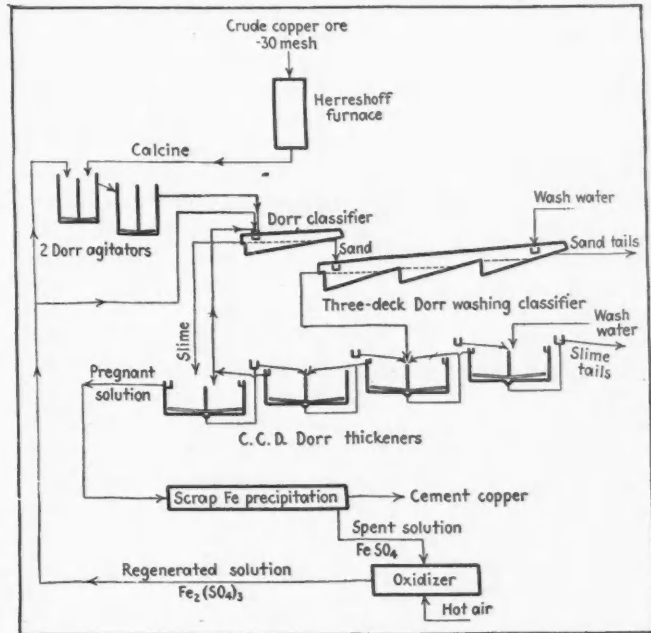
The following is a brief account of the Miami experiments: The ore contained from 3 to 5 per cent copper, occurring as chrysocolla, was crushed to $\frac{3}{8}$ in., and treated in a kiln, wherein it was subjected to the action of reducing gases from a small gas producer. The calcine, which contained some of the copper in metallic form, was treated with a solution containing 5 per cent copper as cupric chloride, and 20 per cent sodium chloride. The 12-mesh product gave an extraction of 83 per cent with hot solution, and the 60-mesh product, in the same time, showed an extraction of 99 per cent, the metallic copper being dissolved in accordance with the equation: $CuCl_2 + Cu = Cu_2Cl_2$. The cuprous-chloride solution produced was electrolyzed in a diaphragm cell, after being divided into two streams, one passing through the anode compartment and the other through the cathode compartment. The anolyte acted as a depolarizer, cupric chloride being formed by the chlorine liberated at the anode. After passing through the cells the anolyte and catholyte were reunited and formed the regenerated solution for subsequent leaching. The cell voltage was one volt, with a current density of from 10 to 12 amperes per square foot. One ton of copper was produced in these experiments.

PROPOSED METHOD OF LEACHING WITH SULPHATE OR CHLORIDE

Returning to the original object of this article, I will endeavor to anticipate the results that would be obtained in leaching a calcine similar to that produced in the Burro Mountain roasting experiments.⁷ Consider the analysis of this calcine as: Cu, 2.52 per cent; total soluble Cu, 2.39 per cent; and water-soluble Cu, 2.02 per cent. Then 80.2 per cent of the total copper content is in the form of copper sulphate, and 14.7 per cent in the form of copper oxide. The copper sulphate being readily soluble in water, all that is required of the solvent is the dissolving of 14.7 per cent of the total copper content, which is 7.4 lb. of copper per ton of ore. Taking the efficiency of the solvent on this oxide copper at 75 per cent, the total extraction will be 91.1 per cent. Experiments at Cananea indicate that at least 75 per cent extraction may be expected from cupric oxide, using ferric sulphate as the solvent, and ferric chloride at Yerrington, Nev., proved to be an efficient solvent of cupric oxide, so that 75 per cent may be taken as a conservative estimate for the extraction with this salt.

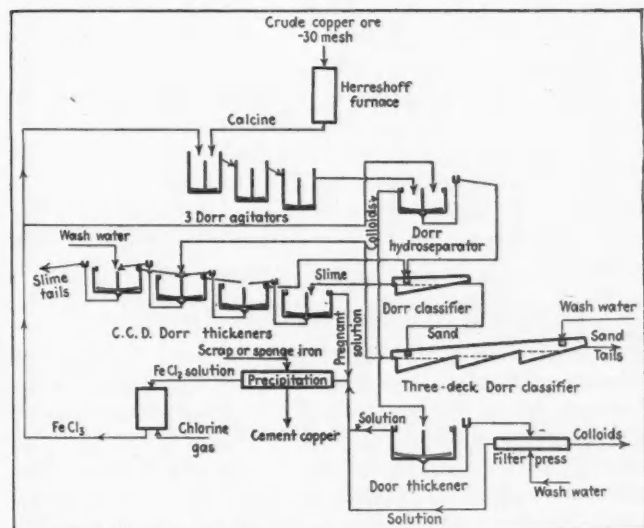
⁶W. L. Austin: "Mines and Methods," November, 1911.
⁷E. & M. J.-P., April 15, 1922, p. 629.

I have drawn two flow sheets illustrating the application of both ferric sulphate and ferric chloride leaching to the calcine resulting from a sulphatizing roast. Flow sheet No. 1 shows the arrangement of the plant required for the ferric-sulphate process. The calcine, after being agitated in two Dorr agitators with ferric-



Flow sheet No. 1

sulphate solution regenerated from spent precipitation liquors, passes to a Dorr classifier, where a separation of sand and slime is made. The sand is treated in a three-deck washing classifier, and the slime is washed in a series of counter-current decantation Dorr thickeners. The pregnant solution is treated with scrap iron for the recovery of copper, and the resulting solution is regenerated in an oxidizer by means of hot air, and



Flow sheet No. 2

is returned to the agitators and classifier. With the exception of the oxidizer, the whole of the equipment is standard and of proved efficiency.

Flow sheet No. 2 illustrates the application of ferric-chloride leaching. This flow sheet makes provision for the removal of the colloidal ferric hydrate, which has

hitherto caused considerable trouble in this process. The calcine, after being treated with ferric-chloride solution in three Dorr agitators, passes to a Dorr hydro-separator, making a separation of the colloids, which are thickened in a Dorr thickener and washed in a filter press. The underflow from the hydro-separator goes to a Dorr classifier, making a separation of sand and slime, the sand being washed in a three-deck washing classifier, and the slime being treated in a series of Dorr thickeners. The overflow from the first of the series of thickeners, after joining the solution from the colloid thickener, is treated with iron for the recovery of copper, and the spent solution, after treatment with chlorine gas for the regeneration of ferric chloride, is returned to the system. The only step in this layout that is not standard is the regeneration of the ferric-chloride solution.

METHOD OF PRECIPITATION MAY BE MODIFIED

A number of modifications may be made to these flow sheets, especially in the precipitation of the copper and the regeneration of the solvent. If cheap scrap iron is available, this method of precipitation could be successfully applied. In view of the encouraging results that have been obtained in the Southwest with the commercial production of sponge iron, it is highly probable that this precipitant will, in the near future, be available. It has long been known that sponge iron can be produced from iron oxides, but mechanical difficulties have been encountered in large-scale production.

The present development of an improved furnace eliminates the mechanical troubles.

The regeneration of ferric sulphate, although unsatisfactory at Cananea, can be effected by hot air in properly designed apparatus. The production of ferric chloride from spent precipitation liquors can be accomplished by either chlorine or the direct electrolysis of ferrous-chloride solutions. The practicability of the latter operation is illustrated in the commercial production of boiler tubes by the Eustis process, in which a ferrous-chloride solution is electrolyzed with the regeneration of ferric chloride.

Although it is impossible to form an accurate estimate of the working costs of the above processes, a glance at the flow sheets is sufficient to show that labor can be reduced to a minimum and the cost of regenerating the solvent should be less than that of the acid required in leaching a similar ore with sulphuric acid, except where acid is produced in the plant as a by-product.

Radioactive Minerals of Ontario

A report by H. V. Ellsworth on the radioactive minerals of Ontario issued by the Canadian Department of Mines states that an examination of all places where such minerals occur, or are likely to be found, showed their presence in small amounts in the majority of the workings visited, extending from Parry Sound eastward nearly to Kingston. It thus appears that uranium and thorium minerals are of common occurrence and widely distributed in the pre-Cambrian rocks of this part of Ontario, though usually present in very small quantities. All the finds of radioactive minerals in the province, with the exception of a lost locality on Lake Superior, have been in the areas of pre-Cambrian rocks south of the French and Ottawa rivers and west of a line between Ottawa and Kingston.

Mr. Ellsworth notes that the most important radio-

active minerals in Ontario are uraninite and euxenite-polycrase. They contain uranium or thorium or both, and are mostly black or brown and rather heavy. Uraninite may contain 70 to 80 per cent uranium oxide, besides thorium, lead, and rare earths. Euxenite may contain up to 10 or 15 per cent of uranium oxide, with large amounts of titanium, tantalum, columbium and rare earths. A little thorium is usually present. Radioactive minerals are rarely, if ever, seen on weathered surfaces and can be found only by opening up the rock. The Ontario radium-bearing minerals are of a different type from the carnotite type deposits worked in Colorado, and are richer in radium.

Fairy Tales of Mining (Metallurgical Series)

"What Happened When Jim Lingered at the River" and "The Fable of Carrie and the Overalls"

The following letter appeared in the *New York Herald* of Aug. 21. Emanating, as it does, from the researches of the Copper and Brass Research Association, we feel sure that readers of the *Engineering and Mining Journal-Press* will be interested:

To the *New York Herald*: Archie Rice's very interesting letter in the *New York Herald* of Aug. 16 purports to give an account of how the leaching process of copper recovery was first discovered. So far as the principles involved are concerned Mr. Rice is quite accurate, but he is not entirely straight on his facts concerning the lucky accident which brought about the discovery by which millions of pounds of copper which formerly went to waste are now recovered every year.

In November, 1889, there was a disastrous fire in the copper mines in the Butte district of Montana. The heat from this fire caused a slow roasting of the copper sulphide-bearing minerals, exactly as happens in the first operation in a smelter. The resulting sulphate of copper dissolved in the water which was pumped into the mines in large quantities to extinguish the fires. Reaching the surface this water flowed across a wagon road in a shallow stream.

The local junk-dealer, one Jim Ledford, allowed his wagon to stand for some time in this stream. When he drove home he discovered a heavy deposit of copper on the iron tires of his wagon wheels. Jim was no metallurgist, but he was keen enough to see that he had discovered something. He applied for and obtained the right to control the entire water supply from the mines. This he diverted into a yard in which he stacked huge piles of junk. By the time his contract ran out he had cleaned up about \$100,000. Later the handling of this phase of recovery in the Butte district became a company operation.

Leaching, as it is called, simply involves the principle of the precipitation of copper in solution. There is evidence that it was practiced in a crude way many centuries ago at the famous Rio Tinto mines in Spain, but the commercial application of the process in this country only dates back to Jim Ledford's discovery.

Curiously enough, another secondary process of copper recovery, known as oil flotation, by which millions of pounds of the metal are saved every year, was discovered by accident. The wife of a miner noticed that whenever she washed her husband's overalls quantities of copper in minute grains rose to the surface of her tub in the soap bubbles. Engineers were quick to appreciate the significance of this, and the result is the great oil flotation plants which today are recovering huge quantities of copper from the tailings or waste sands of past decades.

WILLIAM A. WILLIS,
Manager Copper and Brass Research Association.
New York, August 19.

Antimony in Southwestern Arkansas

Stibnite Deposits in Sevier County Represent Fillings in Fault Zones in Paleozoic Shale and Sandstone—Mineral Composition Suggests Igneous Origin—Presence of Dike of Ouachitite Noted

BY GRAHAM JOHN MITCHELL

THE MINING OF ANTIMONY in Sevier County, Ark., has been carried on intermittently since 1873. Stimulated at times, as during the period of high prices for the metal in 1906, when prospecting and mining were carried on vigorously, today the industry is dormant.

The deposits which have received the most attention occupy a narrow belt of country extending from the May shaft, near Gillham, southwest to the Otto and Valley mines, as shown on the accompanying sketch map. This area is composed of interbedded Paleozoic sandstone and shale which have been strongly folded and show evidence of metamorphism. Erosion of the steeply dipping beds has produced a topography characterized by even-crested east-west ridges made up of the harder sandstone, and the intervening valleys have been developed in most instances along the shale. Topographically, the country resembles parts of the folded Appalachians.

The following discussion is based on a study of the

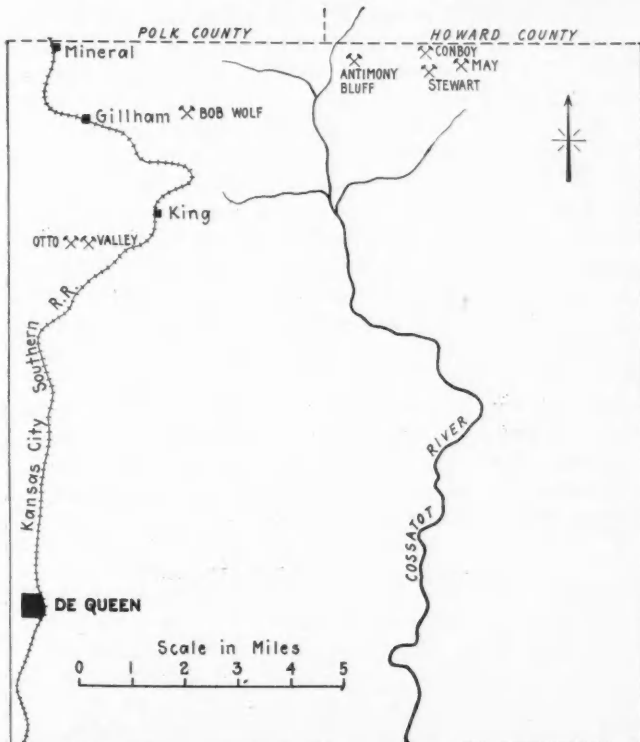


Fig. 1. Map showing situation of antimony properties in Sevier County, Ark. Based on De Queen topographic sheet, U. S. Geological Survey.

surface workings and a reconnaissance of the geology of the surrounding region. Although the properties were flooded, data bearing on the mineralogy, structure and mode of occurrence are obtainable in the excavations. The presence of igneous rock near by, not previously noted, is a factor to be considered in determining the genesis of the ore.

Stibnite, which is the chief ore mineral present, has formed in fault zones in Paleozoic shale and sandstone. The veins, which are parallel to the steeply dipping beds, with slight replacement of the walls, follow closely

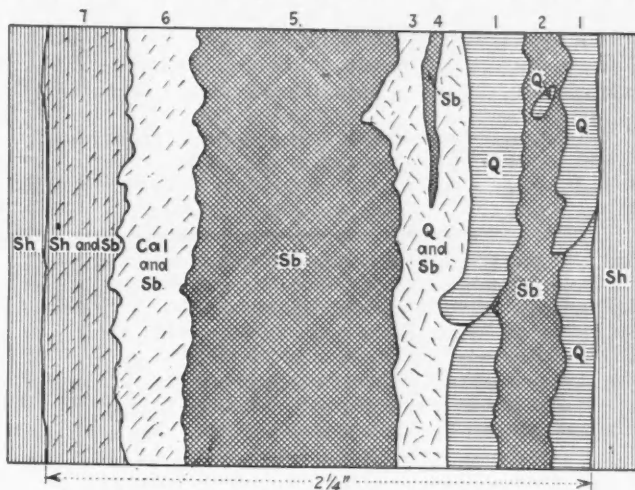


Fig. 2. Details of banded antimony vein.

the strike of the sedimentaries. The mineralized zones vary in width from a few inches to 4 or 5 ft. and contain the antimony sulphide in lenses and banded vein-fillings with quartz and calcite as the chief gangue. Fig. 2 shows details of a banded vein, with three veinlets of crystalline stibnite associated with quartz and calcite. The quartz veinlet (1) has been faulted and replaced by stibnite (2). Fillings (3), composed of quartz through which is scattered stibnite, and calcite (6), which also contains the sulphide, were introduced later than the quartz (1). Stibnite (5) replaces quartz (3) and calcite (6), and is probably the same age as the stibnite veinlet (4).

A summary of the evidence presented by this vein shows quartz to have been the first mineral formed, with stibnite following. Still later, stibnite and quartz were introduced simultaneously. Calcite came in about this time and was followed by another period of antimony deposition. That quartz also formed later than stibnite is proved by the presence of small plates of the sulphide in quartz crystals.

The ore also occurs in small lens-like masses in the fault zones. Pieces of pure stibnite larger than one's fist were seen and masses 30 in. thick have been reported mined. Much of the ore in these lenses is not pure, being mixed with quartz, siderite, pyrite, calcite, and included fragments of the inclosing shale and sandstone.

The lenses of ore pinch and swell along the strike and dip of the veins, in places no antimony being present. Prospecting is guided by the quartz veinlets which crop out at many places in the region. While examining this area, I located a vein carrying antimony at a point where it was crossed by a wagon road.

The decomposed condition of the country rock and the thick coating of soil concealed the underlying antimony in the vicinity. In the road, however, the wheels of passing vehicles had cut through this surface cover and, encountering stibnite, had produced a brilliant polish on the sulphide which readily attracted the eye.

Oxidation is evident in the upper part of the veins, where a yellowish coating of antimony oxide has been formed on the sulphide. Oxidized ore is said to extend to a depth of 115 ft.

The presence of arsenopyrite in the veins has been noted by Hess.¹ Other minerals listed by him are quartz, stibnite, jamesonite, zinkenite, galena, sphalerite, pyrite, chalcopryrite, siderite, and calcite, with traces of arsenic, bismuth, cadmium, cobalt, silver, and, rarely, gold. His analysis of ore from the Antimony Bluff mine gives: Stibnite, 99.711; chalcopryrite, 0.055; bismuthinite, 0.005; gangue, 0.229; total, 100 per cent.

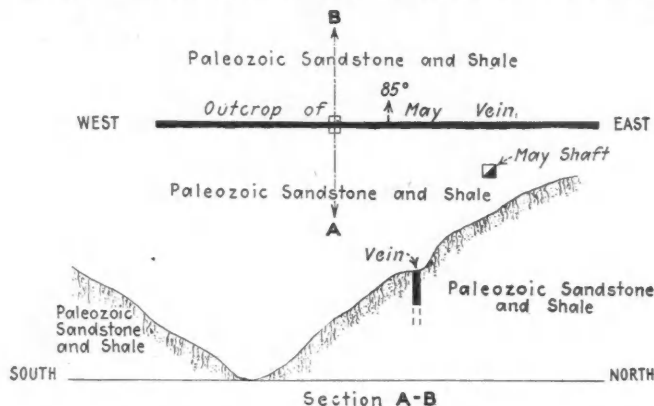


Fig. 3. Outcrop of May vein and section through A-B.

Sufficient data have not been secured to determine the source of the mineralizing solutions. The mineral composition of the veins would suggest an igneous origin, but no igneous rock has been found associated with the deposit. There is, however, a 5-ft. dike of ouachitite, which I found a little more than two miles to the southeast. This rock is a black heavy material, with biotite, augite, and pyrite recognizable in hand specimens. The presence of igneous rock in this section of Arkansas has not previously been recorded, although it has been suggested that such might exist.

As a type of occurrence of antimony, the Sevier County deposits represent fillings in fault zones in Paleozoic shale and sandstone, in which respect they resemble the stibnite veins of Bolivia.² These zones vary in width from a few inches to four feet or more and follow closely the dip and strike of the sediments, which have been folded into steeply dipping beds with minor departures from an east-west strike. Besides the banded veins, lenses and pockets of ore are present. Pure masses of antimony of any considerable size are not abundant, the greater part of the ore being mixed with gangue which is chiefly quartz and calcite. In some instances, fragments of shale and sandstone are included in the lenses of stibnite.

In discussing the genesis of antimony deposits, Lindgren says,³

"There is, then, convincing testimony that deposits of quicksilver, antimony, arsenic, gold, and silver may be

formed close to the surface by hot ascending waters of the kind related to volcanic phenomena. It is probable, indeed, that the majority of fissure veins which contain notable amounts of gold and silver together with sulphides of the baser metals have been formed by these waters. On the other hand, it is certain that warm and even cold waters of the meteoric circulation in non-volcanic regions are likewise competent to form mineral deposits of the baser metals containing oxides and carbonates of iron and manganese, and sulphides of copper, lead, and zinc, with very small quantities of gold and silver."

In the Arkansas deposits, the mineralogy of the veins, together with the presence of igneous rock in the near vicinity, points to an igneous origin for the mineralizing solutions responsible for ore deposition.

The Way of the Promoter in Queensland

As in parts of the world nearer home, the ways of company promoters in Australia are sometimes peculiar. Lately in Queensland an attempt was made to form a company to prospect for oil at a place called Monduran Valley, near the port of Gladstone. The evidence contained in the prospectus in support of the proposition may be termed negative and presumptive—or, in the words of Gilbert, "very presumptive." For instance, "The promoters desire to draw attention to the fact that since no boring has been carried out in the Monduran Valley up to date, there is therefore no evidence to the contrary that the efforts of the proposed company in testing this country for oil will prove successful." An "American petroleum geologist," from whom it was proposed that the company should buy a prospecting license, reported that "it must be understood that the whole of the area examined is a *terra incognita* from a boring point of view." Professor David had expressed the opinion that, of only three regions known to him in the commonwealth where evidences for the occurrence of rock oil are reasonably good, the eastern portion of the great artesian basin in Queensland, in the area between Roma and Blackall, is one of them. The prospectus, calling in Professor David as a witness, says Gladstone is "in a direct line" from Blackall. So it is, but—what the prospectus does not say—it is east 350 miles away, while the line from Roma, over 200 miles to the south of Blackall, runs nearly south and north. Incidentally it may be added that Boulia, on the eastern boundary of Queensland, is also "in a direct line" from Gladstone (about 800 miles), but the prospectus does not mention this. Up to the time the last mail left, the proposed company had not been formed.

Production of Gold in Brazil

The total production of gold in Brazil averages slightly less than \$3,000,000 per annum, according to General A. Gaulin, Consul at Rio de Janeiro. It is mined in the states of Minas Geraes, Matto Grosso, Goyaz, and Bahia, but the only mines of any importance are situated in the state of Minas Geraes.

The largest gold mine in Brazil is at Villa Nova de Lima, in the State of Minas Geraes. The mine, which is now owned by an English concern, has reached a depth of nearly 6,600 ft., and it is claimed to have still a reserve of 1,200,000 metric tons of ore. The monthly output averages from 12,000 to 15,000 tons, and the yearly production is valued at about \$2,092,595. About 3,000 men are employed in this mine.

Another important mine is at Passagem de Mariana, Minas Geraes.

¹F. L. Hess, Bull. U. S. G. S., No. 340, 1907.
²Miller, B. L., & Singewald, J. T., Jr., "The Mineral Deposits of South America," McGraw-Hill Book Co., 1919, p. 87.
³Lindgren, W., "Mineral Deposits," McGraw-Hill Book Co., 1919, p. 114.

The Case for and Against a Metal Exchange

Diverse Sentiment Between Consumer Who Generally Favors and Producer Who Is Opposed to Such a Mart
—Mining Companies Desire to Sell Direct to Consumer

BY FELIX EDGAR WORMSER

Assistant Editor, *Engineering and Mining Journal-Press*

A METAL EXCHANGE is a place of business where buying and selling of metals may take place under certain rules and regulations prescribed by the members of the exchange. In practically all respects its principles and methods of handling transactions resemble those of grain, cotton, and stock exchanges. Many metal exchanges exist, and they are particularly well known in Europe, where they are old and well established. The London Metal Exchange is the greatest in the world. Although there is a New York Metal Exchange, it has never become of importance in the marketing of any metal except tin, which is not mined in the United States.

Early in 1922 several persons closely identified with the metal business in New York asked Mr. J. E. Spurr, Editor of *Engineering and Mining Journal-Press*, to investigate the possibility of broadening the scope and membership of the present New York Metal Exchange so as to include more producers of metal and enlarge the present practice of dealing in the metals.

This investigation was gladly undertaken, and letters were sent to nearly all the leading metal producers and many important consumers in the United States inviting them to give, in confidence if they chose, their opinion as to the advisability of establishing a strong metal exchange in New York City, with reasons for their attitude. The number of replies received attested to the great interest in the subject and to the careful consideration that had already been given it by both producers and consumers of the metals. Some producers and dealers, apprehensive of the delicate nature of the topic and their position, preferred to give their opinions verbally.

Practically all of the most important producers of metals—copper, lead, zinc, and silver—take a stand against an exchange. Consumers as a rule favor it. However, the fact that the American metal producer is so uniformly opposed to such an institution makes it exceedingly difficult to do anything to establish a metal exchange that shall be true to its name, unless the producer be persuaded to change his mind.

MINING COMPANIES DESIRE TO CONTROL DISPOSITION OF THEIR METALS

The producers have excellent reasons for refusing to entertain the idea of a metal exchange. They wish to retain full control of their products and do not desire to have it fall into the hands of anyone but an actual consumer. Dealers and speculators are anathema so far as the majority of the producers are concerned. This attitude is not an arbitrary one, but the result of bitter experience. Frequently a major producer has endeavored to aid a dealer by supplying him with a lot of, say, copper at a fixed price. In a rising market the dealer has been glad to accept his shipment, but in a heavily falling one, such as occurred last year, contracts were evaded and obligations forgotten. Furthermore, the producer time and again has had to compete with some of

his own metal which he had previously sold to a dealer, only to have it shuttle back and forth in the market. In other words, the producer wants to eliminate the middleman and to deal directly with the consumer. In this way he can build up satisfactory relations with buyers, become intimately acquainted with their wants and can serve their interests to best advantage. The president of a large lead company in illustrating this point writes frankly as follows:

"Our policy is so directly contrary to selling on a metal exchange that, so far as we are concerned, no metal exchange can expect support from us. Our endeavor is to sell direct to the consumer and in no case to sell him more than he expects to use at the time of purchase.

