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ENGINEERING AND MINING JOURNAL

A Weekly Journal of the Mining and Mineral Industries Largest Circulation of Any Mining and Metal Journal in the World

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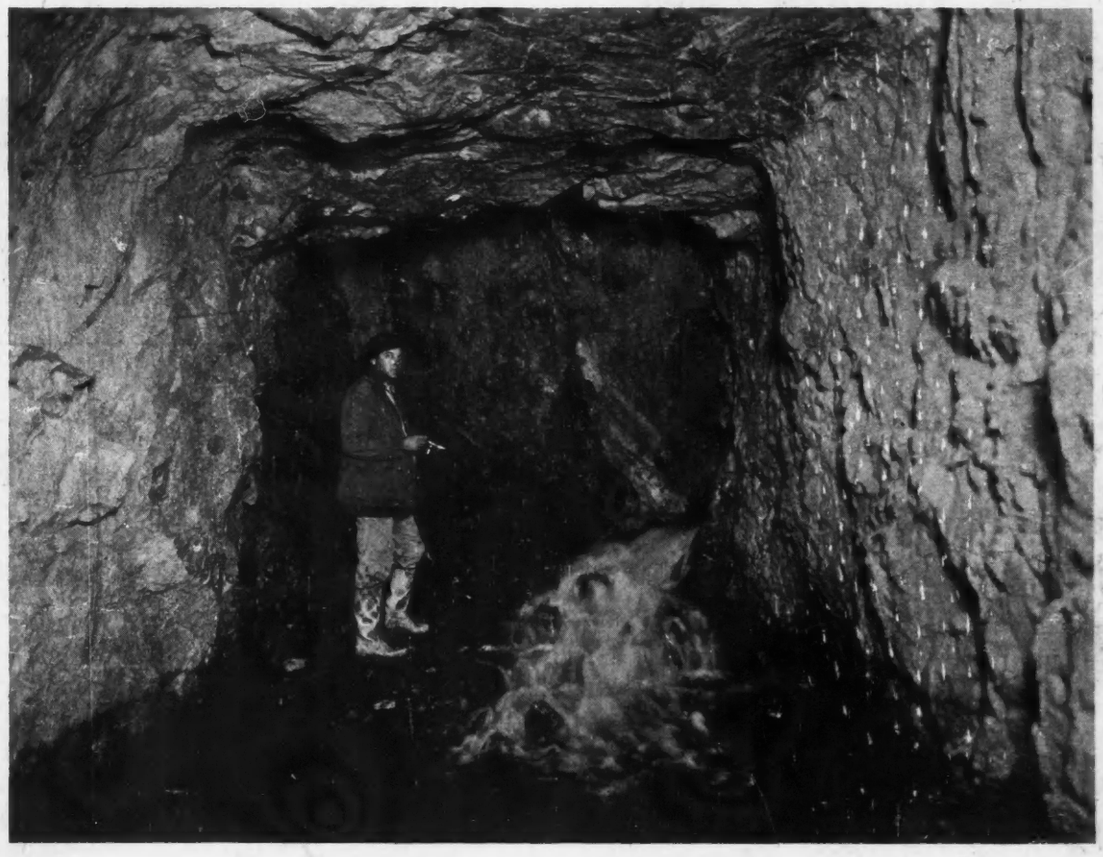

Good Hope Fluorspar Mine, Hardin County, Ill.—*Water Entering 500-Ft. Level*

NON-METALLIC MINING NUMBER

Non-Metallic Mineral Industries of the United States

By Raymond B. Ladoo

The Mining and Milling of Fluorspar

By J. M. Blayney, Jr.

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Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
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Volume 111 **New York, January 29, 1921** *Number* 5

Mining Concessions in Russia

A CORRECT appraisal of conditions in Russia and Siberia under the sway of the Soviet government is of importance to American mining men, many of whom have interests in those countries, and many others of whom would be willing to invest capital in the development of Russia's mines if they could count on anything like a fair deal and stable conditions.

For a long while the news from Soviet Russia was confused and contradictory. For the last six months, however, we have not been lacking in absolute and harmonious testimonials as to the desperate industrial and social conditions which have descended upon that unhappy country. We published some months ago the abstract of a confidential letter sent out secretly by an American in Petrograd, giving details of the appallingly swift disintegration of the symbols of prosperity and civilization. Also, we had testimony from the American Bolshevists who were deported to Russia, and there found disillusionment. Still later British socialists, or semi-socialists, like Russell and Wells, visited Russia and returned with the same story, although the latter has ruined his reputation as a thinker, after pointing out the utter industrial collapse and the abandonment of all communistic and socialistic ideals, by concluding that Russia needs some despot and that Lenine is the best in sight.

It is, however, with renewed interest that we read the summary of Russian conditions as seen by Germany, and as related by a German, our correspondent in Berlin, and published in another column. The letter is doubly interesting, in that it reflects not only Russian conditions, but the correct German appraisal of them, as transmitted from a committee of German radical leaders who recently visited Russia at the invitation of the Bolshevist government, and have returned with the verdict that the country is hopelessly ruined.

Railroads in Russia are nearly extinct, and becoming still worse. Over 80 per cent of existing engines are out of repair, and general conditions are so bad that even those passenger trains which can run can attain the speed of only four to nine miles per hour. Productivity in the still existing industrial works has shrunk unbelievably. "One works manager," says our correspondent, "states that the output per man and working day equals the output of one and one-half hours of the pre-war standard." The number of industrial workers is steadily diminishing, the workers going to work in the country, where there is food, or becoming administrative officials, "of whom there exists now one for every six heads of the population!"

It is to the recognition of their utter failure by the Bolshevist leaders that our correspondent ascribes the recent decision to give concessions to foreign capital. It appears that the concession recently allotted to Washington B. Vanderlip is only one of many which the Soviet government is now willing, in its last extremity, to give. Our correspondent, however, states that "the opinion of Continental business men is so far highly unfavorable toward the scheme. Foreign capitalists and business men lured into embarking in the scheme are believed to take a heavy risk, as the Soviet government are hardly able to observe their guarantee, even if they are willing to do so."

Recent news indicates that Lenine and Trotzky are having difficulty in explaining how their latest move to invite capitalists into Russia harmonizes with their crusade for the abolishment of capital; and they are explaining it as a clever political move. Political it doubtless is, but not so clever as desperate. It seems hardly credible that the existing regime should endure in Russia much longer. In the meantime, American mining men should not stake a penny on Bolshevist promises of concessions. As the Bolshevists have repudiated all the pledges and obligations of Russia, so inevitably will the succeeding government or governments hold worthless and invalid any acts of the Bolshevists. The pledges of the Czar's government will eventually have a far better rating.

Opportunities for Copper

IN A PREVIOUS ISSUE we spoke about extending the uses of copper as one means of disposing of the large surplus stocks and suggested an investigation of the price of copper products. If a fair price can be maintained, many promising avenues of expansion can be conceived.

Where are the copper kettles of our grandmothers' kitchens? We remember hearing that they were hard to keep clean, but possibly modern varieties of household fuel would eliminate any trouble caused by setting a kettle in a smoky wood fire. They would be more resistant than aluminum to alkaline substances, and would conduct heat readily.

For roofing, copper is said to be equaled by no other metal from a structural standpoint. It is light and durable; it weathers to a most artistic green color, as witness the roof of the Cathedral of St. John the Divine here in New York. Several other New York buildings, in the construction of which the best was demanded, also have copper roofs, notably the Schwab and Carnegie homes, some of the Columbia University buildings, and several large office buildings.

Copper screens on a house will last a lifetime. An iron screen will rust out, and before we know it the early summer fly will be admitted, whose progeny we are told amounts to several billions by fall. Or ingress will be made possible for the low-lived female mosquito, with her (we quote Webster) long and slender but firm proboscis.

A copper hot-water tank in the kitchen engenders a pride which makes us even willing to admit visitors to those sacred precincts, and also obviates the curse of rusty water in the bathroom and wash boiler. Those

living in mining camps or smelter towns where the water is slightly acidulated know particularly well what this means.

Copper steels should also be thoroughly investigated. Small percentages of copper added to steel have been shown to assist greatly in lengthening its life. The manufacture of copper steel we understand has been confined largely to sheet metal, but the life of these sheets has been found to be 300 to 500 per cent longer than sheets of ordinary steel exposed to atmospheric corrosion. With the vast tonnage of steel used for roofing, the subject merits early and thorough investigation on the part of the copper interests.

A possible use of copper which we have just noticed is for binding. Most magazines are fastened together with steel staples. We see, however, that *The Review* of the American Chamber of Commerce in France is secured with copper staples. Is there any advantage?

A little investigational work and advertising of the red metal should accomplish wonders. Suppose the copper interests forget about the "Surplus Stock" bogey for awhile and do some constructive thinking on widening the outlet for their product.

Buying Versus Thrift

TWO separate campaigns are now being prosecuted in the country—a campaign to buy, and a campaign to save and invest. Each of these is offered as the cause for business depression, as the remedy for unemployment, as the means for the replenishment of that liquid capital which has become scarce, and as the swiftest means toward renewed industrial prosperity.

The two campaigns are certainly opposite. The S. B. S., Start Buying Something, slogan is put out by an association composed of representatives of retailers and wholesalers. They believe that the citizen who finds himself with a hundred dollars today should buy himself a new overcoat, a hat, a shirt, and a pair of shoes—and he can do all that if he is a sharp shopper. The other campaign, carried on by bankers, says "Stop: do not spend your money; your old overcoat will do for the winter, and you can have your shoes half-soled again; put your money in the bank; or buy a Liberty bond; or, better yet, put your money into industrial bonds or securities."

Superficially, either call seems logical, and worthy; but one must be better, and the other worse. There can be no question which it is: the relative value of thrift versus free spending has been too often tested out on a national as well as a personal side. Thrift is the great gospel, as Franklin preached and the French nation has demonstrated. Thrift provides a reserve of power, and enables sane planning and easy adjustments. It moderates the inflation of prosperity, and digs down into its stocking to tide over the stagnation of adversity. It is a wonderful stabilizer for good. Again, the practice of thrift carries with it satisfaction for those who clamor "Start Buying Something." The thrifty have at all times something to spend for necessities and a trifle more. The reputation of the Jewish people for thrift and for liberal spending goes hand in hand, and is typical. The hand-to-mouth earner and spender, on the other hand, spends his all in times of easy money, and has nothing for even some of the necessities in hard times; and so is an economic unbalancer and nuisance. So much for the relative merits of ant and cricket.

It would have been far more opportune if this thrift campaign had been launched during the time of easy money. But then the producers of goods had no need for a buying campaign; and the bankers and great industrial organizations themselves were largely in the vast army of crickets. Witness the vast plants and inventories created in those flush days, to provide for future business, by concerns which now have closed down.

Editorial Selection

ONE of the duties of an editor is to pass upon contributions for publication, to accept the best and to decline the others. This is understood and approved by his readers. There is one class of contributors, however, who have special privilege, and the power of passing through closed doors—namely, the contributors who write letters criticising the editor. There is a feeling, based upon sound sentiment, that fair play demands the publication of such letters. It does: but is there not a reasonable limit? Suppose we receive, as we did this morning, a letter out of which we can make neither head nor tail, except that active exception is taken to a certain editorial and that the author considers us pro-British. May we not decline to inflict the unintelligible piece of writing on our patient readers? Some time ago we received a letter which was not only unnecessarily abusive but was full of statements that were incorrect: it was from the kind of person and was the sort of letter that one does not argue with. It did not occur to us that the writer could desire to have such a letter published; and the tone was so discourteous that we thought it best to make no personal reply. The letter was then sent by the writer to a contemporary for publication, who published it with the remark that it was at a loss to know why we had not published it—the inference apparently being that publication of anything is obligatory if it contains abuse of the editor.

We do think that fair play and sportsmanship demand that the attacking contributor be given a little more than an even chance at publicity, as compared with the editor; but it is nevertheless necessary to establish a dead line somewhere, and while allowing greater latitude in controversial literature of this kind than in any other department of the *Journal*, to require that writers of letters much make themselves intelligible and, if possible, intelligent, as well as peppy. Otherwise, we shall sometimes be unable to publish their letters, not because we are not glad of their criticism, but because our literary judgment controls, and our readers should not be offered just plain shavings for their meal.

Cheap Copper Hard on Yavapai County

NOT only the mining companies of doubtful standing and of stock-market sponsorship but some of the old reliables are having hard sledding to keep out of the poorhouse during these strenuous times. Our observation is prompted by the recent announcement that the Consolidated Arizona Smelting Co. at Humboldt has gone into the hands of a receiver; not new hands, however, for Mr. Colvocoresses, the highly esteemed general manager of the company, is to have the new title.

This company was organized in 1906, passed into bankruptcy soon after, and was sold for $200,000 and the assumption of mortgages aggregating $600,000. Its record at that time was very unsavory. Those interested in it included Thomas W. Lawson and Charles W. Morse. In more recent years, however, it has been

soundly managed and intelligently operated, so that its present difficulties are by no means caused by the factors so much in evidence in the earlier days. Copper had to go to 30c. before this company paid its first dividend in 1917, and payments were suspended at the close of the war, after paying a total of 30c. per share. However, considerable money was applied toward modernizing the plant, the smelter being now in excellent condition.

The Consolidated Arizona Smelting Co. is what may be termed a high-cost producer. Its own ores do not furnish a desirable smelting mixture and, owing to their hardness, are difficult to mill. With copper below 20c., as it seems likely to be for some time, the custom business will be small. The outlook for 1921 is not encouraging.

It is unfortunate that the mining district about Prescott cannot enjoy more prosperous conditions. More than a mile high, and wooded, the climate and country are much more attractive than the hot desert lands in the southern part of the state. The country is rich in prospects but poor in real mines.

Lenine Calls Vanderlip a Jackal

FURTHER illuminating remarks by Lenine concerning the famous concession to Washington B. Vanderlip are contained in recent dispatches. Lenine is having a hard time explaining to the Communist party. The Bolshevik Premier, in a speech which is published in full in the *Pravda*, the official organ of the Bolshevik party, said that one of the objects of Soviet foreign policy is to sow still greater discord among the Allies.

"This discord has increased considerably," he added, "as a result of the project for the conclusion of a trade agreement with a group of American capitalist jackals of the most savage kind, headed by a multimillionaire who plans to round up about him a group of other multimillionaires." He observed that the Vanderlip concessions were capable of rousing discord between the United States on one side and France and England on the other. He was apparently under the impression that Vanderlip represented American capital in general, and that, therefore, American capital would be able to force the Washington Government into trade relations with Russia, or even a recognition of the Soviet government.

Ah, foxy Lenineski!

Fuel Oil and Industrial Development in California

IN AN address presented some time since to the Commonwealth Club of San Francisco, D. M. Folsom discussed in an illuminating way the fuel-oil situation in relation to industrial development. He pointed out the inability of the California petroleum industry to meet the ever-increasing demand for fuel oil. Out of 100 units of oil production, he stated that 75 units were available for fuel oil, whereas the rate of consumption approximated 85 units. Mr. Folsom said:

"This is no artificial shortage which confronts the community. It is actual and immediate. There is more drilling in the state than ever before. Every possible effort is being made, both to maintain production and to find new fields. There is only a limited area in California which has even a possibility for oil, and each month sees some portion of that area tested and condemned by the failure of wildcat wells. We have been forced to draw heavily on our resources for our current needs. We cannot continue to burn more oil than we produce. There is only one answer to this situation—someone who is burning oil today will have to use another source of energy tomorrow."

Priority restrictions are, in Mr. Folsom's judgment, impracticable, although they have operated to the extent of compelling oil users such as copper-smelting plants operating reverberatories to install coal-dust firing in place of oil. Mr. Folsom offered two remedial solutions: One was the substitution of internal-combustion engines for steam plants. He stated that in such a plant one barrel of oil would do the work of three in a steam-power plant of equivalent capacity. The other was the further development of hydro-electric power. Continuing, he said that we have been too anxious to get our power cheaply and that fuel oil has been so cheap that we have not realized its value.

California has had cheap power both from fuel oil and from hydro-electric plants. The situation as presented by Mr. Folsom is of interest to the mining industry of the Western States, in that it indicates that power costs may be expected to increase rather than diminish in the future. Under date of Jan. 1, 1920, there was a total of 942,000 hp. in hydro-electric plants in California, and for the year 1920 the new construction approximated 243,000 hp. Hydro-electric development is estimated to cost $200 per kw. for dams, ditches, pipe lines, waterwheels, transformers, and line switches. Power lines and distribution costs add another $200 per kw. A steam plant of first-class construction for central power distribution costs $200 per kw., not including transmission line distribution. A Diesel engine plant will probably cost not far from $175 to $200 per kw. The construction of such plants is predicated on a comparatively stable market for the power produced. This fact and the relatively large capital investment required mean that delivered power is going to be high as compared with power costs when hydro-electric power companies had surplus power and were anxious to market it. Industrial competition for power operates like demand for any other commodity.

Hitherto the mining industry had the alternative of either developing its own hydro-electric plant where conditions were favorable or installing a steam plant with crude oil as a fuel. Many reverberatory copper smelting units found in fuel oil a cheap source of power, but the increased cost of this fuel and its scarcity will put some of these smelting plants to the necessity of finding new fuels. Some small mining plants operating semi-Diesel units and distillate engines are finding difficulty in getting supplies of gas oil and the lighter oils that they have been accustomed to use. They are paying higher prices and cannot secure time contracts, without which their power costs will be uncertain and dependent solely upon market conditions.

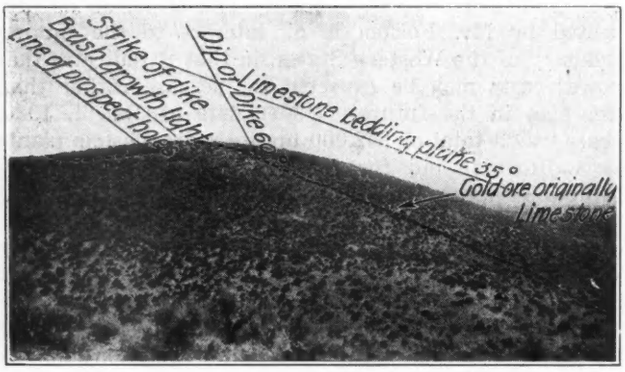
For the mine so situated that it can be served by existing central power plants, higher power charges can best be met by a more efficient use of power. This would necessarily entail a thorough study of the power utilization scheme at a given plant. The elimination of unnecessary motors, the substitution of proper size for oversize motors, and the use of counterbalance hoisting wherever practicable are some of the things that can be done. The mine outside of the electrical power areas and situated where fuel costs are high represents a difficult problem, and there appears to be no escape from high power costs.

WHAT OTHERS THINK

Botany Applied to Mining

An article by F. M. Wichman on "Botany Applied to Mining" in the *Engineering and Mining Journal* of Dec. 11 attracted my attention.

I am forwarding a photograph (see accompanying cut) which I have marked to show a line of distinct division, as between the vegetation that exists in the different rocks as mentioned. I had taken this view a few years ago, just after the discovery of the mines of the Buffalo Valley Mines Co., sixteen miles south of Valmy, Nev., a station on the line of the Southern



Pacific R.R. At that time the country was in its virgin state. The photograph barely shows a few shallow cuts on the surface defining the outline of an aplite dike. On either side of this dike, the brush will be observed to grow much more abundantly. The prospecting that was done at the time proved the mineral-bearing ground to be confined, almost to the point of precision, to the territory outlined by the ground bearing the heavier growth of the native brush *(artemesia)*, the common sagebrush of the desert region of Nevada.

At the extreme top portion of the hill, the dike is covered by a part of the ore-bearing rock, an altered limestone. The irregular dotted line marks this. All of that portion of the hill from the dotted line to the surface, and pitching into the valley, is a highly metamorphosed limestone, which had received the gold-bearing solutions emanating from the dike and become altered therefrom, in greater part, into a low-grade siliceous gold-bearing ore. When the dike had intruded itself into the sedimentaries, which are very thick apparently, it was doubtless thrown out of its course in ascending to the surface, and deflected, by the various bedding planes forming the several series of sedimentary rocks, to some extent.

A small portion of the particular strata of limestone forming the orebody was thus separated from the main body, a small segment of which is shown on the opposite side of the dike, where it is also noted that the growth of brush is quite heavy as compared with that along the strike of the dike. The dike has eroded at a somewhat faster rate than the adjacent harder silicified limestone, which possibly may account for the brush not being able to fix itself so firmly as in the limestone altered area. This occurred in spite of the fact that the dike contained more plant food than the sedimentary rock, and, altered as it was to a silicified hard rock, was of a softer consistency, as the dike rock at the extreme surface was somewhat decomposed.

The brush along the strike of the dike and on top thereof was somewhat smaller as well as being less dense than elsewhere, giving the impression that, although it seemed to thrive well, its life was cut rather short because of the decomposing of the dike. Likewise, it would also appear that the scattering seeds of the brush would find it difficult to secure root in the ground, due to the work of the decomposition of the rock of the dike, and only succeeded now and then in the most favorable spots along the dike. It need hardly be pointed out that this is of much importance to the miner in determining, in advance of development, the course and extent of his mineral deposit.

JOHN T. REID.

Lovelock, Nev.

The Interpretation of Geology

Many thanks for your editorial, in the Jan. 8 issue of *Engineering and Mining Journal*, entitled "The Interpretation of Geology." Don't let the matter drop with the writing of this one editorial; keep hammering at it until the idea is driven home.

It is a mistake to suppose that people in general are not interested in scientific truth; it is equally a mistake to suppose them incapable of understanding. It is the greatest mistake of all to assume that they are not entitled to everything that can be in any way made plain to them. And it is most unfortunate that the passing on of the truth is, in largest measure, left to clever writers who know, for the most part, only by hearsay.

It is hardly too much to say that there is no such thing as a "popular" book on geology. Such a book must be very readable; not exhaustive, but scrupulously in accord with the best geologic opinion. Controversial matters would be out of place in such a work.

Some of the simple truths about the rocks should certainly be taught in school as early as possible. Your statement that geology is not taught below the colleges is hardly accurate, as fairly good elementary courses are given in many of the high schools of the country.

The trouble with our high school and college freshman courses in geology, and also in other sciences, seems to be that they are not given for the right purpose. Such courses are commonly given with the object either of enabling students to pass examinations or of preparing them to undertake more advanced work in the same subjects. The chief aim of all our elementary science work should be to get as many of our young people as possible to take a live and intelligent interest in their natural surroundings.

Shaler, "Uncle Nat" of blessed memory, saw this more clearly than any other teacher with whom I have had the fortune, good or bad, to come in contact. Would that there were more like him today!

Augusta, Me. FREEMAN F. BURR

Exercising the Right of the Gold Miner

In a letter "In Opposition to the McFadden Bill," printed in your issue of Dec. 25, W. de L. Benedict goes out of his way to refer to certain resolutions which I presented to the recent Gold Conference in Denver; and which I subsequently withdrew, at the urgent request of the secretary of the American Mining Congress, who feared that their adoption at this time might tend to endanger the passage of the McFadden Bill.

Mr. Benedict writes: "It is to be regretted that persons like the foregoing 'proposer' do not take the trouble to study the subject sufficiently to inform themselves correctly regarding present conditions, before advocating measures for relief."

Perhaps, if I were disposed to emulate Mr. Benedict in a mere matter of manners, I might express regret that persons like himself should not take the trouble to read a few lines further before rushing into print. I presume that few of your readers will require my assurance that I am aware (perhaps quite as completely aware as is Mr. Benedict) that the law provides for the free coinage of gold, and that when we deposit gold bullion at the mint we are entitled to demand gold coin in exchange for it, and to use this gold coin for such payments as we have occasion to make.

The point which Mr. Benedict overlooks is that we are not doing it now, and that the gold is not being coined. When a very large producer of gold, like the Portland mine, recently asked through its banker for a minute percentage of its own product in the form of gold coin to distribute among its employees at Christmas, it was unable to obtain it. When we deposit gold bullion in the mint, we actually receive, not gold coin, but an order on the national Treasury, which is ultimately paid in the form of Federal Reserve Bank notes. The actual gold is refined, cast into bars, and either used as a basis for currency or sold to the jewelry trade in exchange for the gold certificates which the rest of us are unable to get hold of. While, therefore, free coinage of gold is theoretically in existence, it is not being practiced at this time. My proposal was, essentially, that producers should exercise their rights of having their gold coined and placed into circulation.

Precisely what effect it would have if domestic gold producers did take steps to place the gold produced by their mines into circulation as coin, and how long it would stay in circulation before finding its way back to the banks, are points which are open to question, and on which Mr. Benedict's opinion might be helpful. I think myself that it would require a campaign of education, even in the West, to keep gold in circulation to the same extent as in pre-war times, and also that a considerable percentage would not return to the banks. The main difficulty in carrying out these proposals is the financial domination of the Reserve Banks, and the pressure that they would exercise on any producers who had the temerity to use their undoubted rights. It is possible that, without the co-operation of the local banks, the gold would drift back to the Reserve Banks in a short time. It would, however, seem that the very fact that the Reserve Banks place such obstacles in the way of issuing gold to the people who produce it indicates that the disposable surplus of our gold reserve is very small, and that withdrawal for circulation by the actual producers of the domestic production, even if effective for only a brief period, might compel reconsideration of what, in the opinion of many of us, is a short-sighted and fatuous policy, which must inevitably fail in the end, bringing evils to our financial stability which may be of the utmost gravity.

In the same letter Mr. Benedict quotes from the report of the Strauss Committee, appointed just after the armistice, to consider the gold situation. It is now nearly two years since the committee reported, and the course of events has already disproved the assumptions on which its report was based. The committee made a bad guess in respect of the length of time that would be necessary before prices could return to a normal basis, and quite overlooked the fact that, after such a lapse of time, gold producers would not be in a position to "respond automatically to normal stimuli" (as they expressed it) in time to be of service.

It does not seem to be generally realized, by those who uphold the gold standard, that gold production, not merely in the United States but all over the world, is rapidly falling to a level which will with difficulty sustain it; and that it will be impossible within a reasonable time to stimulate production, however great the need, after the individual mines from which it is to be derived have closed down. The maintenance of a healthy gold-mining industry should be regarded as a necessary safeguard to the maintenance of the gold standard: or perhaps as a cheap form of insurance against conditions which may disturb it.

GEORGE E. COLLINS.

Denver, Col.

Quoting Mr. Clemens on the Apex Law

I have been greatly interested in the various letters, editorials, and articles that have appeared from time to time in the *Engineering and Mining Journal* in connection with the apex law problems that have for so long vexed the minds and disturbed the dreams of our friends in the mining industry in certain of the Western states.

Viewing the matter from this safe distance, and having no immediate interest in the outcome, I am irresistibly demanded of Mark Twain's remark to the effect that the opinions of wise men are worth exactly as much as the opinions of fools, and no more; for the simple reason that for every wise man's opinion on a given subject there is another wise man's opinion exactly to the contrary; and for every fool's opinion there may be found the opposite opinion of another fool. When equals are substracted from equals, the remainders are equal. Q. E. D.

All of which goes to show the fallacy of a system which permits the employment of experts, either wise men or fools, to testify on both sides of a case.

Augusta, Me. FREEMAN F. BURR.

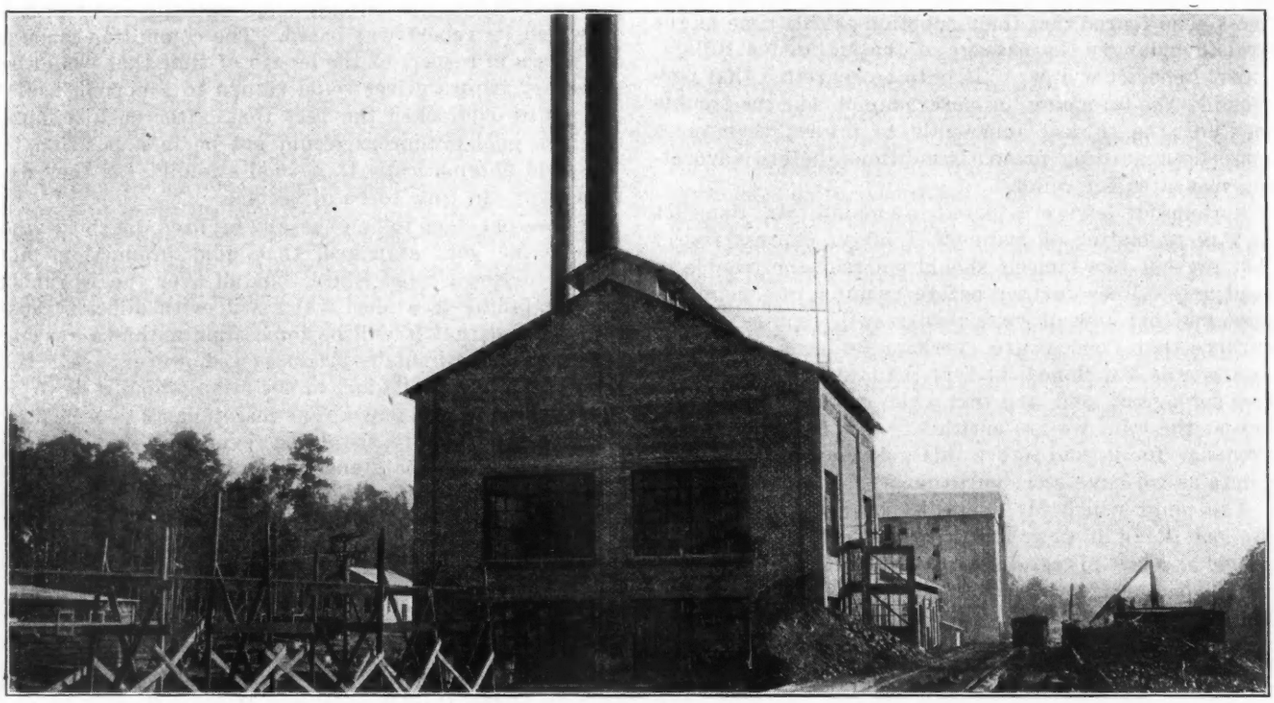
Repairing Ladles at Garfield

I note in *Engineering and Mining Journal* of Dec. 25, 1920, a description of the method used at the plant of the British American Nickel Corporation, for patching holes in steel ladles by means of thermit welding. Similar work has been done at the Garfield Smelting Co.'s plant in repairing spouts on cast-steel ladles, only in all such repairs the repair piece or insert was a steel casting instead of a forging. A large number of ladles have been put into serviceable condition at moderate cost.

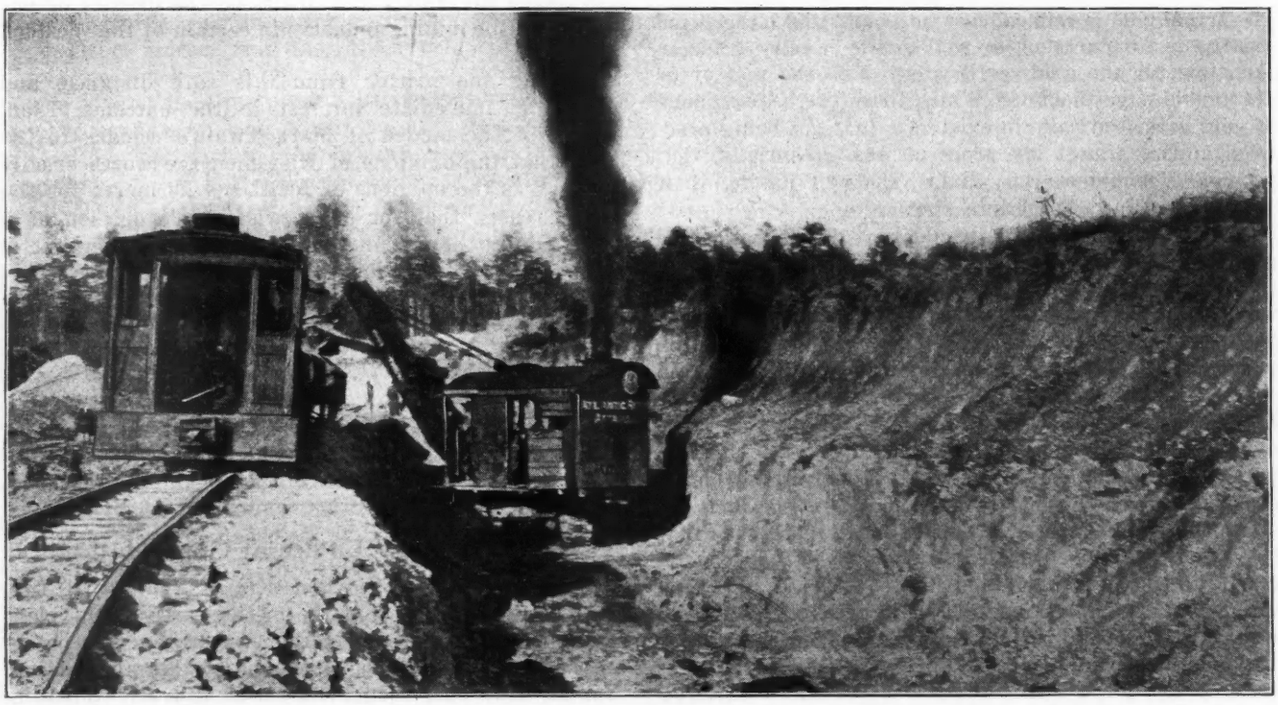
N. L. STEWART.

Salt Lake City.

Mining Fuller's Earth in Georgia



POWER HOUSE, FULLER'S EARTH PLANT, ATLANTIC REFINING CO., ATTAPULGUS, DECATUR COUNTY, GA.



STEAM SHOVEL MINING FULLER'S EARTH, ATLANTIC REFINING CO., ATTAPULGUS, DECATUR COUNTY, GA.

Fuller's earth is employed chiefly in the refining of petroleum and edible oils, in which operations it is used as a bleaching, clarifying, and filtering agent. The industry has grown rapidly, and whereas ten years ago about 32,000 tons was produced annually in the United States, production last year is estimated at about three times this rate. At the same time that domestic production has grown, the imports of fuller's earth have declined, indicating that increasing reliance is being placed upon domestic supplies. Florida has first place as a producing state, followed by Georgia and Texas. The two illustrations show the large establishment which a Georgia producer has built for the preparation of fuller's earth, and a common method of mining with steam shovel.

The Non-Metallic Mineral Industries Of the United States*

Comparatively Little Attention Paid to These Important Resources, Which Generally Require Intelligent Engineering Guidance and the Introduction of Efficient Methods of Mining, Milling, and Marketing

BY RAYMOND B. LADOO†
Written for *Engineering and Mining Journal*

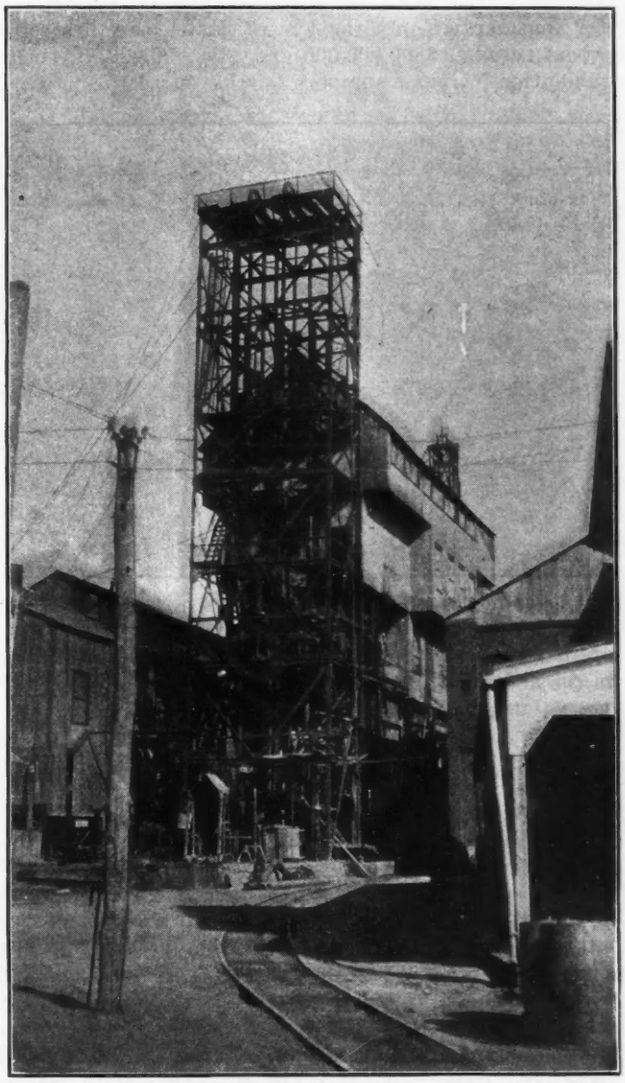
LACK of coherence and united effort in the inorganic non-metallic mineral industries, as compared with the methods adopted in the mining of the metals, coal, and petroleum, has allowed this important group of minerals to remain in comparative obscurity. During the war attention was temporarily drawn to certain essential minerals, formerly imported in large quantities, such as graphite and magnesite, but the relative importance of the whole group has not been generally appreciated.

Producers of most of the non-metallic minerals and mineral products have not considered themselves part of the mining industry. On the other hand, few mining engineers have any real knowledge of this field. Mining schools and colleges pay little or no attention to the non-metallics. But their mining and treatment are as truly a part of real mining and metallurgy as the mining and the subsequent treatment of copper, lead and zinc.

"METALLURGY" OF NON-METALLICS

The manufacture of lime from limestone, of cement from limestone and clay, of glass from glass sand, involves the use of many machines and processes common to metallurgy and really constitutes the "metallurgy" of the non-metallics. The mining of fluorspar or limestone underground may follow the same methods as the mining of copper or coal; the open-pit mining of phosphate rock or clay is closely comparable to the open-pit mining of iron; the dredging of sand and gravel for road making or building purposes is almost identical with the dredging of gold-bearing sand and gravel. The washing and sizing of sand and gravel on a large scale constitutes an "ore"-dressing problem of magnitude. Some of the mills used in producing crushed stone for the building industry have a larger capacity in tons per day than any except a few ore-dressing plants. Indeed, in the mining of bauxite the mining of the metallics and the non-metallics meet and merge, for bauxite may be used as an ore of aluminum or as an abrasive or refractory. But despite this very close connection there is available very little literature dealing with the engineering, technical, and commercial phases of the non-metallics, exceedingly few mining engineers are conversant with the problems in this field, and great wastes and inefficiencies are to be noted in the operation of mines and mills. Of course this does not apply to all phases of all the non-metallics, for in certain industries mechanical and chemical control is excellent; but there are many mills which are very good mechanically and very poor metallurgically.

Though there is probably a larger proportion of small companies in the non-metallic mineral industries than in the metallic mineral industries, many large and important companies are engaged in operations in this field. But even the large companies often use as poor mining and milling methods as the smaller operations. Some very large companies have found from experience



HEADFRAME AND PART OF MILL, ROSICLARE LEAD & FLUORSPAR MINING CO., ROSICLARE, ILL.

that "practical" managers do not pay. Often management of this type can show good results for several years, but ultimately engineering management is necessary and the rehabilitation of the property may be very expensive.

Some idea of the importance of this group of minerals may be obtained by a consideration of the number of

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†Mineral Technologist, U. S. Bureau of Mines.

products included and the annual value of such products. The most important non-metallic minerals and mineral products are as follows:

Abrasive materials	Gypsum
Asbestos	Lime
Asphalt	Magnesite
Barytes, strontium, and lithium minerals	Mica
Bauxite	Mineral pigments
Cement materials	Phosphate rock
Chalk	Potash salts
Clay and clay products	Salts and salines
Dolomite	Sand and gravel
Feldspar	Sand-lime brick
Fluorspar	Silica
Fuller's earth	Slate
Glass sand and glass	Sodium salts
Graphite	Stone
	Talc and soapstone

The number of minerals actually used is much greater than would appear from the above tabulation, for mineral pigments include ocher, umber, sienna, mortar colors, and metallic paints. Stone includes marble, granite, sandstone, limestone, and other building stones. The annual value of the above products produced or imported for consumption into the United States now lies somewhere between $800,000,000 and $850,000,000. Another tabulation in round numbers for the year 1916, in which

GYPSUM QUARRY NEAR MOUND HORSE, NEV.

are not included all of the inorganic non-metallics given in the above list, is given below:

ANNUAL PRODUCTION OF U. S. IN 1916

Inorganic non-metallics		$534,000,000
Organic non-metallics	$1,318,600,000	
Metals	1,661,400,000	2,980,000,000
Total		$3,514,000,000

From this it appears that the value of the non-metallics was about 15.2 per cent of the total, the fuels 37.5 per cent and the metals 47.3 per cent; or the ratio of importance was as 1.0 to 2.5 to 3.1. Expressed as totals, the ratio of value of the non-metallics to the value of all other mineral products is as 1.0 is to 5.6. This, of course, is only an approximate figure, but it serves to show the relative importance of this group. If non-metallic mineral products, such as glass from glass sand, were included in the above tabulation, which gives values of the metals and not the ores, the non-metallics would represent a far greater sum.

Assuming that the ratio of 1 to 5.6 is fair, it would be only reasonable to expect that mining literature should be found in a comparable ratio, that our mining schools should devote a reasonable part of their attention to the non-metallics, and that consulting engineers familiar with this field should be fairly plentiful; but none of these reasonable expectations coincide with actual conditions. As a matter of fact, the literature of the non-metallics is very meager and is mostly geological rather than technological. The ratio as evidenced by literature would seem to be nearer 1 to 50 than 1 to 5.6. A brief examination of a few volumes of the Transactions of the American Institute of Mining and Metallurgical Engi-

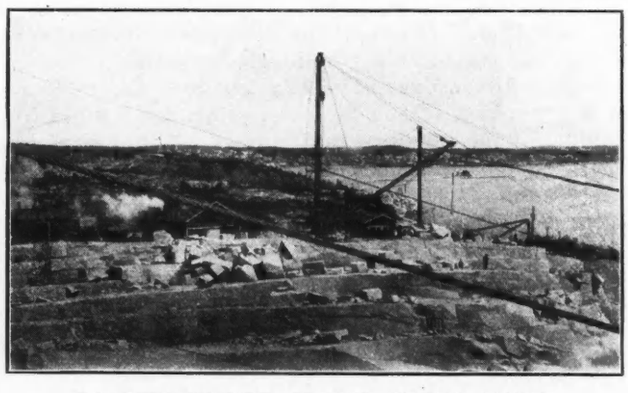
QUARRYING TRIPOLI NEAR SENECA, MO.

neers gave ample evidence of the fact that the ratio of 1 to 50 is conservative.

As a result of the lack of engineering knowledge and absence of the application of the best methods of business, the mining of the non-metallics has often been wasteful, inefficient, uneconomical, and unsafe. In many operations the cream has been skimmed from the country's deposits, leaving them in a condition which will make further recovery expensive or impossible. Already, the country's apparent reserves of some minerals, which were considered inexhaustible a few years ago, are so low as to cause concern.

Another illustration of the importance of the non-metallics which may be of significance to metal-mining engineers is the fact that the annual value of inorganic non-metallic mineral products (exclusive of coal, oil and gas) of the State of Pennsylvania alone in 1917 was greater than the total value of *all* mineral products, including petroleum, from such old mining states as Utah, Missouri, Colorado, Texas, Nevada and Idaho.

The non-metallic minerals are of as great importance in our daily life as are the metals, for they form the basis



GRANITE QUARRY, CROTCH ISLAND, MAINE

of our chemical and building industries and they include the raw materials used in the construction of our pavements and highways, docks, breakwaters, dams, bridges, and other structures relating to land and water transportation. In fact, few of our metals could be produced without non-metallic mineral refractories or electrodes.

Agriculture is dependent for fertilizers upon phosphate rock, lime, gypsum, potash, nitrates and other non-metallic minerals and mineral products.

Distribution of Production and Consumption

Mining men hold a rather general impression that the most important producing states in the non-metallic field are the old Southern States of Georgia, Florida, Tennessee, the Carolinas, Kentucky and others, but the actual facts show quite a different situation. The chart (Fig. 1), plotted from totals recalculated from figures published by the U. S. Geological Survey, shows the actual distribution of production for the first thirty-

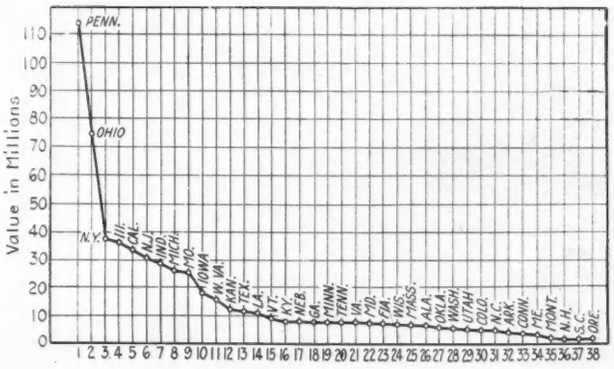


FIG. 1. VALUE OF INORGANIC NON-METALLIC MINERAL PRODUCTION OF U. S. IN 1917

eight states. From this chart it will be noted that the first ten states include none of the Southern States and that Vermont and Massachusetts stand ahead of Alabama and the Carolinas. As clay products, such as brick and tile, chinaware and porcelain, are included in the totals in Fig. 1, and the propriety of such inclusion for this purpose might be questioned, a second chart (Fig. 2) has been prepared omitting both clay and clay products. Though this omission flattens the curve somewhat at its upper end, and causes a few readjustments, the order in the main is relatively little changed.

Another fact well illustrated by these charts is that there are many states not ordinarily considered mining states which are really of considerable importance in the mining industry. Many of them have no mining laws, and inadequate attention to safety in mines, quarries and mills is often noted.

Though there are probably large deposits of non-metallic minerals in many of the Western States, production from this section of the country has not been large. This is due to several causes. One is that some of the materials in this group, such as sand and gravel, low-grade clays, and cement materials, have a small unit value and a wide distribution, so that production is localized and corresponds roughly to the distribution of large centers of population. A second reason is that Western prospectors are not as familiar with barytes, asbestos, talc, and fluorspar as they are with the metallic ores. No romantic glamour accompanies the discovery of an asbestos deposit as in the discovery of a gold or silver deposit. All the non-metallics are often thought of as low grade. Ground feldspar at $30 per ton and gravel fluorspar at $25 per ton are not to be scorned. As the population of the Western States increases and manufacturing industries develop, the non-metallics will become better known and production in the West is sure to increase.

The industries which consume the non-metallic minerals may also be divided into two groups. As has been previously shown, such low-priced materials as sand and gravel and brick clay must be used close to their source, and consumption is largely in proportion to population. Such materials as lime, cement, and gypsum may have a wider range of sale, and they merge into the second group in which are minerals so relatively scarce that centers of consumption bear little relation to centers of production. For example, mica is mined, in the United States, chiefly in North Carolina, but most of it is used in the large cities of the northeastern part of the country, where electrical equipment, gas lamp chimneys, wall paper, and lubricants are made. As most of the higher-grade non-metallics are used in the chemical and manufacturing industries, the centers of consumption naturally lie in the large manufacturing cities east of the Mississippi and north of Virginia.

The geographical relations which exist between producing and consuming centers of some non-metallics result in some interesting situations which are not found in the metals. For example, talc is used largely as a filler in paper in competition with English clay. Competition is possible both on the basis of price and on that of results obtained. It so happens that the country's largest talc deposits are in the states of Vermont and New York, and within a comparatively short distance of some of the largest paper mills in the country. If these deposits were in Colorado instead of in the East, talc probably could not compete with English clay, and the talc production of the United States would be but a small fraction of its present size. The fact that some of the largest domestic manufacturing centers lie comparatively close to the Atlantic seaboard makes many of the country's non-metallic minerals particularly susceptible to completion with imported materials. Thus, without a protective tariff it is claimed that barytes from Georgia cannot compete in eastern markets with barytes imported from Europe, but as a part of the barytes mined in Missouri is not dependent upon eastern markets, Missouri producers are not as interested in a tariff. Before the war, domestic fluorspar mined in Illinois and Kentucky could not compete with imported spar east of Pittsburgh. The whole question of the relation between producing and consuming cen-

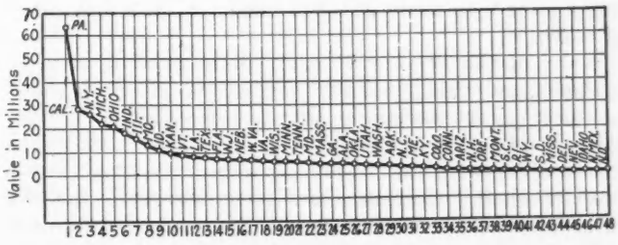


FIG. 2. VALUE OF INORGANIC NON-METALLIC MINERAL PRODUCTION OF U. S. IN 1917 (CLAY AND CLAY PRODUCTS OMITTED)

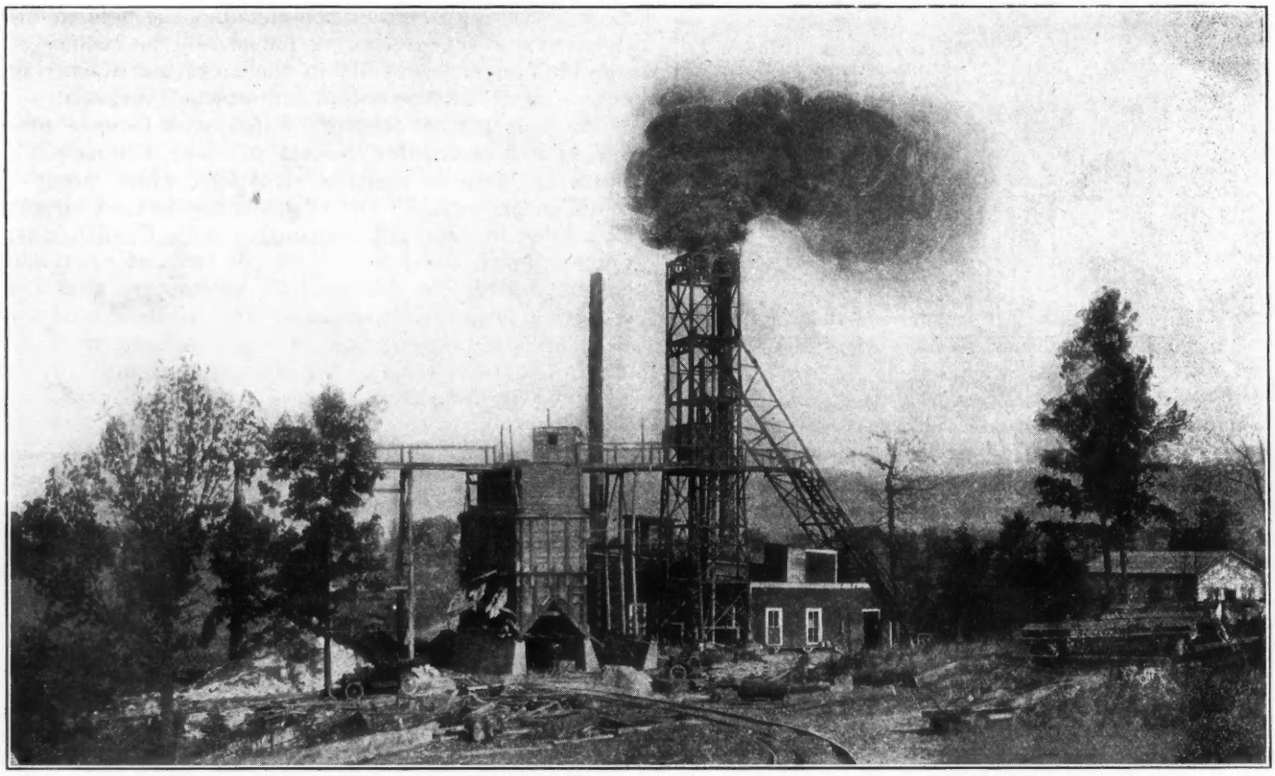
ters and the part which imports play is one which has not received sufficient attention by either producers or consumers.

It is an unfortunate fact that the non-metallic mineral industries in general are not in as advanced a stage of development as the metals or even the fuels. Both of the latter groups of industries have emerged, to a large extent, from the disorganized, inefficient stage which is now occupied by many of the non-metallics.

The large companies or syndicates which control most of the metal mines of the country are highly organized, provided with ample capital, and realize the economy of employing efficient technical talent and using efficient methods and machines. But in the non-metallic field the engineer is continually astonished at the lack of even elementary knowledge of technical and business principles exhibited by fairly large producers. One company interested in several different non-metallics and operating several mines and mills has never employed a geologist, a surveyor, a mining engineer or a chemist. Another large company operating four or five mines and as many mills, representing a large capital investment, had never, until a few months ago, had a mine map made, and had not heard of a flow sheet of a mill.

Many of the non-metallics are distributed largely by jobbers, and this situation has a bad effect on both producers and consumers. In such cases producers receive little for their products, and, as they usually are not familiar with the consuming industries, they cannot prepare their materials most advantageously for the intended use. This often results in haphazard mining, skimming the cream, and leaving the lower-grade material in such a condition that later recovery is difficult and expensive. In some operations this lower-grade material could be used advantageously by the consuming industries; in others the high- and low-grade ore could be mined together and a marketable grade made by concentration; in still other cases the low-grade material could be stockpiled, separately from the waste, to be later concentrated when market conditions warranted.

An example of another result of the lack of close contact between producer and consumer is afforded by the following incident: A manufacturer of enameled kitchenware formerly used imported clay, but during the war his supplies were cut off and he was forced to use domestic clay. After many tests one clay was found which was superior to the imported clay, and an order was placed. On receipt of the shipment part of the clay corresponded to the sample and part was entirely unsuitable, but, as no other clay was available, it was necessary to place subsequent orders for the same material; but shipments continued to be very ununiform, causing much loss and annoyance. Eventually it was discovered that the good clay occurred as a separate and distinct bed which could be mined and shipped separately. When the producer fully understood the consumer's requirements shipments of high-grade, uniform material resulted. This example is typical of conditions in the high-grade clay industry.



DAISY MINE HEADFRAME, ROSICLARE LEAD & FLUORSPAR MINING CO., ROSICLARE, ILL.

Crude feldspar now sells for $7.50 to $14 per ton (average probably about $9) and ground feldspar for $17 to $30 per ton. Much of the feldspar from North Carolina is produced by farmers and shipped in crude form to companies which grind and market it. Only high-grade spar will stand high freight charges, and the lower-grade spar is put on the waste dump. There can be little profit in selling crude spar at $8 or $9 per ton; but, after adding the cost of grinding and freight, the present sale price should allow an exceedingly liberal profit. The miner who has no mill is thus at a great disadvantage and can hardly be blamed for saving only the best and most easily obtained material. This situation is gradually being remedied by the erection of grinding mills at or near the mines by companies which are also mine owners.

Another phase of the non-metallics is that of milling. Milling or concentration in the metallics is usually done to free an ore from its impurities and produce a concentrate which is later smelted or treated to yield a finished product. In the non-metallics, milling alone

often must produce a finished product. In other words, the chemical properties of the non-metallics are often unaltered from the mine to the finished product. In metallic ore concentration differences in specific gravity may be used to effect separations; but in the non-metallics many valuable minerals have specific gravities very close to those of the impurities. Thus, talc, calcite, quartz, and feldspar differ little in specific gravity. It would seem reasonable to suppose that special types of machines would have been evolved for the non-metallics. This is true to a certain extent, but too little attention has been given this subject, and too often machines used in metallic ore dressing have to be used, though inefficiently, for the non-metallics. Probably the most common process used in the non-metallics that is not largely used in the metallics is dry grinding and air separation. In the milling of asbestos special fiberizing machinery is used. In the milling of fluorspar at a mine in Canada the property of mineral decrepitation is utilized. Fluorspar mixed with gangue is gently heated to the point at which it decrepitates or flies apart. The gangue minerals at this temperature are unaffected, and a separation is made by screening.

Imports and Exports Not of Much General Influence

Generally speaking, the non-metallics with a low unit value are not affected by imports or exports except near large Atlantic ports. At Atlantic ports imported low-grade material often comes in from European ports as ballast and competes successfully with domestic products. An interesting example of this was afforded a year or so ago when imported sand and gravel could be bought in New York City cheaper than domestic. A short distance away from the coast, railway freight costs became so great that competition of this nature is impossible.

Before the war, European production costs and water freights were so low that many domestic non-metallic products could not compete with imported material in the Eastern States. Where the chief centers of consumption of such materials were in the East, domestic products had difficulty in competing. Examples of this condition were barytes and barium compounds, fluorspar, magnesite, and high-grade talc. During the war imports of all of these products were cut off, and domestic production increased greatly. Since the war, imports in all cases have not yet returned to their pre-war status, but domestic freights have increased and water freights are decreasing. Domestic producers of several non-metallics feel that unless a protective tariff is imposed they will not be able eventually to compete with imported material.

Another class of non-metallics comprises that in which are such minerals as asbestos and high-grade lump crystalline graphite. These minerals the United States does not possess either in sufficient abundance or of sufficient quality to satisfy the needs of the country, and they must be imported regardless of cost or of tariff. Domestic substitutes may be developed for some of these minerals, but the country's industries will probably always have to import large quantities of some materials, for example spinning-fiber asbestos.