"This policy on our part arises not only from the desire to eliminate middlemen profits and speculation, but from the further fact that grades of lead which are suitable for one buyer are unsuitable for another, and we endeavor to see that each buyer of our brand receives the lead which is suitable for his uses. We, of course, can have no objection to others selling their product in whatever way seems best to them."

We did not find a single metal producer whose business was confined to producing the metal he sold, in favor of a metal exchange. One of the largest copper producers in the world placed himself on record as being unalterably opposed to an exchange. He maintained that the larger producers were interested primarily in having a stable copper market, something to which dealers and speculators were not committed, as speculators depended for a profit upon a rise or decline in prices and hence were anxious to have a fluctuating market. He remarked that dealing in a metal exchange would place the producer at the mercy of people who lived by their wits and that influence would undoubtedly be brought to bear on the metal exchange in order to manipulate prices.

One of the most illuminating letters on the subject is reproduced at length, as it shows great study on the part of a prominent metal producer and brings out a comparison between the activities of the London and a prospective American exchange that is decidedly informative:

"The argument is made that because of the fact that the United States furnishes a very large part of the world's production of silver and copper, and a very large part of the world's consumption of tin, there is no reason why the major speculative market for these metals should not be in New York rather than in London. The argument is plausible, to my mind, were it not for one major difficulty—namely, that the whole machinery of the metal business in this country is not built on lines which would work well with a large speculative exchange. London must have exchanges of this sort because of the nature of its business.

"The English are essentially traders, dealers, and merchants; their business has been built up on the basis of buying and selling products produced in other markets, on all of which they secure commissions and speculative profits and losses. Their big men in the metal trade are dealers, and their shrewdness and business ability have built up firms of dealers, all with large financial resources and with many

years of experience and successful business dealings behind them either as firms or as individuals. These firms make the London Metal Exchange, and although they, without doubt, use the Exchange at times for their selfish ends, even as responsible Stock Exchange firms in this market use the New York Stock Exchange for their selfish ends, still in the long run the business is conducted in a broad-minded and inherently responsible manner. They have no personal necessity for supporting the market, because they are not primarily producers; neither have they any necessity for depressing the market, because of other than a natural desire to see British consumers get their raw materials as cheaply as possible; they can, and generally do, look at the market from a world viewpoint, unbiased by any personal considerations except their desire to be right as to the swings in the market.

"On the other hand, in this (New York) market I think I may say the big men in the metal trade are essentially producers and consumers of metal; their efforts are directed toward the production or consumption and sale or purchase of the metals they produce or consume. I should say that 95 per cent of the metal business of this country is carried on directly between the producers and consumers of the metals. There isn't the need for substantial firms of dealers and traders. If there was such a need we would have developed such firms, and we have not done so. The nature and reputation of the comparatively few concerns who act as dealers does not, I am convinced, compare with the English firms. I am not referring to the strictly brokerage houses who do not buy or sell on their own account.

PERSONAL INTEREST VALUABLE

"In view of the essential difference between the two markets as above, I ask myself, therefore, what a big representative New York Metal Exchange would accomplish. I cannot imagine such a representative market, unless the metals traded in were the actual metals consumed and not scraps of paper representing unusable forms of these metals. To make a broad representative market there must be daily dealings between a wide variety of firms, and a large part of these dealings would represent sales by producers to consumers. This would result in nothing, to my mind, but the elimination of the personal equation and the personal interest now existing between buyers and sellers, and I consider that this personal intercourse between the buyers and the sellers is most essential and helpful; they do not need any metal exchange to permit them to get together.

"Furthermore, there are periods such as we have recently been going through when the consumers are out of the market for weeks at a time. A metal exchange would in such periods present an ideal opportunity for selfishly interested parties to rig the market and either artificially depress or stimulate the price, and by circulating rumors would convince the consumers that the prices quoted on the metal exchange were representative of real market conditions; to combat this, it might be necessary for producers to interest themselves in the quotations of the metal exchange. Due to the Sherman Anti-Trust Law, each producer would be obliged to act as a unit in such dealings, and the possibility of unfortunate consequences along these lines is so evident that I hardly think the point need be argued.

"Furthermore, such an exchange, if widely recognized, would offer inducements to the speculative fraternity 'to take a position' in metals as they do now from time to time in stocks, cotton, wheat, and other commodities, and I cannot help but feel this would be unfortunate for the metal markets. It would not be unfortunate if the volume of trading in the metals were of such proportions as the volume of trading in cotton and wheat, because then the market would be governed largely by fundamental conditions, and with proper rules against improper manipulation and squeezes such a metal exchange might serve a very real purpose. I cannot convince myself, however, that such a broad interest could be attained, or, if attained could be sustained, due to the nature of the business and the character and small number of the buying and selling firms.

"We hear no demand for a lead exchange, and the reason for this, to my mind, is that lead, although produced and consumed in very large volume, is not a speculative metal; it could be made just as speculative a metal as copper, tin, or spelter, but for years past the trade has become accustomed to stability of price, and, therefore, has not indulged in the wild buying, followed by complete lack of interest, which has characterized the other metals.

"If the 'big men' of this country should really bend their efforts toward a stabilization of the metal markets, which they are in a position to control, and should base their action on broad economic principles, it might be a severe blow to the speculative fraternity, but it would result, to my mind, in a lack of demand for a metal exchange and in a great new peace of mind for the metal producers and consumers of this country. Hitherto the edicts from Washington have seemed to prevent even an attempt along these lines. I am convinced that sometime in the next five or ten years Washington is going to see the injustice and economic waste occasioned by the American business men's fear of the Sherman Anti-Trust Law and will make it possible for such stabilization to be attempted.

"It is for the reasons given above that I do not believe it advisable to endeavor to force interest in a new and larger New York non-ferrous metal exchange."

Quotations from other letters might be introduced at this point to strengthen those that have preceded, but they would only needlessly accentuate the emphatic disapproval of a non-ferrous metal exchange on the part of practically all metal producers.

Although the case looks pretty black for it, the reader must not imagine from the foregoing that no kind words were spoken for a metal exchange. On the contrary many influential companies and individuals are highly in favor of it. Their arguments deserve to be heard and weighed as carefully as those of the opposition.

CONSOLIDATION AFFECTED MARKETS

The New York Metal Exchange feels that the lack of interest in its operations manifested by producers is partly the result of the absorption of many separate producing units into great consolidations. In the days when a flourishing business was transacted on the Metal Exchange there was no single interest strong enough to dominate a market:

¹"The change came when so many separate units were absorbed into great consolidations or combinations. These consolidations were the outgrowth of acute competition, and the object sought was restriction of competition, regulation of output, and control of prices. To secure this control various arbitrary methods were adopted. Free and open markets were abolished, producers were to sell direct to consumers, and to nobody else, and at delivered prices only, and the consumer must not resell. This policy was carried to much greater lengths than would now be possible. It soon came into collision with the courts, and laws were framed for the particular purpose of restraining it. In any event it was foredoomed to failure, because founded on an unsound economic principle. Probably no one would be quicker to admit this than the very men who twenty-five or thirty years ago put these great combinations together. There will be many great combinations in the future, but they will be forced to integrate their industry from the raw material to the finished product—to diminish waste, lower costs, improve quality, widen markets, increase efficiency—in short to *serve*, with all that the word *service* implies, for which the world is always willing to pay and for which it never grudges a fair reward.

AN OPEN MARKET BEST

"The idea of controlling markets was proved futile and has been abandoned. It was a boomerang, far more injurious to its originators than to those against whom it was

¹Communication from New York Metal Exchange.

aimed, and is now so recognized. The greater the company the greater its need for broad, free and open markets in which to trade. The best of us may be wrong, but of what use to be right if we cannot deal? It has taken a generation for this simple truth to penetrate into high quarters, but it is firmly lodged there at last. Everyone is now as free to buy and sell copper, tin, lead, and zinc as he is to buy and sell stocks and bonds on Wall Street, or wheat, corn, and cotton on the Produce Exchanges of the country.

"To meet these new conditions, and adapt itself to the changes which have occurred, the New York Metal Exchange has thoroughly revised its rules and contracts, and presents them to the public in the full confidence that they will meet every requirement of the trade and of all those who wish to deal in metals. The produce of every smelter and refinery, every standard and established brand of copper, tin, lead, and zinc, will hereafter be a good delivery on the exchange. Quantities, qualities, shipments, deliveries, prices, terms, and conditions are all carefully prescribed; every interest is safeguarded and every right protected. The machinery is modern and up to date in every respect.

"The exchange will maintain in the future the same high standard of integrity and fair dealing which has characterized it in the past, and it invites the co-operation of the non-ferrous metal trades in putting the industry on a sound business basis."

SPECULATION A STUMBLING BLOCK

So far as the machinery necessary to expedite business on a metal exchange goes, the New York Metal Exchange is well prepared to offer the metal broker or producer every facility for the prompt execution of his business. Objections to the methods of the exchange are no longer vital. One important complaint about the personnel of the present exchange points out the financial weakness of some of its members compared with the powerful firms dealing in metals on the London Exchange. Even this objection has been met by the offer to establish a clearing house which would protect sellers and where contracts would be subject to its approval.

In answer to the charge that trading on a metal exchange would encourage speculation, with disastrous results to the producer, the advocates of a metal exchange contend that by having the brokers and others carry metals a broader market would be obtained and the producers would be relieved, particularly in times of stress, from carrying a heavy financial burden themselves. They furthermore maintain that a market would attain its proper level promptly in a broader market, and the exchange would be a more stable one. Frequently, so they claim, attempts are made to hold the metal markets at fictitious prices—prices not representative of supply and demand.

The manufacturer is heartily in favor of a metal exchange for the reason that it would enable him to "hedge" and to quote on finished products for future delivery, as he is very often asked to do beyond the months for which the producers are willing to sell. He would do this by "hedging" for his metals on exchange, thus eliminating the element of speculation which now creeps in. A further advantage to the manufacturer would be the greater ease with which he could obtain definite information regarding prices at which he could actually buy and upon which he could base the sale of his finished products. At present, actual daily market conditions can be ascertained only by tedious investigation and often only by firm offers to purchase metals. Weekly metal market reviews aid considerably and the

daily trade papers assist in this work, but they do not give this information as promptly as a metal exchange would.

"HEDGING" AN ADVANTAGE IN EXCHANGE TRADING

This brings up the whole matter of "hedging" and speculation, subjects that have received a great amount of attention from Congress in recent months in connection with the investigation of trading methods in agricultural products. "Hedging" is a common perfectly legitimate method of insurance against loss due to a decline in the value of a commodity. It is in daily use by flour mills in their purchase of grain and by metal manufacturers (in London) in their purchase of metals.

In operation a "hedge" is normally the sale of a commodity for future delivery, concurrently with the purchase of an equal amount of that commodity in the spot market. By this simple expedient the manufacturer is able to protect himself against a decline in price. To illustrate: if a copper-wire manufacturer had the facilities of a representative metal exchange at his disposal—which he hasn't—he might buy, say, 100 tons of copper today at 14c. per lb. and at the same time sell 100 tons for delivery in three months at the future price which might be 14½c. per lb. At the end of three months in the event of a decline in the spot copper market to, say, 13c., the loss he would make on selling his finished product would be practically compensated by the gain in purchasing metal at 13c. to fill the contract he had made three months back at 14½c. It is common for bankers lending funds to dealers in agricultural commodities to insist that all transactions be covered by "hedges."

"Hedging" is practiced to a great extent in the London Metal Exchange, where quotations are made covering both prompt and future prices of metals. American manufacturers and dealers often avail themselves of the privilege in order to protect their purchases. It stands to reason that they would much prefer to deal on an American exchange were it open to them.

AMERICAN MINING COMPANIES STRONG FINANCIALLY

Although "hedging" helps American metal manufacturers and is an important advantage of a metal exchange, the other argument that the financial burden of carrying metals in dull periods would be distributed among dealers loses force when one considers the great financial strength of most of the copper, lead, and zinc companies in the country and their ability to carry their own financial load or obtain important support from banks. The farmer, on the other hand, is usually a man of limited means, and it becomes important for him to have other people aid in the work of financing his crops. This distinction between the function of the broker in agricultural and mineral commodities should be kept clearly in mind. The producer of wheat and other grains cannot deal directly with the consumer as easily as the mining company. The broker performs a valuable service in marketing agricultural products. The smaller dealers in metals and ores would be benefited by a place where they could practice "hedging."

The proponents of a metal exchange also incline to the belief that a certain amount of speculation is healthy for any market. Such trading would have considerable influence in stabilizing the market, they claim, either by the one element known as "bulls," who endeavor to

have prices advance, being kept in check by the "bears," with opposite intentions, or *vice-versa*. It also assures a continuous market valuable in times of depression.

Although the present method of dealing in the metals makes it difficult for a consumer to ascertain the true status of any metal market without extensive inquiry in the trade, this difficulty is mutual, as a producer labors under almost the same trouble. The technical and commercial press have an important function to perform in helping to acquaint both producers and consumers with the status of the markets so far as the results of their individual researches go. Producers are generally content with the means at their disposal nowadays for ascertaining market conditions. They rely chiefly on the exchange of information over the telephone and the knowledge of events which are likely to improve or depress prices.

One large and influential producer inclines to the belief that the large consumers, those who purchase 20,000-ton lots of copper, desire to avoid any brokerage expense if possible, which could not be done if they bought through a metal exchange. He calls attention to the fact that the largest producers of the non-ferrous metals have offices in New York and can easily be reached by the prospective purchaser in person or by telephone. Judging from the opinions expressed by the important consumers, however, I believe they would gladly pay the broker his commission and have the privilege of being able to deal on an exchange. From a consumer's standpoint this attitude is quite understandable. The prospective purchaser must do considerable shopping before he can satisfy himself where and what and how much metal he can purchase, and its price. This takes time and effort, a good measure of which he might save by dealing on an exchange and have the added assurance that he was buying at the market rate.

The consumers approached were either outspokenly in favor of a metal exchange or made no objections to its establishment. One of the largest consumers of lead and copper in the United States simply wrote, "I am heartily in favor of an exchange, which in my opinion would produce results most beneficial." Another large consumer who has had experience with the working of the New York Metal Exchange replied as follows:

"I feel that as this country is the principal producer of practically all metals (with the exception of tin, of which it is the largest consumer), prices should be established in this country on the basis of trading on Exchange, rather than to depend on the London Exchange.

"Form of contract and trading rules of the New York Metal Exchange were revised to what was thought would meet the situation (and these have since been further perfected), and the board of managers were, and I am sure are still, prepared to bring about any additional changes to meet the views of producers and others who would be willing to trade on the Exchange, but no favorable response has been received from the producers.

"Some of the larger producers seemed to prefer to do business by private negotiation, feeling that in so doing they would have better control of the market, by limiting the amount of metals in the hands of speculators, to possibly plague them later from time to time when the demand was light, or when speculators or dealers were obliged to dispose of same by throwing them on the market, in order to enable them to give shipping specifications.

"Others gave as a reason for not caring to trade on the Metal Exchange, that so many of the members were not financially responsible to justify trading with them, but it was suggested, and as a matter of fact steps were taken in that direction, that a clearing house could be established within the Exchange which would protect sellers, whereby

contracts would be subject to approval by the clearing house.

"While it is true that the present method to a certain extent limits speculation, it is also true that the producers would, by having a broader market, have the speculators and others to help carry the burden, instead of doing so themselves. They could, more or less, control matters by refusing to sell at the quoted prices, if they considered them too low, and they could also to whatever extent found necessary do business by private negotiation.

"It would, no doubt, be better for all concerned to have the market reach its proper level promptly and thus have a more stable one, which would be the result if copper were freely dealt in on the Exchange, rather than, as often under present conditions, to attempt to hold the market at a fictitious price.

"Manufacturers would be in a position to quote on finished product for future delivery, as they are very often asked to do beyond the months for which producers are willing to sell, by covering for their metals on the Exchange, thus eliminating the element of speculation which now obtains.

"A further advantage to the manufacturer would be that he would have more definite and up-to-date information with regard to prices at which he could actually buy, on which to base sales of finished products, than is the case at present, when the actual copper market conditions can only be ascertained by tedious investigation, and very often only by firm offers to buy."

A metal exchange would not destroy the relation which exists between some producers and consumers. Heavy tonnages would still be sold directly to the manufacturers, as is brought out in the following communication from a large lead consumer:

"Personally, I cannot help but feel that this country, being the largest producer of copper, zinc, and lead, and the largest consumer of tin, should not be compelled to go to London to conduct hedging operations. On the other hand, the policy of the large producers of all of these metals to sell only direct to consumers makes it a difficult problem. Obviously, it would be a far easier matter to promote active trading in tin than in any of the other metals.

"As a large consumer of pig lead, we are interested in stabilizing prices, and from this point of view it might be argued that a metal exchange where real speculation took place would work out to our disadvantage. We, naturally, under any conditions, would buy the larger portion of our requirements direct from producers. I am afraid that while the movement for a metal exchange has many things to recommend it, it would be exceedingly difficult to accomplish."

The importance of hedging is difficult to overstress. It may be considered just as important as insurance; in fact, it is price insurance. The London brokers now get the benefit of any hedging practiced by producers and consumers in the United States, as London is the only metal market where futures are bought and sold freely. An important New York metal dealer calls our attention to the result of failure to hedge and the importance of hedging privileges to dealers in the metals:

"The question of hedging is very little understood by the general consumer, and an example might perhaps best illustrate it. When sugar went up to 20c. one of the big consumers contracted for the supply of 10,000 tons, and the broker suggested to him that to protect this purchase against any decline in the market, he should sell sugar on Exchange against it, as his profit was not on sugar but on the manufactured product. The reply was that he was no gambler, and would certainly not speculate in sugar on Exchange. Result, loss of one and one-half million dollars when the break came.

"The London Metal Exchange did not gain its present predominant position immediately upon its start some fifty or sixty years ago. It took a number of years to educate the consumer, the producer, and the banks to the advantages of

protecting profits on material bought for cash for future delivery, or for conversion or otherwise.

"We ourselves bring in a considerable amount of copper ores. Quite often, the terms of the refinery are ninety days, and especially if tin or copper has to be returned as refined material, one would not be able to get the refined tin or copper back until ninety days after delivery. At the present moment either the importer runs the risk of the copper market for ninety days or he is called upon to hedge against this copper in England.

"Again, take tin. At the present moment tin can be sold for shipment from China or the Straits to only comparatively few houses, most of whom are dealers. The bulk of the consuming trade wishes to buy tin for delivery within fourteen days after receipt of order, if not more readily. While in London, we used to buy our Straits tin, hedged against it on Exchange, and after the tin had passed Gibraltar on its way to the United States we were able to dispose of it to the consumer and undo our sale on the London Exchange.

"I believe that given the right start with a consuming clientèle ready to co-operate, the producers will soon find it to their advantage to make use of the Exchange."

CONCLUSION

From all the letters received and from conversations with interested parties this much stands out: *It appears unlikely that a metal exchange truly representative of the American metal-producing industries can be established in the United States at the present time, and that this condition will obtain indefinitely.*

The whole matter narrows down to this: Will the producer gain anything by trading on a metal exchange? It makes little difference what the consumer thinks, as the producer possesses the metal and can take whatever action he cares to take regarding its disposition. At present the vast majority of American metal producers are opposed to selling on an exchange—they are not even lukewarm to it. Although willing to grant that trading on an organized basis in an exchange carries with it certain advantages, they feel that these advantages offset the disadvantages to a small extent only. No way leads out of this *impasse*. If this country were ever to be placed in a position compelling it to import a large proportion of its metal supplies, the outlook might be different, but as no such contingency is likely to arise for years to come—if it comes at all—the chance for a representative exchange is small. And, such being the situation, one cannot help but wonder if the great American non-ferrous metal industries, in trying to sell directly from producer to consumer and avoiding handling of their products by intermediaries—and having noteworthy success in doing so—are not setting an example that other fundamental industries—agricultural—are endeavoring with difficulty to follow.

The case for and against a metal exchange is still debatable and has not by any means been closed by this article, which has only attempted to set forth the reasons for the attitudes taken by both sides in this controversy.

Everything Expensive in Chile Except Drinks

The following are the official figures showing the rise in the cost of living in Chile during the last ten years, according to *Commerce Reports*: House rent, 54 per cent; light and heat, 109 per cent; domestic food, 38 per cent; imported food, 116 per cent; beverages, 33 per cent; clothing and domestic articles, 112 per cent; and railway transportation, 172 per cent. There was no increase in the rates of tramway transportation. The average increase during the decade amounted to 65 per cent.

Sintered Concentrates Now Smelted in Mount Lyell Blast Furnaces

Decrease in Amount of Pyrite Coming to the Smelter Necessitated Concentration, a Hancock Jig Classifier and Filters Being Installed

SPECIAL CORRESPONDENCE

THE new smelting practice initiated at Mount Lyell, Tasmania, last year, is not revolutionary, though it involves fundamental alterations designed to bring about the elimination of Mount Lyell pyrites hitherto functioning as basic flux for the siliceous copper ore of North Lyell. These changes have necessitated a reduction of the silica content of the latter ore to render it practically self-fluxing. This is achieved by putting the coarse ore through a Hancock jig and subjecting the fine, up to 20 per cent, copper to the flotation process, the hand-sorted richer ore from the mine being smelted direct. This process involved the installation of a Hancock jig, a Dorr classifier, two additional vacuum filters, and a new and larger Dwight-Lloyd sintering machine. The concentrates have, of course, to be agglomerated for blast-furnace smelting, and for this purpose the Dwight-Lloyd plant is brought into play. Far less material, in the practice noted, has to be smelted for a given recovery of copper than when the Mount Lyell pyrites were smelted.

The alterations necessary to carry out this practice are still in progress, and a temporary result of the changes is a reduced tonnage treated, amounting for some time to only about 7,000 tons a month. The second Dwight-Lloyd plant is being erected, and when this is completed it is expected that 11,000 tons will be treated monthly.

In the last half-yearly report of the Mount Lyell company, dated Oct. 30 last, it was stated that the new scheme was then the current practice and was giving satisfactory results. In February it was reported that the practice was still proving satisfactory, that it had proved that the concentrates from North Lyell ores could be smelted without the admixture of Mount Lyell pyrites, and that it had been decided to close the Mount Lyell mine for the time being and confine blast-furnace operations to concentrating and smelting alone on ore averaging 6 per cent. Later, however, it was announced that the Mount Lyell pyrites, consisting of 1,700,000 tons containing from 40 to 50 per cent sulphur, were to be disposed of for sulphuric acid and superphosphate manufacture. As a result, advices by the last Australian mail, which left at the middle of July, showed that the Mount Lyell mine was becoming more active, as shipments of pyrites were to be resumed to the fertilizer works in Victoria. It has also been found that it would always be advisable to use a little of the Mount Lyell pyrites as an assistant basic flux in smelting the concentrates. The alterations rendered necessary were expected to require an expenditure approximating £15,000 to £20,000.

At Mount Morgan, Queensland, a somewhat similar change in practice to that later followed at Mount Lyell had already been made, involving extensive additions to the flotation plant to reduce the silica and obviate the need for a basic flux, which for years had been obtained from the Many Peaks mine. One result of the change there is that Many Peaks, to which a seventy-mile railway had been built to convey the fluxing ore to Mount Morgan, is now idle.

USEFUL OPERATING IDEAS

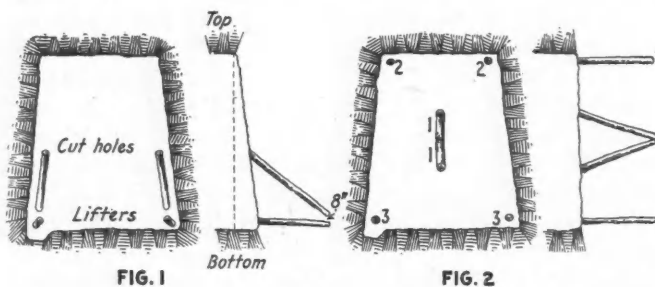
Driving Drifts and Small Crosscuts

BY D. M. HOUSTON

Drifting may cost from 20 to 50 per cent more than it should if those who are doing the work do not understand their business. Especially is this true when the drifts are in hard granite and gneiss. I mention these two kinds of rock because I have had more experience with them than with other varieties. Other factors enter into this also, such as the size of the drift, the drill holes (their number and direction), and the powder used.

The size of the drift will make a big difference in the footage pulled, according to the rock in which it is driven. Some rock breaks beyond the width and some does well to break as far as the width of the drift. Different mining districts have different sizes that have been accepted as standard. These are usually the sizes that have been found to give the greatest satisfaction at the least cost per foot.