Many non-metallic minerals are now being mined in Canada and shipped into the United States, and Canadian production of many materials can be largely expanded. But imports from Canada must be considered on a different basis from imports from Europe, Africa, Asia, or South America. Labor costs in Canada are about the same as in this country, business conditions are similar, and most material must be shipped by land freight at rates about the same as in the United States. Thus, exclusive of a tariff, competition is on an equal footing; engineering ability and business sagacity are the deciding factors. Furthermore, many deposits in Canada are being worked by capital from the United States, and almost the entire output is shipped to this country. The United States even exports to Canada some non-metallic minerals and mineral products which are or could be produced in Canada.

Our hold on Canadian trade, and the possibility of competition both with Canada and with other countries,

HYDRAULIC STRIPPING OF BEDFORD LIMESTONE, BEDFORD, IND.

aside from tariff possibilities, rests upon our efficiency of production as measured by production costs, uniformity and high quality of products, and extension of markets and uses. More research work must be done, capital must be provided for consolidation of present enterprises and for larger-scale operations, and the need for engineering talent and business ability must be recognized. If our domestic resources cannot be utilized wisely, is it desirable to deplete our reserves by the exclusion of foreign products? Our present shortage of petroleum shows the folly of rapidly depleting our resources for immediate gain. Ultimately we may become dependent upon imports anyway.

Methods of Mining and Milling Require Careful Planning

Methods of mining and milling some non-metallics closely resemble those used in metal mining, and in others methods wholly different are applied. In general, though, mining processes and those of recovery are not so carefully worked out and are not so efficient. For example, in one non-metallic mineral industry most of the ore is obtained by underground mining, but in only one or two mines is a real mining method used. In some of the other mines practically all the ore is taken in large development openings; in other operations the mines are merely irregular holes in the ground from which the best ore is removed as encountered.

The quarrying of limestone for cement manufacture, for lime, agricultural limestone and blast furnace flux, and the quarrying of road materials, railroad ballast and concrete aggregate, often closely resemble the open-pit mining of copper or iron ore. But in the quarrying of building stones such as marble, limestone, sandstone, and granite special methods and machines are used

which find no counterpart in metal mining. Here large blocks of stone must be removed from the ground intact, and most of the quarrying is done in the open, though actual underground mines are operated for dimension stone.

In marble and limestone quarrying channeling machines are used to cut out large blocks. In some marble quarries huge blocks are cut out by sawing with a moving wire fed with sharp sand as an abrasive. Granite is removed in blocks by taking advantage of joint planes, and wedging off great slabs with "plugs and feathers." Occasionally machines borrowed from other industries are used successfully. Thus, coal-cutting machines have been used in quarrying limestone for cement manufacture. The "milling" of these materials consists of sawing or splitting the large blocks to exact dimensions and the surfacing, grinding, tooling, turning or polishing of the blocks to give the desired finish.

The mining of sulphur by melting with water under pressure at the temperature of superheated steam, and pumping the molten brimstone to the surface, and the mining of salt by solution and pumping, find no counterpart in metal mining. But the recovery of sand and gravel by dredging and the mining of sand by hydraulicking and sluicing closely resemble methods of placer gold mining. The methods of mining and milling of fluorspar in some districts are almost identical with metal-mining processes, for shrinkage stoping is used and the mills employ picking belts, jigs, and Wilfley tables.

Many of the non-metallics find their principal uses in finely pulverized form. Thus barytes, cement, chalk (whiting), clay (chinaware and paper clay), feldspar, fluorspar (except gravel spar), fuller's earth, gypsum, limestone (agricultural and other), mineral pigments, mineral fillers, phosphate rock (raw), diatomaceous earth, tripoli, and talc are all marketed either wholly or in part in ground form. For this reason methods of dry grinding with fine screening or air separation and wet grinding with water classification are used in the milling of most non-metallic minerals. Air separation is probably the most useful process which has been developed in this field. At present air separation cannot be practiced economically to produce large tonnages of material finer than 200 mesh. For 300 to 350 mesh or finer wet grinding and water classification or water "flotation," as it is usually called, must be used; but aid separation methods are constantly being improved, and it is probable that finer sizes may eventually be separated economically.

In many instances no attention has been given to the proper proportioning of machine capacities in mills. For example, one talc mill had a very small jaw crusher, fed by hand, as its primary breaker. The capacity of the rest of the mill was several times the capacity of this crusher. Consequently, most of the mill was shut down over half the time waiting for crushed rock. Even in some large and well-constructed mills the efficient use of power, proper machine drives, and the best methods of transferring ore from one machine to another have seemingly received no attention. In some industrial centers such as New York City there are a number of small grinding plants which are run only intermittently. In these mills ores are ground to order in small lots, which necessarily often results in high costs and ununiform products.

Many plants have been noted in which expensive, efficient machinery has been installed, but the machine drives, general layouts, and methods of elevating and conveying have been so poor that the general efficiencies were very low. A gypsum plant was recently built by a company which had been very successful in the gypsum business. The latest types of labor-saving machinery were installed, and an effort was made to build a most modern mill. But the services of a trained engineer were not employed, and the co-ordinating details were poorly worked out, with the result that the plant was far from successful and many thousands of dollars were lost.

Probably the most important result of poor mining and milling practice is lack of a uniform, high quality of finished products. The consuming industries are partly to blame for this situation, because in many instances they have developed no standards and no series of uniform tests by which materials may be tested and compared. In fact, even the properties which materials must possess for some uses are unknown or are subject to wide divergence of opinion. Materials submitted are tried out under actual commercial conditions; if the finished product is satisfactory the material is considered suitable. But if the finished product is not good, due perhaps to the material under test and perhaps to other factors, the material is condemned. Thus the producer can often hardly be blamed for poor preparation of his products, as he has no means of testing. But certain tests may well be applied which are at least a rough check on uniformity. Finely pulverized material may be frequently tested for size by hand screening, but, unfortunately, even this simple test is often omitted. Chemical composition may be checked accurately by analysis, but few producers of the non-metallics maintain chemical laboratories.

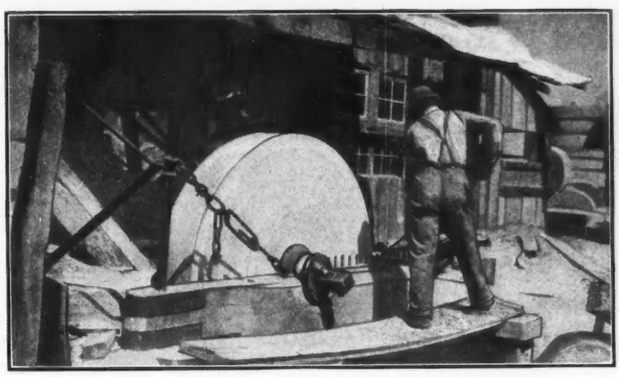
Domestic materials are often condemned for lack of uniformity and imported materials used in preference. Unfortunately, it is or has been true that in many instances foreign producers have taken greater pains with their products and have maintained uniform high quality over long periods. This has been especially true in certain grades of clays and mineral pigments. American producers have been inclined to sacrifice quality and uniformity to quantity and speed in preparation.

To place the mining and milling of the non-metallics upon a sound, efficient basis, much research work must be done. First, simple accurate tests must be devised for the determination of all the important physical properties of the major non-metallics. Second, the properties which materials must possess to fit them for various uses must be determined in terms of standard tests. Third, specifications should be drawn up defining these properties, and these specifications should be the basis of purchase and sale of non-metallic mineral products. Only in this way can the efficient domestic producer protect himself from foreign competition and price cutting by irresponsible domestic producers; and only thus can the consumer be assured of a uniform and constant supply of high-grade material at a reasonable price. Coal, oil, and metals are purchased on the basis of analysis and standard tests, but many of our non-metallics are apparently bought on the basis of friendship, personal opinion, prejudice, or sheer luck.

Some of the non-metallic industries have made considerable progress in organization and in improvements

in methods and practices within the last few years. The industries which have made the greatest progress are those which have efficient trade associations. Thus, the Portland Cement Association, the Gypsum Industries Association, and the National Lime Association have done and are doing very good work. But even in these industries there is great room for improvement. For example, the more general use of trained engineers (not surveyors alone) in the quarrying of limestone for cement manufacture would be very beneficial. In other industries progress has hardly started; but the realization that a great change is necessary and inevitable has begun to be generally felt. Efficient production on a small scale is becoming economically impossible. Large-scale production or the backing of a large amount of capital is becoming more and more necessary.

Present tendencies toward the development of more efficient operations are in several different directions,



METHOD OF FINISHING A GRINDSTONE, OHIO

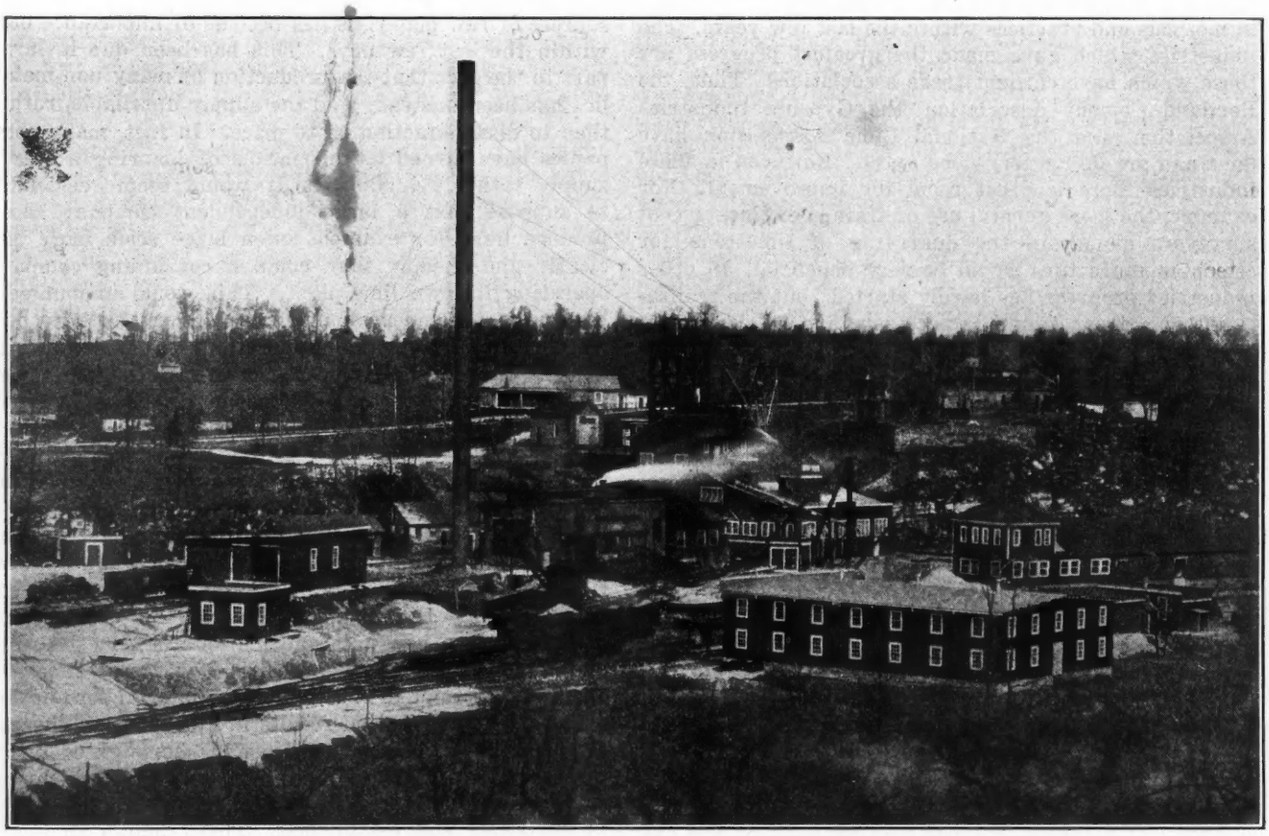
and it is difficult to see which will prevail or which is more desirable for the good of the industries. First, there is the tendency toward consolidation of many small companies into a few large corporations. This is well illustrated by the gypsum industry. Second, there is the tendency toward betterment of methods and business conditions of individual companies, both large and small, by co-operative effort through associations. This is illustrated by the lime industry acting through the National Lime Association. Third, there is a pronounced tendency for consuming industries to own their own sources of raw materials and operate their own mines. This is illustrated by the action of paper companies, both individually and co-operatively, in purchasing clay mines and limestone quarries; and by chemical companies which produce their own limestone and other raw materials. The Eastern Potash Corporation will require large quantities of lime in its processes, and is now installing at New Brunswick, N. J., a lime plant, capable of producing 1,000 tons of lime per day, which will be the largest lime plant in the world. Fourth, there is a tendency toward the formation of companies to produce a variety of non-metallic mineral products which are shipped in the crude and milled or prepared in centralized mills near centers of consumption. Several companies of this type are now operating, but they are not yet sufficiently large to justify drawing conclusions as to their ultimate influence.

At present it seems as though the third tendency is most pronounced, but it is questionable as to whether this method of progress will be most beneficial to the non-metallic mineral industries in general. The tendency for consuming industries to acquire their own sources of raw materials has become of importance only within the last few days. This has been due in large part to the fact that the production of many non-metallics has been unsteady and the supply unreliable, rather than to dissatisfaction as to price. In fact, many companies have turned to this means of insuring a steady supply rather reluctantly. It would seem reasonable to suppose that a large independent company could produce lime, for example, on a large scale more efficiently and cheaply than could a consuming company operating its own lime plant. This would undoubtedly be true if the independent companies utilized the best methods of mining and preparation. But in most instances the consumer-controlled properties have been equipped and operated more efficiently than the independent properties, because usually only large consuming companies can acquire mining properties, and they not only have plenty of capital but value engineering advice and efficient operation.

New uses for the non-metallics are constantly being found. In some industries search for such new applications is very active, and in others little attention has been given to this important work. In general, the development of new uses and markets is very desirable and should be extended, but it is a waste of time and energy to attempt to substitute one material for another unless such substitution results in a better or a cheaper product. It is also an unwise and shortsighted policy to seek new uses for a mineral product of which our supply is very limited and which is an absolute essential in industries now established. Thus, though an extension of the uses of lime or cement is justified and desirable, the desirability of actively seeking new uses for spinning fiber asbestos is at least questionable.

In order that the non-metallic minerals may be produced and utilized with greater efficiency, intelligence, and profit, much work must be done along several different lines. First, research must be undertaken to determine exact physical and chemical properties of non-metallic mineral materials for various uses, to devise simple and uniform methods of testing for these properties, and to set up specifications based upon such tests. Second, studies must be made of methods of mining, and of machines and processes for the preparation of the non-metallics, in order to produce uniform materials of standard grades at a reasonable cost and with a minimum of waste. Third, the importance of the non-metallics, the need for research and engineering work, the possibilities of expansion of markets through extending the use for materials now mined and through development of uses for materials not now utilized, and the attractiveness of the non-metallics as a field for investment, must be clearly and forcibly brought out through extensive educational publicity.

Publicity work will probably have both to precede and to supplement research and engineering studies, in order that capital may be made available and the industries convinced of the need for and the value of such research. As soon as it is recognized that the non-metallics offer as attractive and a more stable field for investment than the metallics, capital will be forthcoming and funds will be available for research and investigation, for efficient equipping and management of mines and mills, and for intelligent sales engineering. Above all, the need for adequate capitalization, sound management, and capable engineering in the mining, preparation and utilization of the non-metallics must be recognized.



GENERAL VIEW OF HOISTING AND MILLING PLANT, FAIRVIEW FLUORSPAR & LEAD CO.

The Mining and Milling of Fluorspar

In the Fairview, Illinois, District Fissure Veins Containing Fluorspar Are Mined Principally by the Shrinkage System—Owing to Flooding From High Water in the Ohio River, a System of Bulkheading Has Been Adopted That Facilitates Unwatering

BY J. M. BLAYNEY, JR.
President, Fairview Fluorspar & Lead Co.

Written for *Engineering and Mining Journal*

EIGHTY-FIVE PER CENT of the fluorspar production in the United States is sold in the form of washed gravel fluorspar, and is used as a flux in the manufacture of open-hearth steel. It is usually under ⅝ in. in size, and is generally sold on a basis of 85 per cent CaF_2 and 6 per cent silica (SiO_2). There is a high-grade produce generally known as "acid" fluorspar, sold either in lump form or pulverized, which is used in the manufacture of hydrofluoric acid, and is usually guaranteed to contain not less than 98 per cent CaF_2 and not over 1 per cent SiO_2. Another grade of ground fluorspar analyzing 92 per cent to 98 per cent CaF_2 and from 1 per cent to 4 per cent SiO_2 is used by the manufacturers of opalescent glass, sanitary and enameled ware.

Other metallurgical uses of fluorspar consist in the extraction of aluminum from bauxite ore, in smelting gold, silver and copper ores, in refining copper, in the electrolytic refining of antimony and lead, in the manufacture of ferro-alloys, in the electric furnace, and in the recovery of byproduct potash from portland cement kilns. Clear, flawless crystals of fluorspar are much in demand for use in lenses of optical instruments. Most of the fluorspar sold in the United States is purchased f.o.b. shipping point, and is marketed through established selling agencies, or through brokers.

ILLINOIS PRODUCES BULK OF DOMESTIC FLUORSPAR

More than 70 per cent of the total amount of fluorspar mined in the United States comes from Hardin County, in southern Illinois, near the Ohio River and about one hundred miles above the junction between the Ohio and Mississippi rivers. Nearly all of this is mined by two companies from the Fairview-Rosiclare vein and the Blue Diggings vein. These mines have direct railroad connection, the shipping point being Rosiview, Ill.

About 20 per cent of the domestic production comes from numerous scattered mines in Crittenden County, Ky., just across the Ohio River from Hardin County, Ill. These mines are all small in comparison with the operations on the Fairview-Rosiclare vein, and only two of them have a railroad connection. Most of the others are from three to fourteen miles from a railroad shipping point. The fluorspar produced and all mine supplies must be hauled over poor dirt roads, impassable during about five months of each year. The shipping

points are Marion, Mexico, and Crayne, Ky. During the years 1914 to 1919 inclusive, the total domestic production amounted to 992,437 tons, of which, according to Government records, the Illinois-Kentucky field produced slightly over 89 per cent. During these same years, Colorado produced about 8 per cent, the small amount remaining being mined in the states of New Mexico, Arizona, New Hampshire, Utah, and Washington.

In the early days of the fluorspar industry in the United States, gravel fluorspar imported from England was a source of serious competition to domestic producers. The English supply was not mined, but was hand-picked from abandoned dumps of lead mines, principally in Derbyshire and Durham. As these dumps neared exhaustion, the supply from England declined, and imports fell steadily from 42,488 long tons in 1910, to 10,205 long tons in 1914, at which figure it approximately remained during the period from 1914 to 1919. In the first ten months of 1920, 19,834 long tons was imported. The English fluorspar is not guaranteed to analyze more than 70 per cent CaF_2, and runs very high in silica.

Fluorspar Deposits Occur Mainly in Fissure Veins

Nearly all of the fluorspar in the United States occurs in fissure veins. The largest deposit yet discovered, known as the "Fairview-Rosiclaire" vein, situated in Hardin County, Ill., occurs in a true fault fissure. The country rock forming the walls is limestone and sandstone, and the throw of the fault varies from 60 to 200 ft. The pitch of the vein approaches the vertical and is seldom less than 70 deg. from the horizontal. The strike is approximately north and south. The fluorspar occurs in lenticular masses in the vein, which pinches laterally and vertically. At some places in the vein the fluorspar outcrops on the surface; at other places it is some distance below the surface.

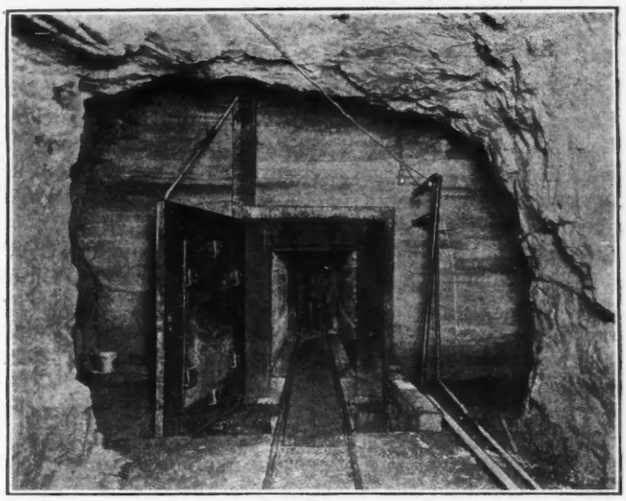
Usually, the gangue is calcite and what is known as "mill grit," which in its origin is sandstone and limestone (generally the latter) and carries a small per cent of lead and zinc. The widest shoots of the ore seldom exceed 30 ft. and the ore is usually not worked narrower than 2 ft., although it is sometimes advantageous to mine narrower streaks in the process of development work. The quality of the spar also varies largely, but apparently does not depend on the country rock forming the walls. Often high-grade spar is found between sandstone walls or between limestone walls, or where one wall is limestone and the other sandstone.

A selvage of rotten shale often occurs between the ore and the wall, and in several Kentucky mines this is 20 to 30 ft. thick; but generally on the Fairview-Rosiclare vein it is not more than a few inches in thickness. As a rule it may be stated that fluorspar decreases in quantity with depth, the fault either pinching or the vein matter being replaced by calcite. In several of the mines on the Fairview-Rosiclare and Blue Diggings veins this occurs between 400 and 500 ft. Some parts of these veins carry 30 ft. of calcite at a depth of 400 ft. and no fluorspar, and there are other places where fluorspar has been mined to a depth of 600 ft. and is still of good quality and width, although not so wide as the ore in the same body at higher levels.

Bulkheading Facilitates Unwatering

All of the producing mines on the Fairview-Rosiclare vein are subject to flooding from high water in the Ohio River. The water enters the workings through underground fissures in the rock. Formerly it was the practice to sink the shafts on the vein. In such operations, when the mine flooded the shaft was also flooded, and underground pumps were useless for the purpose of unwatering, which had to be accomplished from the surface by means of a sinker pump, sometimes assisted by an air lift or bailing, a slow and expensive process and resulting in long interruptions to production.

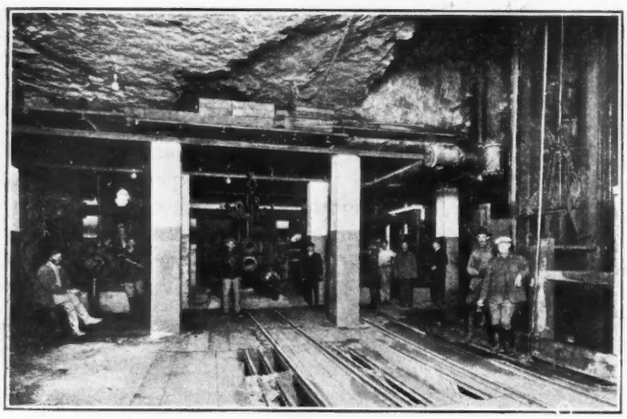
The last two shafts sunk by the Fairview Fluorspar & Lead Co. are unique in the fluorspar district in that they were sunk some distance off the vein in the solid country rock, which is practically water-tight, and crosscuts were driven from the shaft to the vein. In the crosscuts, still in the country rock, heavy reinforced concrete bulkheads are built, and these are fitted with suitable heavy steel doors. The concrete bulkhead on the 500-ft. level at the Good Hope mine of the Fairview Fluorspar & Lead Co. is shown in an accompanying illustration. During the time that the mine is in operation the steel doors are kept open. Whenever the river reaches a point where the flooding of the mine is threatened, the steel doors are closed and only the shafts are kept clear of water.



CONCRETE BULKHEAD ON 500-FT. LEVEL OF GOOD HOPE MINE

The bulkheads are equipped with suitable water pipes and valves, so that when the river recedes these valves can be opened and the water permitted to flow to the station pumps, situated near the shaft. This system permits the use of heavy pumping equipment and greatly facilitates the unwatering of the mines. The Good Hope mine of the Fairview Fluorspar & Lead Co., which required six months to unwater by the old system, was recently unwatered in ten days by the new method. The pumping equipment on the 500-ft. level in the Good Hope mine is capable of handling between 3,500 and 4,000 gal. of water per minute, being equipped with three units, i.e., one 1,300-gal., 500-ft. lift Cameron centrifugal pump, which on actual test delivered 1,500 gal. per minute; one compound Worthington reciprocating pump, 1,300-gal. capacity, 500-ft. lift; and one compound Prescott pump, 1,000 gal. capacity, 500-ft. lift.

The Extension mine of the Fairview Fluorspar & Lead Co. on the same vein is operated through a shaft similarly situated and equipped, and has practically the same pumping capacity. No other mines in the Illinois-Kentucky fluorspar district are thus protected against long periods of interrupted production due to the flooding of the mines.



PUMPING STATION AT 500-FT. LEVEL OF GOOD HOPE MINE

All of the mines on the Fairview-Rosiclare vein pump from 600 to 1,200 gal. per minute. The frontispiece of this issue shows normal water entering at the face of the 500-ft. level in the Good Hope mine at the rate of 1,100 gal. per minute.

Shrinkage System Generally Employed

The shrinkage system of mining is followed by the Fairview Fluorspar & Lead Co. and by the Rosiclare Lead & Fluorspar Mining Co., although some underhand stoping is done. Levels are driven on the vein at intervals of 100 ft. in depth, and are usually carried about 14 ft. high when the drift is in fluorspar. Drifts driven through pinches in the vein are usually carried 6 to 8 ft. wide and 8 ft. high, but when driven in ore, the drift is carried the full width of the vein. The levels are then stulled over at a height of about 8 ft., and bins are placed between the stulls at approximately 10-ft. centers.

The stulls are poled over, leaving openings for the bins. The fluorspar is then broken and drawn through the bins into tram cars, generally mule or motor driven, and conveyed to the shaft, where the ore is dumped through a grizzly, which is made of railroad irons set at about six-inch openings, into a skip bin holding from ten to fifty tons. From the bin it is drawn into 1½-ton skips and hoisted in balance to the surface bin. The shafts are three-compartment, 5 ft. x 16 ft. to 20 ft., two compartments carrying the skips and cages, the third compartment containing the ladderway, steam, air and water lines.

Milling Methods Follow Uniform Practice

The following method of milling is practiced by the Fairview Fluorspar & Lead Co. at Rosiview, Ill., a general view of the milling plant being shown in an accompanying illustration. The ore generally carries, as hoisted, from 10 to 30 per cent waste, and is passed over a washer of special design. A portion of this washer is perforated with round ¾-in. holes, the undersize from the washer passing directly to the rolls. The oversize is delivered to a picking belt about 50-ft. long, and 24 in. wide, which travels at a speed of 25 to 40 ft. per minute, the pickers standing on each side.

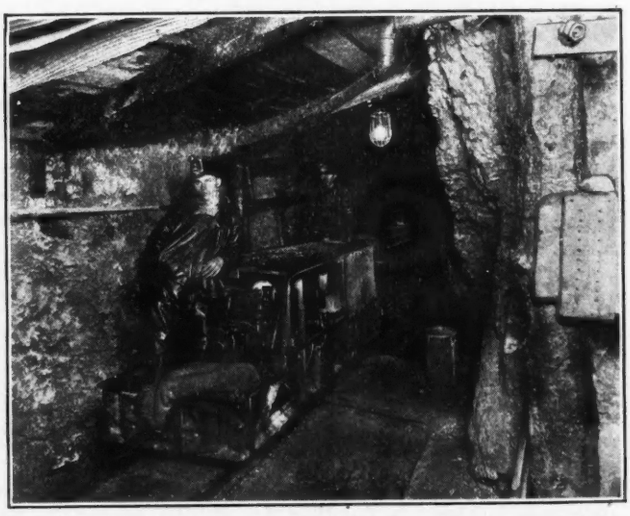
As the ore passes over the belt, waste, a certain amount of high-grade spar, and a type of closely disseminated lead and zinc ore are removed. The high-grade spar so removed is then either shipped in lump as acid spar, or pulverized through a Griffin mill and shipped in bags or barrels. The closely disseminated lead and zinc ore is removed for treatment in a separate mill. The ore remaining on the belt is discharged into a rock crusher, from which it passes through a set of rolls, thence through trommel screens and classifiers to the jigs. The jig product, in the form of gravel fluorspar, is delivered to a large, reinforced concrete bin, from which, after draining, it is loaded into railroad cars for shipment to the steel mills. The finer material from the classifiers and from the jigs (after reclassification) passes over concentrating tables, where further separation is made.

Lead and Silver Byproducts

A lead concentrate analyzing from 75 to 80 per cent is also produced on the jigs and tables, and this lead concentrate, which at Fairview varies from 1 to 2 per cent of the crude ore hoisted, carries seven to eight ounces of silver per ton. The tailings from the jigs are allowed to accumulate on a tailing dump, and either sluiced out with water or rehandled with a locomotive crane. The limestone waste from the picking belt is delivered to a separate mill, where it is converted into agricultural limestone.

In the Kentucky district in Crittenden County, the orebodies are much narrower and shorter than those on the Fairview-Rosiclare and Blue Diggings veins in Hardin County, Ill., and the pinches are much longer. The largest producing mines in Kentucky are the Franklin mine, owned by the Fairview Fluorspar & Lead Co.; the Mary Belle mine, owned by the Kentucky Fluorspar Co.; and the Haffaw mine, owned by the Aluminum Ore Co. The first two are on the Franklin-Mary Belle vein, about ten miles southeast of the mines on the Fairview-Rosiclare vein in Hardin County, Ill. The Haffaw mine is on the Tabb vein near Mexico, Ky., and about ten miles south of the Franklin and Mary Belle mines. The Tabb vein is quite different from the three others above mentioned, and is apparently a series of faults, sometimes parallel and close together, at other times diverging and several hundred feet apart.

The surface rock, which is a flinty limestone and quartzite, seems to have weathered very much, and the orebodies have settled on themselves in places, making them wide, with most of the ore disintegrated to gravel size. The Haffaw mine on this vein has an orebody which at a depth of about 80 ft. is from 75 to 100 ft.



TRAMMING FLUORSPAR BY MOTOR

wide, and of good quality. Development work to date on the Tabb vein indicates that the orebodies do not extend as deep as on the veins described above, and often when solid formation is struck at the bottom of the gravel fluorspar chutes, the veins are small and filled with shale or calcite and contain no recoverable fluorspar.

Milling in the Kentucky district ranges from a crude log washer to a complete concentrating plant patterned after the larger mills in the Illinois field. Most of the mines are not large enough to justify independent mills. The only mines having complete milling plants are the Franklin, the Haffaw, and the Keystone (near Mexico, Ky.). The Kentucky Fluorspar Co. and the Roberts Fluorspar Co. have concentrating plants at Marion, Ky., to which the product of various mines is hauled and milled.

Alunite in South Central Texas

BY J. G. BRAUN

Written for *Engineering and Mining Journal*

ABOUT thirty miles southeasterly from San Antonio, Tex., in what appears to be a disintegrated "trachyte," irregular deposits of alunite occur. The mineral is in two forms. One is rather soft, white and somewhat stained by iron. Outwardly it resembles chalk, and has been used as such by the school children in the neighboring county schoolhouses for many years. This variety contains approximately 12 per cent silica and from a trace to 0.6 per cent of iron oxides; probably, also, basic sulphates of iron. The other is more compact (cannot be used on the blackboard like chalk), snow white, free from iron and contains only 2.5 per cent silica.

I know of three outcrops of the mineral. They are from six to twelve miles apart, and, judging from the way they occur, as well as from general surface appearances (numerous outcrops of the decomposed "trachyte"), there should be more of the mineral below the surface. I have named the area the "alunite district." The outcrop of the snow-white, high-grade variety covers approximately twenty acres and has the composition given in Table I.

TABLE I. RANGE IN COMPOSITION OF WHITE VARIETY OF ALUNITE

	Per Cent
Silica (SiO_2)	2.5 to 2.7
Water (H_2O)	14.0 to 13.6
Sulphuric anhydride (SO_3)	36.5 to 37.0
Alumina (Al_2O_3)	34.5 to 34.4
Potash (K_2O)	11.2 to 10.8
Soda (Na_2O)	0.2 to 0.6
Undetermined	1.1 to 0.9

The other variety has a similar composition, but contains 12 per cent silica, only 8.5 per cent potash, about 2 per cent soda and small quantities of iron. This variety can also be obtained by washing the decomposed "trachyte," through which it appears to be disseminated in the form of fine grains, apparently replacing the original feldspar of the rock. Wherever this replacement has occurred, the "trachyte" is of a light, whitish color.

In the examination of the mineral I have made laboratory tests on 100-gm. samples. The result of the first test was that the potash alum crystallized out while the aluminum sulphate remained in solution, which was later evaporated to its solidification point. The potash alum naturally contained the silica, which was removed by resolution and filtration. The recrystallized salt passed ordinary tests for purity. The aluminum sulphate was iron free, but that was due to the fact that I had used the high-grade mineral as well as c.p. sulphuric acid in the test.

The result of this second test is given in Table II.

TABLE II. APPROXIMATE ANALYSIS OF END PRODUCTS No. 2 TEST

Loss on ignition (water and the greater part of the SO_3)	42.0
Water-soluble alkalies (about 95 per cent K_2SO_4)	19.2
Residual alumina, containing the 2.5 per cent silica (by diff.)	38.8

This experiment indicates a high recovery of the potassium sulphate contained in the mineral. The mineral was powdered to pass a 100-mesh screen previous to roasting, and subsequently treated with two washes of hot water. Tests to convert the residual alumina into ultramarine with cobalt proved successful with respect to color, but I did not go into further detail.

Apparently there is a large tonnage of the mineral in the district, but, owing to lack of time and of funds for purposes of investigation, I have been unable to arrive at a definite figure.

Dana states that the mineral occurs in fissures in trachyte and allied rocks. The district in which the alunite is found is altered and level. Excavations will have to be made before it can be determined as to whether the deposits are commercially workable or not. I am strongly inclined to believe that they are, but have no proof to that effect.

The Second-Foot of Water

"Second-foot," as defined by the U. S. Geological Survey, is an abbreviation for cubic foot per second and is the unit for measuring the rate of discharge of water flowing in a stream one foot wide and one foot deep at a rate of one foot per second. It is generally used as a fundamental unit in measurements of stream flow.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

An "acre-foot" is equivalent to 43,560 cu.ft. and is the quantity required to cover an acre to a depth of one foot. The term is commonly used in connection with the storage of water for irrigation.

A flow of one second-foot equals 7.48 United States gallons a second, 448.8 gal. a minute, or 646,317 gal. a day. As a California "miner's inch" equals 0.187 gal. a second, there are forty California miner's inches in one second-foot.

The Control of Bismuth

The production of bismuth and the market price of the metal have been strictly controlled for many years, according to the Imperial Mineral Resources Bureau, and Messrs. Johnson, Matthey & Co., Ltd., a London firm, are the chief buyers. The world's supply is obtained party from bismuth ore and partly from bismuth metal recovered during the process of electrolytically refining lead and copper.

Bolivia is the chief producer of bismuth. Other important producing countries are Australia, Mexico, Peru and Saxony. An occasional shipment of bismuth ore has been reported from the "Kjenner Bismuth" mine, in Norway, and both Spain and Chile produced small quantities.

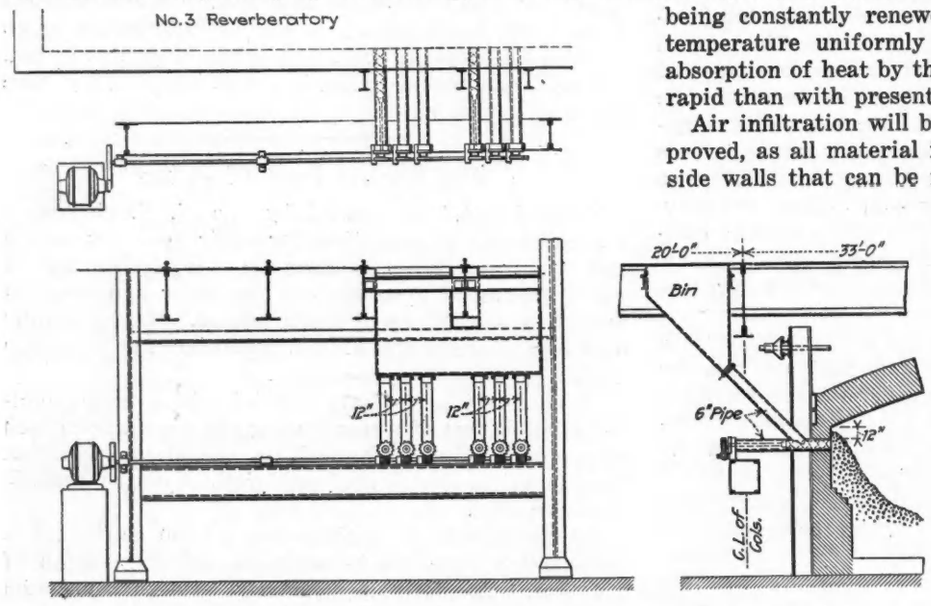
New Method of Charging Reverberatory Furnaces

BY J. O. AMBLER
Smelter Superintendent, Arizona Copper Co., Ltd.

Written for *Engineering and Mining Journal*

AN EXPERIMENTAL machine which promises marked improvements and economies over the present system of charging material into a copper reverberatory smelting furnace has been on trial for the last eighteen months at the smelter of the Arizona Copper Co., Ltd., at Clifton, Ariz. Briefly stated, the basic purpose is to charge the material at a practically continuous rate into the furnace by mechanical means, without the production of dust. Although the method is not new, having been advanced as early as 1914, its mechanical application has not been pushed, and for that reason results obtained from the machine are of interest.

With the above objects in view, an experimental machine was designed by Spencer Bishop, chief engineer for the Arizona Copper Co., Ltd., using mechanically driven screws for feeders, as shown in the accompanying figure. This has been running fairly continuously since June, 1919, during which time experiments have been made to determine the best type of screw and the materials of which to construct it, with tests of different methods of drive, diameters and lengths of screws and pipes, power consumption, and other operating and construction details. On the basis of the results obtained from this experimental machine, a similar machine is now being designed large enough to feed one furnace of about 500 tons' daily capacity.



CONTINUOUS SIDE FEEDER DESIGNED FOR NO. 3 REVERBERATORY AT ARIZONA COPPER CO. SMELTER

The principal advantages expected to be obtained by this method of mechanically charging reverberatory furnaces are as follows:

Dusting will be practically eliminated inside the furnace, and as the fluxing action of the dust produced by the present methods of charging causes the greatest part of the necessary roof repairs, a material saving will be made in this item. From observation, it is estimated that this saving alone will more than pay the cost of operating the machine.

A much better utilization of heat will be effected, resulting in lower oil ratios and larger tonnages. With present methods of charging, in which large amounts of comparatively cold material are charged periodically, the furnace temperature varies within wide limits. Immediately before charging the temperature is above the smelting point of the mixture, but it drops below the smelting temperature when the charge is dropped, and there is an appreciable interval during which little smelting is done. With the mechanical feeder, designed to feed the charge at about the same rate at which it is smelted, the furnace is kept at a uniform temperature and the heat acts on a thin layer of material which is being constantly renewed as it is smelted. With the temperature uniformly above the smelting point, the absorption of heat by this thin layer will be much more rapid than with present charging methods.

Air infiltration will be decreased and combustion improved, as all material is charged through pipes in the side walls that can be made absolutely dust-tight, and all holes for charging and for fettling pipes through the arch can be eliminated. The arch itself will be stronger, and the infiltration of air through all openings formerly necessary can be entirely obviated. This will materially lengthen the life of the arch, conserve heat, and, by simplifying air regulation, permit better combustion conditions, more nearly approaching boiler practice.

In this connection, experiments have indicated the possibility of feeding wet or dry high-sulphur concentrates direct to the reverberatory and utilizing their heat of combustion in this furnace instead of the roasters. Should this line of experimentation continue to develop favorably, the regulation of the air supply will be an important factor.

The slag and stack losses should be smaller. With the uniform smelting temperature and feed, the settling conditions in the furnace will be improved, and with elimination of dusting the amount of dust settling on the slag and passing into the boilers, flues, and stack should be greatly lessened.

In the machine being designed, particular attention is being paid to the elimination of dust losses while charging the material from calcine cars to the feed hoppers at the reverberatory, and to the insulation of bins to conserve the heat of the material to be smelted. The furnace on which the machine is to be installed is approximately 25 x 100 ft. in hearth area and is fired with Mexican low-gravity oil, using air at 30 to 32 oz. pressure for atomization.

HANDY KNOWLEDGE

Details of Shaft Lagging

BY JOHN L. DYNAN

Written for *Engineering and Mining Journal*

An effective method of placing lagging in vertical shafts, although by no means original, has been in use at the Tonopah Extension mine in Tonopah, Nev., for several years. Fig. 1 shows the details of this method, and Fig. 2 the method in general use in Nevada.

In Fig. 1, a "keyboard" projecting two inches above and two inches below the wall plate is spiked to the

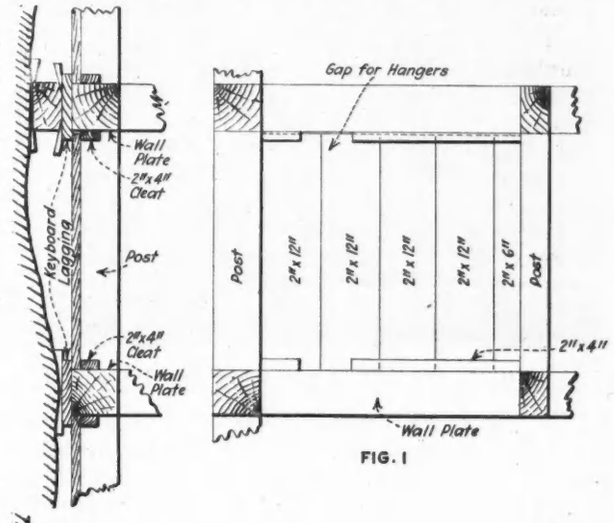
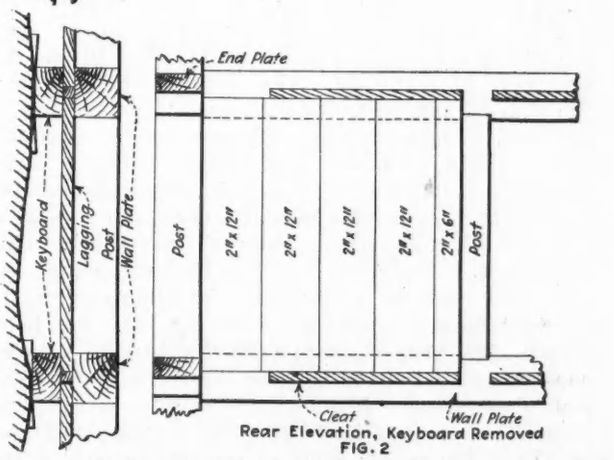


FIG. 1



Rear Elevation, Keyboard Removed
FIG. 2

FIGS. 1 AND 2. METHODS OF PLACING SHAFT LAGGING

back of the wall plate. This is done on the surface, before sending the wall plates down. For a 10 x 10-in. wall plate, the keyboard is 2 x 12 in. Back of this keyboard are inserted whatever stringers and blocking may be necessary to block the wall plate tightly in place. The lagging are stood upon the wall plates, and are prevented from falling into the shaft by cleats, usually 2 x 4 in., spiked to the wall plates, top and bottom, as shown. The ends of the shaft are lagged in the same way. A gap is left on the wall plates for the hanging-rod nuts and washers. This may be filled, if desired, after the hanging rods are removed.

In the other method, shown in Fig. 2, the lagging are back of the wall plates, supported on a small cleat. The lagging for any set must be inserted from below that set, through a space at the end left without any cleat. The last lagging over this space is held by wedging it to the "keyboard."

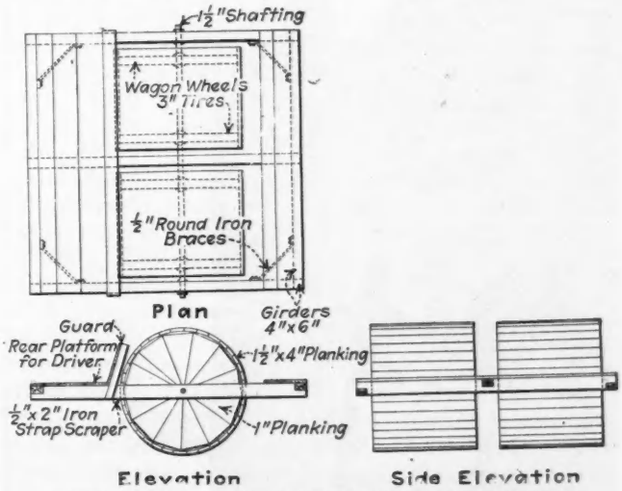
The method shown in Fig. 1 has been found to have several marked advantages. First is the much greater ease with which a set can be lagged. A shaft crew of four men can lag a set in a shaft of four 4 ft. 6 in. x 5 ft. compartments in twenty minutes. A second advantage is the ease with which lagging may be removed to be replaced when broken, or to ease the ground back of the shaft timbers. It is necessary merely to pull up the cleat with a bar or pick, instead of chopping out the lagging, as in the other method. The method provides ample strength, as the lagging will bend in the center to a degree necessitating their replacement or easing off, long before they can fail by pushing off the 2 x 4 in. cleat. In cutting, lagging must be a little shorter than the theoretical length, if the wall- and end-plate timbers are at all oversize; otherwise the lagging will not fit.

An Efficient Snow Roller

BY DONALD D. FRASER

Written for *Engineering and Mining Journal*

The illustration shows a snow roller which is being used successfully in Cariboo, B. C., between Quesnel and Barkerville. In that section the snow on the roads may lie up to eight feet deep. Before the roller was used, much trouble was experienced when teams met. Frequently it was a three- or four-hour job to get the one team past the other.



DETAILS OF CONSTRUCTION OF SNOW ROLLER

This device makes a fine hard roadbed, and frequent turn-outs are rolled. The greatest benefit comes in the Spring when the snow is melting. The rolled roadbed melts away slowly and evenly, one side of the road not being bare ground while the other side is covered with a foot of snow. When the snow is not too sticky, the roller works to perfection.

The construction is simple. The rollers are built up on four wagon wheels, each roller having two wheels. These wheels are mounted on axles. The spacing will depend on the desired width of the roadbed. The rollers described are each about three and one-half feet wide and placed about nine inches apart. A framework is made, as shown, of 4 x 6-in. lumber, being carried by the ends of the axles. A platform is made on the rear end for the driver, and the tongue is fastened to the front end. The construction throughout is heavy, to give both weight and strength. Four horses are generally used to pull it.

Repair of a Broken Jaw Crusher

By W. R. Canton

Written for *Engineering and Mining Journal*

A breakdown of a primary jaw crusher usually means a stoppage of the plant that depends upon it for crushed material. A quick and also reliable repair is therefore necessary. The crusher the repair of which is here described is a 36 x 42 in., jaw type. Its breakdown necessitated the shutdown of the plant. One side frame casting broke along the line of the bolts which hold the back end of the frame. No apparent reason for the break, such as, for example, a large piece of steel, was found, but it is supposed that a piece of drill steel caught in such a way as not to slip, causing the break.

A plan for repair was devised at once and the work started. The following material was required: Six pieces of 2 1/8-in. shafting, each 14 ft. long, for side tension rods. Each end of the rods was threaded, for a length of twelve inches, 3½ turns to the inch. It required about two hours in the lathe to run the thread on one end. Twenty-four 3-in. drop-forged nuts and

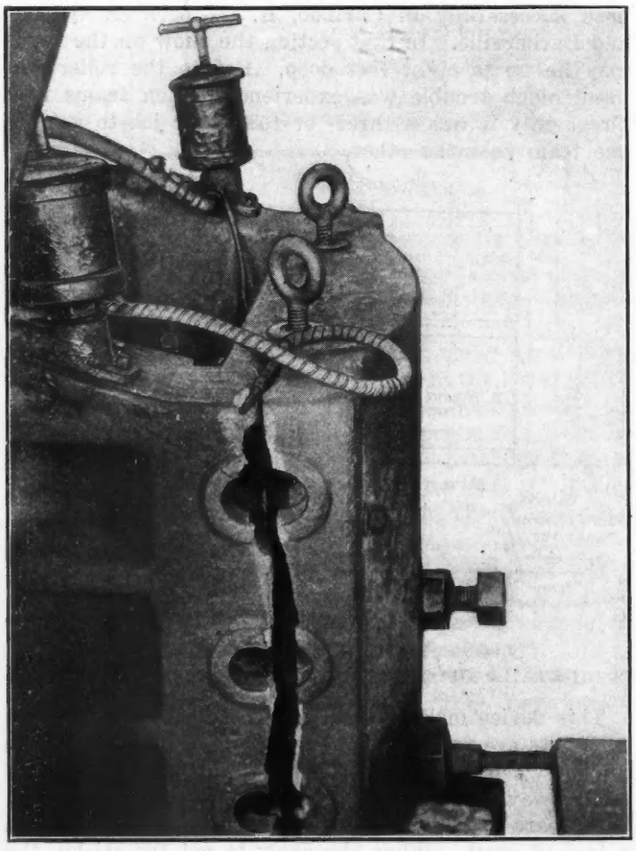


FIG. 1. BROKEN CASTING ON JAW CRUSHER

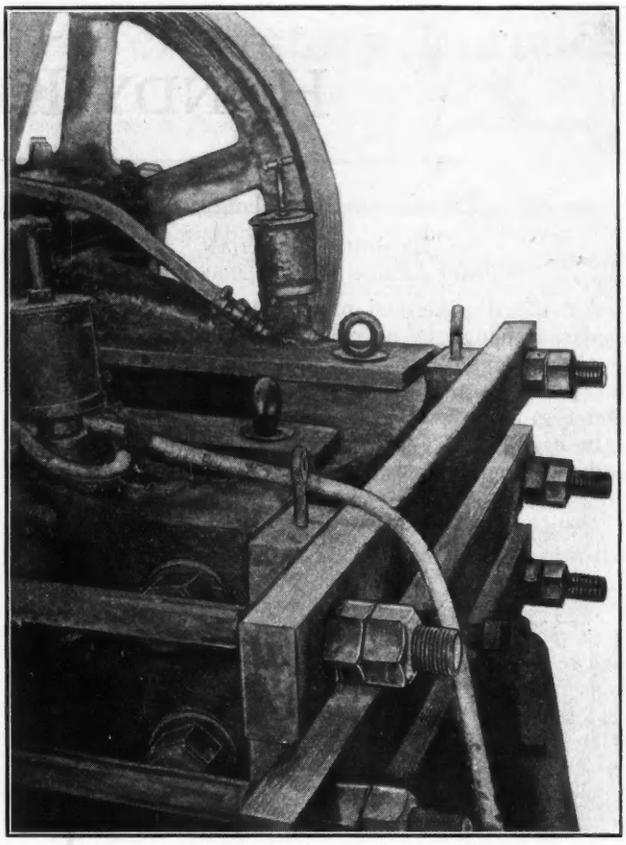


FIG. 2. REPAIRS MADE ON JAW CRUSHER

six 7 ft. x 8 x 4-in. stays made of drop-forged steel were required. In each of these there were drilled two 3-in. holes, 6 ft. 8½ in. on centers. It required 1¾ hours to drill one hole. Four pillar blocks were required, on account of the curve in the casting of the crusher. Two were 34 x 6 x 10 in. and two were 34 x 4 x 10 in. All were made of cast iron. The material was obtained from near-by plants, and was assembled on the job in four days. The parts were put in place and the nuts taken up with a one-ton chain block, using a 36-in. open wrench. They were tightened and then heated for one-half hour, and while the heat was on, the nuts were given one full turn on both sides of the crusher. This amounted to a length of 3/32 in. In heat tightening, the middle bolt, one on either side, was tightened first; then the bottom one, and lastly the top one. The bolts on each side were tightened simultaneously. Wooden wedges were next put in between the frame and rods at both ends to prevent the lateral movement. The job was a complete success. Fig. 1 shows the broken side frame and Fig. 2 the repair work at the broken end of the crusher.

Scrap Iron for Cold Converters

When a converter is running cold, says H. C. Robson in a paper recently presented before the Institution of Mining and Metallurgy, the addition of coal is of little avail, as the volatile matter does not burn until it passes out of the converter mouth, thus only resulting in overheating the hood. Scrap iron, however, has been found most suitable for heating a cold charge, and old ladles used for dipping copper from a refinery furnace broken up into small chunks have come in handy for this purpose.

By The Way

Notes on Annual Reviews

When the next Annual Review Number appears, readers will do well to peruse carefully the able article on "Pig Lead and Pig Tin," by Ellis Parker Butler, the w. k. authority on pigs.

As stated in the recent A. R. N. the Ringwood iron mine, at Ringwood, N. J., is owned by the Ringwood Co. of Ringwood. We feel sure that this statement will thoroughly satisfy every booster in the Chamber of Commerce of Ringwood.

There's one good thing about the Annual Review Number, anyway. It is the one issue that the subscriber can get along without reading. But as a reference work it is comparable only to the *Brooklyn Eagle Almanac*. No higher praise, even though it seem self-praise, can we think of.

The Almighty Dollar

Though hopeful of the future, we live in the present—a sign that youth is still with us; and as we look around thus early in the new year, about the brightest thing that we can see within our horizon is silver. As a man in love is said to see all things through rose-colored glasses, so those in the dumps may cure their ill-humor by wearing spectacles with lenses of silver that shut out all the world besides. The silver dollar, the cartwheel favored of Westerners, makes a pretty pocket piece. Gripped tightly in the fist it sends a comforting feeling through our being, that seems to tell us that here, as least, is something real and not merely a scrap of paper. It would be well if Easterners were more familiar with rea money. Instead, there are tradesmen here in New York who have never seen the shining simoleon and who look the customer askance if by chance he drops one on the counter. There is in existence an organization known as the Sunshine Club. We would like to form our own sunshine club, the principal qualification for membership in which would be the possession of a silver dollar carried on the person. There are some, no doubt, who will say that such a club might better be known as the moonshine club, owing to the silvery lustre of the metal. But we wave such trifling suggestions aside. If only half of our population could be persuaded to join such a club, and hold to their obligation, no less than fifty million bright and shining silver dollars would find their way from Treasury vaults into the pockets of the people. But such a thing should not be carried too far, else this country might become another sink for silver such as India is. Perhaps our native extravagance could be relied upon to prevent this. In that case the movement could go to any length, the result benefiting the producer. We repeat, we are fond of the silver dollar. We are collecting as many of them as possible. To cure the blues over the metal situation the following prescription is recommended: Take one squint at a cartwheel, say a prayer for the Pittman Act, and presto! the deed is done.

International Courtesies

Beginning Jan. 1 the railroads of this country were permitted to accept small arms and small arms ammunition for shipment into Mexico according to an announcement by the American Railway Association. Now if Don Alvaro Obregon will facilitate the shipment of *mescal, cerveza* and other commodities in the same classification into this country the courtesy will be properly reciprocated. But has there ever been lack of any of these commodities at any time on either side of the border?

The Miner's Almanac

If Dr. Eliot had introduced his five-foot shelf of books fifty years ago perhaps he would have included the farmer's almanac, by which our grandfathers, both in town and country, were wont to inform themselves of forthcoming events and refresh their memories of things gone by. That the moon has phases and the sun rises and sets constitutes the sum total of many a person's knowledge of astronomy, and more perhaps have learned this from the farmer's almanac than from deep and learned textbooks. This almanac was an institution. It is therefore with pleasure that many will read the Miner's Safety and Health Almanac for 1921, the third of a series published by the U. S. Bureau of Mines and compiled by R. C. Williams. In it the phases of the moon are given due prominence, and a safety hint or an historical event is listed for each day of the week. On Feb. 21 the reader is informed that the day will be Monday, that flies do not wash their feet, that the sun will rise at 6.45 and set at 5.43, all of which should be enough to keep anyone straight on that particular day. The month closes with the good advice that cheerfulness increases working efficiency. In place of the jokes and anecdotes in which the old almanac abounded, numerous short sermons on hygiene, sanitation and safety are given, lightened with cartoons and other illustrations.

Before the Copper Surplus Piled Up

Ancient mining on the shores of Lake Superior was discussed by Charles Whittlesey back in 1856. Mr. Whittlesay's paper was later published in the Smithsonian Institution's "Contributions to Knowledge." He arrived at the following conclusions:

An ancient people extracted copper from the veins of Lake Superior of whom history gives no account. They did it in a rude way, by means of fire and the use of copper wedges or gads and by stone mauls. They had only the simplest mechanical contrivances and consequently penetrated the earth but a short distance (the deepest works are about the same depth as those of the old tin mines of Cornwall, which were wrought before the conquest of Britain by the Romans). They do not appear to have acquired any skill in the art of metallurgy or of cutting masses of copper. For cutting tools they had chisels and probably adzes or axes of copper. These tools are of pure copper and hardened only by condensation or beating when cold. They sought chiefly for small masses and lumps and not for large masses. No sepulchral mounds, defences, domiciles, roads or canals are known to have been made by them. No evidences have been discovered of the cultivation of the soil. They had weapons of defence or of the chase, such as darts, spears, and daggers of copper. They must have been numerous, industrious, and perservering and have occupied the country a long time.