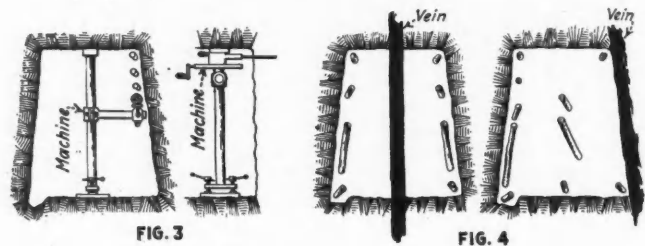
It will also make some difference if a crossbar or column is used, as better results will be obtained by carrying the back a little higher with the crossbar than with the column. For instance, assume that the drift



is 5 ft. wide by 7 ft. high and that a column is being used. In changing to a crossbar the back should be raised, making it a little higher, to obtain the same advance in feet. The reason for doing this is to allow plenty of head room to crank down the cut holes. With the column the arm can be lowered in case a piece of rock is projecting down and interfering with the crank; with the crossbar, it is a case of collaring the hole higher and not having as great an angle or pitch on it.

The ideal drift or crosscut should be about 1 ft. or 18 in. wider at the bottom than at the top. This is done for several reasons. Ninety per cent of machine men place their cut holes in the bottom. If the drift is wider in the bottom it gives the holes a better chance to break. It will also give more room for a ditch to carry away the water. If the ground is soft or swelling and needs timber, the tunnel sets will not push in at the bottom and interfere with the tramping. The reason is that when they start to move they move only a short distance before they begin to bind against the solid rock of the bottom.

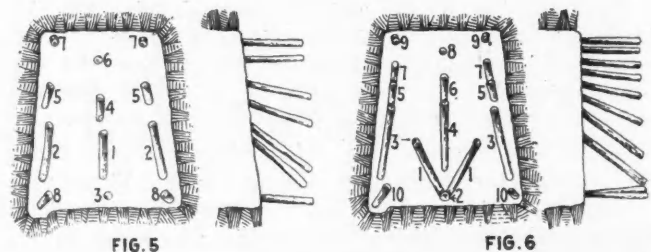
Most machine men place their cut holes in the bottom because doing so allows the largest amount of drilling to be done with the machine on top of the arm or crossbar,



thus doing away with turning under except for the lifters. It also allows a greater angle to be put on the cut holes. In hard ground this is absolutely necessary. The runner will secure the maximum break by running his cut holes a foot or more deeper than the round he expects to pull and by placing the bottom of them 8 or 10 in. from the bottom of his lifters. See Fig. 1. By doing this he will also leave the face of the drift squared up and free from little arches that stop the next round from breaking clean. It is also desirable in using a bottom cut to keep the lower part of the breast advanced from a few inches to a foot more than the rest of the face. See Fig. 1. However, in soft ground it is sometimes better to place the cut in the middle, because it will take fewer holes to pull. See Fig. 2; the numbers represent the order of firing.

When using a crossbar, the cut holes should always be placed in the bottom, the reason being that most of the drilling can be done by the time the muckers have the muck out. All that then remains to be done is to drop the bar to the lower set-up and run the required number of holes. In setting up the crossbar much time and energy can be saved by using a short board or powder box to rest the bar on while placing the blocking and driving the wedges. When running a drift or crosscut with two or more shifts on a crossbar, the shift boss should see that the machine man does not pull his back holes down lower than the amount that is required to carry the drift the needed height. By doing this he will secure a better break to that round, but will leave the back so low for the next round that more holes will be needed to obtain the same footage. When a machine man does this he prevents the drill runner following him from getting the necessary pitch to his cut holes and forces him to raise his back holes a little higher. This gives the next round a good chance to break. Where a heading is being driven on two shifts, this trick is sometimes done to discredit the opposite shift.

Better results will be secured with a column than



with the crossbar, provided the machine man does not have to muck back to set-up. Mucking back is a waste of energy. By doing this the muck is handled twice, once by the machine man and once by the mucker. By providing a clean set-up, the labor of the machine man is saved for another job.

If possible, two drifts should be run near to each other and the muck taken out of one while the round is being drilled in the other. If this cannot be done, the muck should be moved on one shift and the round drilled on the other. When neither of these things can be done, a crossbar ought to be used in drilling. The time the machine man would consume in mucking back can be used in drilling, thus allowing a deeper round of holes to be placed.

When setting up a crossbar or column, the length of a pick handle is about the right distance from the breast, if the breast has been properly squared up. The usual proceeding in setting up the column is to lay the foot block or board, place the shoes on this, then set the column in place, put the head block in position (the long way of the block parallel with the drift), then

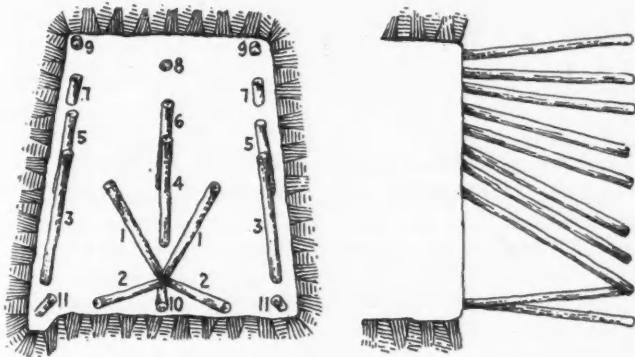


FIG. 7

secure the four corners as tightly as possible with wedges, and then jack it tight. After jacking, it may be necessary to secure the jackscrews with iron pins, about 18 in. long, through the holes provided for the jacking bar. This prevents the jackscrews from working loose. The arm is then put on. It should be long enough to permit the machine to run the side holes nearly straight with the side of the drift or crosscut to bring the cleanest break; that is, to leave the smallest gun. See Fig. 3. In drilling the back holes, the arm, with the machine on top of the clam, should be raised high enough to collar the holes 2 or 3 in. higher than the top of the column. They ought then be drilled so that the bottom of the holes is not over 2 or 3 in. higher than the collar.

The best machine men will drill the back holes on one side first, then move around to the other side of the column and drill the other back holes; the arm is then lowered for the breast and cut holes on the same side, after which the runners swing around and drill the breast and cut holes of the side on which they started. The machine is then oiled, turned under, and lowered for the lifters.

After tearing down and blowing out the holes, they are ready to be loaded. Care must be taken to see that the primer is placed at about the same depth in all the holes and the fuses trimmed properly, to make them fire in their turn. The primer cartridge ought not be slit on the side, as this renders it likely to misfire if the hole contains water. In unusually hard ground it is

sometimes necessary to use stronger powder. Sixty per cent, used in the cut holes, will bring a much cleaner break than a less powerful explosive. For the average ground, however, 40 per cent is generally considered strong enough.

When drifting on a well-defined vein, it is possible to use the vein as a row of holes either in the center or on the side. See Fig. 4. However, this should be left to the runner's judgment.

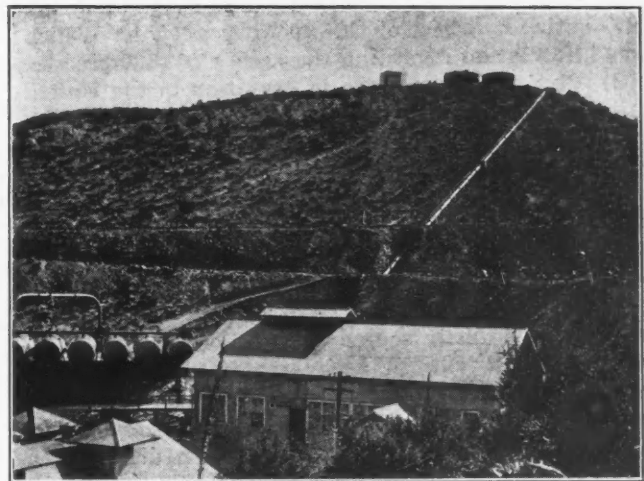
For the benefit of those who do not know how to keep a crosscut straight, it may be said that the system usually followed is to hang up two plumb bobs with candles in the center. A sight is then taken over these two lights to the breast, where someone stands with another light. When all three of these lights are in a straight line, a mark is made on the breast. This is the center of the face. To obtain the sides of the crosscut, half the width of the crosscut is measured from the center mark. This is repeated for the other side.

In conclusion, let me say that the main thing about pulling any round is to get the cut out of it. If the cut is pulled, the rest will come easily. In the rounds pictured in Fig. 5, 6, and 7 the holes that are to be fired after the main cuts are below the cut and are fired that way to make sure the cut is cleaned. Fig. 5 is used in medium rock, Fig. 6 in hard rock, and Fig. 7 in very hard ground. The numbers represent the order of firing.

Plan to Equalize Air Pressure

BY A. W. ALLEN

When large quantities of air are used underground, it often happens that there are wide fluctuations in the amount needed at any one time. A plan to keep the pressure uniform and to provide additional storage is in use at a plant near Bisbee, Ariz., which is shown in the accompanying halftone. At the top of the hill, which is about 200 ft. high, is a reservoir. Into the bottom of this a large pipe is connected, which follows the contour of the hill down to the base, where the air receivers are situated. This pipe acts as an auxiliary receiver. Under conditions of small air reserve it is filled with water. If the amount of air on hand increases, the water is forced up the pipe and into the reservoir. When increased demands are made on the available supply of air, the water falls in the pipe and so keeps the pressure uniform.



Arrangement of air-pressure equalizing device

CONSULTATION

Tin Smelting in the United States, Its Literature, and Ore Prices

"Will you kindly supply the following information:

"(1) The name and author of the most modern and reliable treatise on tin smelting.

"(2) Names and addresses of the tin smelters in the United States and whether they are using imported or domestic ores.

"(3) Does the price of tin ore bear a definite relation to the price of metallic tin, and if this is the case, what is the ratio? In other words how much is there in it for the smelter?

"(4) The average prices of tin ore since 1917. London prices if no New York quotations are available."

Answering these questions in the order propounded:

(1) We know only one book published in English exclusively devoted to tin smelting. It is "The Metallurgy of Tin," by Henry Louis, published by McGraw-Hill Book Co. In German a book by K. Richter, "The Metallurgy of Zinc, Lead and Tin," published by A. Hartleben, Leipzig, partly treats the subject, as does one by William Gowland, "The Metallurgy of the Non-Ferrous Metals," published in England. A few short sketchy papers have appeared, but none thoroughly cover the smelting of tin.

The world's tin is supplied chiefly by British colonial possessions; in fact, the largest tin smelters in the world are situated in the Straits Settlements. It would appear from the paucity of literature on the subject that the secrets (?) of tin smelting are zealously guarded and that tin smelting has not reached the enlightened stage of copper smelting, a subject upon which volumes have been published and which, owing to the free and open exchange of technical information, has attained a point of perfection that few other non-ferrous metals enjoy. Although the United States occupies a subordinate position in the world's tin-smelting industry, it does possess the only electrolytic tin refinery in the world, located at Perth Amboy, New Jersey, operated and owned by the American Smelting & Refining Co. A paper has been published by Prof. E. F. Kern in the *Proceedings* of the American Electro-Chemical Society for August, 1920, entitled, "Electrolytic Refining of Tin," which gives information regarding the nature of that process.

(2) Five tin smelters are in operation in the United States. They are, in order of importance, those of the American Smelting & Refining Co.; the Williams Harvey Corporation, at Brooklyn, N. Y.; Richards & Co., Malden, Mass.; the Andes Electin Co., Brooklyn, N. Y.; and the Seaboard Metal Corporation, Arlington, N. J.

As, relatively, only a handful of tin is produced in the United States, the tin smelters in this country have had to rely on the importations of foreign ores and concentrates. The main source drawn from has been the tin mines of Bolivia. A heavy export tax designed to confine the smelting of tin ores to the Straits Settlements prevents the export of concentrates from that country elsewhere. At times it has been difficult for American smelters to procure an adequate supply of tin concentrates.

(3) The price of tin ore bears a definite relation to the price of metallic tin. As a matter of fact, the settlement of tin-ore contracts is generally based on the price of either Straits or 99 per cent tin as established in either the New York or the London market.

We do not know what profits tin smelters are in the habit of making from the smelting of custom tin ores, nor do we know what schedules are in force among the various smelters covering custom work. It would be advisable to communicate directly with the several tin smelters to ascertain whether they are in a position to smelt custom ores and their rates for doing so.

(4) The prices for tin ore or concentrates depend directly upon the tin content, so that neither in the New York or the London market will one find ore quotations.

An early issue of *Engineering and Mining Journal-Press* will contain an article on the marketing of tin which will furnish additional information.

The Uses of Cerium

"Will you please give me some information about the uses of cerium? Is this country a producer of the metal?"

Small amounts of metallic cerium are manufactured in the United States. Practically all of it consumed in this country is used in the manufacture of ferrocerium. We do not believe that the production of ferrocerium runs over three-quarters of a ton per month, at best. It is an alloy consisting of approximately 30 per cent iron and 70 per cent cerium, and may contain other rare earths, such as lanthanum, didymium, and traces of other metals. Cigar lighters, gas lighters, and the small lighting attachments on carbide lights for mines frequently use this ferro-alloy. It is produced by electrolytic methods from the mineral monazite, which is found in India, Brazil, and the United States.

The mining, separating, purifying, and utilization of the rare earths, cerium, lanthanum, didymium, yttrium, zirconium, and thorium, is part of the pyrophoric-alloy industry. This industry was developed intensively by the Austrians and Germans, and first took root in the incandescent gas mantle industry about the time of the Civil War. Experimentation showed that 1 per cent or 2 per cent of cerium oxide, when added to a gas mantle, gave an exceedingly brilliant light. Baron Auer von Welsbach, the founder of this industry, hardened the relatively soft cerium with iron, and produced a hard metal which would give sparks when scratched. This is the base of the ordinary cigar lighter.

For a long time the pyrophoric-alloy business was centralized in Germany and Austria, where the manufacturing companies controlled the basic patents. Owing to the disorganization caused by the war and the taking over of alien patents, licenses were granted to several American manufacturers to produce ferrocerium. The entire industry, however, is not very large.

Ferrocerium may also be used as a desulphurizer in steel when employed up to 0.3 per cent. During the war cerium was used in certain classes of ammunition.

THE PETROLEUM INDUSTRY

Japan Wants Saghalien for Petroleum

The possibility of producing petroleum in large quantities is understood to be the reason for Japan keeping control of the island of Saghalien, according to the opinion held in British oil trade circles. "One of the engineers" (says the *Petroleum Times*, London), "who has been six years at the work, says that the island can supply 10,000,000 tons of naphtha per annum—practically equal to the resources of Royal Dutch companies. The island has a long, narrow, fishlike shape with a strong mountain ridge down the center. Oil wells worked at present are in three different regions of the island, one in the extreme north and the two others to the south. At one southern field, the Chiva, there are five large lakes of naphtha, one being nearly 150 yards wide by nearly 500 yards long. A French engineer just returned from a visit to the island—which, by the way, is carefully guarded from the eyes of curious, and almost entirely closed against foreigners—says that three operators are occupied in exploitations there—the Mitsubishi, the Kuchave and the Suzuki companies."

Belgians Now Interested in Rumanian Petroleum

A Belgian company that is financing petroleum enterprises is reported in London to have succeeded in buying important blocks of shares in German oil ventures in Rumania. These shares were under sequestration in Great Britain, and negotiations for their purchase have lasted a considerable time. As a result Belgium now has an important field of action in Rumania. Before the war Rumania had decided to preserve for the state certain holdings, but her present financial position has obliged her to draw on her resources. The Rumanian government has, therefore, decided to concede a part of these holdings. In order to exploit this concession a syndicate had been formed, composed of English, French, and Dutch oil interests. Belgium now has also been admitted.

Senate Gets Preliminary Report Under McKellar Resolution

Statistics of stocks of crude oil, gasoline, and other petroleum products, together with price fluctuations for crude and refined over a period of two and a half years, have been submitted to the Senate in a preliminary report from the subcommittee of the Committee on Manufactures in response to the McKellar Resolution. Definite conclusions of special point are not given in the preliminary report and no recommendations are made. Senator McNary, chairman of the subcommittee, stated that further hearings would soon be held.

The resolution instructs the committee to gather information as to stocks of crude and refined oil and other products during 1920, 1921, and the first half of 1922; price changes; whether such changes in price were uniform by all companies; profits of refiners; and whether effective competition is prevented.

Two Companies to Prospect in Cold Bay District, Alaska

Increased activity in development of the oil fields of Alaska is expected as a result of the recent action of the Interior Department in granting two large Western oil companies permission to prospect for oil on a large tract in the Cold Bay district of the peninsula. The Standard Oil Co. of California and the General Petroleum Co., according to advices received from the West, are sending from Seattle a complete well-drilling outfit to operate on their Alaskan claims. In all approximately \$2,000,000 will be spent by these two companies for development.

California Against Outlaw Oil Companies

The State Corporation Department of California has declared war on "outlaw" oil companies. The highly speculative character of the oil industry has been taken into consideration, but the "outlaw" companies or individuals evade proper supervision. Such individuals are, in general, classed in three divisions: First, the persons or companies who operate without any license or supervision; second, the persons or companies who have a real-estate license, but use it as a subterfuge; third, the persons or companies doing business under the corporate seal of a bank or trust company. As to the last class, the people are led to believe that because certain financial institutions issue a security under their own corporate seal, they pledge their assets as a guaranty of the oil-promotion project. This they cannot do. The State Corporation Department, therefore, is endeavoring to obtain the aid of the banks, trust companies and proper state authorities to prevent further operations under this method.

Review of Oil Land Decision Asked

The U. S. Supreme Court has been requested by the Peoples Development Co. to review the decision of the Circuit Court of Appeals, Ninth Circuit, which gave title to certain oil lands in the Coalinga field of Fresno County, Cal., to the Southern Pacific R.R. under the land grant of 1894, which are being operated by oil companies, including the Kern Trading & Oil Co., Confidence Oil Co., Aztec Oil Co., Penn Coalinga Petroleum Co., and the St. Paul Consolidated Oil Co. The Peoples company claims the lands on discovery of oil made in 1909 under placer locations and contends that the grant to the railroad excluded all minerals except coal and iron.

Wildcat Well Near Kosse, Tex., a Gusher

The Humphreys Petroleum Co. is reported to have a 10,000-bbl. gusher in its wildcat test on the Jones farm, near Kosse, Tex., fifteen or twenty miles southwest of Mexia, in Limestone County. The oil tests 29 gravity, the sand being topped at 3,707 ft. This has long been considered uninteresting territory.

Technical Papers

Determining Rock Dust—"The Sugar-Tube Method of Determining Rock Dust in Air" is the title of Technical Paper 278, issued by the U. S. Bureau of Mines, Washington, D. C., for free distribution. The bulletin is of forty-two pages, and is a critical study of the efficiency of sugar in removing the finest dust particles from the samples.

Arizona Ore Deposits—Bulletin 725-J of the U. S. Geological Survey, Washington, D. C., twenty-two pages, obtainable on request, describes the ore deposits of the Sierrita Mountains, in Pima County, Ariz.

Bibliography on Sampling—The Director, U. S. Bureau of Mines, Washington, D. C., is prepared to furnish on request a complete bibliography on sampling, containing nearly 1,100 references on sampling at mines, mills, smelters, power plants, pumping stations, and refineries. It includes a few references to methods for sampling such materials as leather belting in mills, salt-impregnated soils, and mine waters.

Dust in Mines—The U. S. Bureau of Mines *Reports of Investigations* No. 2,339, six pages, obtainable on request, "Drilling and Dustiness of Metal-Mine Air," describes research work on the use of wet and dry drills, which goes to show that wet drills reduce the amount of dust markedly, but that they must be kept in repair and operated intelligently.

Marketing of Ore—"Notes on the Valuation of Ores, Concentrates, and Smelter Products" is a thirty-two-page paper appearing in the *March Bulletin* of the Institution of Mining and Metallurgy, Cleveland House, 225, City Road, London, E. C. 1. Copies of the paper may be obtained for 1s. 6d. It will, we believe, prove of considerable interest to American ore buyers and sellers.

Copper Electrolyte—"The Conductivity of Copper-Refining Electrolytes" is the subject of an eighteen-page paper published by the American Electrochemical Society (Bethlehem, Pa.). The effects of various impurities, of different temperatures and of various concentrations, are illustrated by curves.

Mellon Institute—The ninth annual report of the Mellon Institute of Industrial Research, of the University of Pittsburgh (Pittsburgh, Pa.), was recently issued. The bulletin describes the growth and accomplishments of the industrial fellowship system by which research is carried on for commercial organizations.

Mercury Poisoning—This is the title of U. S. Bureau of Mines *Reports of Investigations* No. 2,354, six pages, obtainable free of charge. It describes the effect of mercury on the system and the precautions to be observed by those engaged in mercury-reduction works.

Serbian Iron Ores—"The Iron Ores of Yugo-Slavia," eight pages, in the *March Mining Magazine* (Salisbury House, London Wall, London, E. C. 2; price 1s. 6d.) The several iron-ore fields are not at present being worked, though they appear worthy of further attention and investigation.

Lime Burning—"Lime Burning in the Rotary Kiln," a six-page article in *Rock Products* for March 25, 1922 (Chicago; price 25c.), describes the advantages of the new practice of using rotary kilns, an adaptation from the cement industry.

Determining Radium in Carnotite—A fifteen-page paper presented before the recent general meeting of the American Electrochemical Society (Bethlehem, Pa.), discusses "A New Method of Determining the Radium Content of Carnotite Ores and Other Products of Low Activity." A simple method, requiring no chemicals, which makes use of the gamma-ray electrometer, was found to agree well with the results obtained by chemical analysis, on material with 10^{-10} g. radium per gram of material.

Arizona Geology—"Geology of the Lower Gila Region, Arizona," is the title of Professional Paper 129-H, recently issued by the U. S. Geological Survey, Washington, D. C., the paper being the result of a reconnaissance investigation made by Clyde P. Ross in 1917 and 1918. Fifteen pages, illustrated with plates and a colored map of the district. Free on request.

Mineral Resources—Recent publications in the "Mineral Resources" series, obtainable from the U. S. Bureau of Mines, Washington, D. C., on request, include: "Asphalt and Related Bitumens in 1921," seven pages; "Cadmium in 1921," five pages; "Fuel Briquets in 1921," five pages; "Gold, Silver, Copper, and Lead in Alaska in 1920," six pages; "Graphite in 1921," six pages; "Lead and Zinc Pigments and Salts in 1920," four pages; "Mica in 1920," five pages; "Quicksilver in 1920," twenty-one pages; "Sulphur and Pyrites in 1919," twelve pages; and "Tin in 1920," five pages.

Methods of Transferring from Stockpiles—In *Rock Products* for March 11 (Chicago; price 25c.) is a seven-page illustrated article on methods of storing and reclaiming material from storage by the use of cranes, single-rope cableways, belt conveyors, power scrapers, and other means.

Roasting Zinc Ores—Gilbert Rigg and W. J. McBride, Australian metallurgists, have a seven-page paper in the *March Mining Magazine* (Salisbury House, London Wall, London, E. C. 2; price 1s. 6d.) on "The Roasting of Zinc-Blende Ores" in Australia. The article discusses the principles which have been followed as to the maintenance of contact between the air and ore particles, the regulation of the temperature, and the size of the ore particles, in both hearth and blast-grate roasting.

Recent Patents

Sulphur in Flotation—Canadian patent No. 229,059. H. V. Seale, and R. D. Nevett, Broken Hill, N. S. W., and T. H. Palmer, Melbourne, Australia. The ore is subjected to flotation treatment in the presence of elemental sulphur in amount not to exceed one-half of 1 per cent of the weight of the ore; or the sulphur may be added dissolved in a solvent. The procedure is also described for differential flotation.

Canadian patent No. 222,083, issued to A. J. Miller, Salt Lake City, Utah, covers the use of free sulphur in finely divided droplets or globules as a flotation agent in the treatment of sulphide ores. Canadian patent No. 222,084, issued to the same applicant, covers the use of sulphur for oxide or carbonate ores, in this case an excess of sulphur dioxide being used in addition. Also a soluble sulphide is added subsequently, to precipitate any soluble salts formed and to convert the solution of soluble salts immediately surrounding the remaining particles to a sulphide film, on which the liquid sulphur attaches itself. Steam may be used in the process.

Flotation Agent—Canadian patent No. 222,061. A. J. Miller, Salt Lake City, Utah, and Jas. Kendall, New York City. Selenium or tellurium in finely divided droplets or globules, or in the colloidal or other form, is used as flotation agent, the idea apparently being that it will form a protective film about the metallic sulphide, whereas the gangue will be wetted.

Flotation—No. 1,418,514. Lewis Bailey, Hayden, Ariz., assignor to Minerals Separation North American Corporation, New York. This patent covers the use of oil vapor mixed with the air used in pneumatic flotation, the oil being introduced in this manner instead of being added as a liquid.

Fume Precipitation—No. 1,413,877. W. A. Schmidt, Los Angeles, assignor to International Precipitation Co., Los Angeles. Dust and fume are separated from hot furnace gases by distributing water mist in the gases, then bringing them into contact with descending streams of water. Any fume particles remaining in the gases are precipitated by electrical apparatus of the Cottrell type.

Flotation Machine—No. 1,413,723. Frank Groch, Cobalt, Ont. A variation of the Groch flotation machine in which horizontal slat openings are provided in the wall between the agitating—and settling—compartments. Patent No. 1,413,724 covers the mechanism for agitating the pulp and introducing the air.

Rod Mill—Canadian patent No. 221,834. F. J. Behneman, San Francisco, and H. S. Rexworthy, Sunnyvale, Cal. A new design of rod mill for crushing ore or other material.