No Gold for the Portland

Although the Portland Gold Mining Co. has mined about $100,000,000 in gold during its existence, it was unable to obtain gold coins to distribute to its employees as Christmas presents, because the banks (for some unaccountable reason) refused to issue gold for such purposes.

CONSULTATION

Manganese Deposits in the Southern United States

"Will you be kind enough to tell the writer, who has been a subscriber of yours for over twenty years, whether there are deposits of black oxide of manganese, also known as manganese dioxide and mineralogically as pyrolusite, in the southern part of this country, and, if there are any workable deposits, whether they are being worked and where they are located? I am much interested in this mineral, and any information you can give me will be appreciated."

The southeastern part of the United States contains extensive deposits of manganese. In order of importance as manganese producers, the Southern States rank about as follows, the figures being taken from data supplied by the U. S. Geological Survey:

MANGANESE ORE SHIPPED IN 1919 IN LONG TONS

	35 per Cent or More Manganese	10 to 35 per Cent Manganese
Virginia	3,900	9,765
Georgia	48	3,496
Arkansas	2,558	564
Alabama	40	"
North Carolina	....	30

It is to be remembered that 1919 was a year of low production in the industry, the production of high-grade ore (35 per cent and over) in the entire United States being 58,085 tons, compared with 305,869 tons in 1918.

In Alabama, manganese is mined principally in the Altoona district, Blount and Etowah counties, and from Calhoun, Clay and Talladega counties. In Arkansas, the most important producing locality is around Batesville —Independence and Izard counties. Polk and Sharp counties are of lesser importance as shippers.

Georgia produces about 80 per cent of its manganese ore from the Cartersville district, Bartow County. The remainder is shipped from deposits in Fannin, Floyd Lincoln, and Whitefield counties.

Virginia is the chief Southern producing state, and has shipped high-grade ore from mines in Augusta, Bland, Campbell, Craig, Frederick, Giles, Nelson, Page, Russell, Shenandoah, Smyth and Warren counties. Most of the manganese ore in Tennessee is produced in Johnson County.

It is noticeable that the Southern manganese deposits extend in a long belt in the Appalachian Mountains which begins in Maryland and extends through the states of Virginia, Tennessee, North Carolina, Alabama and Georgia.

The great stimulus of war requirements for ferromanganese was responsible for a widespread activity among manganese producers all over the United States. Although for a decade prior to the war the United States produced less than 1 per cent of its manganese ore supplies, the cessation of imports and the insistent demand for this necessary war mineral led to a phenomenal expansion in production—from about 3,000 tons in 1913 to over one hundred times this output in 1918. The resumption of importation after the war and the strong competition of other countries producing more uniform grades of manganese at costs which enable them to make a reasonable profit will probably prevent any great resumption of domestic manganese production on a scale comparable to that maintained during the war. At present Southern manganese producers are active, but more in regard to consolidation of properties and planning for more efficient working of the mines than for active ore production. They seem to feel, particularly in the Arkansas field, that is to their advantage to co-operate in an endeavor to sample and market their products in a better manner and that there are many problems of operation that can be attacked collectively with the prospects of better returns than if attempted individually.

The U. S. Geological Survey maintained close contact with the industry during the war, and has published reports on the geology and manganese resources of practically every important producing district in the country. A bibliography of the reports would be too detailed to reproduce here, but the reader would do well to communicate with the Survey if he desires to obtain reports covering the particular section of the United States in which he is interested.

Low Sulphur Content Presents a Metallurgical Problem

"We find that smelting tests of the average ores at Rosita give a sulphur content too low to throw down all of the copper as a matte. The copper content is, therefore, found to come down in the reverberatory furnace as a mixed mass of native shot copper and high-grade copper matte. I understand that under this smelting condition the copper content of the slag is usually found to be high, but in our operation we get a very clean slag of not over $\frac{2}{10}$ or $\frac{3}{10}$ of 1 per cent of copper. The problem is, will this combined mass of shot copper and high-grade matte blow well in the converters and give the usual blister copper product, or will it be necessary to add an additional amount of sulphur to the charge in order to get proper action in the converters?"

We have never had to solve the problem mentioned in your letter and also have never heard of material such as you describe being converted. Possibly some of our readers can throw some light on the subject.

Evidently your reverberatory product would contain little or no ferrous sulphide, inasmuch as free copper is present. All of the heat therefore must come from oxidation of the sulphur. Without an analysis it is impossible to calculate just how much heat would be evolved and to compare this with that which might be assumed as lost in the stack gases and by radiation. You might be able to blow the mixture to blister without difficulty provided you ran your reverberatory very hot previous to tapping and thus superheated the converter charge. It would also probably be necessary to keep the converter shell hot by oil burners or otherwise. The size and type of converter would enter into the question. Scrap iron and quartz might be charged to the converter occasionally for increasing the temperature, but then, of course, you would have a slag to handle with which otherwise it would be unnecessary to deal.

THE PETROLEUM INDUSTRY

Imperial Oil Co.'s Program for 1921

SPECIAL CORRESPONDENCE

The plans of the Imperial Oil Co. for the season's operations in the Fort Norman oil field on the Mackenzie River include the erection of a permanent camp, so that a force of men may remain there throughout the year. The season under present conditions is a short one, owing to the time required for going in in the spring and returning before navigation closes. Last year the drillers had only seventy-three days in which to work. Considerable time will be saved by the use of airplanes, which will enable more work to be accomplished in 1921 than was possible last year. When the workmen reach the Fort Norman well in the spring it is intended to test it, and if found desirable to sink it to a greater depth. The company has several blocks under lease in the field.

Drilling will also be carried on at Windy Point, several hundred miles south from Fort Norman. Three wells are being drilled in Saskatchewan and six in Alberta. Of all the operations carried on by the company in western Canada, the Fort Norman well is the only one where oil has been secured in commercial quantities. Two airplanes have been secured for the air service from Edmonton to Fort Norman.

Further Searches for Oil in Utah

SPECIAL CORRESPONDENCE

An effort is being made to add to oil production from Utah sources, and oil is being sought in Emery and Garfield counties by a number of companies. In the San Rafael field, in the former county, the Ohio, Midwest, Carter, and Kasoming companies, subsidiaries of the Standard Oil Co., have filed leases on large tracts. The Ohio and the Carter Oil and the Midwest also hold leases on lands at Circle Cliff, in Garfield County.

A recent report says that the Midwest company has opened a small flow at 75 ft. in the Circle Cliff field. The strata in which it is hoped to open a larger flow is stated to be found at a depth of 1,500 ft. Another company in the field is the Bay State Mining & Development Co., which has filed on 600 acres of oil land at Circle Cliff and 2,660 acres at San Rafael.

Oil Possibilities in Southeastern Montana

The Wolf Mountain area, in southeastern Montana, which lies within the drainage basins of Powder, Tongue, and Rosebud rivers, was examined in a reconnaissance made to discover anticlines or other structural features that are likely to contain oil, in October, 1920, by C. E. Dobbin and W. T. Thom, Jr., of the U. S. Geological Survey. The wide, shallow syncline or inverted arch of strata corresponding to the drainage basins of these three rivers includes several broad, low arches and minor flexures, but practically all the known oil fields of adjacent regions in Montana and Wyoming are associated with rocks that dip much more steeply than those observed in the Wolf Mountain area.

In this area the sands that may yield oil or gas lie at great depth, under a great thickness of coal-bearing rocks. The depth to these sands decreases gradually toward the east, owing to the thinning of the geologic formations, but this same thinning must also decrease the number and thickness of the sands in the eastern part of the field. Except on the extreme eastern and western margins of the Wolf Mountain syncline, the sands of the Colorado and older formations, which yield oil near Newcastle, lie too deep to be reached by ordinary drilling.

The three structural elevations which more distinctly invite further investigation are the anticlinal noses near Ridge, northeast of Hardin, and west of Busby. Even these features, however, do not appear particularly promising.

Oil From Pennsylvania Shales and Coals

A preliminary report on a series of experiments which have been conducted by the Pennsylvania Geological Survey to determine the amount of oil obtainable from Pennsylvania coals and black shales has recently been issued. The results show that Pennsylvania is not well supplied with rich oil-producing coals or shales. The conditions that produced the valuable anthracite in the eastern part of the state and the high carbon coals in the eastern part of the bituminous fields drove the oil and gas out of the black shales of those regions, so that good results were obtained only from the coals and black shales in the extreme western and northwestern counties of the state.

The experiments show that anthracite will yield no oil on distillation, nor will the black shales of the central and eastern parts of the state. This has been one of the facts that have led geogolists to believe that those parts of the state contain no commercial supplies of petroleum or natural gas.

The coals and black shales of the counties lying immediately west of the Allegheny front—Tioga, Lycoming, Clinton, Center, Clearfield, Cambria, and Somerset—likewise give little promise, yielding only from 2 to 12 gal. of oil per ton of coal or shale.

Specifications for Petroleum Products

The Bureau of Mines announces the publication of Bulletin 5 of the Committee on Standardization of Petroleum Specifications, containing in the latest revised form all of the specifications which have been adopted by the specifications committee for Federal purchases of petroleum products. It also gives complete descriptions of the methods of testing adopted for each product. These specifications supersede those previously published in Bulletins 1, 2, 3 and 4 of the committee. Bulletin 5 became effective Dec. 29, 1920.

The committee has done a great deal of work in revising the wording of these specifications to make them more definite. The methods of testing have also been made more definite and brought into closer agreement with standard methods adopted by the A. S. T. M. and other societies.

NEWS FROM THE OIL FIELDS

Extra Supervisors Appointed in Texas Oil and Gas Division

From Our Special Correspondent

The Texas Railway Commission has announced the appointment of four additional deputy supervisors in the oil and gas division, making a total of twelve deputies. The new appointees are W. F. Arnold, H. H. Fitzpatrick, Fred S. Kinsley, and Hamilton Parks.

In the Mexia field, Limestone County, the Humphrey No. 1 well continues to flow by heads, and will be completed in a few days, when a much larger production is expected. The Texas Co. has completed a pipe line from the Houston & Texas Central R.R. to the well. Six new derricks are being built in this section, and considerable drilling will be done.

Fire at Humble, Harris County, on Jan. 15 destroyed several buildings in the business section of the town. The total loss is estimated at $25,000. The oil field was not damaged. Production from this field is about 9,000 bbl. daily.

Hull field, Liberty County, is still increasing its production, and pipe-line and storage capacities are taxed. The largest producing well completed recently is the No. 2 Hooks Spell of the Humble Oil & Refining Co., which came in at 3,220 ft., flowing at an estimated rate of 10,000 bbl. per day. Another big well is the No. 4 Harrison of the Monarch Oil & Refining Co., making 5,000 bbl. initial capacity.

West Columbia's production for the week ended Jan. 15 was about 34,000 bbl. per day. The only important completion during this week was the No. 2 McGregor well of the Big Belt Oil Co., between the old field and the north extension. This well came in flowing 2,000 bbl. from 2,520 ft.

One producing well was added to the Blue Ridge field during the week ended Jan. 15. This was the No. 1 Pearson well of the Humble Oil & Refining Co., flowing 400 bbl. from 2,950 ft. This well is on the west side of the field near the Texas Co.'s No. 1 Robinson, but in a shallower sand, through which several other wells have been drilled, it is claimed. Kerry Kinney et al. well No. 1 Bentley, on the east side of the dome, was abandoned in salt.

One of the deepest wells in the Gulf Coast region is again producing. This is the No. 33 Ashbell Smith well of the E. F. Simms Co. The well was first brought in producing gas at 4,100 ft.; it later went to salt water, and recently, after setting screen and packer, began flowing 150 bbl. of oil daily. The Gulf Production Co.'s No. 20 Hoffman-Gaillard is pumping 50 bbl. daily from 4,200 ft., a depth exceeded by few producing wells on the Gulf Coast.

Mexican Petroleum Companies Have Extensive Programs for 1921

From Our Special Correspondent

The Tidmex Oil Co. brought in a salt water well on Lot 215, Amatlan. At a depth of 2,500 ft. the well struck the oil, but flowed only about thirty minutes, when it gradually went salt. The well was closed in soon afterward by the contractor.

Millions of dollars will be spent in the Mexican oil fields this year, as announced in the programs of several of the largest companies operating there.

The Mexican Gulf Oil Co. has planned to drill ten to fifteen new wells in proved territory, in addition to several wildcat wells in different parts of Mexico. Extensions to the company's pipe lines include two new eight-inch lines from its pump station on the Tancochin River to Lot 23, Zacamixtle, where it purposes erecting a new station to handle the oil from this field. A line will also extend south from this lot to the company's holdings in Toteco. A general camp will also be erected on this lot, including shops, bunk houses, a hospital, and a hotel.

The Freeport Mexican Oil Co. plans to drill several wells during 1921, some being in new territory. The company expects to add several tankers to its fleet, and to bring enough oil through its terminal to increase its capacity to over a million barrels a month.

The International Petroleum Corporation plans to pull two of its sea-loading lines early in the year. These will have a capacity of about 100,000 bbl. per day. This company expects to drill several wells in the Amatlan, Zacamixtle, and Toteco pools, and anticipates a large production from them. The company's second ten-inch line is nearing completion and will give it a capacity of 130,000 bbl. daily.

The Island Oil Co. will drill at least six wells in the south fields at once, with several others to follow as soon as possible. The company also plans an addition to its main line to the terminal on the coast.

The Huasteca and Aguila companies also have extensive programs, but they have not yet been made public.

A favorable report, according to the *Wall Street Journal*, has been made to the Senate on a bill introduced by Senator Owen to extend from 1931 to 1956 rights of Osage Indians in Oklahoma to oil and mineral deposits in their lands, even though surface lands have been sold. The bill also extends for the same period leases of oil companies which are now paying royalties on production.

Salt Creek, Wyo., Producers Hold Meeting With Interior Department Representatives

From Our Special Correspondent

A meeting of the crude-oil producers of the Salt Creek field, Wyoming, and a conference with the representatives of the Department of the Interior were held in Denver on Jan. 27. The Government holds big royalties in the Salt Creek field and desires to prevent damage to the field by overdrilling.

In the Lance Creek field the Cash well of the Ohio Oil Co., on Sec. 4, it is stated, has started flowing oil at the rate of 700 bbl. daily. This was originally a gas well.

Western States Oil & Land Co. recently completed its No. 12 well in the Hamilton field northwest of Thermopolis. The well is making a good production. No. 15 well will be completed soon. The Secretary of the Interior has granted this company permission to produce oil from its well on Sec. 5-39-78 of the Salt Creek field, and impound it pending the granting of the lease to the company.

Reports of Oil in Coahuila and Durango Confirmed

From Our Special Correspondent

Torreon—Reports of the existence of oil in paying quantities in the states of Coahuila and Durango have been confirmed through the Secretary of Hacienda in Mexico, according to published reports. The State of Coahuila is now producing crude oil in various regions. In the famous mining district of Mapimi, in the State of Durango, and bordering on the State of Coahuila, a producing well has been brought in.

The central government is being asked to pass a law creating a national reserve of a portion of these oil lands in order to prevent them from being monopolized by foreigners. English geologists have been prospecting for oil in the northern part of Coahuila, and are said to have discovered a good grade of crude oil in paying quantities.

It is reported from reliable sources that Nuevo Leon, Durango, and Coahuila are now producing thousands of barrels of oil per day.

Well drillers who were boring for water in the State of Chihuahua at the time the revolution broke out in 1910-1911 claim to have struck oil in a number of districts, but kept their discovery secret. It is becoming generally known to prominent geologists and big oil concerns that crude oil is to be found in large quantities throughout the entire northern part of Mexico and is going to cause an unprecedented rush to this country within the near future.

Book Reviews

Asbestos. By A. Leonard Summers. Cloth; pp. 107; 34 illustrations; 4½ x 7, Isaac Pitman & Sons, Ltd., New York. Price, $1.

This is one of Pitman's "Common Commodities and Industries Series." It claims to be the only comprehensive book on asbestos, notwithstanding Cirkel's well-known monograph which has a world-wide reputation. The author gives a fairly complete description of the various products in which asbestos is used, particularly those employed in England, and apparently he speaks with some authority on that phase of the subject. It is to be regretted that he had not confined his work entirely to finished products, for the introductory part dealing with raw materials is noteworthy particularly for its errors. The statement that Italian asbestos is the best in the world, the failure to mention Arizona and Rhodesia as producers, and the remarkable claim that "next to coal asbestos is undoubtedly the most important of the non-metallic mineral products" are examples of the numerous errors which place the book in the too common class of unreliable "popular" works. O. B.

The American Engineer in France. By William Barclay Parsons. Cloth; pp. 429; illustrated; 6 x 8¾. D. Appleton and Co., New York, 1920. Price, $4.

Colonel Parsons states in the preface to his book that, "Perhaps it may serve to give those who did not go overseas a picture of what is meant by engineering in modern war." We do not believe it is an exaggeration to say that in this particular he has succeeded admirably, and his contribution to the literature relating to the accomplishments of American engineer units in the Great War is a notable one. The reader is constantly impressed with the versatility shown by the engineers, and, although this is a trait with which we, as engineers, are entirely familiar, it is refreshing to see the statement in print and presented in such able fashion. The narrative, besides the inclusion of a great deal of statistical, historical and technical data, is interspersed with many delightful personal touches, experiences, and suggestions of the engineer's daily life, and portrays in an excellent manner his relations with the engineers of the Allied armies. D. E. A. C.

Straight Business in South America. By James H. Collins. Cloth; 5½ x 8; pp. 305. D. Appleton & Co., New York. Price, $2.50.

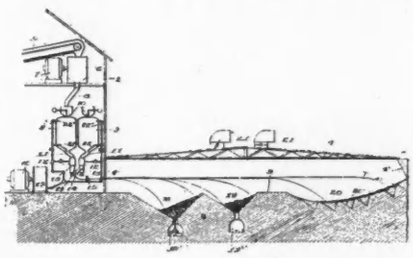
This is a well written book on a subject of very general interest to the business men of the United States. Its principal value would seem to be that it puts the reader in the proper frame of mind to absorb the details of his particular business in South America. Although many pertinent facts are presented, it indicates to one *why* certain things are done rather than *how*, and in that sense is quite different from the more technical works about the same field. The book is easy to read, and treats of interesting subjects in an intelligent way, and the author has apparently consulted with men who know the continent well.

It is unfortunate that the few Spanish expressions used have been mistreated somewhere between the typewriter and the bindery, as they tend to create a false impression upon persons familiar with the language. This is in no way a serious matter, however, and does not detract from the book's real value to busy men. V. L. H.

Recent Patents

Patent specifications may be obtained from the Commissioner of Patents, Washington, D. C., for 10c. each. Postage stamps not accepted.

Pneumatic Concentrator—Nos. 1,359,496 and 1,359,497. F. G. Gasche, Chicago, Ill. A process of blowing



finely crushed ore into a confined atmosphere and separating the constituents according to the ease of settling.

Slime Cone—No. 1,360,703. Charles Allen, El Paso, Tex. A modification of the well-known Allen cone classifier.

Ball Mill—No. 1,360,648. Joseph E. Kennedy, New York, N. Y. A form of mill which has a partition screen in the middle of the mill so that relatively coarse grinding can be done in one end and finer grinding in the other. A mill of somewhat similar type is covered by patent No. 1,361,205 issued to P. C. Van Zandt, Chicago, Ill., and assigned to the Allis-Chalmers Co.

Copper Precipitation—No. 1,360,666. L. D. Mills, San Francisco, Cal., assignor to the Merrill Co. A method of using finely divided freshly reduced iron to precipitate copper from its solution.

Sealing Oil Wells—No. 1,361,282. W. E. Nolan, Tulsa, Okla. A method of sealing wells which consists in heating the walls of the well so hot, by electrical means, that the material will melt and coalesce.

Flotation Machine—No. 1,361,342. I. R. Margetts and William Fagergren, Salt Lake City, Utah. A mechanically agitated machine with a horizontal impeller.

Technical Papers

First Aid—The U. S. Public Health Service, Washington, D. C., has published *Miscellaneous Publication No.* 21, entitled, "What to Do in Accidents," which may be obtained on request. This is an excellent, illustrated pamphlet of sixty-one pages which all of our readers should have. Accidental injuries of all kinds are covered, and the best treatment, in the absence of a physician, is described. A favorite home remedy is hydrogen peroxide. Concerning this the book says: "The practice of applying hydrogen peroxide to fresh wounds is not recommended. . . . It causes a great deal of pain, wets the wound and is not an efficient germicide." Tincture of iodine is much to be preferred.

Western Australia—The annual progress report of the Geological Survey of Western Australia for 1919 has been received. Copies may be obtained by addressing the Survey at Beaufort St., Perth, Western Australia. The book gives the results of the year's field operations and reviews the mineral industry of the state. A large map, 22 x 32 in., is included.

Idaho Copper Deposits—Bulletin No. 1 has just been issued by the Idaho Bureau of Mines and Geology. It is devoted chiefly to the geology and copper deposits of the Seven Devils district, Idaho, which extends for a distance of 120 miles along the Snake River in the western part of the state. The publication also contains brief descriptions of the Heath, Hornet Creek, Hoodoo, and Deer Creek districts. The bulletin is of 101 pages, and contains numerous maps and illustrations. Copies may be obtained free from Francis A. Thomson, Moscow, Idaho.

Miners' Almanac—The Bureau of Mines has been issuing a miners' safety and health almanac for the last three years, and the 1921 issue is now available at 5c. from the Superintendent of Documents, Washington, D. C. Every man employed in the mining industry should be familiar with facts given in this forty-eight-page book. General managers and those directing the labor at mine and mill will make no mistake in placing a copy in the hands of each of their employees.

Tripoli—U. S. Bureau of Mines *Reports of Investigations* No. 2,190, (Washington, D. C., free on request) describes the mining and preparation of tripoli and diatomaceous earth. The massive form is chiefly used for filters, and the ground tripoli as a mild abrasive, as a parting sand, and as a filler for paint and rubber. A bibliography is included.

Gypsum—"Gypsum in 1919," fifteen pages (a section of "Mineral Resources"), has been published and the pamphlet may be obtained on request from the U. S. Geological Survey, Washington, D. C.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Drill Steel Failures To Be Studied By Bureau of Mines

Urgent Call for Data and Points Worth Investigation Issued by B. F. Tillson—To Meet on Feb. 16

Rock-drill makers, mine operators, drill-steel metallurgists, and all others interested in the breakage of drill steel are urged to co-operate with the U. S. Bureau of Mines and Benjamin F. Tillson, of the New Jersey Zinc Co., Franklin, N. J., by preparing such data and information as they may have on any or all of the points in the following tentative outline:

1. Study of the steels which give the greatest service before failure by breakage of drill steel.
   A. Nature of section. B. Composition.
2. Maximum and minimum service which might be expected. A. Life of steel. B. Methods of heat treatment.
3. Mechanism of failure.
   A. Micro-analysis. B. Nature of stresses. C. Detection of incipient failures—(1) Magnetic analysis. (2) Other methods not destructive of steel. D. Is failure due to fatigue of metal?
4. Methods and machine development for accelerated tests.
   A. Nature of forces involved—(1) Impact. (2) Vibrating compressural waves. (3) Combined bending and vibratory.
5. Correlation of field tests and accelerated laboratory tests.
6. Reclamation of depreciated drill steels.
   A. Before failure. B. After failure. C. Methods of heating.—(1) Oil-fired furnaces. (2) Electric furnaces—a. Resistance, Carbon, Ni-chrome; b. Induction, high frequency, low frequency. (3) Ohmic resistance methods. D. Welding of fractured steels—a. Electric; b. forge.

Conclusion: Presentation of conclusion in form understandable by men in field and development of instruction for best handling and treatment of steels, if different from methods standard now.

Mr. Tillson has been asked to co-operate with the U. S. Bureau of Mines in that investigation and has tentatively arranged for a meeting of those specially interested at the coming annual meeting of the American Institute of Mining Engineers in New York City on Feb. 16. He would like to obtain papers giving definite data which have been collected in regard to various points which might be covered by this investigation, for presentation at this time and to hold a round-table discussion of such information and proposed plans for prosecuting this work. The reader is urged to write to Mr. Tillson giving views and suggestions for elaborating this outline and to indicate what information he has available to present in February at the organization meeting. Replies should be addressed to Benjamin F. Tillson, assistant superintendent, New Jersey Zinc Co., Franklin, N. J.

Public Works Department Not Needed

Same Duties Now Performed More Efficiently and Satisfactorily—Engineer Corps Defended

Many arguments against a national Department of Public Works, with concrete illustrations of its faulty functioning if put into practice, are brought forward by Lieut.-Col. C. O. Sherill in the course of his recent discussion of the Jones-Reavis Bill (S-2232, H.R.—6649).[1]

After setting forth in their own words the arguments advanced by the propagandists of the Public Works Department Association he summarizes the objections submitted by the Chamber of Commerce of the United States. Briefly these are:

A. The proposal is too vague and indefinite for adoption.

B. Careful examination of the governmental functions for which existing Federal departments were created should furnish the basis of a logical reorganization, but the present bill has not this virtue.

C. The inefficiency of the existing arrangement of engineering and constructing services has not been proved.

D. Economy would not be promoted, but expenditures would be increased, each bureau of the proposed new department striving to build up a large clerical organization for itself.

E. "Public Works Department" at best would be a misnomer, as the United States does not have important public works of the kind described by the propagandists, sufficient to warrant setting up a new department for them. "This department suggests strongly public ownership and operation of utilities not now apparent."

F. The governmental departments can secure competent engineering services in other and more appropriate ways.

G. Governmental organization must be functional. Engineering is not a function but a branch of technique of governmental functions.

H. Many special objections will arise due to concentration of engineering work to be done for other departments.

Colonel Sherill points out that the advocates of the bill have lost sight of the two fundamentally distinct classes of engineering and construction work carried on by the Government: (1) For the public-at-large, being the principal business of the bureau and the reason for its existence, and (2) engineering and construction activities merely incidental to the primary functions of the bureau or the department. Therefore, the bill makes illogical and inconsistent groupings of bureaus.

They also fail to realize that Government departments and bureaus are created solely to carry out some essential governmental function for the benefit of the whole people. The construction of engineering works is never a function of but merely one among many means employed by the executive departments in carrying out their proper functions. Every one of the departments and nearly all the bureaus and commissions perform engineering and construction, legal, commercial, educational, and research work; all are part of the machinery essential to carrying out their purposes, and of which they must have control. Were, for example, the classes of construction work needed by the different departments to be secured through an entirely independent outside department such as this Public Works Department it would be almost impossible to secure its accomplishment, owing to interminable referring, rereferring, annoying delays, and interferences of many kinds. Before a "cantonment would be built . . . the war would be over or the battalion out of the service due to exposure."

The attack by the engineers of the association on the Corps of Engineers, U. S. Army, naturally strikes Lieutenant Sherill as being of questionable ethics as well as wholly unjustifiable from any point of view. He believes that "no possible rearrangement of Government functions can ever do more than to secure a similar high quality of service from Government officials, commissioned or civilian."

He concludes that "there should be no Department of Public Works created as a new department or out of the Department of the Interior; that there is a possible necessity of a general reorganization of the Government departments as a whole, but that any such reorganization should be based on governmental functions rather than on engineering technique; that the Corps of Engineers should continue, as in the past, to be charged with the execution of public works of construction to the fullest possible extent, in the interest of honesty, economy, and preparedness."

[1] See *Engineering News-Record*, Dec. 30, 1920, p. 1273-1276.

MEN YOU SHOULD KNOW ABOUT

W. A. Harrod, mining engineer, formerly with the Consolidated Arizona Smelting Co., was in New York recently.

Donald F. Irvin, metallurgical engineer, of San Francisco, Cal., sails from New Orleans, La., on Feb. 9, for South America.

Eugene Stebinger has tendered his resignation as a geologist of the U. S. Geological Survey. It will become effective Jan. 31.

A. R. Martinez, of the Mexican Geological Survey, is studying the methods of the U. S. Geological Survey, and particularly those used in petrographic research.

James Frame, mining engineer, has gone to Chalchihuites, Zacatecas, Mexico, to examine several silver properties near there. He expects to be absent from his Boston office until Feb. 1.

Arthur W. Burgren, mining engineer, assistant superintendent of the Dolores mine, American Smelting & Refining Co., Matehuala, S. L. P., Mexico, who has been at Oakland, Cal., has gone to Knights Ferry, Cal.

C. H. Macnutt has resigned the resident management of the Black Lake Asbestos & Chrome Co., Ltd., to take charge of the Vimy Ridge property of the Bennett-Martin Asbestos & Chrome Mines, Ltd., Coleraine, Que., Canada.

William T. Curley, assistant superintendent for the Oliver Iron Mining Co. in the Chisholm, Minn., district, will leave soon for Brazil to be employed at the Morro da Mina manganese property, recently acquired by the U. S. Steel Corporation.

H. C. Boydell, mining engineer, who has spent the last fifteen months at the Massachusetts Institute of Technology in a study of mineral deposits, was in New York City recently on his way to Greece and Macedonia, where he will do some professional work.

W. M. Weigel, recently superintendent of the smelting department of the Missouri Cobalt Co., Fredericktown, Mo., has resigned to become a mineral technologist with the Bureau of Mines. Mr. Weigel will be at the bureau's Sourthern station, with headquarters at Tuscaloosa, Ala.

A. E. Drucker, professor of metallurgy in the Wisconsin State Mining School, has resigned that position to become associate professor of mining in the department of mining engineering of the University of Illinois. Professor Drucker's new appointment at Urbana, Ill., is scheduled to take effect on Feb. 1.

Sir Robert Hadfield, chairman and managing director of Hadfield's Steel Foundry Co., Ltd., Sheffield, England, has been awarded the John Fritz gold medal for notable scientific and industrial achievement. He is the inventor and developer of manganese steel and other special steels. The award of the medal to Sir Robert was announced on Jan. 22.

R. E. Collom has been appointed state oil and gas supervisor of California to fill the position made vacant by the resignation of R. P. McLaughlin on Jan. 1, 1921. Mr. Collom was U. S. Deputy Supervisor for California in the administration of oil and gas regulations under the Federal leasing act of Feb. 25, 1920, when called to re-enter the state's service.

A. W. Allen, for some time metallurgical editor of the *Engineering and Mining Journal*, and recently in charge of extensive and successful research work

A. W. ALLEN

by important American interests in developing a commercial process for the recovery of Chilean nitrate from low-grade caliche, has become Associate Editor of the *Mining & Scientific Press*, of San Francisco.

It is a pleasure to express to the *Journal's* contemporary on the Coast our felicitations on the coming of Mr. Allen to its staff, and also to extend to a much-esteemed former associate a welcome upon his return to the sphere of technical journalism.

SOCIETY MEETINGS ANNOUNCED

The Annual Meeting of A. I. M. E. will be held Feb. 14 to Feb. 17 inclusive in the Engineering Societies Building, 29 W. 39th St., New York City. The Institute of Metals Division hotel headquarters will be at Hotel Seville, Madison Ave. and 29th St., as last year. Registration will begin at 9 a.m. Feb. 14 at Institute headquarters. The program includes: On Feb. 14, 2 p.m., simultaneous sessions on mining and milling, non-ferrous metallurgy, non-metallic minerals; dinners for Iron and Steel Committee at Engineers' Club, Executive Committee of Institute of Metals at Chemists' Club, Committee on Industrial Relations at Engineers' Club; smoker in headquarters auditorium at 8:30 p.m. On Feb. 15 the annual business meeting will be held at 10 a.m.; at 10:30 come simultaneous sessions on "Rehabilitation of French Coal Mines" (illustrated), "Iron and Steel" and "Institute of Metals." The old and new directors will lunch at the Engineers' Club, and the board will meet at 1:30 p.m. in Room 903. At 2 p.m. come sessions on "Coal," "Iron and Steel" and "Industrial Relations." The Committee on Petroleum and Gas will dine at Engineers' Club. At 8:30 entertainment and dancing at headquarters. On Feb. 16 at 10 a.m. simultaneously welfare films; session on "Petroleum and Gas"; annual reports of industrial relations sub-committees; and discussion of proposed research on drill steel (Room 903). At 2 p.m. come films on asbestos and sulphur mining; continuation of drill steel research discussion; A. I. E. E. Mines Committee meets with A. I. M. E. Mining Equipment Committee. The reception to the old and the new president at the Waldorf-Astoria (6:45 p.m.) precedes the annual banquet there (7:15 p.m.). Feb. 17 forenoon will be devoted to the museums at American Geographical Society quadrangle.

Tickets to the banquet ($5) will be issued in order of mailing of payment as indicated by postmark. Reservations and checks should be sent payable to Donald M. Liddell, chairman, Room 330, 2 Rector St., New York City. Applications for hotel accommodations should be made to Wilber Judson, Room 1507, 14 Wall St., New York City.

OBITUARY

Hugh N. Camp, Jr., 150 W. 59th St., New York City, vice-president and treasurer of the St. Joseph Lead Co., died in that city on Jan. 17 at the age of fifty-three. Mr. Camp had been long associated with the company and one of its trustees since 1904.

Capt. Richard J. Mitchell, general superintendent of the Oliver Iron Mining Co., in the Eveleth, Minn., district, died Jan. 12, 1921, as the result of an injury to his shoulder and side sustained some months previously. Capt. Mitchell was born in Vermont on May 22, 1857, and had been connected with the Oliver Iron Mining Co. or its predecessor since 1893, when he removed to Hibbing, Minn.

THE MINING NEWS

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

LEADING EVENTS

Sale of Alice Gold & Silver Co. to Anaconda Annulled

Lower Courts Reversed—Price Paid Declared Inadequate—95 Per Cent of Stock Held by Defendant

The sale of the Alice Gold & Silver Mining Co. to the Anaconda Copper Mining Co. was set aside on Jan. 24 by the U. S. Supreme Court on the ground that the price paid was inadequate. The court, however, sustained the right of the majority of Alice stockholders to sell to Anaconda. When the latter acquired the Alice property in 1911, suit to annul the sale was brought by minority stockholders represented by Peter Geddes, Joseph R. Walker and Joseph S. Bear. The district and circuit courts affirmed the sale, however, and appeal was made to the Supreme Court. The purchase was effected through the transfer by Anaconda of $1,500,000 of its own stock for the Alice holdings. The court based its decision on the findings in lower courts that this price was inadequate and said that the fact that no bid was received at a public offering was not evidence that a sale could not have been made at a higher figure.

John D. Ryan, chairman of the Anaconda board, said that the decision was of little importance as 95 per cent of Alice stock was owned by the Anaconda company.

Miami Copper Flotation Hearing Held in Wilmington

A hearing was held before Judge Morris on a supplemental bill and answer on Jan. 17, in the U. S. District Court, at Wilmington, Del., through which bill it was sought by Minerals Separation, Ltd., to have Minerals Separation North American Corporation brought into the Minerals Separation, Ltd., vs. Miami Copper Co. suit. After each side had introduced evidence—consisting of the examination of one witness, and the introduction of several exhibits (documents) — adjournment was taken until Feb. 21, at which time the case will be argued.

Tomboy To Cut Wages

The Tomboy Gold Mines Co., Ltd., has filed notice with the Colorado Industrial Commission that it will reduce the wages of its employees 50c. per day beginning Feb. 15, 1921. The Tomboy is the seventh company to file such a notice with the commission.

WEEKLY RÉSUMÉ

Iron mines of the Gogebic Range, in northern Michigan, are beginning to reflect the dullness in the steel trade, and a general cut in wages is expected. Further curtailment and wage reductions are reported from various points. Operators in Colorado will cut wages 50c. on Feb. 15. Anaconda has shut down its ferromanganese plant at Great Falls following the closing of the Emma mine. The proposed reduction in freight rates on Plumas County (Cal.) ore shipped to Wabuska, Nev., is being opposed by the Western Pacific. On the other hand, the Santa Fe has made a more favorable rate on low-grade Chino ores between Santa Rita and Hurley, N. M. In Colorado, a bill that will greatly increase mine taxation is before the Legislature. Furthermore, permission is sought by the Colorado Power Co. to make effective at once increased rates asked some time ago, pending final decision. In Nevada, some resentment has been aroused among mine operators by propaganda unjustly belittling the amount paid in taxes by mining companies. In Montana, the customary annual bill for taxing all copper produced has been introduced at Helena. In South Dakota, the Homestake Mining Co. has broken ground for a new mill. At Wilmington, a further hearing in the Miami flotation litigation was held during the week. Some damage was caused at Pachuca, Mex., when the failure of a dam flooded the lower sections of the camp.

At Washington, the recent hearing on the metal schedule before the House Ways and Means Committee attracted many desirous of being heard. The bill to liberalize the War Minerals Relief Act has been reported favorably to the House. The McFadden Bill has been endorsed by the California Legislature.

Mines in Mohave County, Ariz., To Cut Wages

On Jan. 12 a meeting of mine operators and merchants of Mohave County, Ariz., was held at Kingman for the purpose of discussing a proposed reduction in the existing wage scale. As a result Oatman mines will make a general reduction of $1 per day on Feb. 15. Other properties will make the same reduction on Feb. 1. Living costs for the miner have been materially decreased in this section, and it was the sense of the meeting that as much publicity be given to this phase as possible.

American Smelting Directors Reply to Karl Eilers

Defend Management of Company, Calling Charges Unjust—Influence of Guggenheims Eulogized

In sending out the notice of the next annual meeting of stockholders to be held April 6, the management of the American Smelting & Refining Co. accompanies the customary call for proxies with a statement on behalf of the directors replying to the charges of mismanagement recently made by Karl Eilers. In appending this statement, Simon Guggenheim, president, says:

"I desire to add (in reference to the criticism made of my stock holdings) that my wife and myself own stock in the company of the par value of over $2,800,000, and bonds to the extent of $300,000—a total of over $3,000,000."

The directors' statement is given in part as follows:

"The attack is made by Mr. Karl Eilers, who is asking proxies for himself and a single associate, which will give them power to elect the entire board of directors. In effect, the request is for a blanket authorization to Mr. Eilers to create an entirely new organization, subject to his sole domination.

"In December last, Mr. Eilers started his campaign for stockholders' votes by bringing a wholly unnecessary and unjustifiable suit against the company for a writ of mandamus to permit him to examine the stock books. . . While the court promptly denied the writ and dismissed the petition, after the matter was heard, the apparent object was accomplished, namely, wide newspaper publicity to the various charges of misconduct or mismanagement which he had injected into his petition. These charges he could not be called upon to prove in the application heard by the court, and they could only be met by a denial and answer on the part of the company setting forth the facts.

"The suggestion or intimation (it is not definitely charged) that the Messrs. Guggenheim, or some of them, have been overpaid by the company or have received large salaries is utterly without foundation. Aside from the president, no member of the Guggenheim family now receives any salary whatever, or has received a salary since January, 1919. The salary received by the president is less by $10,000 than Mr. Eilers enjoyed at the time of his

discharge. The salaries paid in former years to such of the Messrs. Guggenheim as held office in the company were always less than salaries paid at the same time to other officers. Such salaries as they did receive were reduced on their own motion in times of financial stringency. The Messrs. Guggenheim never participated in any of the bonuses paid to all other employees and officers, including Mr. Eilers.

"The falsity of the charge that the company was not permitted to acquire a certain Bolivian tin property examined by it because it was wanted by Guggenheim Brothers, who did acquire it, is shown by the simple fact that no tin or other property ever considered or examined by the company has been acquired by the Guggenheims.

"With reference to the Premier gold mining property: So far from the company having been forced to give up to Guggenheim Brothers one-half of its option on a quarter interest in the property, the company solicited the firm named to take a half of its option off its hands, for the reason that, while it was willing to take a chance on a one-eighth interest, it wanted for financial reasons to limit its investment and its risk to that amount.

"The charges which have to do with the marketing of copper (the word 'gambling' is used) are incorrect, misleading and grossly unjust. . . .

"Any losses in marketing copper were not due to any change of policy, but were the inevitable outcome of the sales agency arrangement under the abnormal and unexpected conditions created by the war. The basic vice of the sales agency as developed by war conditions was the pro-rata feature, under which this company could only sell its copper in the same proportion that the mining companies sold their copper. This feature the mining companies, though repeatedly urged by this company, would never consent to forego. In justice to the mining companies, their right to this provision could not be questioned; in justice to the smelting company, the effect of that provision could only be avoided by the termination of the agency.

"At the start of the agency, the mining companies (Utah, Ray, Chino, Nevada Consolidated, and much later Braden, Kennecott, Cerro de Pasco, and Chile) were all new and small mines, and the amount of copper belonging to this company constituted a large percentage of the total copper in the agency. The mining companies in the agency have since become among the largest producers in the world, and by the time the war broke out, the proportion of the copper in the agency owned by this company (notwithstanding it had also increased) was only about one-fifth of the total amount available for sale. The smelting company was under contract obligation to sell to the best advantage. Obviously, the opinion of the owners of four-fifths of the copper should control the policy of selling, or the smelting company might be the subject of a heavy claim for damage.

"The mining companies, having only the cost of production, wished to withhold from sale on a dull market, and to sell largely when the price met their opinion of the future.

"The smelting company sought, not to make a profit in the buying and selling of copper, but to make its profit out of smelting and refining, and was anxious to sell its copper at the price it paid for it in the ore.

"Gradually, the mining companies came to think that the smelting company's interest in selling its own copper might unfavorably affect the smelting company's attitude in seeking to get the best price.

"On the other hand, the smelting company felt that it was often unable to sell its own copper because the mining companies took a different view of the future of the market, and also often because in dull periods the market would not consume the total amount of copper controlled by the agency.

"As the result of this duality of interest, it became necessary to terminate the agency. As a matter of fact, of their own motion, some of the most important members of the agency themselves took the initiative and withdrew because of a conviction that the conflict of interest above described could not be avoided. The decision to terminate the agency, as to the remaining members, was reached by the entire board (excluding the Guggenheims) after careful and prolonged study.

"The undersigned wish to emphasize that every member of the Guggenheim family studiously avoided influencing the opinion of the remaining directors, refrained from the expression of any opinion, and absented themselves from the meeting at which the question was decided, in order that no charge of a conflict of interest on their part could possibly be made."

Colorado A. I. M. E. Elects

The Colorado Section of the American Institute of Mining and Metallurgical Engineers has elected the following officers for the ensuing year: Richard A. Parker, chairman; F. C. Gilbert, vice-chairman; H. F. Lunt, secretary-treasurer; R. W. Gordon and R. M. Henderson, members of the executive comittee.

Colorado Mining Association Chooses Officers

At the annual joint meeting of the Colorado Metal Mining Association and the Colorado Chapter of the American Mining Congress the association elected officers for the ensuing year as follows: George M. Taylor, president; Jesse F. McDonald, R. M. Henderson and Bulkeley Wells, vice-presidents; A. M. Collins, treasurer, and M. B. Tomblin, secretary. The new officers of the Colorado Chapter of the American Mining Congress are: George E. Collins, governor; J. F. Welborn, Charles A. Chase and George A. Stahl, vice-governors; A. M. Collins, treasurer, and M. B. Tomblin, secretary.

Conditions in Soviet Russia Described From Berlin

Available Evidence Confirms Worst Apprehensions—Lack of Transportation Paralyzing—No Gold for Purchases

From Our Berlin Correspondent

The conditions in Soviet Russia are an enigma even to her immediate neighbors. Most of what transpires from Russia appears in the form of rumors, and is very contradictory. Fugitives report disastrous conditions, which remind of countries on the lowest stage of civilization. Soviet emissaries on the other side are eager to spreadу rosy views. Of Russian newspapers very few find their way abroad, and as they are edited under the strict control of the Bolshevist authorities, their contents are highly flavored. Still they form the only source of reliable news, as verbal reports can rarely be trusted. Besides, it seems unnecessary to dig deeper for news, because what the Bolshevist newspapers are allowed to print is sufficient to confirm the worst apprehensions of the country's interior conditions. They are chaotic, and only a slight pretense of order is maintained. The Bolshevist government has made strong efforts, with surprising energy from the side of the leaders, to effect improvements, but it is easy to recognize that instead of progress the process of dissolution is continuing.

This view is upheld by no less an authority than a number of German radical leaders, who have visited Russia, on the invitation of the Bolshevist government and who have been given an opportunity to look up a party of some hundred German workmen which had volunteered to work in Russia, more than a year ago. These workmen, themselves of decided communistic leanings, who therefore can be said to be unbiased witnesses, have transmitted tales of strongest disappointment and misery. Their enthusiasm and hopefulness have suffered a complete reverse, and they are unanimous in the opinion that the country is utterly and hopelessly ruined.

Manufacturers and dealers all over the world will do well to keep these facts in view, specially as during the last months rumors have been spread of enormous orders for manufactured articles which are said to have been placed in Germany and elsewhere. It is a fact that several emissaries from Russia have visited Continental countries and negotiated with manufacturers for the purchase of machines of all descriptions and finished products, some orders having even been given, and alluring pictures drawn of further orders which were to follow. None of these orders, however, have been executed, because they all suffered shipwreck when it came to the point of settling the mode of payment. Russian buyers, when entering into negotiations, always hold out that payment will be made in gold, but when it comes to making definite arrangements, they have to confess the absolute impos-

sibility of doing so, and they propose to pay by raw products, of which they say they have enormous quantities in store, which only need shipment. Manufacturers in Continental Europe have, however, become very sceptic toward such tales. A number of German manufacturers have even been invited to Russia to inspect stores of raw products, but came back entirely unconvinced. Such stores of merchandise which Russia could spare for furnishing against foreign purchases are widely scattered over the country, with no possibility within sight of shipping them to the frontier.

Transportation Insufficient for Food and Fuel Distribution

Transportation in Russia is even unable to cope with the most stringent requirements of the distribution of food and fuel within the country. Regular goods traffic there is none. The railroads are in a state of decay; fuel and rolling stock are lacking everywhere. Over 80 per cent of existing engines are out of repair, and they have lately been put out of use at the rate of 200 a month. Repairs are carried out in a slipshod manner, as time is pressing. The same applies to cars. Visitors to Russia are struck with the number of cars out of repair or completely wrecked which are clogging the side tracks of the stations. The decay of the roadbeds is continually progressing, and the railroad bridges are in an appalling condition. As no rails are produced, repairs of the metallic bed are made by taking rails from side tracks and even from main lines. The mileage of roadbeds in service is therefore steadily decreasing. Over 2,000 miles of track were thus broken up in 1919 for repair purposes. On account of bad fuel and inferior repair of engines, the latter cannot produce sufficient steam. Even passenger trains travel at a speed of from four to nine miles per hour only.

The Bolshevist government is fully aware that before an improvement of the country's economic conditions can take place, transportation must be improved. For this reason they, a while ago, formed groups of engineering works, mostly engine and car factories, called "Advance Groups," which receive special attention in the matter of supplies of raw material, fuel, and food for the workmen. One of these groups comprises the largest and best developed mills, locomotive and car works, namely, the locomotive factories in Sormorow, Kolomna, and Brjansk, steel mills in Wyksa, and the wagon works in Twer and Moscow.

Efforts to Provide Rolling Stock Bear Little Fruit

This group of works has been given a specific task to perform in the way of construction of rolling stock. Reports on the result of the work of the first half year have lately been made public, which showed that this task, although very modest, has not been nearly completed. The works in Sormorow, for instance, were directed to produce within six months eight new engines, thirty extensive engine repairs, and a specified number of duplicate parts. These works, which employ 8,500 workmen, performed the following work: New engines, none; repairs, fourteen, and roughly 80 per cent of the duplicate parts.

The works in Kolomna, employing 4,100 workmen, were asked to produce six new engines in six months, ten narrow-gage engines, and eighteen repairs. The result was: One new main line engine, five narrow-gage engines, and five repairs. This factory produced in pre-war times thirty engines a month. The Moscow wagon works, employing 2,500 workmen in 1914, produced per half year in peace time 1,500 trucks, reserve parts for another 1,200, 150 new passenger cars, 120 street railway cars, and sixteen motor cars. The works management states the present output of the last half year to have been 120 trucks and no passenger cars. As to snow plows, which in pre-war times were a specialty made in large numbers, the management of these works says that preparations for their manufacture have been completed and "one snow plow is actually in the state of assembling."

Inadequate Fuel, Scarcity of Labor, and Inefficiency Responsible for Results

All managers' reports are unanimous in their opinion that inadequate supplies of fuel, lack of workmen, and the latter's inefficiency are responsible for the poor results. The works in Moscow are furnished only with a poor sort of lignite; pit coal is not obtainable even for these works which have the special attention of the country's rulers. It is significant that it has been impossible to procure for the works mentioned above the requisite number of workmen, which was to be 50,000. The actual number of workmen employed at these works was 18,000. It is said that none of the laborers work full time, the actual working hours having been only 60 per cent of the regulation time. One works manager states that the output per man per working day equals the output of 1½ hours of the pre-war standard.

The same deplorable conditions prevail in water transport. The complete fleet of barges for petroleum traffic on the Volga consists now of only 190 units, which is insignificant, considering that, in pre-war times, from 900 to 1,000 of such vessels were constantly moored in the harbor of Nishni-Novgorod only.

Reports from other manufacturing works show that the diminishing of the number of productive workers in Russia is general. From labor statistics recently published it is seen that in thirty-five government districts 6,090 factories, employing 1,250,000 workmen, were running in 1918. In 1920 only 5,800 of these works, employing 860,000 workmen were in business. The decrease of the number of workmen was from 26 to 42 per cent inside of two years, whereby it is to be considered that the factories have lost nearly 75 per cent of their workmen since 1918. The most strenuous efforts of the Bolshevist government to increase the army of workmen, even the strong compulsion which is exercised, are without effect. Most of the workmen have hired themselves to peasants, or have become administrative officials, of which there exist now one for every six of the population.

It is an open secret that the Bolshevist leaders have long become conscious of the utter failure of their methods. This recognition does not find expression in public, but is proved by certain measures which have been taken lately. One of them is a bill recently passed regulating the conditions under which foreign private capital and enterprise is admitted in the country. The object of this bill is stated to be the improvement of the country's production and it creates facilities in the form of concessions for foreign business men individually or organized in companies. Holders of such concessions shall have the right to export part of their production. They shall receive privileges if they introduce such new methods which will raise the production.

Such concessions will be given for a long period, and the Soviet government gives a guarantee not to interfere with them in any way, either by nationalization or confiscation. The Soviet government is trying to give this matter wide publicity, in order to attract capital and enterprise from all sides, but the opinion of Continental business men is so far highly unfavorable toward the scheme. Foreign capitalists and business men lured into embarking in the scheme are believed to take a heavy risk, as the Soviet government is hardly able to observe its guarantee, even if it were willing to do so.

Southwest Purchasing Agents Meet at Bisbee

An interesting meeting of the purchasing agents of the various copper mines and smelters in the Southwest was held at Bisbee, Ariz., at the Copper Queen Hotel, Jan. 14 and 15. Much valuable information was exchanged in regard to questions pertaining to the purchase of supplies and to the handling of stocks now on hand. Addresses were made by several of the managers. It is probable that a permanent organization will be effected.

Bill Introduced To Tax Copper Produced in Montana

The usual measure which does up with every session of the Montana Legislature showed its head again recently at Helena, when a measure was introduced to place a tax of one cent a pound on copper produced in Montana. The Montana Mining Association anounced that it would join with the companies in fighting the bill. The measure is regarded as having slight chances for enactment.

Taxation Propaganda in Nevada Held Unjust by Mining Men

Mines Paid $17,000 Last Year, According to Governor; Nearer $120,000, Say Operators

There is considerable feeling of injustice among mine operators of the state of Nevada over certain propaganda now being circulated and published throughout the state regarding comparative taxes paid by the mining industry on the one hand and the agricultural, manufacturing and railroad interests on the other. In the *Reno Gazette* of Jan. 10 Governor Boyle, who is head of the State Tax Commission, is credited with stating before a meeting of the stockmen that he believes "the taxes on mines last year amounted to about $17,000, or about 7 per cent. This year they will I believe pay slightly under 7 per cent of the total roll." That the statement is in error and decidedly misleading is shown in a table prepared and published by the *Tonopah Miner* in its issue of Jan. 15 which shows very approximately the amount of taxes paid by the five principal mining companies of the Tonopah district. The companies included are the Tonopah Belmont, Tonopah Extension, West End, Tonopah Mining and MacNamara, and the amount is for 1920 taxes. For these companies taxes on plant and improvements are given as $48,359.72, and bullion tax as $47,854.27, total tax being $96,213.99. It is estimated that, taking into consideration the smaller companies, total taxes in this district alone would be $120,000 per year.

The official figures of the State Tax Commission show a total assessed valuation of mines during 1919 as $15,984,187, or 8.061 per cent of the total assessed valuation in the state. It is estimated by the *Tonopah Miner* that the total taxes paid by the mines of the state will amount to about $535,470, and that of this sum $107,174, went into the state treasury.

This apparent discrimination against the mining industry in Nevada is viewed with concern by mine owners, as it is a well-known fact that costs of operation have, in most districts, offset any increase in value of product; and in many districts reduction in value of product has caused partial or complete suspension of operations until either costs of operation are reduced or value of product increased. It is quite possible that any increase in taxation on the mines of Nevada would result in decreased tax receipts from that source, on account of the shutting down of mines that would ensue.

Dam Breaks Above Pachuca, Damaging Properties

A number of people were drowned and others were injured at Pachuca, Mexico, on Jan. 18, when two dams above the city broke and the water swept through the lower sections of the mining camp.

Homestake Mining Co. Breaks Ground for New Mill

Ground is being broken for the new treatment plant to be erected at Lead, S.D., by the Homestake Mining Co. The new mill will be equipped with heavy duty stamps and ball mills and will have a capacity of 2,000 tons daily. The stamps to be used will be neavier than those now dropping and when installed the company will have a daily milling capacity of about 7,000 tons.

At present operations are nearly at full capacity and the present year's bullion recovery will exceed that for the past two years. The new hoist has been set in position at the Ellison shaft but it will require some time to cut skip pockets at the different levels and make other necessary changes to equip shaft with skips. In all probability the new electric installation will be ready for use this coming summer.

Thomas F. Ward Reported Frozen to Death in Alaska

Thomas F. Ward, president and general manager of the Ward Copper Co., was found frozen to death a few miles from Teller, Alaska, Jan. 12, according to a press dispatch from Nome dated Jan. 19.

According to the report, Mr. Ward left the company's mining camp in the inner Seward Peninsula with an Eskimo man and woman and two dog teams en route to Teller, a reindeer station on Grantley Harbor. After reaching the top of the divide above Teller the three became lost in the darkness. The Eskimos said they decided to go back to a cabin they had seen, but Ward proceeded alone.

The Ward Copper Co., of Teller, has been working a high-grade copper property on Kougrak Mountain, 50 miles inland from Port Clarence Bay, its shipping point. The deposit was discovered in 1904 by Mr. Ward, and the company was organized in 1918.

Mr. Ward left Seattle for Teller on June 2 last. During May he called at the offices of the *Engineering and Mining Journal* and outlined his plans for developing the property. He intended working eight men this winter and to purchase a hoist at Nome. The company has a New York office at 41 Broadway.

A New Use for Airplanes

Further use of airplanes is to be made in the effort to solve the smoke problem at Salt Lake City. Among the theories advanced as to why coal smoke in the Salt Lake City area does not diffuse rapidly was that gases from nearby smelters formed into strata in the upper air, through which the coal smoke did not penetrate readily. Tests of the air above the city by airplane have produced no evidence to support that theory. Airplanes are now to be used to watch the effect of wind on fog and cloud banks in nearby valleys. The Bureau of Mines is co-operating in this work.

Would Triple Tax on Mining in Colorado

Tax Commission's Bill Now Before State Legislature—Support Expected from Farmers

To increase the tax on producing mines three times the present rate and to leave to the assessor and the Tax Commission unrestricted power to fix the valuation, for taxation purposes, of non-producing mines and claims, is the purpose of a bill sponsored by the Colorado Tax Commission and now pending before the legislature.

An effort to have the bill initiated at the November election was defeated, but the Tax Commission will endeavor to secure its passage during the present session, hoping to enlist support of farming districts' representatives.

The present law provides that the valuation of producing mines (a producing mine is defined as one making a gross output of $5,000 or more annually) shall be fixed at one-fourth of the gross output, providing that the net does not exceed that amount, in which event the net becomes the valuation for that year. Non-producing mines and claims are valued and assessed as other property.

Bendigo Amalgamated May Enter Rubber Industry

Arthur Moline, general manager of Bendigo Amalgamated Goldfields, Victoria, Australia, is in New York on business for the company. According to Mr. Moline Bendigo Amalgamated, which is operating a group of thirty-eight mines, has been financially successful during the last two years after a very difficult period in 1917-1919. In round figures the company has paid £44,000 in the first dividend; it has established a reserve fund of £50,000 and in addition has decided to branch out on new lines, for which it possesses £100,000.

Having regard to the uncertain outlook for gold mining and to the fact that industrial conditions at Bendigo are satisfactory, the directors decided to embark on another industry to be run in conjunction with mining, either by a separate company or otherwise, as circumstances might determine. After reviewing the whole position they selected the rubber industry as being the most attractive. Mr. Moline has come to this country to seek information on this matter, to purchase plant and select technical assistance.