SOCIETIES, ADDRESSES, AND REPORTS

Lake Superior Mining Institute Meets in Copper Country

Francis J. Webb Elected President—
A. J. Youngbluth Continues as Secretary

The Lake Superior Mining Institute held its annual meeting Aug. 28-30 inclusive, in the Michigan copper district. Headquarters were at Houghton. The session was featured by visits to mines, mills, and smelters and by the presentation of papers on mining and kindred subjects. The attendance was large, all mining districts of the Lake Superior region being represented, and several were present from places more remote.

The 1923 meeting of the Institute will be held on the Mesabi iron range in Minnesota, the place and time to be announced later. Francis J. Webb, of Republic Iron & Steel Co., Duluth, was elected president; E. W. Hopkins, Ironwood, treasurer; and A. J. Youngbluth, Ishpeming, secretary. Vice-presidents for two years are: John E. Hodge, Minneapolis; Earl E. Hunner, Duluth; and George R. Jackson, Negaunee, Mich. The managers are: W. M. Tappan, Hibbing, Minn.; John E. Nelson, Negaunee, Mich.; and G. E. Harrison, Crystal Falls, Mich.

Utah Metal Mining Institute Meets at Park City

The Utah Metal Mining Institute held its summer session in Park City, Aug. 2 and 26, the time being devoted chiefly to visiting mining properties, in particular those in which there had been new and interesting developments. Friday, the first day of the convention, was spent mainly at the Silver King Coalition mine and mill. Particular attention was given to the high-grade orebody on the 1,450 level, 450 ft. long by 40 ft. wide by 25 ft. thick, which is at present producing heavily, and to the Silver King shaft. Saturday, the second day, was spent in visiting the Judge, Daly West, and Ontario properties. The points of chief interest in the Judge and Daly West were the new finds on the 900 level, which are rejuvenating these old and steady producers. The Judge mill was visited. The members of the institute visited the 1,700 and the 1,500 levels of the Ontario. On Friday luncheon was taken at the Silver King Coalition and on Saturday at the Daly West. On Friday evening Park City mining companies entertained the members at dinner in the Athenaeum Building, and during the evening there was dancing at the Elks' club.

Safety Congress Held at Detroit

National Council Enters Current Year With Finances in Good Condition—Membership Lower—Numerous Papers Presented

UNDER the administration of A. H. Young, president of the National Safety Council during the past year, the council's deficit was wiped out, all of its debts were paid, and a surplus of \$12,000 was accumulated. This was stated by the president in the course of his address to the council at its eleventh annual meeting which was held in Detroit from Aug. 28 to Sept. 1. The gross revenue for the year was \$205,996.52. The *National Safety News* cost \$24,220.40 and brought in (dues from council members not included) \$20,386.24. On the other hand the "safety" calendars distributed cost \$16,490.10 and brought in \$23,358.81, about \$7,000 profit. The membership declined 566 during the year, the present number of members being 3,060.

The Mining Section began its program on Aug. 29. At the first session, John S. Boardman, of the Anaconda Copper Mining Co., said that nothing had been done toward founding a Butte Section of the council, owing to the depressed state of the industry. However, a Joseph A. Holmes Safety Association had been established and fostered, he said.

"Mine Hygiene and Sanitation" was the topic of R. R. Sayers, Chief Surgeon of the U. S. Bureau of Mines.

W. W. Adams, statistician of the Bureau of Mines, presented a paper entitled "The True Causes of Mine Accidents." The glaring defect in all accident records of national scope, he said, was the omission of the important element of exposure to accident.

Mr. Adams also introduced several forms of accident reports and occupational censuses for those members of the National Safety Council that desire to use them in making returns to the Bureau. These were prepared with the aid of C. L. Colburn. Their purpose is to discover not only the number and kind of accidents, fatal and non-fatal, and their minute causes, but also the occupational hazard for each type of work in the mine. Many changes were made in the original draft, the whole matter being discussed at length, and the blanks will be revised.

"Mine-Fire Prevention and Fighting" was the title of the paper by R. H. Seip, of the New Jersey Zinc Co., at the session on Aug. 30. Mr. Seip outlined the causes of mine fires and discussed preventive measures. The paper on

"The Use of Telephones in Mines," by D. E. A. Charlton, was published in full in the Aug. 26 issue of *Engineering and Mining Journal-Press*.

In his paper on "Mine Rescue Training and Operation," D. J. Parker, of the U. S. Bureau of Mines, told of the governmental requirements that mine rescue apparatus is expected to meet.

C. L. Colburn, who fills the joint rôle of mining engineer for the Bureau of Mines and safety engineer for the National Safety Council, told of the visits that he had made to mines in the United States for the purpose of promoting safety work.

Lucien Eaton, superintendent of the Ishpeming district mines of the Cleveland-Cliffs Iron Co., was not present. His paper on "Underground Transport" was read by Mr. Conibear.

Other papers presented at the remaining sessions were "Portable Ventilating Equipment for Mines," by T. E. Dudley, of E. I. du Pont de Nemours & Co.; "Bulletin Boards," by R. T. Solensten, of the National Safety Council; "Hoisting Equipment at Mines," by Rudolf Kudlich, of the U. S. Bureau of Mines; "European Hoisting Practice," by Graham Bright; "Wire Rope Connections," by E. O. Keator; and "Inclined Haulage," by Walter Prokter, of the Safety Appliance Co.

On Monday evening, a dance was held at the Statler Hotel. On Tuesday evening there was a "smile" party, on Wednesday evening a boat ride and on Thursday a banquet. At the banquet the speakers were the president, Mr. Young, Marcus A. Dow, General Safety Agent of the New York Central Lines, and Edgar A. Guest, of the *Detroit Free Press*. The new officials of the National Safety Council were announced. These were: M. A. Dow, president; Charles B. Auel, of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., vice-president in charge of industrial safety matters; David van Schaak, Aetna Life Insurance Co., New York City, vice-president in charge of public safety matters; George T. Fonda, of Fonda & Tolstead, Washington, D. C., vice-president in charge of sectional activities; L. A. De Blois, Delaware Safety Council, Wilmington, Del., in charge of local councils; Homer Niez, Commonwealth Edison Co., treasurer and chairman of finance committee; and William H. Cameron, managing director and secretary.

MEN YOU SHOULD KNOW ABOUT

W. de L. Benedict, mining engineer, of New York, arrived at Wallace, Idaho, on Aug. 29.

Albert Burch has left San Francisco for Butte, Mont., in connection with forthcoming mining litigation.

C. E. Meissner has returned to New York from a two months' prospecting trip in the Hudson Bay region, Canada.

H. S. Munroe, general manager for the Granby Consolidated Mining, Smelting & Power Co., of Canada, is in Seattle, Wash.

Edwin Higgins has been elected a member of the board of governors from California of the American Mining Congress.

James S. Douglas, president of the United Verde Extension Mining Co., has returned to Arizona from a trip to France.

C. M. Weld, of Weld & Liddell, of New York City, is en route to Montana, where he will spend the month on professional business.

J. S. Bradford, formerly manager of the Chiksan mine, in Korea, has returned to San Francisco, after eleven years' residence in Korea.

Frank M. Darrow, of Jackson, Cal., who is developing a process for the treatment of carbonaceous gold ores, was in San Francisco recently.

F. V. Bodfish, of the Alta Tunnel & Transportation Co., of Utah, has been visiting mining districts in Idaho in company with W. K. Webber, of Denver, Col.

G. F. Moulton, a geologist who has been serving as a member of the staff of the U. S. Geological Survey, has recently accepted an appointment at the University of South Dakota.

John D. Ryan, president of the Anaconda Copper Mining Co., who has been spending his vacation in the Michigan copper district, has returned to New York City.

F. W. Bradley, of San Francisco, president of the Bunker Hill & Sullivan Mining & Concentrating Co., is at Kellogg, Idaho, where the company's mine and smelter are situated.

Orr Woodburn, director of mine-rescue work in the Globe-Miami district, volunteered in the Argonaut mine disaster at Jackson, Cal., joining actively in the efforts to reach the entombed miners.

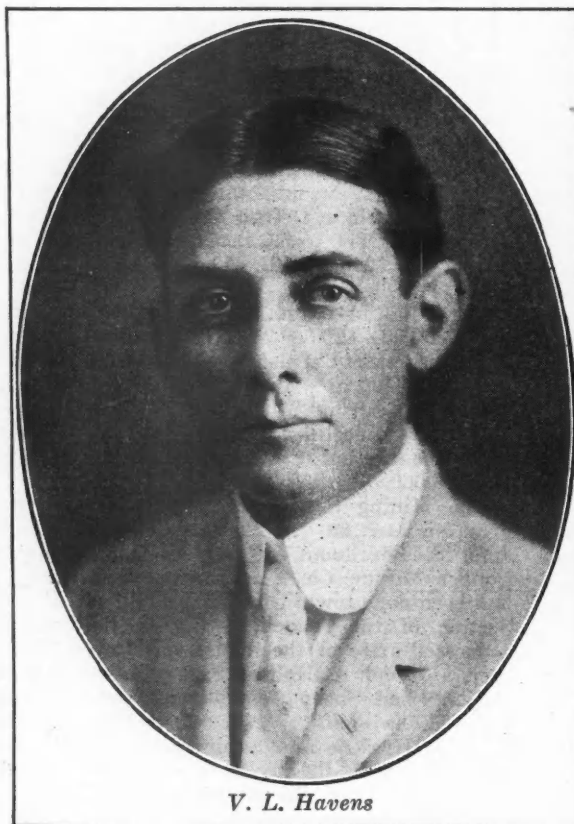
K. C. Heald, of the U. S. Geological Survey, is visiting field parties working out of Billings, Mont., and Casper, Wyo. On his return he will visit the

party engaged in geological work in the Black Hills.

Irving Howbert, president of the First National Bank of Colorado Springs, and chairman of the Portland Gold Mining Co., has been elected president of that company to succeed the late Frank G. Peck.

J. C. Adami, of Bonne Terre, Mo., general manager of the St. Joseph Lead Co., was in Wallace, Idaho, recently for a week's visit with his brother, Henry C. Adami, a metallurgist with the Hecla Mining Co.

Verne Leroy Havens, editor of *Ingenieria Internacional*, is now in Rio de Janeiro, Brazil. Mr. Havens is



V. L. Havens

chairman pro tem of the joint committee appointed by the four national engineering societies to consider and act upon all matters arising from their participation in the International Congress of Engineering. Upon the termination of the congress, Mr. Havens will visit Uruguay and Argentina for business purposes before returning to the United States.

L. O. Howard, dean of the School of Mines and Geology at the Washington State College, has returned from a summer spent in Massachusetts and Connecticut and in the inspection of several Eastern schools of mines.

Jesse J. MacDonald has severed his connections with the Crown King Consolidated Mines Co., at Crown King, Ariz., and is now engaged in an examination of the Thorpe mine on the Mother Lode, near Angels Camp, Cal.

Hugh M. Henton, of Cleveland, Ohio, has been appointed assistant professor of mining and metallurgy in the

School of Mines and Geology at the State College of Washington, at Pullman, and will take up his new duties on Sept. 1.

T. H. Jenks, of Los Angeles, is now engaged upon professional work in the San Juan district, with headquarters at Lake City, Col. He will be in the vicinity of Denver until about Sept. 20, when he expects to return to California.

Governor Parker of Louisiana has established a chair of geology in the state university. He justifies his action by the fact that Louisiana has large mineral resources and that the youth of the state should be afforded an opportunity at home to acquire the knowledge necessary to their successful exploitation. H. B. Howe, who has been selected to occupy the chair, is a Yale graduate.

Ira B. Joralemon, since 1919 assistant general manager of the Calumet & Arizona mines at Warren and Ajo, Ariz., and near Lordsburg, N. M., has resigned, effective Sept. 15, and will open offices in San Francisco as a consulting engineer. Mr. Joralemon came to the Calumet & Arizona in 1907 and in 1911 was made the company's chief geologist. In 1914 he spent about a year in the examination of South American properties for the Anaconda Copper Mining Co., going back to South America in 1916 and to Russia and Siberia in 1917 on similar business. In 1917 he enlisted in the Army air service and was overseas till February, 1919.

Arthur W. Ambrose has been selected to succeed E. A. Holbrook as assistant director of the U. S. Bureau of Mines. Mr. Ambrose has been in the service of the Bureau since 1917, during which time he has risen through the various grades from petroleum technologist to chief of the petroleum division of the Bureau. His appointment as assistant director is an indication of the increasing importance of the Bureau's petroleum work. F. B. Tough, who has been serving the Bureau as chief supervisor of oil and gas leases, will succeed Mr. Ambrose as chief petroleum technologist. F. J. Bailey, the assistant to the director, under a rearrangement of the work, will take over a portion of the duties formerly assigned to the assistant director so as to allow Mr. Ambrose to give a portion of his time to the petroleum work.

Mining and metallurgical engineers visiting New York City last week included: G. H. Cunningham, of Melbourne, Australia; H. L. Rau, of Maracaibo, Venezuela; F. Crabtree, of Pittsburgh, Pa.; M. W. Bacon, of Los Angeles, Cal.; W. L. Remick, of Pittsburgh, Pa.; and John J. Case, of Great Falls, Mont.

THE MINING NEWS

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

Leading Events

WAGES of coal miners in Colorado have been raised 30 per cent. The granting of this increase is expected to disturb the situation in the metal-mining districts of the state.

Lower freight rates on ore have been granted on shipments from the Pioche district, in Nevada, to the Salt Lake Valley smelters.

Smelting on a limited scale has been resumed by the International Nickel Co. at Copper Cliff, Ont.

Officials of the Hollinger Consolidated Gold Mines

have announced that the way is now clear for developing sufficient power to permit the desired increase in milling capacity.

Antimony will be brought within the provisions of the War Minerals Relief Act if an amendment just introduced in the Senate is adopted.

The San Pedro, Los Angeles & Salt Lake R.R. is fighting the project of the Iron County R.R. Co. in Utah, which proposes to build a new railroad line into Iron County.

Argonaut Miners Still Entombed Strenuous Efforts Made to Reach Them —Slight Hope of Rescue—Some Criticise State Laws

By Wire

San Francisco, Sept. 6—Since midnight Aug. 27, when forty-six men were trapped below the 3,000 level of the Argonaut mine by a fire, which broke out two sets below the 3,000 level, sustained efforts have been made to rescue the imprisoned miners. No communication has been established and only remote hopes are entertained that the men are alive. The rescue is being attempted through the neighboring Kennedy mine. Drifts upon the 3,600 and the 3,900 levels of the Kennedy are being reopened and relatively rapid progress is being made by short shifts and by as many men as can be worked. The connection cannot be made before Thursday at the best. A conference of mine superintendents and safety men decided upon this campaign for rescue, and all the resources of the district have been marshalled to put it through. Rescue teams from the neighboring mines from Grass Valley and even from Arizona have been rushed to the scene.

There is manifest a disposition to criticize the existing state safety laws. A statement by Will J. French, Commissioner of the State Accident Commission, indicates that all the safety requirements had been complied with by the Argonaut company. The implication is that the safety laws did not go far enough. A careful analysis of the information as present available indicates that no conclusions as to the inadequacy of existing laws can be made until all the facts concerning the origin of the fire, the mine conditions, the mine inspection, and the discipline

of the mine crew, and the adequacy of the management are known. Without these facts it is futile to criticize the regulations.

Wages of Colorado Coal Miners Increased 30 Per Cent

New Schedule Expected to Complicate Situation in Metal-Mining Districts of State

Colorado coal operators have made application to the State Industrial Commission for authorization of a 30 per cent increase in wages to employees, effective Sept. 1. This notice is in compliance with the Colorado industrial law, requiring at least thirty days' written notice of an intended change affecting conditions of employment, wages or hours. Operators announce that the price of coal will be advanced \$1 per ton as soon as the new wage scale becomes effective.

In November of last year the operators with the approval of the Industrial Commission announced a 30 per cent cut in the scale which was the wage established during the war and the same as that of the union mines throughout the country and for which the United Mine Workers are now contending. With the announcement of a 30 per cent reduction in wages last November the price of coal was reduced \$1 per ton.

The new high wage schedule in Colorado coal fields will complicate the situation in metal-mining districts as well as in other lines of industry. Metal mine operators are paying \$4.50 for machine men, \$3.50 for muckers, and the new coal mine wage schedule will inevitably increase the depletion of labor for the metal mines as conditions are already acute.

Nevada Consolidated to Mill 2,000 Tons Daily by Oct. 1

Construction of Third Unit Will Wait Until Spring—Copper Production at 2,500,000 Lb. per Month

Immediately following the fire, which almost totally destroyed the main concentrator building of the Nevada Consolidated Copper Co. on July 9, contracts were made for structural steel to replace two units. These will contain grinding and concentrating capacity of 8,000 to 9,000 tons per day, according to the company's quarterly report just issued. The old wooden storage bins will be replaced with bins of steel, and the new plant will contain no wood at all except in apparatus where the employment of wood is necessary. The building steel for the first unit has all been shipped from the fabricating shops and much of it has arrived at the plant. Erecting equipment and crews are also on the ground and, barring unforeseen delays, the first unit building will be completely erected by or before Oct. 1 and the second one likewise finished by or near the end of that month. By using the undamaged grinding machinery and such spares in the way of other apparatus as were on the ground, together with a considerable amount of machinery borrowed from the Utah Copper Co.'s plants at Garfield, it is now estimated that the concentrating operations will be resumed to the extent of about 1,000 tons per day on Sept. 15. An additional thousand tons of concentrating capacity will be available for use on Oct. 1 and thereafter added equipment will be put in operation weekly, to the end that the entire two units should be available for use by about the end of the year, dependent upon deliveries of new equipment as well as upon the demand for production.

In the meantime, copper output is being maintained at the rate of about 2,500,000 lb. per month, and possibly somewhat more, through the treatment of increased quantities of ore drawn from the high-grade deposits of the Ruth mine, together with the small stock of concentrates and other smelt-able material on hand. Upon resumption of concentrating operations to the extent of 2,000 tons per day by or before Oct. 1, production will be immediately restored to the curtailed rate prevailing prior to the fire.

According to present plans, construction of the third unit will be deferred until the coming spring in order to take greatest advantage of re-using salvaged material, including steel, and for the further reason that it is believed the capacity of two units will be ample for the immediate future. Three units of the new plant will have a capacity considerably in excess of the whole original mill, and it is not the present intention to rebuild the fourth unit except as to that portion covering the old upper main floor which will be used as a shop for repairs and maintenance.

Hollinger's Way Now Clear to Develop Power

Officials of the Hollinger Consolidated Gold Mines, of Porcupine, Ont., state that all opposition to the development of hydro-electric power by the company has been cleared away. The development proposed is good for a minimum of 20,000 hp., and it is expected that construction work will be started soon. As one step toward increasing the daily milling capacity to 7,000 tons, which is the immediate objective of the company, the stamps will be replaced by rod mills. This change will be made as quickly as possible. The company has crossed the Schumacher line at the eighth level. This property was recently purchased for over \$1,600,000, and it is understood there is a large tonnage of low-grade ore.

Hollinger Drops Option at Elbow Lake

The Hollinger interests have dropped their option on the Murray claims at Elbow Lake, Man., and a new company has been formed to take them over. The property has been acquired by mining interests headed by Frederick G. Corning, mining engineer of New York, W. R. P. Parker, vice-president of the mining corporation, and Robert Sweeny, of New York. Gordon Murray and associates are accepting shares in the company in payment of their claims.

Smallest Claim Staked

A claim was recently staked in Kirkland Lake, Ont., having a length of only 300 ft. and a width of 15 ft. It lies between the Wright-Hargreaves and the Sylvanite, and, as far as is known, is the smallest claim ever staked in Ontario. Prospectors are wondering how it will be possible to do the necessary assessment work on this small piece of ground.

Stimulation of Silver Output Sought in China

Owing to the shortage of silver specie in China, the Ministry of Finance has circularized the various provinces and areas, urging the institution of a thorough investigation into all silver mines with a view to their exploitation, according to Reuters Agency.

Washington Magnesite Districts Depressed

News that the Senate had rescinded its recent action increasing the tariff on crude and burned magnesite has plunged the Washington magnesite industry into deep gloom. It is asserted that the reduction will not permit operation of this industry, which during the war assumed considerable magnitude in Stevens County.

International Nickel Co. Resumes Smelting

The smelter of the International Nickel Co. at Copper Cliff, Ont., resumed operations on Sept 1 after being closed down for eighteen months. It is operating at one-third of its war-time capacity, employing 650 men on eight-hour shifts. The Creighton mine began operations Aug. 24. Regular shipments of matte will be made to the refinery at Port Colborne, and the refined nickel will be shipped to the rolling mills at Huntington, Va., where it will be rolled into malleable metal.

Peculiar Hoist Accident on Gogebic Range

A serious accident occurred to the hoisting plant at the Woodbury shaft of the Newport Mining Co. at Ironwood, Mich., on Aug. 31, but fortunately no one was killed or seriously injured. The engineer had stopped the cage hoist with one cage at the shaft collar and left his stand to make an adjustment on the engine. Apparently he neglected to set the brake on one drum, and while working, accidentally moved the throttle of the clutch engine for this drum, thus releasing the latter. Before he could regain the stand and set the brake the drum was beyond control, the cage went to the bottom of the shaft, and the drum burst, tearing a great hole in the end of the building and many smaller ones in the roof and other end. Miraculously none of the six enginemen in the building were injured by the bombardment of steel fragments and falling brick, and none of the other six or eight large machines in the room were damaged. Even the hoisting engine itself, a 22x48-in. duplex Corliss double-drum Allis-Chalmers hoist, was damaged very little, aside from the broken drum, with its post brakes and clutch engine. One of the brake posts was thrown through a solid brick wall and 50 ft. beyond. The idler stands, shaft house and shaft were not much damaged.

Pioche Gets Lower Freight Rates to Salt Lake Valley

New freight rates, effective from Aug. 30, between Pioche and Caliente, Nev., and the Salt Lake Valley smelters, have been granted by the Union Pacific Railroad Co. with the permission of the Interstate Commerce Commission. These rates, which show a substantial reduction, are as follows:

Valuation of Ore at Smelter	Pre-war Rate	New Rate
\$6.50	\$1.75	\$1.80
7.50	1.75	1.80
8.50	2.25	1.80
10.00	2.25	1.80
11.00	2.75	2.00
12.00	2.75	2.20
13.00	2.75	2.40
14.00	2.75	2.60
15.00	2.75	2.80
16.00	3.50	3.00
17.00	3.50	3.20
18.00	3.50	3.40
19.00	3.50	3.60
20.00	3.50	3.60
30.00	4.50	4.00

New rates will also be published on ores of higher grade. The principal movement at the present time is on ores valued between \$8.50 and \$20.

Arizona Copper Co. Wins Award in Bullion Rate Case

Reparation has been awarded by the Interstate Commerce Commission to the Arizona Copper Co., Ltd., to cover overcharges on shipment of copper bullion from Clifton, Ariz., to New York. The case grew out of charges made by the carriers on a basis of a minimum weight of 60,000 lb. to the car. The copper company produced evidence to show that the initial carrier refused to accept the cars if loaded with copper to the full capacity. The carrier and its connections, however, contended that the shipments could have been withheld until cars of greater capacity could have been furnished. "If complainant had elected to pursue the latter alternative," says the commission in its decision, "the shipments might have been subjected to unreasonable delay, as a car shortage which existed at the time of the movement made it questionable when equipment of the type desired could have been furnished. The effect of the compulsion placed upon complainant was analogous to physical inability to load the cars to the prescribed minimum. It is unreasonable to base transportation charges on minimum weights in excess of the cars' capacity."

Feldspar Colloquium at Exposition of Chemical Industries

The American Ceramic Society has provided the program for one of the days during the week of the Exposition of Chemical Industries which is to be held in New York, Sept. 11 to 16. A symposium on "Feldspar" has been arranged in which several will take part. J. D. Dickey, of the Industrial Filtration Corporation, will talk on the "Preparation of Clays and Minerals for Ceramic Purposes."

News from Washington

By PAUL WOOTON
Special Correspondent

Hope for Mine Law Revision Bill Abandoned

Federated Societies Not to Let Efforts Slacken—May Propose Rigid Enforcement of Existing Statutes

Practically all hope of securing further action by the House Committee on Mines and Mining on the bill providing for the revision of the mining laws has been abandoned. Representative Rhodes, the chairman of the committee, states that Representative Arentz, of Nevada, has been promised that the committee will take no further action on the bill until the Nevada Congressman returns to Washington. Since it is known that Mr. Arentz opposes most of the revision suggested in the measure, it is believed that his influence will not be used in an effort to bring the bill out of its pigeonhole. The Committee on Mines and Mining is inclined to be guided in the matter by Mr. Arentz, who introduced the bill. The bill was drafted by a committee of engineers headed by W. R. Ingalls. Mr. Arentz states that he introduced the bill to facilitate its distribution for criticism and suggestion. He pointed out on numerous occasions that he had no intention of sponsoring the bill.

Largely through the efforts of Mr. Arentz, who is a mining engineer, about 5,000 copies of the bill were systematically circulated throughout the West. Particular attention was given to the effort to get the bill in the hands of the small operator, the mine superintendent, and the prospector. These elements within the industry interpreted the bill to be in the interest of the large operator and saw in it a blow at the prospector and those engaged in mining in a small way. The weight of this opinion so impressed the Committee on Mines and Mining that there is very little desire among its membership to push this legislation.