Nevada Mine Operators Elect

At the annual meeting of the Nevada Mine Operators Association, held in Reno on Jan. 10, the following officers were elected: President, Frederic Bradshaw; first vice-president, John G. Kirchen; second vice-president, W. P. Larsh; secretary-treasurer, Henry M. Rives; executive committee, Frederic Bradshaw, John G. Kirchen, W. P. Larsh, E. A. Julian, W. H. Blackburn, Roy H. Elliott and Arthur Lawry.

Colorado Power Co. Seeks Relief in Emergency

Seeks To Put Proposed Increased Rates into Effect at Once Pending Commission's Decision

On Dec. 20, 1919, the Colorado Power Co. made application to the Public Utilities Commission for permission to make a twenty per cent increase in rates for power from its transmission lines serving the principal mining districts of the state. The company was ordered by the Commission to submit under direction of its engineers, a full and complete inventory and appraisement of its physical property as of Jan. 1, 1920, located in Colorado. In the meantime no increase was anthorized.

The company was given until May 17, 1920, to complete its appraisement and later the date was extended to November 17. In October, 1920, the power company filed its inventory and appraisement made by its engineers together with a supplementary petition asking for a 40 per cent increase, instead of 20 as in the original petition. Upon verification of the inventory of the power company, by the engineers of the Utility Commission, a hearing will be held and a final determination of rates will be made which in the opinion of the Commission, will render a fair return upon the appraised value of the property. This hearing, it is believed, will be held some time in March of the present year.

Recently the power company made application for an immediate hearing upon the supplementary petition, asking for emergency relief, and that it be permitted to charge and collect the increased rate pending the final hearing. With the application the company tendered a bond, in an amount to be determined by the Commission, conditioned upon the final determination of rates by the Commission, and guaranteeing the refund of excess rates, if any, to the users when the final rate is fixed by the Commission.

The petition stated that according to the inventory and valuation report on file it was shown that the present rates do not yield a just and reasonable rate of interest upon the value of the property and that the increase asked for would not yield a net revenue in excess of 6 per cent on the appraised value of the property.

Notice has been sent to power users by the Commission, advising them of the application, and numerous protests have been filed by power users. It is generally believed that action on the supplementary petition will be deferred until the final hearing in March.

McFadden Bill Endorsed

A resolution endorsing the McFadden Gold Bonus Bill was adopted by the California Legislature on Jan. 20.

Cie. du Boleo, Baja California, produced 1,014,160 lb. copper in December against 771,680 in November.

Colorado Operators To Reduce Wages in Fortnight

Notice of a 50-cent decrease in wages, effective Feb. 15, has been filed with the Colorado Industrial Commission by the principal mining companies of the state. The Colorado wage scale varies in the several districts, the minimum for machine men ranging from $5 to $5.50 per day, and hand men from $4 to $4.50. No trouble is anticipated in any part of the state.

The low price for metals and the distressing conditions affecting the metal mining industry have resulted in the closing down of several of the largest mining enterprises in Colorado during the past sixty days.

Among the mines where production has ceased during the last two months, is the Vanadium Corporation of America, employing 400 men, the Sunnyside Mining & Milling Co., employing 500 men, the Standard Chemical Co., employing 300 men, and the Wellington mine, employing 150 men.

According to the report of the U. S. Geological Survey, the number of producing mines in the state has declined from 852 in 1916 to 288 in 1920.

British Columbia's Mine Output Increased in Value in 1920

In the official review and estimate of British Columbia's mineral production in 1920, just issued by William Sloan, Minister of Mines, is given the following table comparing the output of the various mineral products in 1920 with that of the previous year:

MINERAL PRODUCTION OF BRITISH COLUMBIA FOR TWO YEARS, 1919-20

	Production, 1919		Estimated Production, 1920			
	Quantity	Value	Quantity	Value	Increase	Decrease
Gold, placer, oz.	14,325	$286,500	13,500	$265,000	.....	$21,500
Gold, lode, oz.	152,426	3,150,645	118,176	2,442,698	.....	707,947
Total gold	.....	$3,437,145	.....	$2,707,698	.....	$729,447
Silver, oz.	3,403,119	3,592,673	3,404,926	3,265,324	.....	327,349
Copper, lb.	42,459,339	7,939,896	42,773,660	7,485,390	.....	454,506
Lead, lb.	29,475,968	1,526,855	21,545,047	1,540,471	$13,616	.....
Zinc, lb.	56,737,651	3,540,429	76,765,268	5,143,272	1,602,843	.....
Total metalliferous	.....	$20,036,998	.....	$20,142,155	$105,157	.....
Coal, tons, 2,240 lb.	2,267,541	$11,337,705	2,712,228	$13,561,140	$2,223,435	.....
Coke, tons, 2,240 lb.	91,138	637,966	68,190	477,330	.....	$160,636
Total collieries	.....	$11,975,671	.....	$14,038,470	$2,062,799	.....
Miscellaneous and building material	.....	$1,283,644	.....	$1,400,000	116,356	.....
Total production	.....	$33,296,313	.....	$35,580,625	$2,284,312	.....

Cananea Consolidated Down

The shutdown of the Cananea Consolidated Copper Co.'s plant at Cananea, Sonora, was completed Jan. 17. Pumping is being done at the Capote mine. This shaft drains several of the adjacent mines. Pumps at the Cananea-Duluth mine have been pulled and the mine allowed to fill. This is a hard rock mine and no damage can result. The power house is being operated and will supply the town with lights and power for the Capote pumps. The city water plant at Oja de Agua is being run. Several excursion trains have been run from Cananea to Guaymas via Nogales to accommodate the people who are leaving the town.

Jones & Laughlin Get Breitung Iron Ore Property

Hematite Mine and Adjacent Holdings at Negaunee, Mich., Acquired by Steel Company

The sale of a portion of the Breitung iron mining property at Negaunee, Mich., to the Jones & Laughlin company has been consummated. The consideration was a large one and by the provisions of the contract there is to be a royalty paid the Breitung interests on all the ore mined in future. The principal ore producer is the Breitung Hematite mine, and stock interests in the adjacent Lucky Star, Bunker Hill and Arctic properties were also secured. These properties have prospective value in bessemer-grade ores. The Breitung interests retain the Mary Charlotte mine, located near the Breitung Hematite, and still hold properties at Humboldt, on the Marquette Range, as well as mines in Wisconsin and Minnesota.

Western Pacific R.R. Opposing Freight Cut to Wabuska

The attorneys for the Mason Valley Mines Co. have received notice that the Western Pacific R.R. Co. will file exceptions to the report of the examiner of the Interstate Commerce Commission, which recommends a reduction of rates on ore from Plumas County, Cal., points to Wabuska, Nev., where the Mason Valley smelter is located. The Southern Pacific has indicated its desire and readiness to put into effect at once the rate recommended by the examiner. The attorneys for the Mason Valley Co. have also filed exceptions with the commission to that part of the report having reference to the division of the rate between the Western Pacific and the Indian Valley railroad, the latter being owned by the Engels Copper Co. and running from Paxton on the Western Pacific to Engelmine, a distance of 26 miles.

Calumet & Hecla produced 7,517,712 lb. copper in December (7,326,763 in November). Production by subsidiaries was: Ahmeek, 1,914,500; Allouez, nothing; C. & H., 4,754,000; Centennial, nothing; Isle Royale, 845,800; La Salle and Osceola, nothing; Superior, 3,412; Tamarack and White Pine, nothing.

Effort To Stop Steel Company From Moving Hibbing Fails

The application of H. P. Reed and others of Hibbing, Minn., for a permanent injunction to restrain the Village of Hibbing, the Oliver Iron Mining Co. and the Mesaba Ry. Co. from removing a portion of that village to South Hibbing was recently denied by Judge Freeman of the district court of St. Louis County, Minn. The suit grew out of an attempt of the Oliver Iron Mining Co., with permission of the village officials and others, to buy all the property within certain limits of the village, as the company owned the mineral rights under a part of the original village of Hibbing.

The application alleged that there was a conspiracy among the village officials and the mining and railway companies to acquire the entire retail and shopping district of Hibbing without regard to interests of the community as a whole. Judge Freeman, however, completely vindicated the defendants.

Mexican Mine Fraud Alleged

Charges that parties in authority in Mexico are interested in fraudulent legal proceedings involving title to the Naica mining property in that country, were made by Frank L. Polk, former Under-Secretary of State, in a memorandum filed with the State Department on Jan. 14 in his capacity as counsel for American claimants to the property.

Informal inquiry as to the status of this case was addressed to the Mexican Government by the State Department this week through Charge Summerlin.

The memorandum asserts that "principal backers" of the Mexican claimant to whom the property has been awarded under a decision of the Mexican Supreme Court, the validity of which is attacked by the American stockholders, are "Roque Estrada, brother of the present Minister of War, the late General Hill, until a few weeks ago Minister of War, and many others."

A. I. M. E. To Organize Section in Northern Minnesota

Organization of a Northern Minnesota Section of the A. I. M. E. has been proposed. A committee composed of W. G. Swart, W. R. Van Slyke, Ralph N. Marble, Carl Zapffe, William Van Evera and Earl E. Hunner has recommended a set of by-laws. There will be three districts of the association, one in Duluth, and one each on the Mesabi and Cuyuna ranges and all members of the Institute are eligible to membership. The officers will be a chairman, two vice-chairmen and secretary-treasurer, these officers to compose the executive committee. It is proposed that the chairman and two vice-chairmen be elected from each of the three main districts and that the expenses of the section, beyond the amounts which may be appropriated by the Institute, shall be met by voluntary subscription, but that no member shall be asked for any subscription exceeding $5 in any one year.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Repeal of Pittman Silver Act Held Unlikely

Effort in This Direction Has Made Scant Headway—Proposal Never Before Committee

Although there is some talk of repealing the Pittman Act providing for the purchase of silver at $1 an ounce to replace the silver dollars broken up during the war, it is very unlikely that any effort to set aside this law will be successful. To start with, the Government is bound morally to sustain this legislation, since the law never could have been placed on the statute books without promise of repurchase at the figure agreed upon at the time. During the negotiations which preceded the enactment of the Pittman Act, some of the senators from silver mining states were of the opinion that the silver reserve could be sold at a higher price than $1 an ounce.

One session of Congress cannot bind another. To a lesser extent one administration cannot bind another, but when a moral obligation is entered into, especially when it is not a partisan obligation, there are few cases in which succeeding Congresses and succeeding administrations have not carried out such an understanding in good faith. The effort thus far to secure the repeal of the Pittman Act has made no headway. The matter was considered by a sub-committee of the Committee on Banking and Currency, but the proposal was dropped and never has come before the full committee.

Metal Men Flock to Washington To Testify at Tariff Hearings Before Ways and Means Committee

House To Get New Bill in April—Revision a Delicate Matter in Time of Business Depression—A. S. & R. Wants Tariff on Tin "for Revenue"

A new tariff bill is to be written for presentation at the forthcoming extra session of Congress. Chairman Fordney of the Ways and Means Committee promises to lay the completed bill before the House of Representatives on or before April 10. Preparatory to writing the bill the committee is conducting public hearings. A very large number of witnesses are being heard.

It is very evident from the testimony thus far presented that one of the basic factors in considering a tariff must be disregarded almost entirely. That is the differences in wage scales and production costs in the United States as compared with those in competing foreign countries. There are so many uncertainties in the situation that it is believed the new rates of duties will be arrived at more or less arbitrarily. This likely will be accompanied by an understanding that the schedules will be subject to frequent amendment as conditions change.

The Republican members of the Ways and Means Committee are keenly alive to the economic and political consequences of tariff revision at a time of business depression. A change in tariff policy is likely to be blamed for effects which may spring from a hundred sources. For that reason unusual care will be exercised to prevent too great a degree of tariff protection. There is no question that the Underwood tariff act will be revised upward to a material extent, but it can be stated with a fair degree of assurance that the expectations of many of those requesting new rates of duty will not be realized.

The Ways and Means Committee has taken a large amount of testimony in connection with the metals schedule. Representatives of the domestic zinc industry asked a duty of 2c. per lb. on ores containing zinc content in excess of 25 per cent. For the ores containing from 10 to 25 per cent of zinc a duty of 1½c. per lb. is asked. One of the witnesses was Otto Ruhl, of Joplin, Mo. He testified that the essential factor in the whole situation is the difference in the cost of production in the United States and in Mexico. The zinc producers found it impracticable to compile the costs of the 212 concerns operating in the Missouri-Oklahoma-Kansas district, but did take the costs of eleven representative plants, from which they calculate the basic cost of each ton of concentrates to be between $45 and $50 per ton. The

cost to the foreign producer is calculated as being about $24 less.

William Loeb, Jr., of the American Smelting & Refining Co., appeared before the committee in support of a duty of 10c. per lb. on tin in bars, blocks, pigs or other metallic form and a duty of 6c. per lb. on tin in ores. He pointed out that no duty is needed on tin and ores for protection purposes, due to the absence of tin deposits in the United States which can be worked commercially. He suggested the duty, however, as a source of revenue. The rates of duty which he proposed will have a revenue yield of $12,000,000 per annum, he estimated. This protection, Mr. Loeb testified, will enable American tin producers to compete on equal terms for tin ores from Bolivia, the one source of supply now available and free. He said it would enable American interests to trade a larger Bolivian output and a consequent increased production of domestic refined tin. He also called attention to the fact it would aid in an effort to enter the Chinese field with the view of opening another source of supply of raw material.

E. H. Wolff, president of the American Zinc Institute, called the attention of the committee to the fact that the zinc industry in the United States is experiencing the worst period of depression in its history. A continuation of the present conditions, he said, would work irreparable injury to the industry. He said that the European smelters have recovered from the effects of the war and that 100,000 tons of slab and sheet zinc are on hand in Europe. The present American cost of production, he declared, is higher than the market price of the metal.

The American Brass and Copper Statistical Exchange submitted a list of proposed rates on brass and copper products. The duties ranged from 1½c. per lb. on copper wire to 14½c. on brass, angles and channels. The argument in favor of this duty was made by Edward H. Binns, of New York.

A duty of 50c. per lb. on quicksilver was suggested by H. P. Baker, general manager of the New Idria Quicksilver Co., which produces one third of the American output. This duty would amount to $38 a flask on imported mercury. He pointed out that last year over 16,000 flasks of quicksilver were imported. Of these 5,700 came from Italy, where the cost of production is much lower than it is in the United States.

Herbert W. Smith, chief of the tariff division of the American Mining Congress, told the committee that there are sixteen mineral industries which are requesting protection by tariff. Nine of these minerals are now on the free list.

Clinton H. Crane, president of the St. Joseph Lead Co., testified that the costs to his company for placing lead on the New York market, including depreciation, depletion and 6 per cent on invested capital, aggregated $6.80 per 100 lb. He recommended a specific duty on lead in ore, in dross, in bullion, pigs, bars and matte, as well as the lead in copper regulus, in sheets and pipes and that imported as old and scrap. He said he would leave it to the committee to determine the proper rate of duty, but declared that the present ad valorem duty is most unsatisfactory in its method of working. Jerome J. Day, representing the lead producers in the Cœur D'Alene district, asked for a specific duty on lead of not less than 2c. per lb. A similar rate was asked by Ernest Bamberger, representing the lead ore producers of Utah.

Clifton Taylor, of the Molybdenum Corporation of America, requested a duty of 50c. per lb. on molybdenum and $1 a pound on ferromolybdenum. Arthur V. Davis, of the Aluminum Co. of America, requested the restoration of the Payne-Aldrich rate of 7c. per lb. on aluminum.

Amendment to Zinc Tariff Bill Introduced

An amendment to the pending zinc tariff bill has been introduced by Senator Spencer of Missouri. His amendment provides a duty of one and one-half cents per pound on the metallic zinc content of ore containing more than 10 per cent and less than 25 per cent of zinc. Upon all ores and drosses containing more than 25 per cent of zinc, the metallic zinc content is to be dutiable at two cents per pound. Ore containing less than 10 per cent of zinc is to be imported free of duty. Zinc in blocks, pigs, slabs and old is to be dutiable at two and three-fourths cents per pound. Zinc oxide is to pay two and three-fourths cents per pound, while zinc in sheets, plates, strips or in manufactured form and zinc dust are to be dutiable at three and three-fourths cents per pound.

Report on Mining Law Revision Expected Soon

H. Foster Bain, the acting director of the Bureau of Mines, states that a final report will be forthcoming in the very near future in the matter of the revision of the mining laws. A committee headed by W. R. Ingalls has gone into the matter exhaustively and is expected to submit a final report shortly.

Assistant Director of Bureau On Western Trip

E. A. Holbrook, assistant director of the Bureau of Mines, is making an inspection trip which will include several of the Western experiment stations. He attended the dedication of the new Reno station on Jan. 21. He will be present at a meeting of Western experiment station superintendents with representatives of co-operating colleges. In addition, he will make some first-hand observations as to the operating phases of the Mineral Leasing Act regulations.

Bill To Liberalize Relief Act Reported Favorably to House

Consideration Unlikely at This Session —Secretary Payne Opposed

The bill intended to liberalize the War Minerals Relief Act, which passed the Senate May 31, 1920, has been reported favorably to the House of Representatives by its Committee on Mines and Mining. The bill was reported in exactly the same language as contained in the Senate bill. An unsuccessful effort was made to pass the bill by unanimous consent. To secure its consideration at this session of Congress will require a special rule. It is very doubtful if such a rule can be secured. In all probability the legislation will die with the session on March 4.

Any amplification of the War Minerals Relief Act is opposed by the Secretary of the Interior. If there is any additional legislation at all it is his opinion that it should be confined to the questions of law surrounding the "request or demand" and the "purchase price" features of the existing act. The opinion of Secretary Payne in this connection was given in response to a specific request on the part of Representative Rhodes, the chairman of the Committee on Mines and Mining of the House. H. R. 13,091 is now on the House calendar. Secretary Payne opposes H. R. 13,091 on the ground that it is too broad and would permit of a re-examination of all claims by the Court of Claims. It would not be wise, he says, or necessary to pass this bill.

Awards to the amount of $6,946.90 were recommended by the War Minerals Relief Commission during the week ended Jan. 15. The awards recommended were: Orren Osborne, tungsten, $887, 21 per cent; Parsons & Carter, chrome, $430.87, 63 per cent; Kerley, Van Winkle & Heinick, chrome, $2,249.22, 52 per cent; Kerley, Van Winkle & Heinick, chrome, $745.29, 29 cent cent; Rose, Kerley, Van Winkle & Heinick, chrome, $2,311.85, 39 per cent. In addition, the claim of Virgil V. Anderson, which had been disallowed, was reconsidered and an award of $322.67 recommended. That amount was 85 per cent of the amount claimed.

During the week ended Jan. 8: A. Hyde, chrome, $2,910.65, 58 per cent; G. J. and W. D. Fuller, manganese, $831.95, 47 per cent; Talbott, Byrne & Wayne, chrome, $234.25, 29 per cent; W. J. Overbeck, manganese, $1,036.69, 55 per cent. The claim of Gustave T. Pinson was reviewed and an additional $415.85 was allowed him.

The Senate has agreed to a resolution introduced by Senator Robinson, of Arkansas, calling upon the War Minerals Relief Commission to furnish the following information: A complete list of all claims filed or presented under the War Minerals Relief Act; a list of all claims allowed; a list of all claims disallowed, and a list of all the legal opinions which have been rendered in connection with the act.

NEWS BY MINING DISTRICTS

Special London Letter

Foreign Office Vetoes Spitsbergen Scheme—Barnatos Reported Seeking Interest in National Mining Corporation

BY W. A. DOMAN

London, Jan. 11—Some time ago I reported that negotiations were in progress for the transfer of the control of the Northern Exploration Syndicate, which owns iron, coal and marble properties in Spitsbergen, to a foreign corporation. Mr. Salisbury-Jones, who was the prime mover in this business, had arranged to obtain an option on shares to be pooled, the idea being that persons pooling would net something like £2 per share on the scheme arriving at fruition. It was believed at the time, though of course it did not appear, that Herr Hugo Stinnes was at the back of the purchasing company. Considerable disappointment has now been caused by the refusal of the British Foreign Office to allow the deal to be consummated, the reason given being that it would be inimical to the interests of Great Britain. The delay in vetoing the scheme has caused a good deal of comment, and in some quarters in the city it is held that the Foreign Office has "crabbed" a fine deal. Presumably the British government is aware of the actual facts of the position, for it seldom interferes in matters of this kind. From the £3 or £4 which the shares of the Northern Exploration Syndicate reached several months ago they have fallen to about 5s. nominal. The decline is not wholly the result of government action; it began last year when experts reported adversely concerning the existence and quality of the iron ore, of which such a splash was made at the flotation of the company.

An interesting rumor is current concerning the National Mining Corporation. For some time it has been under a cloud, mainly, it would appear, owing to the fact that some of the properties in which it has invested capital are still in the development stage. It possesses so powerful a backing that many speculators bought the shares heavily in the belief that they would enjoy a substantial rise. This did not materialize, as all mining and kindred shares have been out of favor, and there was talk of wiping out the liability of 10s. a share. Now it is said that the firm of Barnato is endeavoring to secure a big holding in the National Mining Corporation. The companies that formed it took up £1,000,000 and Barnatos were not included. This latter is the richest mining firm in the city, and is always credited with maintaining a very substantial liquid position, ready for any contingency or opportunity. Its activities embrace the Johannesburg Consolidated Investment Co., various subsidiary gold mining companies, the De Beers, the Premier, Jagersfontein Diamond Mines and the Diamond Syndicate, to say nothing of industrial ventures. One of the mines under its control, the New State Areas, in the Far Eastern Rand, has just struck the reef in a shaft at a depth of 3,578 ft. The assay was disappointing, both in regard to width and value, the former being only 6 in. and the latter 1 dwt. This does not repeat the concern's former experience with Van Ryn Deep and Government Gold Mining Areas. The shaft, however, touches only a pin point so far as the size of the property is concerned.

Some of the Nigerian tin-mining companies have certainly fallen upon evil days. The Northern Nigeria (Bauchi) company was at one time regarded as one of the best concerns operating on the plateau. Owing to financial reasons it is in such low water that the possibility of reconstruction with a 5s. liability has reduced both the preference and ordinary shares to a merely nominal value. Another company, the Jantar, is in need of funds, and the shares are suffering in consequence.

CANADA

British Columbia

Premier May Build Aerial Tramway—Bunker Hill Action Cheers Kootenay Shippers

Squamash—Preparations are being made by the Tatlayoco Lake Gold Mines, Ltd., to install a 100-ton mill. The ore contains gold, silver, antimony and arsenic.

Vancouver—The manager of the Hedley Gold Mines, Ltd., stated recently that if economic conditions permit the Nickel Plate mine will be reopened within three months.

Stewart—It is reported to be a possibility that an 11-mile aerial tramway will be constructed from the Premier mine, Salmon River, to tidewater to take care of the transportation problem facing the management of the Premier Gold Mining Co. To keep the road open is said to be proving too costly and constant a task. The drop between No. 2 tunnel, where shipments originate, and Stewart is about 1,400 ft., of which 900 ft. occurs in the first three miles.

Alice Arm—The Dolly Varden mine has closed down temporarily owing to a heavy snowfall which shut down the railroad.

Sandon—Milling was stopped at Silversmith mill about Jan. 15 owing to water shortage and market outlook. About forty men will be kept on development work during the winter. Over 400 tons of silver-lead concentrates are on hand and a much larger quantity of zinc concentrates.

New Denver—Milling operations have been suspended at the Rosebery-Surprise mill which ran last season entirely on the product of the Bosun mine, between New Denver and Silverton. The Surprise mine, at Sandon, has continued inactive since the start of labor troubles in the Slocan last spring, as have also Canadian and Ivanhoe groups.

Kaslo—The only mining activity of any consequence being carried on this winter along the South Fork of Kaslo Creek is at Silver Bell and Silver Bear groups. A resumption of operations at Revenue group, also on the South Fork, is looked for in the spring. Affairs of Gibson Mining Co., Ltd., which have been in a chaotic condition following protracted litigation, have been placed in the hands of a liquidator, James H. Doyle, sheriff of South Kootenay.

Ainsworth—Mining operations at the Florence mine, Princess Creek, are very largely in the hands of lessees at the present time, five different sets being engaged.

Nelson—Dismay of silver-lead producers of West Kootenay at the condition of affairs brought about by the virtual refusal of the Consolidated smelter at Trail to handle any more custom ore for the time being, and upward revision of freight rates on ore shipped from this side to smelters in the United States, is tempered somewhat by announcement that Bunker Hill & Sullivan Mining & Concentrating Co. has at last secured a through freight rate on ores and concentrate from British Columbia points to the Bunker Hill smelter at Kellogg, Idaho. Rates from Slocan points are given as $6.90 per ton on ore running up to $50; $8.10 per ton on ore valued at between $50 and $75; $10 per ton on ore valued at between $75 and $100. The Bunker Hill management is prepared to pay cash for such product as proves acceptable, instead of effecting a temporary settlement by means of warehouse receipts, the method now followed by the Consolidated smelter at Trail.

Ontario

Drilling Near Timmins Stopped—Davidson Consolidated To Be Sold

Porcupine—The English interests which were diamond drilling on the sand plains southwest of Timmins have stopped for the winter. Several thousand feet of drilling was done. The claims on which this work is being done are in a direct line with the McIntyre vein systems, but are covered with about 100 ft. of sand overburden.

At a meeting of the shareholders of the Davidson Consolidated on Jan. 17, it was decided to sell the property to an English syndicate. The latter has purchased 1,000,000 shares of treasury stock at 75c. per share, and will buy the outstanding stock held by shareholders

at $1.18 per share. The mine will be reopened March 1 with ample funds to carry on work and erect a 500-ton mill.

Toronto—Mining men are keenly interested in a proposed change in the mining regulations, which would permit the time spent in road cutting and trail-making to render their properties accessible to count on their assessment duties. It is pointed out that during the last two years the government has given very little assistance in road making, which has mainly had to be done by the mining men at the season of the year when they should be working on their claims. A strong case is made out for the change in connection with the building of the Boston-Creek-Skead road, built to reduce the haul to the railway by 12 miles. The work was done entirely by prospectors and miners on account of the delay by the government in providing badly-needed road facilities.

Cobalt—The McKinley Darragh has been closed. The company has a considerable portion of its surplus tied up in silver bullion, which it has not sold.

It is understood that the recent developments on the Ontario-Kirkland have shown two years' ore supply for a 60-ton mill. It is expected that construction work will be started on the mill in the spring.

MEXICO

Durango

Decreased Export Tax on Silver Encouraging—Wages and Prices Coming Down—No Further Shutdown

Durango—The Federal government has lowered the export taxes on metals materially, and as a consequence the mines that were holding on have continued operations. Under the new decree the tax will be 1 per cent when silver is over 60c. and not exceeding 70c. per ounce in New York, and when less than 60c. in New York there is to be no tax whatever. When silver is between 70 and 80c. the tax will be 1½ per cent; between 80 and 90c., 2 per cent; over 90c. and under $1, 7 per cent; over $1 and under $1.10, 8 per cent; over $1.10 and under $1.20, 9 per cent; over $1.20 and under $1.30, 10 per cent, and so on up to 12 per cent when silver is above $1.40.

The workmen are also realizing the difficulty of the present situation in the mining field, and seem willing to accept a reduction in wages. This reduction is accepted by labor more particularly because at this season of the year in Mexico and for the next three or four months there is no other field of activity for the common laborer, as the crops have been gathered.

The effect of the general reduction of prices is now just beginning to be felt in this district. Lumber and some other construction materials have dropped, but not to the extent to which similar materials are reported to have fallen in the United States. Dynamite, caps and fuse have not yet reacted. The small miner is waiting and the companies are running along from hand to mouth on all classes of supplies.

According to information at hand there have been no further shutdowns during the last two weeks, but, at the same time, there is no report of any of those closed at the end of last year opening up. Notices have been sent out to some of their clients by the Minerales y Metales Co. that they will open their smelter at Torreon some time in February, but a fixed date has not been set. This notice, with the continuance of operations at Asarco, Dgo., of the American Smelters plant, has given encouragement. Unless something more than is at present apparent develops the mines now working will keep on, and within a few months those that have closed down will resume.

The temporary panic in Mexico City and the short run on the banks there had practically no effect here whatever. There are no organized banks in Durango, and as the banking business is distributed among the stronger commercial houses of the city there was no occasion for alarm at this capital. Each mining company of importance has its own financial agent in the capital, and as all the important commercial houses do their own banking business the funds available and usable are so widely distributed that no outside panic can make more than the merest ripple on the surface of general business at this center.

To sum up, the present situation is one of hope. Most mining men do not expect any great change in metal prices to occur soon, and so have gone to work to do the best they can as things are.