On the other hand, the Federated American Engineering Societies is determined to keep alive the effort to secure revision of the mining laws. That organization points to the fact that metal mining never before has been so dead, and never before was the opportunity to find and develop a mine so limited. It is believed that the claim staker has been protected at the expense of development and that the metal-mining industry must be free from many of the handicaps imposed by laws enacted to meet widely different conditions.

It is possible that the Federated societies may take steps looking to the rigid enforcement of the existing laws, which it is believed will more than any other one thing bring home to the West that revision is not in the interest of the large operators and that the existing laws are tolerable only because they are not observed in all particulars.

Manganiferous Iron Ores To Be Tested

A series of blast-furnace tests on the manganiferous iron ores of the Cuyuna Range will be run in the near future. These tests are the most pretentious ever undertaken and are expected to have an important bearing on smelting practice as applied to the low-grade manganiferous ores.

Conferees Pushing Work on Tariff Bill

Driving at top speed, Republican conferees on the Fordney-McCumber Tariff Bill have considered and tentatively agreed upon more than half of the amendments to rates which were made by the Senate. Working seven hours daily, and with prospects of night sessions, the conferees have declared that their report will be submitted to Congress by the middle of September.

In making this record of speed, however, the conferees have passed over until the end of the bill all highly controversial points in the measure. The question of the basis of valuation to be used in determining ad valorem rates will not be disposed of until the last. The House used American valuation as its basis—the value of a comparable American article. The Senate used foreign valuation, which has been the basis of all previous tariff measures. In proceeding with the discussion of rates, the conferees are using the Senate basis of foreign valuation, but with experts of the Tariff Commission keeping a parallel column translating such duties into terms of the American wholesale selling price of the imported article. This is the so-called Burgess plan, suggested by William Burgess, now a member of the Tariff Commission, and which was considered and rejected by the Senate Finance Committee when the bill first came from the House more than a year ago. If this plan were adopted finally by the conferees, it would change every ad valorem rate in the bill—and ad valorem rates constitute about 22 per cent of all rates in the bill—and would destroy any accurate basis of comparison with previous tariff laws.

Nothing as to definite agreements on rates is being given out by the Republican conferees. The Democratic conferees are excluded from the sessions, and no meetings are being held with reporters, as was done during conference on the tax bill.

While no authoritative information has been given out by the conferees, it is the general understanding in the corridors of both houses of Congress that the conferees have made some reductions in the chemical schedule and in the metals schedule, the latter being in manufactured articles.

Republican leaders in both the House and Senate predict that the new tariff bill will be on the statute books by Oct. 1.

Will Try to Bring Antimony Under War Minerals Act

Senator Pittman Introduces Amendment—Further Awards Recommended on Claims for Relief

Senator Pittman, of Nevada, has introduced an amendment to the War Minerals Relief Act which adds antimony to the minerals covered by the existing act. The amendment makes the act retroactive, in so far as antimony is concerned. The existing act covers manganese, chrome, pyrites, and tungsten.

Subject to the approval of the Secretary of the Interior, the War Minerals Relief Commissioner has recommended awards as follows: Tom Travis Lane, San Francisco, \$3,886.11; E. J. Emmons, Bakersfield, Cal., \$1,358.28; J. E. Birmingham, Chico, Cal., \$539; John Madrid, Angels Camp, Cal., \$941.07; Henry Augustus Ball, Cecilville, Cal., \$411.21; Harry N. Boynton, San Francisco, \$558.45; Timms & Bailey, John Day, Ore., \$216.60. In each of these claims, new dates of stimulation were established under the amended act. The claim of Mary E. Ashley, of Montrose, Cal., was disallowed, on the ground that it does not come within the purview of the act.

Seeking Safeguards for Future of Silver

Representatives of Mining Industry and Western Senators Discuss Ways of Stabilizing Price

Legislation and other means of stabilizing the price of silver, including the possibility of a loan of 300,000,000 ounces to China through the United States Treasury, were discussed last week at a meeting of Western Senators and the representatives of the silver mining industry which was held in the Washington office of Senator Key Pittman, of Nevada. As a result of the conference, which continued two days, a committee was appointed to consult mining experts, economists and students of international affairs to obtain the best thought on the subject so that a definite program of action may be determined upon, a firm foundation and suitable legislation drafted for presentation to Congress at the December session. This committee comprises Senator Pittman as chairman, Senators Nicholson, of Colorado; Walsh, of Montana; Gooding, of Idaho; and King, of Utah, with J. F. Callbreath, secretary of the American Mining Congress, as secretary. In addition to the members of the committee, among others who attended the conference were Senators Phipps, of Colorado, and Oddie, of Nevada; H. N. Lawrie, managing director of the American Gold and Silver Institute, and Ravenel Macbeth, president of the Idaho Mine Operators' Association, who is a State Senator of Idaho.

News by Mining Districts

The conference discussed informally what Senator Pittman characterized as propaganda for the repeal of the purchase clause of the Pittman Act; the King resolution for the summoning of a conference looking toward an international agreement for the use of silver at a fixed rate as an additional reserve behind currency, which is pending in the Senate; possible measures to break British control of the world price of silver; revival of demand in India; the needs of China when the internal political conditions in that country are composed, and other features of the situation.

Explaining his view of the situation, the Nevada Senator said:

"Eighty per cent of the entire silver production of the world is in the United States, Canada, and Mexico. More than 50 per cent of all silver is controlled by Americans, yet, notwithstanding that for twenty years the demand has been greater than the production, there is no department of this Government which has looked after the product of the silver industry. The world price is arbitrarily fixed every day by four brokers in London, with the support of the British Government. We know this thing can be stopped and arrangements made so that silver cannot be depreciated by people who do not produce it and by countries which only buy it. The whole thing is that nobody has ever tried to do anything for it."

Senator Pittman estimated that the United States Treasury will continue to purchase silver at \$1 an ounce, under the Pittman Act, for eighteen to twenty months longer, with the present world price of 70c., and for a longer period if the world price should go above \$1, in which event American producers would not offer their silver to the Government.

China, when composed politically, will need credit above all else and the United States is the logical country to extend this credit, Senator Pittman stated. He believes that China would pay \$1 an ounce for silver, if permitted to pay for it over a term of years and without interest, and he has in mind a sale, or loan, along these lines of \$300,000,000, or 300,000,000 ounces of silver, by the United States Government.

Brain Worker vs. Artisan

A concrete instance of the disparity between salaries paid those who work with their brains and those who work with their hands is cited by Clifford M. Holland, the chief engineer of the New York and New Jersey Bridge and Tunnel Commission. In a letter to Director Bain, of the U. S. Bureau of Mines, Mr. Holland tells of an instance at a Middle Western university which just has come under his notice. Apparatus was being constructed for some very important research work. The carpenters engaged on the work received \$2 per hour, whereas the scientists who used the apparatus in their research work received \$1 per hour.

London Letter

E. P. Mathewson Makes Supplementary Report on Burma Corporation—Broken Hill Proprietary's Position

BY W. A. DOMAN

London, Aug. 25—On previous occasions I have written concerning the Burma Corporation, and its ore reserves and scale of operations. For a company of the magnitude of the Burma Corporation the scale of operations is relatively small. Some months ago I referred to the technical report written by E. P. Mathewson. This engineer has gone further into the matter, and has made a supplementary report to the directors. The document has not yet seen the light of day, but I understand that it contains a recommendation that the metallurgical works should be increased. Before the war the Broken Hill mines supplied a goodly proportion of the pig lead used in the East. They will now apparently find the Burma Corporation coming into keener competition with them, for both time and freight rates will count.

The Broken Hill Proprietary Co. itself is typical of the Barrier Range mines in general. Labor conditions militate against the earning of profits, or even of operating economically, and, though occasional dividends are paid, the prosperity of the field has to a great extent been undermined. During the twelve months ended on May 31 last the report states that productive operations underground were suspended owing to the impossibility of profitable working on account of labor awards. The seriousness of the position can be gathered from the fact that actual working time at face is reduced from 106 hours to 55 hours weekly. Tailings are still being treated, and last year 184,701 tons yielded 2,789 tons of lead concentrates and 37,837 tons of slimes. The zinc separation plant treated 144,207 tons of tailings, producing 23,932 tons of zinc concentrates and 2,813 tons of slimes. The slimes flotation plant produced 11,081 tons of lead concentrates and 28,837 tons of zinc concentrates. From the standpoint of the Newcastle Steel Works the company is virtually strangled, for wages and hours have been fixed by arbitrary legal tribunals of federal and state governments. The only alternatives were to work at a loss or suspend operations. The latter was decided upon, though quite recently, owing to the placing of small government orders, the works have been partially restarted. The net profit for the year, after providing for depreciation and debenture interest, was £103,300.

The Rayfield (Nigeria) Tin Fields, Ltd., which had such bright prospects when tin mining in Nigeria was a paying business, has fallen upon evil times. At one time the Rayfield was regarded as the premier tin mining company of the country.

Johannesburg Letter

Rebel Leader Sentenced to Ten Years' Imprisonment—Benefits of Reduced Working Costs at Rand Mines Set Forth—Mining Board Ends Sitings

BY JOHN WATSON

Johannesburg, Aug. 1—At the special Treason Court, on July 24 the Judge-President, Sir J. Dove-Wilson, concluded his judgment in the trial of Rasmus Peter Erasmus, the so-called "General" of the Newlando (rebel commando) for high treason, as follows: "In all the circumstances we feel that in the due exercise of our duty towards the community we cannot inflict on you a less sentence—and you will recognize that in all the circumstances it is a lenient one—than imprisonment with hard labor for a period of ten years."

An important statement was presented to the Mining Industry Board on July 14 by Sir Evelyn Wallers, H. R. Hill (consulting engineer, Union Corporation), P. M. Newhall (consulting engineer, Central Mining Group) and W. Gemmill (actuary and labor adviser, Chamber of Mines.) It shows how the workable ore contents of the Rand will be enlarged and improved by such economic measures as a diminution of working costs. Improved economic measures must confer the following benefits on the state: (1) Longer life to the industry; (2) wider field for employment; (3) greater return to investors; and (4) attraction of new capital. More extensive economic employment of white men on the mines of the Rand can best be attained by a decrease in the cost of production, which will ensue from an unrestricted right to recruit native labor up to full requirements of the industry, and from increased efficiency on the part of all employees, white and colored, together with the other factors which have been brought forward in evidence.

The various mines affected are divided into four classes:

(1) A list of thirty-five mines is given, consisting of present producers, which contain large quantities of ore which could not be worked profitably at the working costs of 1921. If, however, costs can be reduced to 15s. per ton milled, the life of these mines will be prolonged to twenty-six years, or nearly doubled.

(2) A list is given of ten mines which were compelled to cease operations before their claim areas had been exhausted. An analysis of the published reports shows that these mines had a total tonnage of fully developed ore amounting to 4,887,000 tons, of an average value of 5.9 dwt. per ton.

(3) There is a class of six mines which have sunk shafts to the reef and carried out a considerable amount of development; but which have exhausted their cash resources. These areas total 5,874 claims and four out of these six

companies had developed reserves totaling 1,000,000 tons averaging 5.6 dwt. in value. On a basis of 25,000 tons a claim, the gross contents of these mines is estimated at 147,000,000 tons of which 40 per cent, or, say, 60,000,000 tons, could reasonably be regarded as payable.

(4) There are areas of unexplored ground on the extreme western and eastern ends of the Rand, a very large proportion belonging to the government. The capital required to develop these areas would be large. The total gold contents of these areas is estimated to be enormous and the importance of their exploitation to the country must be strongly emphasized. A summary of the additional tonnages mentioned under the four headings, would be: Class 1, 379,000,000; Class 2, 60,000,000; Class 3, 60,000,000; Class 4, 225,000,000; and total 724,000,000.

The sittings of the Mining Industry Board closed on July 26. Sir Carruthers Beattie said the board did not intend to deal with the federation, the Augmented Executive, or the strike; but with the future and methods by which benefit might be derived. The discussions had already been referred to as a washing of dirty linen on the part of the unions.

The second reading of the Iron and Steel Encouragement Bill was carried by the Senate July 18. The minister of justice, who was in charge of the bill, explained that if an industry turned out 50,000 tons per annum of pig iron convertible into steel, the bounty would be 15s. per ton, such bounty remaining for three years, when it would taper down by 2s. 6d. per annum until by 1931-32 it would disappear, by which time the industry should be firmly established. It was stated that there are mountains of iron ore in South Africa, millions of tons of ore of gold, and base metals, yet thousands of pounds worth of material was imported. Of machinery, which could be made in the country, a million pounds' worth a year was imported.

A statement was presented to the Mining Industry Board July 20 by the Home Native Co-operative Society of East Africa, which has been formed to protect the interests of natives in Portuguese territory, and which has its headquarters in Mozambique. This society considers that the color bar and *status quo* agreement are retrograde steps and are most inequitable to human beings. They regard these two measures as keys by which are closed the doors of the development and progress of the country and as causing many mines to be shut down. There are about 57,504 East Coast native laborers (recruited from Portuguese territory) on the Rand gold mines, mostly working underground. They are mostly recruited on a twelve-months' contract; but many renew and some stay as long as fifteen years on one mine. They thus become experienced miners; but the mining regulations prevent them doing certain classes of work reserved for the white miners.

BRITISH COLUMBIA

Nelson-Ymir Highway Serving to Prospect District Traversed

Vancouver—Among those interested in the newly organized Coast Range Steel, Ltd. (see *E. & M. J.-P.*, Aug. 19, 1922, p. 338) are Mayor Gale, of Vancouver, B. C., H. J. Landahl, John D. Kerns, F. D. Congdon and John Streta, of Vancouver; H. H. Shallengberger, of Spokane, and C. P. Williams, steel specialist of Port Talbot, South Wales. Mr. Landahl and Mr. Williams have been most active in promoting the enterprise in England and British Columbia. Vickers, Ltd., Simon Carves, Ltd., and Wellman Owen Engineering Corporation of London are reported interested, and the first-named corporation will have control of operations.

It is claimed that most of the money has been raised in England and that the Canadian and British Columbia governments under the Trade Facilities Act of Canada will extend aid in guaranteeing the bonds.

No information has yet been made public as to the location of the plants, but some point in eastern British Columbia will be the site of the blast furnaces, with the rolling and finishing mills situated on the Pacific coast, according to the latest rumors.

Ymir—Activity among the prospectors of this district has been stimulated by the construction of a highway between Nelson and Ymir, the last connecting link between the United States and the interior of British Columbia. For one and one-half miles north of Ymir the road enters heavy rock work, and is serving to prospect the surface across the prevalent strike of the veins. The road has already cut five veins on the Golden Age and Greenstone claims disclosing high-grade ore. Terzian Bros., who own the properties, are sorting ore from the veins disclosed, and three cars are ready for shipment.

Britannia Beach—The Britannia Mining & Smelting Co. has been released of all further liability for loss of life arising from the disastrous flood of last fall at Britannia Beach. The company has paid claims amounting to approximately \$56,000.

Alice Arm—The Esperanza mine has begun shipping ore. Approximately 750 sacks of high-grade has been sent to the smelter, and about forty tons of lower grade ore is ready.

Halcyon Hotsprings—Development work at the Big Ledge and the Monarch groups, on Petersen Creek, Upper Arrow Lake, is proving up the existence of a large body of zinc ore. A series of open cuts has demonstrated that the lode is 40 to 60 ft. wide, and it is said that average samples across the lode have given assays ranging between 40 and 50 per cent zinc. The lode has been traced through twelve claims, and a trial shipment will be made as soon as the trail, now being made, is completed. There is ample water for both power and ore dressing.

ONTARIO

Important Discovery at Tough-Oakes—Dome Not to Increase Milling Capacity—Clifton-Porcupine Mill Ready

Cobalt—The recent high-grade discovery at the McKinley has developed into two veins, each having a width of approximately 2 ft. of ore averaging about 1,000 ounces.

The Genessee has passed through the high-grade oreshoot recently cut, and is now opening up a new level 100 ft. deeper, as it is believed the recent discovery was the apex of a shoot.

Coniagas has put its second diamond drill to work on the Newray. Drilling has not yet proceeded far enough to permit of any opinion as to potential values.

Shipments for the week ended Aug. 25 from Cobalt were heavy, the total being 1,246,000 lbs., but consisting mostly of residues. The Nipissing sent eight cars, containing 687,000 lbs., the Mining Corporation five cars, of 392,000 lbs., and the McKinley and Dominion Reduction one car each, of 84,000 pounds.

Kirkland Lake—It is understood that a discovery of unusual importance has been made on the bottom level of the Tough-Oakes mine.

The Bidgood has reached 600 ft. and will start crosscutting immediately.

During July the Lake Shore treated 2,098 tons and recovered \$55,000, an average of \$26.25 per ton. A new compressor and electric hoist are being installed and the shaft is being enlarged to three compartments from the surface to 400 ft. It is expected that the mill will be enlarged to 200 tons per day capacity.

The Harvey-Kirkland is putting a power line to its property and will install electrical machinery for underground mining.

An option has been taken on the control of the Queen-Label group of properties.

Porcupine—It is stated that the Dome has no immediate intention of increasing its milling capacity. Underground development is satisfactory, and a large new crusher is being installed at the 12th level, at 1,450 feet.

The small 20-ton mill of the Clifton-Porcupine will be ready for operation within the next week. The company has a narrow vein of high-grade ore.

The McIntyre has two diamond drills at work exploring the Schumacher Veteran claim, adjoining the Dome. The company is not looking for a continuation of the Dome deposits, but for similar occurrences.

QUEBEC

Lachine—A merger has been arranged between British asbestos interests, a mining firm of the Eastern Townships of Quebec, and the Asbestos Manufacturing Co. of Lachine. The new company will be called the Asbestos Manufacturing Co. of Canada, with a capital of \$2,500,000.

CALIFORNIA

Yuba River Development—Randsburg—
Brunswick Stockholders Delinquent—
Downieville—Reid Mine Reopened

From Our Special Correspondent

San Francisco—Construction work on the Bullard's Bar restraining dam, the first link of the Yuba Development Co.'s program on the Yuba River, started on Aug. 21, when forms were erected for the base of the dam. The Great Western Power Co. will supply power for the construction work at the dam.

Silver mines not operated for thirty years are being opened in the vicinity of Porterville by mining men from the Randsburg district. The North Rand Mining Co., operating in the north end of the Randsburg field, in the course of developments on the 400 level, 185 ft. from the shaft on the east crosscut, has struck ruby silver ore. A southerly drift from this crosscut exposed an 18-in. quartz vein, and a drift is now being run along this. The Swastika Mining Co., headed by E. T. Grady, is now operating two properties about 2,000 ft. southeast of the old Grady lease. The No. 1 shaft is now down to a depth of 995 ft., bedrock having been encountered at 675 ft. The No. 2 shaft is still in the wash. The Foster group of claims is being developed by the Randsburg Silver Mining Co.'s Foster, or No. 2, shaft, which is down to 450 ft., and diamond drilling is in progress.

Stockholders of the Brunswick Consolidated Mining Co. owning nearly 50,000 shares are delinquent in the payment of the recent assessment levied by the company. The stock was sold to satisfy the amount of the assessment. Operations at the mine recently started after an idleness of nearly five years. A new hoist is being installed and other improvements are to be made prior to reopening the mine. The assessment was levied for this purpose.

Owners of the Pilot Placer, four miles south of Downieville, are starting a new tunnel, 600 ft. long, to tap the channel about 75 ft. lower than the old Rosenfeld tunnel run some years ago. Five stamps are dropping at Bessler Brother's mine, in the heart of Downieville.

The El Dorado mine, at Alleghany, has suspended operations temporarily. Estimates on the daily output from the Alleghany district are as high as \$10,000. This is reflected in an insistent demand for labor and a scarcity of housing that may soon become critical.

After ten years of idleness, the Gold Leaf mine, between Shasta and Redding, is being reopened. The property was deeded last April to the Gold Leaf Mining Co. by Ira Judson Coe, Richard T. Tomlinson, and F. W. Heron, all of San Francisco. The shaft is being re timbered, preparatory to unwatering the lower levels.

Work in the Reid mine, in Shasta County, is to be resumed after a shut-down for over three years. The Shasta Zinc & Copper Co. at Winthrop has placed an order for a steady supply of fluxing ore.

WASHINGTON

Bead Lake Gold Acquires Conquest
Holdings—Gladstone Mine
Shipping

Newport—The Bead Lake Gold & Copper Mining Co. which is operating eight miles north of Newport, has acquired the Conquest Mining Co.'s holdings and has completed an aerial tramway to its mill. The 100-ton concentrator is practically completed. It will be operated with power from the Mountain States Power Co.; the transmission line to the mill is erected and ready for operation. An aerial tramway from the Comstock workings will be completed soon, and active mining and milling will begin in thirty days.

Northport—The Gladstone Mining Co. is shipping ore from its property near Lead Point. Five cars shipped during June and July netted \$9,700, according to D. D. Dodd, superintendent. Crosscuts have been started from the main shaft to the No. 5 and No. 7 chimneys, and buildings and equipment have been overhauled for continuous operations during the winter.

ARIZONA

Tax Commission Makes Final Adjustments
in Evaluation of Mining
Properties

Phoenix—Final adjustments by the State Tax Commission give the American Smelting & Refining Co. a valuation in Gila County of \$2,434,316, an increase of \$40,000; the International Smelting Co., \$2,061,942, an increase of \$167,799; the Old Dominion Mining Co., on mines, \$7,081,009, a decrease of almost exactly \$1,000,000; the Inspiration Consolidated, on producing mines, \$56,796,908, a decrease of about \$200,000; the Miami Copper Co., on producing mines, \$20,002,968, this being practically no change. In all of the Arizona mining counties the county tax rate is very low, compared with that of the agricultural subdivisions. In Yavapai County it is only 49c. of each \$100 of valuation and in Cochise County 53c.

Plans are already afoot for the entertainment of the members of the A. T. M. E. on their return from the annual meeting at San Francisco, which ends Sept. 29. A trainload to be routed through Arizona will be taken over the Apache Trail to Miami and Globe.

Jerome—At about 300 ft. depth, the Calumet & Jerome has entered an orebody found by drilling a year ago. The crosscut is in a full face of commercial ore, which is chalcopyrite in soft schist. An oxide streak not found by the drill carries 4 oz. silver, \$42 gold, and 3 per cent copper.

Globe—Superior & Boston is employing about 100 men, its maximum force. E. G. Deane, the manager, says that the property for the last year or more was operated mainly because of the good silver value of its ore. Now, almost as soon as the copper smelters started operations, the silver has "petered out."

NEVADA

West End's Lease on McNamara Mill
Expires—Goldfield Deep Gets
Money for Shaft Sinking

From Our Special Correspondent.

Argentite—The Francis property has one shaft which has reached the 200 level. The second shaft is down 50 ft., and a contract for an additional 50 ft. is already granted. The Mohawk shaft has now passed the 260 level.

Candelaria—Additional leaching vats are being added to the new Candelaria Mines Co.'s mill, which will increase the tonnage treated to about 600 tons daily.

Goldfield—The Goldfield Deep Mines Co. has recently obtained \$450,000, which will be used to sink the four-compartment shaft to a depth of approximately 2,400 ft. The bottom of the shaft is at present in dacite, the principal vein formation of the camp. The lessees on the Great Bend Mining Co. sent out their seventh car of ore recently. The Silver Pick lease on the Red Top claim of the Goldfield Consolidated Mines Co. shipped two carloads of ore averaging \$22 a ton to the Belmont mill at Tonopah.

Mina—The West End Consolidated Mining Co. has shipped the third car of high-grade ore from the Mabel mine to its mill at Tonopah.

Tybo—The reorganized Louisiana Consolidated Mining Co. will soon start to unwater the 400-ft. shaft to allow an examination to be made of the mine workings.

Tonopah—The crop of sweeps from the Belmont tailing pond has been harvested, and the sweeps plant will soon be placed in operation. The Tonopah Mining Co. shipped \$48,000 in bullion, which represented the clean-up for the first half of August. The West End Consolidated Mining Co.'s lease on the McNamara mill expires Sept. 10, and the mill will be turned over to its owner, the McNamara Mining & Milling Co.

Divide—The Alto Divide is drifting to the west on the 400 level toward an area of Divide breccia. The new Tonopah Dividend is also drifting on the 400 level.

Pioche—Work is being continued on the Silver Dale and Silver Horn mines, at Silverhorn, the scene of last year's spectacular boom, and with machinery installed at both properties good progress is being made. At the Silver Horn, a tunnel is being driven to cut the ore-bearing formation at a depth of 100 ft. from the outcrop, and the heading is expected to reach its objective this month. On the Silver Dale, work is going forward in the tunnel connecting with the 70-ft. level of the shaft; the vein at this point averages 30 oz. in silver to the ton. About fifteen men are employed by the companies now operating at Silver Horn. R. K. Brown, of Tonopah, is in charge of the Silver Dale, and H. R. Bradley, with Clay Coveney as foreman, is directing the development of the Nevada Silver Horn mine.

Preparations are being made to resume work at the Prince Consolidated mine, and a small force is now employed in tuning up the power plant. A satisfactory arrangement is being formulated to finance operations, besides which a satisfactory income is being derived from the sale of the tailings from Bullionville and Dry Valley.

The following shipments were made in the week ended Sept. 1: Bristol Silver, 765 tons; Prince Consolidated, 100 tons; a total of 865 tons. No tonnage being moved from Bullionville, on account of severe washouts.

Ely—Work is being done on the Jennie A mine, at Hamilton, and a shipment of silver-lead ore is now being hauled from the mine to the Keystone siding. Eureka mining men are considering the treatment of Hamilton ores at Eureka, which would open up the Hamilton district, containing as it does a large tonnage of smelting ore.

That the Consolidated Coppermines will soon resume operations is indicated by the arrival in Ely of Robert Marsh, who will assume the general management of the company. It is reliably reported that the company has been amply financed as a result of the recent reorganization.

UTAH

All Camps Show Increase in Shipments—Custom Ore Received at Smelters Drop

Salt Lake City—Mining conditions in August were good, and there was a moderate increase in shipments from all the camps, including the Cottonwoods and American Fork. The principal handicap was a shortage of labor. Good miners are very scarce, and more could be used at Bingham and all other camps. Mining and smelting have been but little affected by the rail strike. There is no coal or coke shortage. Less miscellaneous custom ores are being received by the smelters on account of the scarcity of labor at the mines.

The Utah Copper Co. averaged 17,000 to 18,000 tons daily for August and shipped as high as 20,000. Utah Consolidated shipped 500 tons of copper ore daily to the concentrator at Tooele. The New England, at Bingham, produced three to four cars of lead ore a week by lessees. Utah Apex shipped 250 tons of lead ore and concentrates daily. Shipments from Park City totaled 15,613 tons, including 8,644 tons of siliceous ore and some tailings by the Park, Utah and Ontario, compared with 13,854 tons in July. The Park-Utah shipped 1,000 to 1,100 tons a week of siliceous silver ores. Bingham's output of lead ores and concentrates in August was 11,930 tons, compared with 10,223 tons in July. The output of the Tintic district was 28,215 tons, compared with 22,135 tons in July. Of the smelters, Murray ran three lead furnaces, and one on matte. The Midvale plant ran three on lead and one on matte intermittently. Garfield three large reverbera-

tory copper furnaces of a capacity of about 1,500 tons daily. The International, at Tooele, ran one copper and two lead furnaces.

Salt Lake City—The Los Angeles & Salt Lake R. R. has filed a protest with the Public Utilities Commission against the granting of a certificate of public necessity or convenience for the construction of a railroad in Iron County by the Iron County R. R. Co., on the ground that it has itself made application for such a certificate to construct a branch line from Lund to Cedar City, which would cover the same territory as that which the proposed new road plans to cover, with a view to serving the Columbia Steel Corporation, which is being organized to exploit the iron ores of southern Utah. The ground taken is that one line will be fully adequate to the needs of the section. The Iron County railroad filed its application Aug. 11 and the Los Angeles & Salt Lake road its application Aug. 17.

Park City—Shipments for the week ended Aug. 26 amounted to 4,111 tons. Shippers were: Park-Utah, 1,165 tons; Ontario, 1,077, Silver Kink Coalition, 1,071; Judge, Park City Mining & Smelting and the Daly, 797 tons.

Eureka—Ore shipments from the Tintic district for the week ended Aug. 26 amounted to 149 cars. Shippers were: Chief Consolidated, 43 cars; Tintic Standard, 40; Victoria, 13; Iron Blosson, 13; Colorado, 10; Eagle & Blue Bell, 10; Grand Central, 7; Mammoth, 3; American Star, 2; Alaska, 2; Dragon, 2; Gemini, 1; Centennial-Eureka, 1; Gold Chain, 1; Swansea 1; and Little May, 1. The Bingham Mines company, owning the Eagle & Blue Bell as well as the Victoria in Tintic, in addition to its Bingham properties, is developing a small area of ground lying between the Chief Consolidated and the Eagle & Blue Bell. This property, the American Star, made its first shipment—two cars—on Aug. 26, from ore which it has opened at 1,600 ft., working through the Eagle & Blue Bell.

Alta—At the Alta Tunnel & Transportation property, the ore, which for a time narrowed, has again widened. Production at the rate of five or six tons daily has continued throughout the shipping season. In the ten months ended Aug. 1 net returns from shipments (of a gross value of \$54,000) have been \$30,000.

IDAHO

Negotiations for Re-financing Snowstorm Mines Under Way

The Snowstorm Mines Consolidated, which is operating the Snowstorm mines, on the Idaho-Montana boundary near Troy, Mont., is working on a one-shift basis and shipping lead-silver concentrates. L. Greenough, the manager, has recently returned from New York where he spent two months in connection with the refinancing of the company, which has an obligation of \$900,000. A plan is sought that will be equally acceptable to the company and to its creditors.

COLORADO

Interesting Discovery of Gold Ore Made on Revenue at Sneffels

Ouray—The Reynolds Estate, operating the old Revenue properties at Sneffels, has discovered a shoot of good gold ore in driving westerly from the main tunnel level on the Terrible-Monarch vein. This work was planned as an exploration under the famous old silver oreshoot which was worked years ago on a much higher level, and the discovery of high-grade gold ore at this depth is unexpected and interesting. Several sets of leasers are working on the Revenue property, on the dumps and in the old stope fills.

Both leasing companies on the Barstow are milling the ore which was opened last spring on the two main levels. The output will be hauled to Silverton for loading on cars, as the main highway is closed to wheel traffic by the contractors building the new automobile highway. This highway will probably be closed to such traffic for the rest of the year.

The Lucky Twenty continues driving its new crosscut on the Guadaloupe, at Ironton, and is making good progress. Recent heavy rains brought down slide rock in the gulch, which damaged the plant and will cause some delay, but it is expected that the crosscut will reach the vein next winter. There is no other operation of consequence in the whole Red Mountain-Ironton district, though an attempt is being made to revive the San Antonio or Koehler Tunnel property, at Red Mountain.

Golconda Mines Consolidated has resumed work at the Golconda, in Horse-shoe Basin, Lake City, with E. R. Rumpler in charge and C. E. Harlan, superintendent. The main crosscut in the basin has been finished to the vein, and work is going forward, drifting easterly on the main vein. A compressed-air line is being carried up the basin to the Bob Ingersoll, and development of that property will be carried on when this line is finished.

Columbine—The Hahns Peak Development Co. is working a small force driving a tunnel on a vein of gold ore.

The Southern Cross tunnel has struck a vein of good silver ore 1,300 ft. from the portal. Richard Paulson is superintendent.

The Master Key Mining Co. owns a large group of patented claims on which many old shafts and tunnels have opened up rich silver-lead ore in the past. T. Kloekner, general manager, has surveyed and is planning on driving a long tunnel.

Peter Boyle is working on a lease on the Minnie D., and has prospected many surface outcroppings and made shipments of good-grade ore running well in silver and antimony. This property is developed with shaft and tunnels.

E. Burnett continues development work on the Lincoln group of claims and has a tunnel well into the mountain on the east side, near the Oro Cache tunnel.

MICHIGAN**The Copper Country****Possibility of Coal Shortage Looms—
Ford's Shutdown May Help Mine
Labor Situation—August
Copper Production**

BY M. W. YOUNGS

Houghton—The mines of the Michigan copper district are still faced with the possibility of a coal shortage. Only two months remain in which to receive coal by boat, and 275,000 tons more is needed to enable the mines, mills, and smelters to continue work through the winter. Shipment by rail this distance is prohibitive on account of the cost. The Calumet & Hecla has a five months' supply, but some of the other properties have less than that. If coal is obtainable, there is still time to ship it, as monthly receipts in other years have been as high as 170,000 tons.

Shutting down of the Ford plants Sept. 16 may relieve the labor situation in the Michigan district somewhat. Many Ford employees are former Copper Country residents, who may return here for employment. All of the mines are short-handed, and this demand for men is expected to result in the return of a considerable number.

Refined copper production in the Michigan district shows a slight increase in August over that for July. The estimated output was 10,025,000 lb., as compared with 9,750,000 lb. the previous month. This is 45 per cent of the monthly yield in normal years. Calumet & Hecla and Ahmeek continued to make gains, owing largely to the contract or bonus system underground. Calumet & Hecla is now producing, including the output of the reclamation plant, approximately 4,250,000 lb. Ahmeek is sending 1,600 to 1,700 tons of "rock" daily to the mill, averaging 30 lb. to the ton. Considerable mass also is coming from the fissure vein. Production in August was 1,425,000 lb. Mohawk is still producing about 800,000 lb. per month, the reduction being due to loss of men. Quincy's output is affected somewhat by the closing of No. 6 shaft for repairs, production being estimated at 800,000 lb. The lower levels of No. 6 are being worked but it is necessary to take the rock to No. 2 shaft for hoisting.

Arcadian Consolidated has reached the 1,250 level in its New Baltic shaft, having sunk 150 ft. in six weeks. The shaft was timbered and piped and the skipway and ladderway built as it was sunk.

Gogebic Range**State Tax Commission Recommends
General Increase in Valuations**

Ironwood—The Michigan State Tax Commission has recommended to the State Board of Equalization that there be a general increase in assessed valuations throughout the state to make the state total nearly \$6,500,000,000, whereas it was \$5,000,000,000 in 1921. This is an increase of 30 per cent, while for Gogebic County the proposed valuation is about \$80,760,000, an increase of

only 17 per cent. This indicates that the commission realizes that valuations of mining properties are already close to true cash value while that of other property is not.

The railroads are still giving good car service to the mines, and ore is moving to the docks at a fair rate. There have been some interruptions, the worst was when switching crews refused to take out any engines because they had not been properly inspected; this and other difficulties have now been smoothed out.

The first of the new model of Cole-Goudie underground shoveling machines has been received in Ironwood and is being given rigid tests at the Pabst mine.

Work is being pushed as rapidly as possible at the new Geneva shaft of the Oliver Iron Mining Co. Railroad tracks have been built, buildings are going up, and most of the sinking equipment has arrived. Actual sinking will begin as soon as this is erected.

Some small shipments have been made from the Berkshire mine, at Mellen, Wis., to the Charcoal Iron Co.'s furnace at Ashland. The Berkshire has a magnetic ore and was equipped to wet concentrate it. Magnetic concentration is now being used with greater success.

JOPLIN-MIAMI DISTRICT**Missouri-Kansas-Oklahoma****Picher Mines Face Water Shortage—
Lack of Cars Hindering Work
Blue Mound Mill Being
Remodeled**

BY P. R. COLDREN

Joplin—Continued dry weather has dried up the waters of Tar Creek, in the Picher camp, and several mines may have to close down as a result. The Dorothy Bill mine closed down Aug. 28 for this cause. This and the car shortage are the outstanding features of the situation in the Tri-State zinc and lead field. Ninety per cent of the cars now being received are coming from the Kansas, Oklahoma & Gulf R.R., which is bringing them from as far south as Dennison, Tex. During the last week one buyer discovered fifteen cars that had been loaded early in July, still standing on a siding in Picher.

The Standard mine, at Picher, has recently been taken over by A. J. Poyner and associates. It has been operated since last fall by Creech and associates, under a lease from the Standard company, for which D. D. Dunkin, of Guion, Ark., is manager. The new management intends to open up an ore cave that was recently located on the lease, and dewatering will be necessary.

Promising drill cuttings have recently been produced by the Chanute Spelter Co., on a lease it owns directly to the west of what is known as the "mill" forty, on the Hartley land, immediately west of Baxter Springs, Kan.

McGhee Brothers & Jesse, of Joplin,

have taken over the Blue Mound mill, in Kansas, just across the state line, north of Picher, Okla., and are remodeling it for a tailing plant. The mill has been idle over a year, although a company of practical miners have been "cleaning up" underground for some time, and have been running dirt over the Blue Diamond mill, which now is in charge of the State Line Mining Co. Charles Jesse is in charge of the tailing project, which will be started in operation about Sept. 15.

ALABAMA**Iron Production Holding Its Own
Though Hampered by Car Short-
age—Construction of New
Cement Plant Begun**

BY GEORGE CLARK

Birmingham—Aside from the lack of cars for adequate distribution of product, Alabama iron makers are maintaining the regular output established on the July basis, with an official record for the first half of the year of 963,019 tons. Furnace coal supplies being mainly drawn from mines individually owned and operated, priorities do not materially affect the district, independent coal producers being permitted to ship wherever they please provided the absolute requirements for railroad and public utilities are taken care of. Car shortage and defective motive power have caused an increase in yard stocks.

Except for these conditions, two more stacks would have been blown in, one of them being the rebuilt No. 1, Ensley furnace of the Tennessee Coal, Iron & Railroad Co., which will have an output of 600 tons per day.

Coal production was estimated to remain at about 400,000 tons per week up to the middle of August, but there was probably some reduction during the last half of the month under existing conditions of lack of transportation.

The closing week of the month was marked by the long delayed resumption of construction on the \$2,500,000 cement plant of the Phoenix Portland Cement Co. at North Birmingham. This plant, when completed, will be the largest and most modern of its kind in the South, having an annual capacity of 1,500,000 bbl. or 6,000,000 sacks of high-grade portland cement. Estimates made based on core drilling to a depth of 200 ft. on the eighty acres purchased from the Sloss Sheffield Steel & Iron Co., are stated to indicate adequate supplies of cement-making material near the plant for making 200,000,000 bbl. of portland cement. Plant construction will be entirely of steel and reinforced concrete, and will have some new features.

During the war a number of small barytes mines were opened up in the state, some of which are still active. The Bertha Mineral Co.'s barytes mine of the New Jersey Zinc Co. situated near Jacksonville, Calhoun County, is pushing production on double shift, and recovering a clay-bedded ore by steam shovel. The plant used is simple, consisting of a double-log cherokee washer with a separation table for the middlings or fines.

THE MARKET REPORT

Daily Prices of Metals

Aug.	Copper, N. Y., net refinery* Electrolytic	Tin		Lead		Zinc
		99 Per Cent	Straits	N. Y.	St. L.	St. L.
31	13.625@13.75	32.25	32.50	5.90	5.55	6.20@6.25
Sept. 1	13.625@13.75	32.25	32.625	5.90	5.55@5.60	6.20@6.25
2	13.75	32.25	32.625	5.90	5.55@5.60	6.25
4	.....	.....	.....	.....	.....	.....
5	13.75	32.00	32.375	5.90	5.575@5.60	6.25
6	13.75	32.00	32.375	5.90	5.575@5.60	6.25

*These prices correspond to the following quotations for copper delivered: Aug. 31 and Sept. 1, 13.875@14c.; Sept. 2, 5, and 6, 14c.

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. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Aug.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
31	62½	63	69½	160½	160¾	24½	23¾	30¾	30¾
Sept. 1	63½	63¾	69¾	160¾	161½	24½	23¾	31½	30¾
4	63½	63¾	70	159¾	160	24½	23¾	31½	30¾
5	63	63¾	70½	159¾	159¾	24½	23¾	31½	30¾
6	63	63¾	70½	159¾	159¾	24½	23¾	31½	30¾

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

Aug.	Sterling Exchange "Checks"	Silver			Sept.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
31	4.45½	99½	69½	35½	4	.....	.....	35½
Sept. 1	4.45½	99½	69½	35½	5	4.47	99½	70½	
2	4.46½	99½	70	35½	6	4.46½	99½	70	

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Metal Markets

New York, Sept. 6, 1922

The Labor Day holiday on Monday interfered somewhat with business during the week, but the market was by no means dull, and prices of all the metals except tin showed tendencies to advance.

Copper

Sales of copper in round lots were made on Thursday and Friday at 13.875c. delivered, but since then practically all business has been booked at the 14c. level, to which most of the producers have held at all times. It might still be possible to pick up a

thousand-ton lot at 13.875c. for far-forward delivery, but business of this kind is not frequent. Most of the sales are of smaller quantities, and for shipment in September-October-November. Consumers report demand active for their products, and a large amount of copper is going into brass, wire, and cable particularly.

Demand from abroad has been quiet; in the last few days a revival of English buying has been a feature.

Lead

The American Smelting & Refining Co. continues to quote 5.90c., New York.

Average Metal Prices for August

Copper:	
New York Electrolytic.....	13.723
London Standard	63.784
London Electrolytic.....	69.932
Lead:	
New York	5.824
St. Louis	5.537
London	24.580
Silver:	
New York, foreign.....	69.417
New York, domestic	99.625
London	34.957
Sterling Exchange	446.069
Zinc:	
St. Louis	6.212
London	31.170
Tin:	
99 per cent	32.134
Straits	32.380
London	160.006
Antimony	5.315
Quicksilver	57.593
Platinum	98.370

The market for the week both here and in St. Louis has been firm and quiet. Despite rumors of advances over the Smelting company's New York price, there is plenty of lead available at the 5.90c. level where the buyer is a responsible consumer, and the majority of sales have been made at that price. Dealers are trying to accumulate lead before an advance in the tariff. Corroding lead was offered at 5.95c. yesterday without finding a buyer. In St. Louis several sales have been made at 5.60c., and possibly one or two at 2½ points above this, though some consumers have been offered lead every day at 5.575c. The most of the metal has gone for 5.60c. In Chicago, desilverized lead has sold as low as 5.65c., though 5.70c. is the level generally quoted.

Tin

Tin has been quiet, and the somewhat unfavorable statistics issued at the end of the month have had a depressing influence. The manner of reporting these statistics by the New York Metal Exchange has been changed so that the figures for August are not exactly comparable to those for July, but English houses report visible stocks to have increased about 1,500 tons during the month. Straits shipments for August were about 5,000 long tons compared with about 4,000 for July, an increase which was not in accord with promises and expectations. The fuel shortage here has interfered with the tin-plate mills, and European demand is reported disappointing. Considering the unfavorable factors the price of tin has held up remarkably well.

Forward Straits tin is selling at approximately the same level as spot,

though in the 99 per cent grade, Chinese No. 1 for forward delivery can be had at $\frac{1}{2}$ @ $\frac{1}{2}$ c. discount from the price asked for spot.

Arrivals of tin, in long tons, for August: Atlantic ports, 3,190, Pacific ports, 150; Sept. 1, China, 150; Liverpool, 25; 2d, Straits, 1,260; 5th, China, 125; Straits, 225.

Zinc

A mixed sentiment is noticeable in the zinc market. Some producers have been inactive and report the market quiet. Others have made sales daily and report it active. The market is strong at its present 6.25c. level.

Inquiries have not been so numerous as last week and are almost entirely for prompt shipment, but metal for delivery in October and November can be had for 6.20@6.225c. per lb. A railroad freight-car shortage is impeding operations in the Middle Western zinc fields. One railroad has laid an embargo on the shipment of concentrates for the moment. High-grade zinc sold for 7@7.25c. per lb. during the week, and business is reported excellent in that grade.

Gold

Gold in London: Aug. 31st, 92s. 4d.; Sept. 1st, 92s. 5d.; 4th, 92s. 4d.; 5th, 92s. 3d.; 6th, 92s. 2d.

Foreign Exchange

On Tuesday, Sept. 5, francs were 7.85c.; lire, 4.355c.; marks, 0.0725c.; and Canadian dollars, $\frac{1}{2}$ per cent discount.

Silver

Silver has continued steady, with a sharp advance on the 5th, succeeded by an equally sharp decline on the 6th. These fluctuations were caused by buying orders from the Indian bazaars in the London market, which was scarce of supplies, followed the next day by re-sales from India and offerings from China. On Sept. 1 the New York quotation for bar silver of "domestic origin" was reduced from 99 $\frac{1}{2}$ c. to 99 $\frac{1}{4}$ c. per ounce .999 fine. This reduction in price is caused by the increased cost of transportation, owing to the fact that the U. S. Government is now accepting delivery of silver purchased under the Pittman Act at the Denver Mint instead of at the Philadelphia Mint.

Mexican Dollars — Aug. 31st, 53 $\frac{1}{2}$; Sept. 1st, 53 $\frac{1}{2}$; 2d, 53 $\frac{1}{2}$; 5th, 54 $\frac{1}{2}$; 6th, 53 $\frac{1}{2}$ c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—Contract prices by principal interest: 99 per cent, 20.1c. per lb.; 98@99, 19.1c.; 94@98, 18c. Odd lots for spot delivery, 98@99 per cent, have been selling as low as 17.75c. Importers are reluctant to sell and where they have stocks in this country are holding for higher prices expected to result from the prospective 5c. per lb. tariff.

Antimony—Chinese and Japanese brands, 5.50c. W.C.C., 6@6.25c. Cookson's "C" grade, 7@7.50c. Market is steady.

Bismuth—\$2@2.10 per lb.

Cadmium—\$1.20@1.25 per lb.

Iridium—\$275@300. Nominal.

Nickel—Standard market, ingot and shot, 36c.; electrolytic, 39c. Outside market, 32@34c. per lb.

Palladium—\$55 per oz.

Platinum—\$118 per oz. Strong.

Quicksilver—\$65 per 75-lb. flask. Market good. San Francisco wires \$63.70.

Selenium—\$1.80@1.90 per lb.

Tellurium—\$2 per lb.

The prices of Cobalt, Magnesium, Molybdenum, Monel Metal, Osmium, Rhodium, Thallium, and Tungsten are unchanged from prices given Sept. 2.

Metallic Ores

Chrome Ore—Indian chrome ore, \$18 per ton, c.i.f. Atlantic ports. Rhodesian and New Caledonian, \$23 and \$25 per ton. Market quiet.

Manganese Ore—29c. per long ton unit, seaport.

Tungsten Ore—Chinese ore, \$3@3.50 per long ton unit of WO₃.

Iron Ore, Magnetite, Molybdenum, Tantalum, Titanium, Uranium, Vanadium, and Zircon ore are unchanged from the quotations published Sept. 2.

Zinc and Lead Ore Markets

Joplin, Mo., Sept. 2.—Zinc blende, per ton, high, \$39.70; basis 60 per cent zinc, premium, \$37@38; Prime Western, \$36@37; fines and slimes, \$35@33.50; average settling price, all grades of blende, \$37.31; calamine, basis 40 per cent zinc, \$20@22; average, \$19.78.

Lead, high, \$83.20; basis 80 per cent lead, \$80; average settling price, all grades of lead, \$80.04 per ton.

Shipments for the week: Blende, 7,978; calamine, 95; lead, 1,608 tons. Value all ores the week, \$428,340.

Shipments continue around 90 per cent of purchases, and buyers continue purchasing ore to secure a quota of cars in the distribution. Intense heat is holding production in check.

Platteville, Wis., Sept. 2.—Blende, basis 60 per cent zinc, \$38 per ton; lead, basis 80 per cent lead, \$81 per ton. Shipments for the week: Blende, 1,086; lead, 75 tons. Shipments for the year: Blende, 12,783; lead, 1,204 tons. Shipped during the week to separating plants, 882 tons blende.

Non-Metallic Minerals

Feldspar—No. 1 pottery, \$7@7.50 per gross ton, f.o.b. North Carolina points. Market fair.

Magnesite—\$15 per ton for crude, \$35@37.50 for calcined magnesite, f.o.b. California points. Northwest American magnesite industry has been shut down for the last year.

Talc—200 mesh, \$15; 300 mesh, \$18.50 per ton, f.o.b. California points.

Asbestos, Barytes, Bauxite, Borax, Chalk, China Clay, Emery, Fluorspar, Fuller's Earth, Graphite, Gypsum, Limestone, Mica, Monazite, Phosphate, Pumice, Pyrites, Silica, and Sulphur

are unchanged from the prices published Sept. 2.

Mineral Products

Arsenious Oxide (white arsenic)—8.50@9c. per lb.

Copper Sulphate—Large crystals, 6.50c. per lb.

Sodium Nitrate—\$2.25@2.65 per 100 lb., ex vessel Atlantic ports.

Potassium Sulphate and Sodium Sulphate are unchanged from quotations of Sept. 2.

Ferro-Alloys

Ferrocium, Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium, and Ferrovandium are unchanged from the prices published Sept. 2.

Metal Products

Copper Sheets—New York base, 21.50c. per lb.; wire, 15.50@15.75c. net.

Nickel Silver—29c. per lb., for 18 per cent nickel Grade "A" sheets.

Yellow Metal—Dimension sheets, 19.25c.; rods, 16.25c. per lb.

Lead Sheets and Zinc Sheets are unchanged from the quotations published in the Sept. 2 issue.

Refractories

Magnesite Brick—\$56 per net ton.

Magnesite Cement—\$35@40 per ton.

Silica Brick—\$33@41 per 1,000, f.o.b. shipping points.

Bauxite Brick, Chrome Brick, Chrome Cement, Firebrick, and Zirkite are unchanged from the prices appearing in the issue of Sept. 2.

The Iron Trade

Pittsburgh, Sept. 5, 1922.

The Pittsburgh district operators having signed the scale last week, the union bituminous coal strike is now practically over. Production is being resumed rapidly, but will be limited by transportation capacity, and on account of various priorities the iron and steel industry will not be greatly benefited for a while.

Steel prices continue to stiffen or definitely advance all along the line. Nothing is farther from the market than a price reaction, now that the coal strike is ended. Minimum prices remain at 1.90c. for bars and 2.00c. for shapes and plates, but orders are hard to place at these prices, and the delivery would be very late. The ordinary market for bars, shapes and plates is 2.25c., against 1.35c. at the low point early in March.

Pig Iron—Small lots of bessemer have brought \$34, Valley, making another \$2 advance. Basic is nominal at \$30, Valley. Pittsburgh buyers of foundry iron have had to go to Buffalo, paying \$34, furnace, equal to \$35.50, Valley basis, or \$2.50 advance in the week.

Connellsville Coke—Furnace coke has reacted upward, at \$11@12; foundry a shade easier at \$13@13.50. Offerings are very light.

METAL STATISTICS

Monthly Average Prices of Metals

	New York		London		Sterling Exchange	
	1921	1922	1921	1922	1921	1922
January.....	65.950	65.450	39.985	35.035	372.650	421.750
February.....	59.233	65.290	34.745	33.891	385.932	435.511
March.....	56.023	64.440	32.479	33.269	389.806	436.912
April.....	59.337	66.575	34.250	34.080	391.784	440.715
May.....	59.810	71.154	34.165	36.023	396.580	444.106
June.....	58.510	71.149	34.971	35.900	377.236	444.615
July.....	60.260	70.245	37.481	35.644	362.565	444.165
August.....	61.597	69.417	38.096	34.957	364.505	446.069
September.....	66.160	.....	40.082	.....	371.725	.....
October.....	70.970	.....	41.442	.....	386.315	.....
November.....	68.234	.....	38.750	.....	396.315	.....
December.....	65.760	.....	35.645	.....	414.880	.....
Year.....	62.654	.....	36.841	.....	384.191	.....

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

Copper

	New York		Standard		London	
	1921	1922	1921	1922	1921	1922
January.....	12.597	13.465	70.964	65.226	79.119	72.321
February.....	12.556	12.864	70.925	60.250	75.925	66.125
March.....	11.976	12.567	67.565	59.245	71.190	65.739
April.....	12.438	12.573	69.381	58.799	71.786	64.028
May.....	12.742	13.111	73.196	61.092	74.298	66.554
June.....	12.697	13.575	71.852	61.988	75.682	69.333
July.....	12.170	13.654	71.155	63.137	75.286	70.321
August.....	11.634	13.723	68.614	63.784	72.705	69.932
September.....	11.948	.....	67.977	.....	72.295	.....
October.....	12.673	.....	67.327	.....	73.476	.....
November.....	13.035	.....	66.614	.....	74.386	.....
December.....	13.555	.....	66.706	.....	74.525	.....
Year.....	12.502	.....	69.356	.....	74.223	.....

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

Lead

	New York		St. Louis		London	
	1921	1922	1921	1922	1921	1922
January.....	4.821	4.700	4.747	4.388	23.387	23.667
February.....	4.373	4.700	4.228	4.396	20.650	20.681
March.....	4.084	4.720	4.000	4.421	18.911	21.266
April.....	4.356	5.115	4.272	4.946	20.589	22.993
May.....	4.952	5.420	4.784	5.281	23.399	24.462
June.....	4.485	5.745	4.293	5.563	22.563	24.685
July.....	4.410	5.729	4.260	5.447	23.399	24.869
August.....	4.382	5.824	4.217	5.537	23.489	24.580
September.....	4.600	.....	4.392	.....	23.148	.....
October.....	4.690	.....	4.439	.....	23.679	.....
November.....	4.683	.....	4.356	.....	24.483	.....
December.....	4.700	.....	4.369	.....	25.322	.....
Year.....	4.545	.....	4.363	.....	22.752	.....

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

Tin

	New York		Straits		London	
	1921	1922	1921	1922	1921	1922
January.....	31.470	31.480	36.000	32.100	190.464	163.065
February.....	28.534	29.835	32.142	30.767	166.250	149.850
March.....	27.296	28.426	28.806	29.171	156.024	143.152
April.....	28.990	29.810	30.404	30.605	163.905	149.840
May.....	31.431	30.149	32.500	30.971	177.411	150.163
June.....	28.514	30.707	29.423	31.497	167.506	152.512
July.....	26.755	31.025	27.655	31.733	164.530	156.149
August.....	25.662	32.134	26.301	32.380	155.318	160.006
September.....	26.280	.....	26.680	.....	156.750	.....
October.....	27.278	.....	27.655	.....	156.380	.....
November.....	28.592	.....	28.935	.....	158.898	.....
December.....	32.106	.....	32.486	.....	169.738	.....
Year.....	28.576	.....	29.916	.....	165.265	.....

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

Zinc

	New York		St. Louis		London	
	1921	1922	1921	1922	1921	1922
January.....	5.413	4.691	25.262	26.321	.....	.....
February.....	4.928	4.485	24.850	24.213	.....	.....
March.....	4.737	4.658	25.077	25.467	.....	.....
April.....	4.747	4.906	25.530	26.576	.....	.....
May.....	4.421	5.110	26.923	27.304	.....	.....
June.....	4.239	5.346	26.750	27.893	.....	.....
July.....	4.186	6.212	25.068	31.170	.....	.....
August.....	4.235	.....	.....	.....	.....	.....
September.....	4.605	.....	.....	.....	.....	.....
October.....	4.667	.....	.....	.....	.....	.....
November.....	4.835	.....	.....	.....	.....	.....
December.....	.....	.....	.....	.....	.....	.....
Year.....	4.655	.....	.....	.....	.....	.....

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	New York	New York	New York	New York	New York
	1921	1922	1921	1922	1921	1922
January.....	5.258	4.463	48.440	49.960	23.400	97.260
February.....	5.250	4.416	49.545	48.295	20.227	89.545
March.....	5.282	4.319	46.796	50.204	22.463	87.500
April.....	5.137	4.980	45.423	52.280	23.404	87.500
May.....	5.250	5.467	47.000	54.885	23.740	85.529
June.....	5.087	5.145	46.846	55.115	24.942	87.212
July.....	4.735	5.091	44.950	55.000	20.440	90.180
August.....	4.597	5.315	45.028	57.593	23.222	98.370
September.....	4.564	.....	42.660	.....	25.960	.....
October.....	5.085	.....	39.840	.....	81.800	.....
November.....	4.734	.....	39.804	.....	82.609	.....
December.....	4.500	.....	49.212	.....	78.192	.....
Year.....	4.957	.....	45.462	.....	75.033	.....

(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	
	1921	1922	1921	1922	1921	1922
January.....	33.96	21.55	31.96	20.15	33.88	21.34
February.....	28.96	21.46	26.96	19.71	30.25	20.88
March.....	28.16	21.35	26.46	19.96	27.85	20.83
April.....	26.96	22.50	24.46	21.26	26.77	22.70
May.....	26.21	26.36	23.84	26.87	25.56	25.96
June.....	24.96	26.96	22.66	26.96	24.38	25.96
July.....	22.84	26.77	20.76	26.33	22.36	25.97
August.....	21.96	30.44	20.29	27.18	21.53	30.81
September.....	21.96	.....	21.21	.....	22.82	.....
October.....	21.96	.....	20.96	.....	22.96	.....
November.....	21.96	.....	20.96	.....	22.74	.....
December.....	21.96	.....	20.65	.....	21.96	.....
Year.....	25.15	.....	23.43	.....	5.26	.....

In dollars per long ton.

Monthly Crude Copper Production

	1922			
	April	May	June	July
Alaska shipments.....	5,892,923	7,969,538	6,321,793	4,510,953
Anaconda.....	14,508,955	17,700,000	15,100,000	13,600,000
Arizona Copper.....	(a)	(a)	(a)	(a)
Calumet & Arizona.....	3,756,000	3,566,000	3,362,000	3,310,000
Calumet & Hecla.....	(c)	(c)	(c)	(c)
Other Lake Superior.....	(c)	(c)	(c)	(c)
Chino.....	1,140,979	1,670,684	3,840,511	(c)
Con. Ariz. Smelting.....	(a)	(a)	(a)	(a)
East Butte.....	(c)	(c)	(c)	(c)
Inspiration.....	(a)	(a)	(a)	(a)
Magma.....	(a)	(a)	(a)	(a)
Miami.....	5,327,000	5,546,000	5,923,000	5,915,000
Nevada Cons.....	2,145,892	5,103,277	4,286,740	(c)
New Cornelia.....	1,496,242	1,544,770	1,565,442	1,783,950
Old Dominion.....	1,164,000	2,690,000	2,870,000	2,787,000
Phelps Dodge.....	5,881,000	6,228,000	7,512,000	6,645,000
Ray.....	750,828	2,107,335	2,914,364	(c)
Shattuck Arizona.....	(a)	(a)	(a)	(a)
United Verde.....	(a)	670,000	4,570,000	5,600,000
United Verde Extension.....	3,517,902	2,790,136	2,941,054	2,646,810
Utah Copper.....	3,593,255	9,082,371	9,484,055	(c)
Others, estimated.....	12,000,000	18,750,000	14,800,000	9,600,000
Total United States.....	.....	.....	.....	.....
Imports: Ore and concentrates, matte.....	10,816,696	6,270,622	8,175,880	.....
Imports of black and blister, unrefined.....	19,015,875	9,700,997	14,596,714	.....
Imports of refined and old.....	9,766,230	11,361,330	28,321,991	.....
Grand total.....	.....	.....	.....	.....
Backus & Johnston.....	888,000	1,108,000	1,276,000	(c)
Boleo.....	838,000	1,499,120	1,377,500	(c)
Cananea.....	(a)	(a)	(a)	1,105,958
Cerro de Pasco.....	4,830,000	6,234,000	5,868,000	(c)
Chile.....	(c)	(c)	(c)	(c)
Cons. M. & S. of Canada.....	464,000	153,115	53,020	(a)
Falcon Mines.....	596,570	586,000	592,000	(a)
Furukawa.....	2,590,344	2,820,880	2,725,989	549,120
Granby Cons.....	(c)	2,294,025	2,263,339	2,601,007
Hampden Cloncurry.....	(c)	(c)	(c)	(a)
Katanga.....	7,285,000	8,370,792	8,859,690	.....
Mount Morgan.....	(a)	(a)	(a)	(c)
Mount Lyell.....	(a)	(a)	(a)	(c)
Phelps Dodge Mexican.....	379,000	862,000	1,098,000	1,505,000
Sumitomo.....	2,029,660	2,751,843	.....	2,298,856
Wallaroo & Moonta.....	(a)	(c)	(a)	(a)

(a) No copper produced during this month. (c) Not available.

Comparative Annual Copper Production

	1919		1920		1921		1922	
	1919	1920	1921	1922	1921	1922	1921	1922
January.....	135,733,511	121,903,744	90,596,597	32,010,292	.....	.....	.....	.....
February.....	111,649,512	117,540,000	86,682,941	45,957,530	.....	.....	.....	.....
March.....	102,040,460	120,309,316	91,046,345	55,705,760	.....	.....	.....	.....
April.....	98,808,998	116,078,871	46,946,523	.....	.....	.....	.....	.....
May.....	92,652,975	114,964,207	25,310,511	.....	.....	.....	.....	.....
June.....	95,856,370	116,107,856	24,623,693	.....	.....	.....	.....	.....
July.....	100,369,247	109,729,610	23,248,398	.....	.....	.....	.....	.....
August.....	107,994,040	112,460,254	23,855,316	.....	.....	.....	.....	.....
September.....	108,703,075	104,919,562	23,231,572	.....	.....	.....	.....	.....
October.....	115,143,143	105,701,571	28,341,442	.....	.....	.....	.....	.....
November.....	117,289,735	106,700,178	29,629,137	.....	.....	.....	.....	.....
December.....</								

COMPANY REPORTS

Lake Shore Mines, Ltd.

Gold; Ontario

A report of operations of Lake Shore Mines, Ltd., for the six months ending May 31, 1922, shows a profit of \$169,167.30 before providing for depletion and Dominion taxes according to the following profit and loss account.

Income		
Bullion production	\$309,637.17	
Exchange on bullion sales	11,435.05	\$321,072.22
Interest on Victory Bonds	1,375.00	
Other interest	1,461.54	\$2,836.54
		\$323,908.76
Expenses		
Operating expense		
Development, mining, milling, maintenance, general expense, Ontario mining taxes, after deducting sundry revenue	\$131,133.61	
Administration expense	3,327.01	
Depreciation of buildings, structures and equipment	20,280.84	
	\$154,741.46	
Profit before providing for exhaustion or Dominion taxes	\$169,167.30	

Balance sheet as of May 31, 1922, is given as follows:

ASSETS		
Cash and bank balances	\$315,890.42	
Bullion products on hand	42,274.81	
Accounts receivable	\$1,666.65	
Less provision for doubtful accounts	201.50	
	\$1,465.15	
Supplies on hand	39,850.93	
Deposits and prepaid expenses	508.93	
Victory Bonds (cost)	50,000.00	\$449,990.24
Buildings, structures and equipment	\$298,234.35	
Less provision for depreciation	135,364.62	
	\$162,869.73	
Mining properties	\$1,021,510.60	
Development and organization expense	201,127.40	
	\$1,222,638.00	
Less provision for exhaustion	390,000.00	
	\$832,638.00	
Insurance reserve fund	3,374.80	\$1,448,872.77
LIABILITIES		
Accounts payable	\$8,698.41	
Salaries and wages	5,563.11	
Accrued charges	11,407.89	
Provision for contingencies, Dominion taxes, etc.	8,751.86	\$34,421.27
Insurance reserve		3,374.80
Capital stock	\$2,000,000.00	
Less discount on shares	667,797.00	
	\$1,332,203.00	
Profit and loss balance		
Profit for six months ending May 31, 1922	\$169,167.30	
Debit balance, Dec. 1, 1921	90,293.60	
	\$78,873.70	
	\$1,411,076.70	
	\$1,448,872.77	

The Mount Morgan Gold Mining Co., Ltd.

Copper, Gold; Australia

A report of operations of the Mount Morgan Gold Mining Co., Ltd., for the year ended May 28 last states that the revenue for the year from all sources is £276,199 4s.; expenditure charged, £301,301 10s. 11d.; deficit, £25,102 6s. 11d.; balance forward, £187,248 0s. 9d. Included in total revenue referred to above is valuation of 929 tons of copper on hand at close of year, which, as usual, has been taken at £55 per ton. The deficit would have been greater but for the realization during year of the balance of stock of copper on hand at April 17, 1921, when operations ceased. The item total revenue from all sources includes £145,111 1s. 1d. belonging to previous periods, made up of gold premiums of £62,496 8s. 6d., and final adjustments in respect of 2,694 tons of copper amounting to £82,614 12s. 7d.

The amount paid in taxation during the twelve months was £26,352 16s. 8d. Reserves, insurance, contingent funds and undivided profits amount to £579,854 4s. 5d.; liquid assets, £480,955 19s. 6d.

The negotiations in progress at the date of the last report for resumption of work ultimately resulted in a proposal by the Queensland government being accepted. This provided a 20 per cent reduction in wages covered by Award Queensland Arbitration Court, Feb. 17, 1922, reduction being met in part by rebate during period of six months on government rail freights up to a maximum of £1,100 weekly, the effect on the employees being a reduction of from 5 per cent to 10 per cent, according to classification.

Operations were resumed underground on March 13, and surface on March 20 last. Unfortunately, the company is experiencing difficulty in securing competent machine miners, and the output of ore and blister copper has been consequently below normal. In resuming, on the basis of current prices for metals, it was recognized that a loss would be made, but the decision was arrived at from a desire to try out economies and prove whether operations could be profitably carried on in future. Overhead expenses have been cut in every direction, but loss is still resulting. The necessity for increased output to correct this position is obvious.

Tests on Dawson Valley coal are not yet sufficiently advanced to permit direct reference to possible economies. A total of 50,528 tons of ore was raised during the period. The concentrating section treated 34,135 tons of ore for production of 11,771 tons of concentrates. The smelting section treated Mount Morgan ore, 16,419 tons; jigged concentrates, 4,187 tons; table and flotation concentrates, 6,331 tons; sundry ores, 101 tons, and produced 1,074 tons of copper and 12,492 oz. of gold.

International Nickel Co.

A comparative consolidated general balance sheet of the International Nickel Co. for the first quarter of the fiscal year 1922 follows:

ASSETS			
	March 31, 1922	June 30, 1922	
Property	\$49,761,054.84	\$50,481,560.49	
Investments	558,485.13	560,409.13	
Inventories	9,340,598.86	7,908,012.04	
Accounts and bills receivable	776,149.44	828,090.59	
Advances	144,889.75	184,749.24	
Government securities	100,000.00	100,000.00	
Loans on all	1,013,000.00	1,013,000.00	
Cash	756,773.71	1,032,491.46	
	\$62,450,951.73	\$62,108,312.95	
LIABILITIES			
Preferred stock	\$8,912,600.00	\$8,912,600.00	
Common stock	41,834,600.00	41,834,600.00	
Accounts payable and tax reserves	688,809.79	537,736.52	
Preferred dividend payable	133,689.00	133,689.00	
Accident insurance and contingent reserves	865,412.55	867,111.41	
Surplus	10,015,840.39	9,822,576.02	
	\$62,450,951.73	\$62,108,312.95	

A consolidated general profit and loss statement for the three months ended June 30, 1922 follows:

Earnings		\$189,647.51
Other income		31,089.37
Total income		\$220,736.88
Administration and general expense	\$85,730.40	
Reserved for federal and franchise taxes	0,456.84	96,187.24
Net income		\$124,549.64
Shut-down expense and depreciation		184,125.01
Deficit		\$59,575.37
Preferred dividend No. 67, payable Aug. 1, 1922		133,689.00
Balance (deficit)		\$193,264.37

MINING STOCKS

Week Ended Sept. 2, 1922

Stock	Exch.	High	Low	Last	Last Div.	Stock	Exch.	High	Low	Last	Last Div.	
COPPER						GOLD						
Ahmeek.....	Boston	64	63	64	Aug. '22, Q	\$1.00	Alaska Gold.....	New York	1 1/2	1 1/2	.....
Alaska-Br. Col. new.	N. Y. Curb	3 1/2	2 1/2	3 1/2	.....	.....	Alaska Juneau.....	New York	1 1/2	1 1/2	.....
Allouez.....	Boston	25 1/2	25	25 1/2	Mar. '19	1.00	Atlas.....	Toronto	*26 1/2	*25 1/2	*25 1/2	
Anaconda.....	New York	55 1/2	54	55 1/2	Nov. '20, Q	1.00	Carson Hill.....	Boston	10 1/2	8 1/2	8 1/2	
Arachian Consol.....	Boston	3 1/2	2 1/2	2 1/2	.....	.....	Cresson Consol. G....	N. Y. Curb	2 1/2	2 1/2	2 1/2
Ariz. Com'l.....	Boston	8 1/2	8 1/2	8 1/2	Oct. '18, Q	0.50	Dome Mines.....	New York	39 1/2	36 1/2	39	
Big Led.ve.....	N. Y. Curb	*10	*9	*9	.....	.....	Florence Goldfield...	N. Y. Curb	*23	*19	*19
Bingham Mines.....	Boston	15	14 1/2	15	Sept. '19, Q	0.25	Golden Cycle.....	Colo. Springs	*94	*91	*91	
Calumet & Arizona..	Boston	23 1/2	22 1/2	23 1/2	June '22, Q	0.50	Goldfield Consol....	N. Y. Curb	*9	*9	*9	
Calumet & Hecla...	Boston	298	296	296 1/2	Aug. '22, Q	5.00	Hollinger Consol....	Toronto	12 1/2	12	12 1/2	
Canada Copper.....	N. Y. Curb	*6	*4	*5	.....	.....	Homestake Mining...	New York	72	70	72
Centennial.....	Boston	9	9	9	Dec. '18, SA	1.00	Keora.....	Toronto	*12	*10 1/2	*10 1/2	
Cerro de Pasco.....	New York	41	39 1/2	40 1/2	Mar. '21, Q	0.50	Kirkland Lake.....	Toronto	*46	*44 1/2	*46	
Chile Copper.....	New York	23 1/2	22 1/2	23 1/2	.....	.....	Lake Shore.....	Toronto	2.80	2.75	2.77
Chino.....	New York	31 1/2	30 1/2	31 1/2	Sept. '20, Q	0.37 1/2	McIntyre-Porcupine.	Toronto	20.00	19.40	19.60	
Con. Copper Mines..	N. Y. Curb	*40	*40	*40	.....	.....	Porcupine Crown....	Toronto	*24	*21 1/2	*24
Copper Range.....	Boston	44	43	43	Mar. '22, Q	1.00	Porcupine V. N. T...	Toronto	.....	.....	.....
Crystal Copper.....	Boston Curb	1 1/2	1 1/2	1 1/2	.....	.....	Portland.....	Colo. Springs	*40	*40	*40
Davis-Daly.....	Boston	7 1/2	6 1/2	6 1/2	Mar. '20, Q	0.25	Sehamaeh.....	Toronto	*76 1/2	*56	*56	
East Butte.....	Boston	10 1/2	10 1/2	10 1/2	Dec. '19, A	0.50	Silver Peak.....	N. Y. Curb	.....	.....	.....
First National.....	Boston Curb	†*70	†*60	*65	Feb. '19, SA	0.15	Teak Hughes.....	Toronto	*81	*73 1/2	*80 1/2	
Franklin.....	Boston	2 1/2	2	2	.....	.....	Tom Reed.....	Los Angeles	*70	*50	*60
Gadsden Copper.....	Boston Curb	†*90	†*85	*90	.....	.....	United Eastern.....	N. Y. Curb	1 1/2	1 1/2	1 1/2
Granby Consol.....	New York	32 1/2	31	32 1/2	May '19, Q	1.25	Vindicator Consol....	Colo. Springs	†*5	†*4	*4	
Greene-Canaan.....	New York	33 1/2	32	32 1/2	Nov. '20, Q	0.50	White Caps Mining...	N. Y. Curb	*16	*13	*14	
Hancock.....	Boston	2 1/2	2 1/2	2 1/2	.....	.....	Wright-Hargreaves.	Toronto	3.40	3.20	3.40
Howe Sound.....	N. Y. Curb	3 1/2	3 1/2	3 1/2	Jan. '21, Q	0.05	Yukon Gold.....	N. Y. Curb	*92	*92	*92	
Inspiration Consol..	New York	42 1/2	41	41 1/2	Oct. '20, Q	1.00	SILVER					
Iron Cap.....	Boston Curb	6 1/2	6 1/2	6 1/2	Sep. '20, K	0.25	Batopias Mining....	New York	*34 1/2	*32 1/2	*33	
Isle Royale.....	Boston	23	23	23	Aug. '22, Q	0.50	Beaver Consol.....	Toronto	1.40	1.35	1.40	
Kennecott.....	New York	37 1/2	36 1/2	37 1/2	Dec. '20, Q	0.50	Crownias.....	Toronto	*26	*22 1/2	*26	
Keweenaw.....	Boston	2 1/2	2 1/2	2 1/2	.....	.....	Coniag Reserve....	Toronto	.....	.....	.....
Lake Copper.....	Boston	4 1/2	4	4	.....	.....	Kerr Lake.....	N. Y. Curb	3 1/2	3 1/2	3 1/2
La Salle.....	Boston	1 1/2	1 1/2	1 1/2	.....	.....	La Rose.....	Toronto	*30	*27	*28
Magma Copper.....	N. Y. Curb	29	27	27	Jan. '19, Q	0.50	McKinley-Dar.-Sav.	Toronto	*31	*26	*28	
Majestic.....	Boston Curb	†*10	†*5	*8	.....	.....	Mining Corp. Can...	Toronto	*90	*90	*90
Mason Valley.....	N. Y. Curb	2	2	2	.....	.....	Nipissing.....	N. Y. Curb	6 1/2	6	6 1/2
Mass. Consolidated..	Boston	2 1/2	2 1/2	2 1/2	Nov. '17, Q	1.00	Ontario Silver.....	New York	6 1/2	6 1/2	6 1/2	
Miami Copper.....	New York	30 1/2	29 1/2	30	Aug. '22, Q	0.50	Ophir Silver.....	N. Y. Curb	.....	.....	.....
Michigan.....	Boston	3 1/2	3	3	.....	.....	Temiskaming.....	Toronto	*40	*37	*46
Mohawk.....	Boston	63 1/2	62	62 1/2	July '22, Q	1.00	Trethewey.....	Toronto	*6	*4	*6	
Mother Lode Coa...	N. Y. Curb	11	11	11	June '22, I	0.50	GOLD AND SILVER					
Nevada Consol.....	New York	17 1/2	16 1/2	17 1/2	Sept. '20, Q	0.25	Boston & Montana...	N. Y. Curb	*17	*15	*15	
New Cornelia.....	Boston	19 1/2	18 1/2	19	Aug. '22, K	0.25	Cash Boy.....	N. Y. Curb	*10	*9	*9	
North Butte.....	Boston	15 1/2	12 1/2	12 1/2	Oct. '18, Q	0.25	Dolores Esperansa...	N. Y. Curb	2 1/2	2	2 1/2	
Ohio Copper.....	N. Y. Curb	*19	*10	*16	.....	.....	El Salvador.....	N. Y. Curb	*22	*12	*21
Old Dominion.....	Boston	25 1/2	24 1/2	24 1/2	Dec. '18, Q	1.00	Jim Butler.....	N. Y. Curb	.....	.....	.....
Oseola.....	Boston	38	36 1/2	36 1/2	Aug. '22, Q	1.00	Jumbo Extension....	N. Y. Curb	*8	*5	*7	
Phelps Dodge.....	Open Mar.	†170	†160	.....	.....	.....	MacNamara M.&M.	N. Y. Curb	*10	*9	*10
Quincy.....	Boston	43 1/2	43	43 1/2	Mar. '20, Q	1.00	Monopah Belmont...	N. Y. Curb	1 1/2	1 1/2	1 1/2	
Ray Consolidated...	New York	16 1/2	16 1/2	16 1/2	Dec. '20, Q	0.25	Monopah Divide....	N. Y. Curb	*94	*71	*80	
Ray Hercules.....	N. Y. Curb	2 1/2	2 1/2	2 1/2	.....	.....	Monopah Extension.	N. Y. Curb	2 1/2	2 1/2	2 1/2
St. Mary's Min. Ld..	Boston	47	46 1/2	46 1/2	Apr. '22, K	2.00	Monopah Mining....	N. Y. Curb	2 1/2	2	2 1/2	
Seneca Copper.....	Boston	.....	*80	1	Nov. '17, Q	0.25	West End Consol....	N. Y. Curb	1 1/2	1 1/2	1 1/2
Shattuck Arizona...	New York	8 1/2	8 1/2	8 1/2	Jan. '20, Q	0.25	SILVER-LEAD					
South Lake.....	Boston	1 1/2	1 1/2	1 1/2	.....	.....	Caledonia.....	N. Y. Curb	*72	*72	*8
Superior & Boston..	Boston	11	10 1/2	11	.....	.....	Cardiff M. & M.....	Boston Curb	.....	.....	.....
Tenn. C. & C. cfs...	New York	11	10 1/2	10 1/2	May '18, I	1.00	Chief Consol.....	Boston Curb	.....	.....	.....
Tuolumne.....	Boston	*70	*70	*70	May '13, Q	0.10	Columbus Rexall....	Salt Lake	*24 1/2	*23 1/2	*24	
United Verde Ex....	Boston Curb	30	28 1/2	28 1/2	Aug. '22, Q	0.25	Consol. M. & S....	Montreal	26 1/2	26 1/2	26 1/2	
Utah Consol.....	Boston	3	2 1/2	2 1/2	Sept. '18, Q	0.25	Daly Mining.....	Salt Lake	.....	.....	.....
Utah Copper.....	New York	71	67 1/2	70 1/2	June '22, Q	0.50	Eagle & Blue Bell...	Boston Curb	.....	.....	.....
Utah Metal & T.....	Boston	1 1/2	1 1/2	1 1/2	Dec. '17, Q	0.30	Electric Point.....	Spokane	*33 1/2	*3	*3	
Victoria.....	Boston	1 1/2	1 1/2	1 1/2	.....	.....	Federal M. & S....	New York	†15 1/2	†12 1/2	14 1/2
Winona.....	Boston	1 1/2	1 1/2	1 1/2	.....	.....	Federal M. & S. pfd.	New York	56 1/2	52 1/2	56 1/2
Wolverine.....	Boston	10 1/2	10	10 1/2	.....	.....	Florence Silver.....	Spokane	*34	*33	*33 1/2
NICKEL-COPPER						LEAD						
Internat. Nickel....	New York	18	17 1/2	17 1/2	Mar. '19,	0.50	National Lead.....	New York	110 1/2	106 1/2	106 1/2	
Internat. Nickel, pfd	New York	†82 1/2	†81	81 1/2	Aug. '22, Q	1.50	National Lead, pfd...	New York	115 1/2	114 1/2	115 1/2	
LEAD						QUICKSILVER						
National Lead.....	New York	110 1/2	106 1/2	106 1/2	June '22, Q	1.50	New Idria.....	Boston	.....	†*10	*15
National Lead, pfd...	New York	115 1/2	114 1/2	115 1/2	June '22, Q	1.75	ZINC					
St. Joseph Lead....	New York	15 1/2	15 1/2	15 1/2	June '22, Q	0.25	Am. Z. L. & S.....	New York	17 1/2	17 1/2	17 1/2	
QUICKSILVER						ASBESTOS						
New Idria.....	Boston	.....	†*10	*15	.....	.....	Asbestos Corp.....	Montreal	66 1/2	66 1/2	66 1/2
ZINC						SULPHUR						
Am. Z. L. & S.....	New York	17 1/2	17 1/2	17 1/2	May '20,	1.00	Freeport Texas.....	New York	24 1/2	22 1/2	24	
Am. Z. L. & S. pfd..	New York	†46	47 1/2	47 1/2	Nov. '20, Q	1.50	Texas Gulf.....	New York	51 1/2	49	49	
Butte C. & Z.....	New York	7 1/2	6 1/2	7	June '18,	0.50	MINING, SMELTING AND REFINING					
Butte & Superior...	New York	31 1/2	30	30 1/2	Sept. '20,	1.25	Amer. Sm. & Ref....	New York	65 1/2	62 1/2	65	
Callahan Zn-Ld....	New York	8 1/2	8 1/2	8 1/2	Dec. '20, Q	0.50	Amer. Sm. & Ref. pf.	New York	102 1/2	101	102 1/2	
New Jersey Zn.....	N. Y. Curb	154	153	154	Aug. '22, Q	2.00	Am. Sm. Sec. pf. A..	New York	†100	†95	97	
Yellow Pine.....	Los Angeles	*50	*50	*50	Sept. '20, Q	0.03	U. S. Sm. R. & M... U. S. Sm. R. & M. pf..	New York	43 1/2	42 1/2	42 1/2	

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

Current Prices of Mine Materials and Supplies

RISE AND FALL OF THE MARKET

Advances—All steel products higher during month excepting standard rails and tin plates. Steel sheets up 10c. at mill; New York and Chicago warehouses quote rise of 25c. per 100 lb. Structural, \$1.90@2.25, f.o.b. Pittsburgh, as against \$1.70@1.80 per 100 lb., last month. Stiff advances in warehouses throughout country. Steel pipe discounts reduced three points on black and two on galvanized; wrought-iron pipe discounts also lower, on new Pittsburgh basing card of Aug. 23. Cast-iron pipe up 50c. at Birmingham mill, \$2 in New York and \$1.46 per ton in Chicago. Yellow-pine structural timbers up \$4 in New York and \$2 per M. ft. in Chicago; general advance throughout country. Cement, \$2.60 as against \$2.40@2.50 per bbl., in New York, one month ago; 15c. higher in Chicago and Cleveland. Cotton waste 1½c. per lb. higher, in New York, owing to mill shortage, due to textile strike.

Declines—Linseed oil down 2c. per gal. in Chicago; fairly stable elsewhere during month.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10 Blue Annealed	\$2.50@2.60		\$4.00	\$4.35	\$4.03
No. 28 Black	3.35@3.50		4.85	5.65	4.60
No. 28 Galvanized	4.35@4.50		5.95	6.50	5.60

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots:

	Pittsburgh		Birmingham	Chicago
	Current	Year Ago		
Standard bessemer rails	\$40.00	\$45.00	\$40.00	\$40.00
Standard openhearth rails	40.00	47.00	40.00	40.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh	Chicago	St. Louis	San Francisco	Birmingham
	Current	Year Ago			
Standard spikes, ½-in. and larger	\$2.35@2.50	\$3.00	\$2.55	\$3.00	\$4.10
Track bolts	3.25@3.50	4.00	3.65	4.25	5.10
Standard section angle bars	2.40	2.75	2.40	3.00	4.00

STRUCTURAL MATERIAL—Following are base prices f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh, Mill	Birmingham, Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	\$1.90@2.25	\$1.95	\$3.04	\$4.20		\$2.92	\$3.25
Channel, 3 to 15 in.	1.90@2.25	1.95	3.04	4.20		2.92	3.25
Angles, 3 to 6 in., ½ in. thick	1.90@2.25	1.95	3.04	4.20		2.92	3.25
Tees, 3 in. and larger	1.90@2.25	1.95	3.04	4.20		2.92	3.25
Plates	1.90@2.25	1.95	3.04	4.20		2.92	3.25

WIRE ROPE—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

Hercules red strand, all constructions	30%
Cast steel round strand rope	32½%
Galvanized steel rigging and guy rope	17½%
Round strand iron and iron filler	15%
Special steel round strand rope	45%
Plain steel round strand rope	40%

Drill Rod (from list)

	New York	Cleveland	Chicago
	55@60%	55%	50%

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

	Inches	Steel Black	Galv.	Inches	Iron Black	Galv.
BUTT WELD	1 to 3	68	56½	1 to 1½	39½	24½
LAP WELD	2½ to 6	65	33½	2½ to 6	37½	24½

STEEL PIPE—From warehouses at the places named the following discounts for hold steel pipe:

	New York	Black Chicago	St. Louis
2½ to 6 in. lap welded	57%	59½%	56%

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	New York		Birmingham	Chicago	St. Louis	San Francisco
	Current	Year Ago				
6 in. and over	\$55.30	\$43.30	\$37.50	\$46.86		\$51.00

	New York	Cleveland	Chicago
Nuts, hot pressed, sq., per 100 lb. Off list	\$1.50	\$3.50	\$4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.50	3.50	4.00

MACHINE BOLTS

1½ and 1¼x3 in. up to 12 in. Button head bolts, with hex. nuts.

	New York	Cleveland	Chicago
1½ and 1¼x3 in. up to 12 in.	25%	65%	50-10-10%
Button head bolts, with hex. nuts.	20%	\$3.90 net	

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York		Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J. Factory
	Current	Year Ago					
4x12x12	\$0.1112	\$0.1137	\$0.0808	\$0.15		\$0.108	
6x12x12	.1667	.1516	.1112			.156	
8x12x12	.2084	.2021	.1516	.18		.244	\$0.17890

LUMBER—Prices of rough Douglas Fir No. 1 common, in carload lots to dealers, in yards at San Francisco. To contractors, \$2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	\$28.00	\$31.00	\$31.00	\$33.00
3x6 and 8	28.00	31.00	31.00	34.00
4x4-6 and 8	28.00	31.00	32.00	35.00

Wholesale prices to dealers of long leaf yellow pine. To contractors in New York City, delivered from lighters or cars to job, \$5 additional.

	New York		Chicago	
	20 Ft. and Under	22-24 Ft.	20 Ft. and Under	22-24 Ft.
3x4 to 8x8	\$44.00	\$45.00	\$43.00	\$45.00
3x10 to 10x10	46.00	47.00	46.00	48.00
3x12 to 12x12	48.00	49.00	49.00	51.00

	8 x 8-In. x 20 Ft. and Under		12 x 12-In. 20 Ft. and Under	
	Pine	Fir	Hemlock	Spruce
Boston				
Cincinnati	\$39.00	\$50.00		\$40.00
Montreal	50.00	50.00	\$35.00	\$38.00
Denver	47.00	41.00	36.25	36.25
Minneapolis	47.00	41.00	42.00	
Kansas City	39.25			49.00
Birmingham	32.00			36.00

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	\$2.40@2.60	\$3.10	\$3.90	\$5.00	\$3.25	\$4.95
Cut	2.25	5.50	5.65	7.75		5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots without bags. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
New York, del. by truck	\$2.60	\$2.40@2.50	\$2.60@2.70
Chicago, f.o.b.	2.20	2.05	2.17
Cleveland, f.o.b.	2.46	2.31	2.43

LIME—Warehouse prices:

	Hydrated, per Ton		Lump, per Barrel	
	Finishing	Common	280-lb. net	Common
New York	\$15.80@16.17	\$13.10	\$3.63	\$2.75@3.14
San Francisco	22.00	16.00		(180-lb net) 1.75

LINSEED OIL—These prices are per gallon:

	New York		Chicago	
	Current	Year Ago	Current	Year Ago
Raw in barrel (5 bbl. lots)	\$0.91	\$0.78	\$0.99	\$0.75

WHITE AND RED LEAD—Base price in cents per pound:

	Red		White	
	Current	1 Year Ago	Dry or	Yr. Ago
100-lb. keg	Dry 12.50	In Oil 14.00	Dry 12.25	In Oil 13.75
25 and 50-lb. kegs	12.75	14.25	12.50	14.00

HOSE

	Fire	50-Ft. Lengths
Underwriters' 2½-in. coupled		49½c per ft.
	Air	
½-in., 3 ply per ft.	First Grade \$0.31	Second Grade \$0.22½
First grade	40-10%	50-5%
Second grade	50-5%	50-10-5%

RUBBER BELTING—The following discounts from list apply to transmission rubber and duck belting:

Competition	60-10-5%	Best grade	60-5%
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LEATHER BELTING—List price per ply, 12-in. wide, per lin. ft. \$2.88.

	Grade	Discount from list
Medium		40-5%
Heavy		30-5%

RAWHIDE LACING—For cut, best grade, 50-5%, 2nd grade, 55-5%. For laces in sides, best, 45c. per sq. ft.; 2nd, 43c. (Semi-tanned: cut, 45-5%; sides, 47c. per sq. ft.)

PACKING—Prices per pound:

Rubber and duck for low-pressure steam, ½ in.	\$0.90
Rubber sheet	.45
Rubber sheet, wire insertion	.70

MANILA ROPE—Per lb., ½-in. and larger, 1,200-ft. coils.

	New York	New Orleans	Chicago
Atlanta	\$0.21		\$0.17½
New York	.17	Los Angeles	.16½
Chicago	.19	Seattle	.18

COTTON WASTE—The following prices are in cents per pound:

	New York	Cleveland	Chicago
White	9.00@11.50	12.00	11.25
Mixed	6.50@10.00	9.00	8.00

EXPLOSIVES—Prices per pound of dynamite in small lots:

	Gelatin	
	40%	60%
New York	\$0.2900	\$0.3200
Minneapolis	.2092	.2295
Denver	.1775	.2075
Seattle	.175	.195
Cincinnati	.2350	.255
New Orleans	.2675	.3025
San Francisco	.195	.235

FLOTATION OILS—All prices are per gal. f.o.b. New York unless otherwise stated, and are based on carload lots. The oils in 50-gal. bbls., gross weight 500 lb.

Pine oil, steam dist., sp.gr. 0.930-0.940	gal. \$1.00
Pine oil, pure, dest. dist.	gal. .95
Pine tar oil, ref., sp.gr. 1.025-1.035	gal. .46
Pine tar oil, crude, sp.gr. 1.025-1.035 tank cars f.o.b. Jacksonville, Fla.	gal. .35

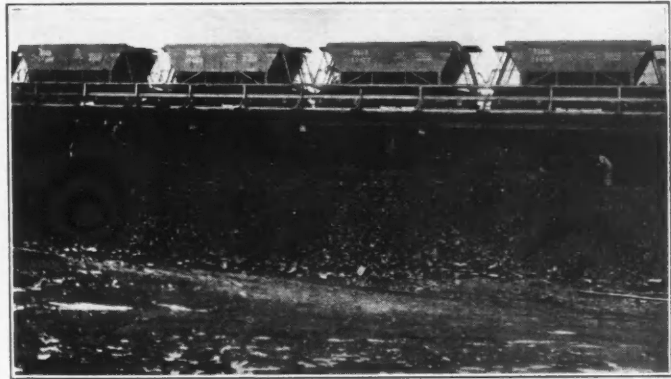
**NEW MACHINERY
AND INVENTIONS**

**Mechanical Methods Applied to
Grading Coal Piles**

One of the large iron mining companies in the Lake Superior district was fortunate in finding available a year's supply of coal. Storage facilities were not sufficient to stock such an amount, so it was a question of enlarging the coal dock or piling the coal in such a manner that it could all be stored on the existing dock. The accompanying illustrations show how this was done, at first using hand methods and later mechanical methods.

Coal is dumped below the trestle, and must be graded off to allow more to be dumped. Twelve men were used for this work, six on each side of the

do all the work. As will be seen in the illustrations, one man with a 6H "Little Tugger" hoist replaces twelve hand shovelers in this particular operation. "Little Tugger" hoists are manufactured by the Ingersoll-Rand Company



Grading coal pile by hand methods. Six men working with shovels on each side of trestle

Lower Temperature Recommended for Pre-heating of Cast-Iron Welds

In order to compensate for the lower melting point of cast iron as compared with steel, the Metal & Thermit Corporation, of New York, recommends that in pre-heating cast-iron sections, preparatory to Thermit welding them, these sections be heated only a little more than necessary to show color, such as a dull-red heat. If this advice is followed, a quieter pour will be obtained and the fusion will be just as perfect. This practice has now been tried successfully in numerous cases, the most important being a weld on a large cast-iron press head which required 1,100 lb. of Thermit. The weld was perfect, with good fusion to the extreme of the edge of the collar, although the iron section was heated only to a dull-red heat.

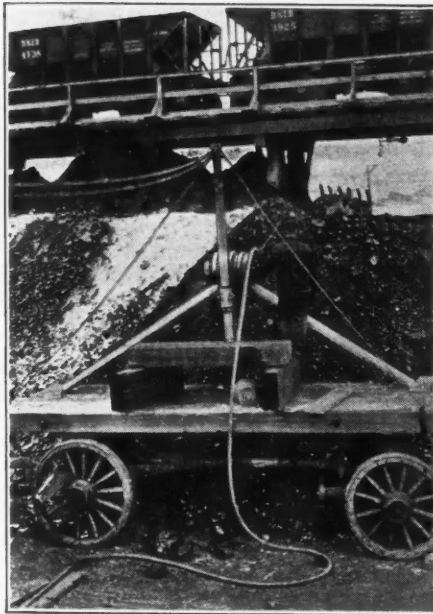
It is believed that it is important to bear this point in mind and that operators will find it will overcome possible difficulties which they may be experiencing in cast-iron welding. One might suppose that as the cast iron of the parts being welded is not so fully expanded at this lower temperature there might be a slightly greater tendency for hair-line cracks to appear in the Thermit steel collar perpendicular to

the line of break. In actual practice, however, this has not been found to be the case, probably because of the fact that the expansion curve is much greater up to a red heat than it is from the red heat to the white heat, and that the sections are, therefore, practically fully expanded at this dull-red heat. It is also true that the Thermit steel at first heats and expands the sections with which it comes in contact, and therefore the slight difference in pre-heating is negligible.

One of the Wastes of the War

The accompanying photograph shows a pile of cartridge belts, made for service overseas during the war, which cost the government \$1.75 each. They are now being salvaged by the Balbach Smelting & Refining Co., Newark, N. J. for the metal value in the snaps and clasps—about 1½c. per belt. The other materials and labor go up in the smoke of the furnace which melts the metal.

The northwestern district office of the Taylor Engineering & Manufacturing Co., of which W. H. Agens is district manager, has been changed from 616 Mohawk Building, Spokane, to 815 Alaska Building, Seattle, Wash. This change was made on Sept. 1.



Grading coal with "Little Tugger"

trestle, when it was being done by hand shovelers. Someone suggested that they use a 6H "Little Tugger" hoist with a drag scraper for doing this work. The mining people in the Lake Superior districts are familiar with this scraper outfit, because it is extensively used to haul and load ore and rock underground and for other purposes about the mines.

The machine shown in the photograph is a small, compact, double-drum hoist, which develops 7 to 8½ hp. on 60 to 80 lb. air pressure. When one drum is engaged, the other runs free. The haulage rope is laid from one drum directly to the front of the scraper. The tail rope is led from the other drum to a snatch block or sheave mounted conveniently behind the coal pile, and is attached to the back of the scraper by a clevis. In this way one man can operate the scraper in both its forward and backward motions, and so



Cartridge belts now being salvaged for their metal content

INDUSTRIAL NOTES

The Mine & Smelter Supply Co. has announced the appointment of A. O. Gates as manager of the machinery department of the Salt Lake City branch of the company. Mr. Gates returns to the organization after a number of years' absence during which he has broadened and ripened his experience in machinery and engineering lines, having specialized as consultant on milling, power transmission and materials handling.

Announcement has been made of the fusion of Aktiebolaget Gröndals Patenter with Aktiebolaget Raméns Patenter from July 1, 1922, under the firm of Patentaktiebolaget Gröndal-Ramén. The new company takes over all patents and methods of the former companies and there will be no change in the conduct of business nor in the technical staffs. Aktiebolaget Gröndals Patenter have specialized on all questions concerning concentration and briquetting of iron and other ores, wet and dry magnetic separation, flotation, and delivery of machinery; and Aktiebolaget Raméns Patenter have exploited the Ramén-Beskow methods for chloridizing roasting and the Ramén methods for copper extracting, briquetting and similar processes.

Announcement has just been made by the John A. Roebing's Sons Co., Trenton, N. J., to the effect that all employees who have been with them a year or longer on Sept. 1, 1922, will be protected by group life insurance and pension plans. By arrangements made with the Equitable Life Assurance Society of the United States, the insurance became effective Sept. 1. The insurance is graded according to length of service, all employees more than one year and less than two years with the company to receive \$500, increasing \$100 each additional year of service until the maximum of \$1,500 is reached for eleven years of service and over. The pension plan contemplates retirement at the age of sixty for males and fifty-five for females, and in the event that this class of employee has served twenty years or more, they may request a pension or be retired at the discretion of the company. Any employee, however, who has served thirty years or more, or any male employee fifty-five years of age and female employee fifty years of age whose term of service is twenty-five years or more, may at the discretion of the company be retired from active service and granted a pension. In working out this program the John A. Roebing's Sons Co. are protecting their employees and their families, thereby relieving them of a certain amount of worry, and at the same time building up that friendly spirit of co-operation so essential for the promotion and development of successful industrial life.

TRADE CATALOGS

Insulating Compounds—Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., is distributing a publication, 4249-A, describing insulating and soldering compounds. Some of the materials treated in the publication are baking varnishes, air-drying varnishes, insulating compounds, finishing materials, insulating glue, soldering flux, and lubricating oil.

Galvanometers—The instruments shown in Bulletin No. 250, issued by Roller-Smith Co., 233 Broadway, New York City, were designed with the particular requirements of educational institutions and laboratories in mind. These galvanometers will also be of interest to anyone who is concerned in electrical measurements involving the use of a bridge network.

Rod Mills—Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has issued Bulletin No. 1,821, which describes and illustrates two distinct types of rod mills, one for wet grinding and the other for dry grinding. The rod mill has been found particularly applicable where a uniform product containing a minimum of oversize and undersize is advantageous in connection with concentration of low-grade ore.

Metal Spraying—A description of the Schoop process and apparatus for simultaneously melting and atomizing any of the commercial metals, either in wire or dust form, and impacting them on any surface, is given in an eighteen-page pamphlet issued by the Metals Coating Co. of America, 495 N. 3d St., Philadelphia, Pa. Three methods of utilizing the process are available, as follows: that which uses the metal in wire form of standard commercial gages and with which coatings of copper, brass, bronze, german silver, aluminum, zinc, lead, tin, nickel, Monel metal and various alloys of the same may be sprayed; that which uses the metal in the form of dust, with which zinc, aluminum, tin, and lead are usually handled, and a combination of either of these methods with a specially constructed rumbling barrel and with which articles weighing from a fraction of an ounce up to 12 lb. each may be treated in lots of approximately 100 lb. at a time.

Hoists—Lidgerwood Manufacturing Co., 96 Liberty St., New York City, has issued Bulletin No. 35, covering its two-speed hoists for slack-line cable excavators. The bulletin shows a new line of engines which the company has designed for dragline scraper work. They are particularly designed to withstand severe usage. They have a two-speed arrangement of gears, giving powerful line pull while the bucket is digging, and a high speed with light pull for rapid conveying of the bucket.

NEW CONSTRUCTION

Washing Plant to Be Built at Billings Mine

The Tod-Stambaugh Co. has let a contract to the Allis-Chalmers Co. for the equipment of a complete washing plant at its Billings mine. The plant is designed for the treatment of about seventy-five tons per hour. The flow sheet is as follows: The ore will be fed from the shaft pocket through an apron-type automatic feeder onto a 24-in. conveyor belt, which will deliver it to the plant proper. From the belt it will be dumped into a Gates revolving washing screen 4 ft. in diameter and 12 ft. long. The undersize will go to a 25-ft. plain log washer and to a 25-ft. log washer of the patented hutch type, from which the concentrated material will go directly to the shipping pocket. The design of the washing screen will permit the handling of the oversize either as ore or waste rock by means of a deflector. If the material handled is ore, the oversize will go to the shipping pocket; if waste to a 16-in. belt conveyor and to the dump.

The equipment will be electrically driven, with individual direct-connected motors. The building and all structures supporting the conveyors will be of steel construction. Work on the new plant will start soon.

Silversmith Mines Will Add to Plant

The plans of Silversmith Mines, Ltd., at Sandon, B. C., provide for the installation at an early date of a 200-hp. Diesel engine, to be used as an auxiliary so that sufficient power may be assured at all times. A new boarding house, with additional sleeping accommodations, will be built at the mine, and additional settling tanks, a filter, and a heating plant will be installed in the concentrator.

Argonaut Decides on Mill

The Argonaut Gold Mines, Ltd., of Larder Lake, Ont., has decided to proceed immediately with the construction of a milling and cyaniding plant, after considerable indecision on the part of the directors.

Three Nevada Companies Plan to Erect Plants

At Manhattan, the Manhattan Consolidated Mines Development Co., according to Secretary C. C. Boak, is to erect a fifty-ton mill immediately.

At Masonic, the Kibble-Cook, Decker lease of the Masonic Mines Association is going to erect a small mill to treat its ore.

At Eureka, Bradley, Bruff & Lebarthe, of San Francisco, will construct the new smelter at Eureka for the Eureka Smelting & Mining Co., according to reports.