Coahuila

Minerales y Metales To Reopen Torreon Smelter

Torreon—Practically all of the mines in this district which are resuming operations are doing so with a 30 per cent reduction of wages to miners and a general curtailment of overhead expenses. Managers and office men are accepting a reduction in salaries. Preparations are being made to blow in all of the furnaces of the Torreon smelter on or about the first of the month and the company will shortly resume the purchase of ores.

Saltillo—La Esperanza Mining Co. at the last meeting of stockholders resolved to issue 50,000 new assessable shares, the maximum assessment to be six cents per month each. The present members of the company will be given 45 days in which to subscribe for this new issue and in the event it is not all subscribed for by them the remainder will be placed on the market to the general public.

Sonora

Cananea—A reduction of 20 per cent has been made in the rate of pay at the property of the Calumet & Sonora Mining Co. This was effective Jan. 15.

CALIFORNIA

Pacific Coast Borax Co. Shuts Death Valley Plant Down

Eureka—Positive assurance that a large electro-smelting plant is to be established shortly at Trinidad, together with large hydro-electric plants at Ishi Pishi Falls and below Orleans, has been received from the Electric Metals Co. of San Francisco. With the water power it is proposed to generate electricity, which is primarily for the purpose of transmission to the Port of Trinidad, there to be used in the electro-metallurgical industry. The sale of power, should the demand arise, is also a possibility, but it is not the intention of the company to engage in the commercial power business.

Amador City—The mill at the Bunker Hill mine, near Amador City, resumed operating this month, after nearly a year's cessation of work.

Greenwood—The Grit company on Jan. 14 settled with W. A. Buckman, the owner of the mine, for the first payment becoming due in April. The next payment of $7,500 will fall due Nov. 1.

Angels Camp—Work is going on actively at the Toll Gate mine, formerly the Port Arthur. The three-stamp mill is ready for operation. New buildings have been completed.

Death Valley—The mines and calcining plant of the Pacific Coast Borax Co. in Death Valley have been closed down. Increased freight rates to eastern points is given as the cause. Over 150 men were laid off. The company's product was marketed under the famous "Twenty-mule Team" trademark.

NEVADA

New Company To Take Over Clifford Mine Near Tonopah

Arrowhead—The Arrowhead Mining Co. reports that the face of the west drift on the third level, which is 267 ft. below the collar on the incline, shows 2 ft. of high-grade ore and 6 ft. of milling ore. The shaft is now down 50 ft. below water level and, after a little more development is done on the third level, it is planned to sink to the fourth level and drift.

Clifford.—Preliminary negotiations toward selling the Clifford mine to New York interests have been completed. This mine is situated at Clifford, about 40 miles east of Tonopah, and has been worked intermittently in a small way since 1905. Total production is about half a million dollars in gold, all of which was in high-grade ore. There is said to be much ore of milling grade in sight, besides good chances of high-grade as the deepest workings are only 200 ft. down. The company to be organized will be known as the Clifford Silver Mines Corporation, and it is expected that a leasing system will be adopted until plans for development and mill construction are completed.

Pioche—Ore shipments from the Pioche district from Jan. 6 to Jan. 12

were above the average, owing to increased tonnage from the Prince and the Virginia Louise. Shippers were: Prince Cons., 1,350 tons; Virginia Louise, 850; Bristol, 315; Black Metals, 105 and Battles-Smith Bristol Lease, 40.

There are over forty men on the payroll of the Prince Consolidated and no wage cut is anticipated.

Tonopah—In the Tonopah Extension the McCane shaft has reached a depth corresponding to the 1440 level of the Victor. Crosscutting will soon be started from the 1880 level of the Victor. This is the deepest working in the Tonopah District. Development totaled 271 ft. for the last week.

The West End reports no new developments of importance from either the West End or Ohio shaft. A connection has been made from the 800 level in Tonopah "76" territory to the Monarch Pittsburg 600 level. This will improve ventilation in both mines.

Divide—The Tonopah Divide reports no change in the southeast drifts on the 800 and 1,000 levels. Daily shipments of 50 tons of ore of a grade said to exceed $30 per ton are being made to the Belmont mill in Tonopah.

In the Rosetta, in the southeast portion of the district, encouraging values have been found on the 300 level. Two drifts are being driven in opposite directions from the main crosscut and spots containing high grade values have been encountered.

Ely—The payroll of Nevada Consolidated for December, 1920, was approximately $265,000. Of this $95,000 was paid out at the mines and $170,000 at mill and smelter. This is about 20 per cent below the average payroll six months ago. At present there is about 2,600 tons of blister copper stocked at the smelter.

Consolidated Coppermines has suspended operations at Kimberley and cut the force to a care-taking basis. However, only a small crew has been working and the suspension affected only fifty men working at Pilot Knob.

Local men have taken over the old Wildwest mine in the Spruce mountain district. About 90,000 tons of ore are reported to be blocked out. There is a mill on the property.

ARIZONA

C. & A. Completes Diamond Drill Work at Bisbee

Bisbee—The Boras Leasing Co. has finished sinking its shaft from the 600 to the 700 level. Sinking was started Dec. 27 and completed Jan. 14. The station is now being cut and after completion the 700 level will be extended toward the ore-bearing ground on the 600 level.

The Night Hawk Leasing Co. is extending a drift on its 650 level to connect with the Boras company's workings.

N. Beatrand has returned to Bisbee after completing several diamond drill holes at the Calumet & Arizona Mining Co.'s Eighty-five mine at Lordsburg, N. M. The C. & A. company has for the present completed its diamond drilling campaign at Bisbee, which has extended over a period of five years and comprises 50,000 ft. of hole drilled. Mr. Beatrand has done most of this work under contract.

Johnson—The Keystone Copper Co. started work Jan. 10 after a sixty-day shutdown. All work will be confined to development and erection of the mill.

Dragoon—Los Angeles and New York mining men have taken an option on the Centurion. The first payment has been made and it is reported that a mill will be erected at once.

The Texas-Arizona has cut the ore on the 3rd level and shipments of lead-silver ore will be resumed.

Stockton Hill.—The C.O.D. mill is rapidly near completion. Practically all machinery is on the ground, and construction is well on the way. Present outlook is that treatment will start within sixty days. The old dumps of ore and tailings, comprising about 50,000 tons, will be run through first.

Chloride — The Dardanelles has shipped a 40-ton car from its new 160-ft. level. Development is progressing on this level, and conditions are checking out with showings on the upper level. A raise being driven to the 100 level has opened up ore averaging $40 in gold and silver.

The retimbering and unwatering of the Pay Roll shaft has been completed. Sinking has been resumed. Superintendent Blackwell reports good progress.

Hayden—The Continental Commission Co. is reported to have sold the 79 Mine near Hayden Junction to Hugh H. Hanger, of Washington, D. C., and associates.

NEW MEXICO

Santa Fe Makes Special Rates for Low-Grade Chino Ores

Santa Rita—The Santa Fe railroad has notified the State Corporation Commission that a rate of 12½c. per ton will be made on low-grade ores between Santa Rita and Hurley, N. M. This is in the interest of the Chino Copper Co. and affects ores hauled from mine to concentrator, a distance of 8 miles.

COLORADO

Portland Gold Passes Dividend After Long Unbroken Record

Cripple Creek—The Portland Gold Mining Co. passed its last quarterly dividend after an unbroken record for many years. The reason is the unwillingness of the company to deplete its resources and ore reserves under operating conditions which do not permit it to make a profit.

Telluride—Shipments from Telluride during December were: Smuggler-Union, 59 cars; Tomboy, 48; Liberty Bell, 19; total 126.

Ophir Loop—The Belmont-Wagner Mining Co. has resumed development in the 7 by 7-ft. mill-level tunnel, which will be advanced to the vein to serve for haulage purposes in place of the aërial tram heretofore employed. The work is under John M. Wagner, former manager.

UTAH

Tintic Standard Again Heaviest Shipper from Tintic District

Eureka—Ore shipments from the Tintic district for the week ended Jan. 15 amounted to 184 cars. Shippers were: Tintic Standard, 77 cars; Chief Consolidated, 31; Dragon Consolidated, 16; Iron King, 15; Eagle & Blue Bell, 15; Victoria, 8; Iron Blossom, 7; Swansea, 3; Grand Central, 3; Bullion Beck, 2; Colorado, 2; Eureka Mines, 1; Sunbeam, 1; Centennial-Eureka, 1; Eureka Hill, 1; Ridge & Valley, 1; total 184 cars. The Tintic Standard is again the heaviest shipper. In addition to direct shipping ore, this company is now sending a large tonnage to its new mill.

Park City—Shipments for the week ended Jan. 15 amounted to 1,911 tons as compared with 1,763 tons the week preceding. Shippers were the Judge allied mines, including the Judge, Daly West, Daly, and Park-Utah—806 tons; Ontario, 600; and Silver King Coalition, 500.

MONTANA

Anaconda Shuts Ferromanganese Plant Down—Boston & Montana Mill Under Cover

Butte — Anaconda has suspended operations at its ferromanganese plant at Great Falls, Mont., following its closing down of the Emma mine of the Butte Copper & Zinc Co.

Mining operations have been suspended at the Moulton mine, pending an improvement in the spelter market. This property is owned by the Moulton company, controlled by the W. A. Clark interests.

The Plutus shaft of the Butte & Plutus has been unwatered and will be sunk from a depth of 360 ft. to the 400-ft. where a crosscut will be driven to the Norwich vein, estimated to be about 325 ft. away.

Silver mining in remote districts of Montana, which practically ceased when increased freight rates went into effect, gives promise now of reviving in consequence of all Montana railroads taking action voluntarily to reduce their tariffs on low-grade ores so as to permit small operators and independent producers to make a profit. The reduction in schedules is as high as 20 per cent on intrastate shipments.

Elkhorn District—The Boston & Montana concentrator at the Elkhorn mine is under cover, and the installation of twenty carloads of machinery will begin shortly. Milling equipment consists of gyratory crushers, Hardinge conical ball mills, Wilfley tables and Janney flotation machines. The first section of the mill with a capacity of 50 tons daily will be completed within 60 days, or possibly a month longer. The Hardinge company, of New York, is under contract to equip the plant.

MICHIGAN

The Copper Country

Franklin Shuts Down—Wolverine Plans Exploration Campaign

Houghton—The Seneca has cut the plat at the 6th level and drifting has started in both directions on the lode. All the drifts in the upper levels are in good copper-bearing ground. The 5th level south drift is approaching the Ahmeek boundary. At the Gratiot branch of this property the two raises being put in from the 13th level to the 11th level are giving satisfactory indications of the ground being developed.

The Mayflower Old Colony Copper Co. is continuing its development program. The west crosscut from the south drift is in about 30 ft. but as yet has not encountered the Mayflower lode.

The Osceola Cons. Mining Co. has installed concrete foundations for electric pumps at its North Kearsarge property. This mine, which is not operating, will be kept unwatered with bailers and air-operated pumps until delivery of electric pumps, a matter of sixty or ninety days.

The Quincy Mining Co. has shut down its three-head stamp mill and is treating its total product at the five-head plant. This is a matter of economy.

The management of the Franklin Mining Co. has decided to suspend all operations for an indefinite period. The last ore was shipped to the Point Mills concentrator in May, 1919, since which time all underground work has been confined to exploring the amygdaloid lode. This work was encouraging, but the depressed condition of the metal market together with the high cost of labor and supplies has forced a shutdown. All equipment has been removed from the shafts, and that at mine and mill has been placed in shape for a long period of idleness.

For over sixty years the Franklin has been a producer of copper, with but few periods of inactivity in that time. It has explored and produced copper from various lodes but has always been unfortunate in that the copper contents of its ore has been very low. The future of the property undoubtedly depends on large scale production.

The Mohawk Mining Co. is drifting south on the 25th level of No. 1 shaft. This shaft is operating but one shift per day and will continue on this basis until such time as sufficient men are available to man it completely on a two-shift basis, when drifting will proceed both north and south on all the lower levels. No. 4 shaft has reached a depth equivalent to the 26th level and the plat is being cut. The 16th level plat has been cut in No. 6 shaft. Mohawk is now producing 2,400 tons of ore per day, which is about the capacity of its stamp mill. At the latter plant the mixed pressure turbine takes the exhaust steam from the stamps in both the Mohawk and Wolverine mills. This practice in common with other plants in the country shows a very marked coal saving, especially worth while at this time.

The Wolverine Mining Co. is producing about 900 tons of ore per day. This production will probably remain constant for some time. The management hopes to inaugurate a campaign of systematic exploration in the near future. Several copper formations will be tapped and developed from different levels of No. 4 shaft in the hope of prolonging the life of the property.

Gogebic Range

Mines Reflecting Dullness in Steel Trade

Ironwood—The iron mines are now showing more results of the dullness in the steel trade. The Newport and Anvil mines were shut down the last week of December and were reopened with wage reductions of about 15 per cent for their 1,200 employees besides reducing forces slightly. Other operators are expected to follow suit, and few would be surprised if the U. S. Steel Corporation should also reduce wages before spring. There seems to be no great number of men out of employment, but the labor turn-over has dropped to nearly nothing. At some mines this decrease has been from about 15 or 20 per cent last fall down to 1 or 2 per cent per month at present.

It is reported that to meet operating expenses the Charcoal Iron Co., operating the Yale mine, has negotiated a loan secured by the ore in stock at the mine. The company is preparing to resume work at its mill at Marenisco.

The Ironton mine of the McKinney Steel Co. has laid off about 140 men. It is expected that all the independent operators on the Gogebic Range will reduce forces and cut wages on or before Feb. 1. The Plymouth open pit of Pickands Mather & Co. has already been shut down, the usual winter stripping work being stopped entirely.

No. 10 shaft of the Tilden mine has been put in operation again after a two-months shut down to permit erecting the shaft-house and engine transferred from the Aurora mine. The shaft has also been fitted out with an electric haulage system supplied from a 100-kw. rotary converter in the new engine house. Putting "H" shaft of the Pabst mine into regular operation has been delayed while alterations are being made to the cage. A storage battery locomotive is being tried out there for use on the stockpile trestles.

The E. P. Allis 30 x 72-in. Corliss duplex first motion hoist at the old "A" Norrie engine house is being dismantled and taken to the Ashland mine, where it will be erected at No. 9 shaft. The engine house will also be moved. A motor-driven Prescott high head pump with 6-in. poles is being installed on the 24th level of No. 9 shaft.

Menominee Range

Iron Mountain I. & C. Co. Decides To Build New Furnace

Iron Mountain—The Iron Mountain Iron & Chemical Co. has finally decided to erect a charcoal iron furnace and chemical plant on the property recently purchased here. Delay in starting construction was due to former high costs, but these have decreased so that the company feels it can go ahead on a basis more nearly normal. The furnace will have a capacity of 100 tons of pig iron daily.

Florence—The Florence Iron company has reduced the forces at the Florence and Ernst mines and has laid some off at the Bates, at Iron River, and the Youngs, at Stambaugh. The mines will run throughout the winter.

MINNESOTA

Cuyuna Range

Onahman Iron Co. Reorganized—Stripping Marquette Ore Co.'s Property Progressing Rapidly

Trommald—Rapid progress is being made in stripping the new pit of the Marquette Ore Co. south of town. Hydraulic equipment is being used and, favored with an unusually mild winter, the operators have succeeded in excavating 135,000 cu.yd. since fall. The largest monthly yardage was that of December, 50,000 cu.yd. Ore is exposed for more than 200 ft. along the bottom of the pit and a raise has been started from the bottom of present shaft to come into the pit near the footwall, to be used later as a chute for ore mined in the pit by steam shovel.

Crosby—John A. Savage & Co. has completed the sinking of a 6 x 12-ft. timbered shaft from surface to the 266 ft. level of its Croft Mine. An electric hoist and cage for handling the timber are being installed. This mine is working a full force double shift and will push production throughout the winter. New ore reserves were blocked cut by development of the 330 ft. level during 1920, and all ore is now being hoisted from this level.

At a recent meeting of directors of the Onahman Iron Co., former operators of the Ferro and Algoma manganese mines near here, a complete reorganization was effected, W. A. McClaren, Minneapolis, succeeding M. A. Dunning, Duluth, as president. Leases to the two mines formerly operated by the company were allowed to lapse last year through alleged mismanagement. The new directors will endeavor to re-establish the company as a miner and shipper of manganiferous iron ores.

Mesabi Range

Rogers Brown Starts New Shaft at Hibbing

The M. A. Hanna Ore Co. and the Pickands Mather & Co. have announced a reduction of 15 per cent on their mine payrolls at all of their mines to take effect Feb. 1. No other pending cuts have been announced.

Virginia—The Julia mine is working a full crew of men underground and stockpiling is to be continued during the winter.

Hibbing—The Rogers Brown Ore Co. has started to sink its new steel-timbered shaft on the south side of its open pit.

Biwabik—Active operations will start at the Ajax about Feb. 1.

THE MARKET REPORT

Daily Prices of Metals

Jan.	Copper, N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N Y.	St. L.	St. L.
20	12.65	31.75	36.50@37.00	4.75@5.00	4.75	5.45
21	12.55	30.00	35.00@35.50	4.75@5.00	4.75	5.40
22	12.55	30.00	34.50@35.00	4.75@5.00	4.75	5.40
24	12 50	29.00	34.00@34.50	4.75@4.90	4.70@4.75	5.30@5.40
25	12.50	28.00	32.50@33.00	4.75@4.90	4.70@4.75	5.25@5.35
26	12.50	28.75	33.50@34.00	4.75@4.90	4.70@4.75	5.25

*These prices correspond to the following quotations for copper, "delivered": 12.90, 12.80, 12.80, 12.75, 12.75 and 12.75c.

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

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

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

London

Jan.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
20	70	70⅛	79	187	191⅜	23	23⅜	25	26
21	69⅛	69½	79	179½	184½	23¼	23¾	25½	26½
22								..	
24	67¾	68	78	171½	177¼	23⅛	23½	24¾	26
25	67	67¼	76	164	1 9⅜	23⅛	23⅜	24½	25½
26	68⅛	68½	77	169	175	23⅝	24⅛	24¼	25¼

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

Jan.	Sterling Exchange	Silver			Jan	Sterling Exchange	Silver		
		New York Domestic Origin	New York, Foreign Origin	London			New York, Domestic Origin	New York Foreign Origin	London
20	377	99½	67⅞	40⅜	24	377	99½	66¾	40
21	376¾	99½	66¾	40	25	379	99½	66¾	39¾
22	376¾	99½	66⅜	39¾	26	38 ½	99½	66⅞	40

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

Metal Markets

New York, Jan. 26, 1921

Conditions continue much depressed in the non-ferrous metal market, with prices declining gradually in the absence of substantial demand. Neither speculative interests nor consumers are buying. Practically all sales at present prices mean sacrifices under cost of production, so that many producers are out of the market. However, there is always some metal in comparatively weak hands, and this is more than sufficient to take care of the demand. Some consumers are still running on stocks which they would ordinarily have had to replenish long ago; others are buying up odd lots of scrap and miscellaneous metal fabricated into munitions. There is a feeling in the New York market that it is now up to the steel industry to do its bit, and that high prices for iron and steel are having a considerable influence in retarding a resumption of business. The steel industries, of course, do not have to meet foreign competition, and, being in good condition financially, do not seem disposed to cut prices under cost of production. Whether they will later find it advisable to do this as a business stimulant remains to be seen. It is also felt that labor prices must be materially reduced. Failing a reduction in costs or an improvement in consumption, and with the foreign market dominating the non-ferrous metal situation, the only alternative is for a complete shut-down on the part of certain high-cost producers. This is being seriously considered, and the cost of holding an idle property and reassembling an organization is being compared with present operating losses.

No one is counting much on the emergency tariff bill to relieve the situation, and there seems to be considerable doubt as to whether any help can be expected from this source for some months.

Copper

Not in the last year do we recall as little business reported in copper as in the week just passed. The export demand of a few weeks ago has flattened out, and no domestic sales have taken its place. Producers generally continue to ask 13c. delivered for first-quarter business. One or two interests, however, have cut under this, but even at reduced prices no business worth the name is resulting. The prices we quote are therefore largely nominal.

In the advertisement of the Ordnance Salvage Board, on page 27 of the Searchlight Section of this issue, the closing date for the reception of bids is given as Feb. 12. Bids close on Feb. 15. The correction was received after the Searchlight Section had been printed.

Lead

The A. S. & R. official price of 4.75c., New York and St. Louis, continues.

Lead quotations have been firmer than those of any other metal in the last few weeks, but demand is now quiet and restricted to small tonnages, except for one large order which was placed during the week at our average prices. Lead has been freely offered in St. Louis at 4.75c. and probably could be obtained for less.

There is a disposition on the part of sellers of corroding lead to increase the premium for that grade to $4 per ton. Increased costs of production are assigned as the reason. Pure ores are becoming much scarcer, and careful segregation of bullion is necessary. The premium has been $2 until recently, when $3 has been charged in some quarters. The $4 figure would seem to be fully justified.

Zinc

Forced selling on the part of small producers in the Middle West, with no demand to absorb the metal offered, has caused the recession shown in our quotations, and today sales even under 5.25c. are rumored, which we have been unable to confirm. There appears to be little hope of immediate improvement, as galvanizers do not anticipate much demand until steel prices recede further, and the brass industry is finding sufficient scrap available for its needs.

Tin

The London market has been greatly agitated, and apparently some one has been hard hit financially. London interests are actively interested in what American producers and consumers are doing and in their plans for the future.

Bargain prices yesterday tempted a little inquiry on the part of consumers, and some sales were made. It is extremely unlikely that Straits tin will be sold for any length of time at anywhere near current prices. Sellers of futures are now scarce. A fair amount of electrolytic tin has been sold at concessions of a fraction of a cent under Straits.

Straits tin for future delivery: Jan. 20th, 37.25@38.00c.; 21st, 36.00@36.50c.; 22d, 35.50@36.00c.; 24th, 34.50@35.50c.; 25th, 33.00@33.75c.; 26th, 34.50@35.00c.

Arrivals of tin, in long tons: Jan. 24th, Straits, 5; 25th, Hongkong, 25.

Silver

Although the New York market has been quiet of late, prices have been well maintained. Buying inquiry for China account continues small, with the real support for the market coming from India. The London market has fluctuated over a narrow margin, and today's advance to 40d. appears to be a squeeze for spot silver, as the future price for sixty days' delivery is only 38⅞d.

Mexican Dollars.—Jan. 20th, 51⅛; 21st, 50⅞; 22d, 50⅞; 24th, 50⅞; 25th, 50⅞; 26th, 50⅞.

Gold

Gold in London: Jan. 20th, 108s. 9d.; 21st, 109s.; 24th, 108s. 6d.; 25th, 107s. 4d.; 26th, 107s. 9d.

Foreign Exchange

On Tuesday, Jan. 25, francs were 6.95c.; lire, 3.58c.; and marks, 1.73c. New York funds in Montreal declined to 12¾ per cent premium.

Other Metals

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

Antimony — Chinese and Japanese brands, 5¼@5½c.; market quiet. W.C.C. brand, 6¼@6½c. per lb. Cookson's "C" grade, shipment from England, 9¾c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony[1] (200 mesh), 7@7¼c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 7c.

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

Cadmium—Nominal, $1.40 per lb., in 1,000-lb. lots.

Cobalt—Metal, $4.50 per lb.; black oxide, $3.40 per lb. in bbls.; sulphate, $1.35 per lb. in bbls.

Iridium—Nominal, $325 per oz.

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

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

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

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

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

Palladium—$70@$75 per oz.

Platinum—Firm at $70@$75 per oz.

Quicksilver—Nominally $50@$52 per 75-lb. flask. San Francisco wires $50.

[1]**Rhodium**—$200@$225 per troy oz.

Ruthenium—$175@$200 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 55@60c. per unit, New York. Practically no change on California chrome ore since August; 40@50 per cent can be bought at 50@60c. per unit, f.o.b. cars, California. One party has offered 800 tons of 40@45 per cent at 55c., and has been able to dispose of only 150 tons.

[1]**Manganese Ore**—38@40c. per unit, seaport; chemical ore (MnO_2) $60 per gross ton, lump; $65@$70 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

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

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

[1]**Tungsten Ore**—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3.25@$3.50, New York.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]**Zircon**—Washed, iron free, 3c. per lb.

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

Zinc and Lead Ore Markets

Joplin, Mo., Jan. 22—Zinc blende, per ton, high, $33.90; basis 60 per cent zinc, premium, $28.50; Prime Western, $27.50; fines and slimes, $25@$20.

Lead, high, $52.85; basis 80 per cent lead, $50@$51; average settling price, all grades of lead, $48.95 per ton.

Shipments for the week: Blende, 6,562; lead, 796 tons; no calamine. Value, all ores the week, $152,230.

Five buyers in the market last week bought no ore this week, only two of those buying taking an average amount. All others were on short orders. The purchase of 4,500 tons is about 2,000 tons under the production. The Eagle Picher company expects to restrict operations at the Henryetta zinc smelter to two blocks within a fortnight.

Platteville, Wis., Jan. 22—No market for lead or zinc ores. Shipments for the week: Zinc ore, 247 tons. Shipments for the year: Zinc ore, 898 tons; lead ore, 360 tons. Shipped during the week to separating plants, 688 tons blende.

Non-Metallic Minerals

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

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

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

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

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

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $25 per ton, f.o.b. Illinois mines, and $25.50, f.o.b. Kentucky; ground, suitable for acid, chemical or enameling purposes, $60; lump, $15, f.o.b. Tonuco, N. M. In Canada 85 per cent calcium fluoride sells for $20 per ton, f.o.b. Madoc; output limited. Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines.

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

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

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

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

Kaolin—See China Clay.

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

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

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

Mica—India block mica, slightly stained, per lb.: No. 6, 50c.; No. 5, $1.20; No. 4, $2@$3; No. 3, $3.25@$3.50; No. 2, $5.50@$7; No. 1, $8. Clear block: No. 6, 55c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $10; extra large, $25; ground, $60@$150 per ton (depending upon quantity); all f.o.b. New York. Ground mica in Philadelphia, $150 per ton.

[1]**Monazite**—Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

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

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

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

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

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

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

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

Mineral Products

Arsenic—White arsenic, 10¾@11c. per lb.; sulphide, powdered, 15@15½c. per lb. in carload lots.

Sodium Nitrate—$2.85@$3 per cwt. ex vessel, Atlantic ports. Market quiet.

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

Potassium Sulphate—Domestic, $220@$230 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

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

Ferrocerium—Per lb., $12@$15.

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

Ferromanganese—Domestic 76 to 80 per cent, $110, f.o.b. seaboard bases; resale, $100; English, $110, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $45, f.o.b. furnace.

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

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

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

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

[1]**Ferrovanadium**—Basis 30 to 40 per cent, $5.75@$6.75 per lb. of V contained, according to silicon content, f.o.b. works.

Metal Products

Copper Sheets—Current New York list price, 21½c. per lb.; wire, 15¾.

Lead Sheets—Full lead sheets, 8½c.; cut lead sheets, 8¾c. in quantity, mill lots.

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

Yellow Metal—Dimension sheets, 19¾c.; sheathing, 19¾c.; rods, ⅝ to 3 in., 16¾c.

Zinc Sheets—$11.50 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 10c. per lb.

Refractories

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

Chrome Cement—40@45 per cent Cr_2O_3, $45@$50 per net ton, and $55 in sacks, carload lots, f.o.b. eastern shipping points.

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

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

Magnesite Brick—9-in. straights, $100 per net ton; 9-in. arches, wedges and keys, $105; soaps and splits, $120.

Silica Brick—9-in., per 1,000: Chicago district, $65@$70; Birmingham, Ala., $56@$61; Mount Union, Pa., $50@$60.

Iron Trade Review

Pittsburgh, Jan. 25, 1921

The volume of buying in the steel industry has not increased. In addition to new orders there are some "releases" against instructions previously given by buyers to suspend shipments on old orders, but the sum of the two does not altogether equal the exhaustion of old orders.

As is invariably the case in an industrial depression, the amount of shading of steel prices is exaggerated in many rumors. In the main prices are being maintained quite stiffly. The real decline will occur when demand broadens and it becomes worth while to name competitive prices. Then declines will be no secret when they occur.

In the general tone or sentiment there is some improvement, as indicated by the reinstatement of orders here and there that had been suspended indefinitely. An increase in buying is expected by April 1, but no really heavy movement, sufficient to give the steel industry anything like full employment, before September.

Pig Iron—The market has been absolutely stagnant. The majority of merchant furnaces are out, and additional stacks are going out, and there is no tendency for idle stacks to come in. Prices remain quotable at $31.50 for foundry, $32 for bessemer and malleable and $30 for basic, f.o.b. Valley furnaces, freight to Pittsburgh being $1.96.

Semi-finished Steel—Mills are generally quoting $47 on sheet bars and $45 for billets, but these prices are nominal, buyers not being interested.

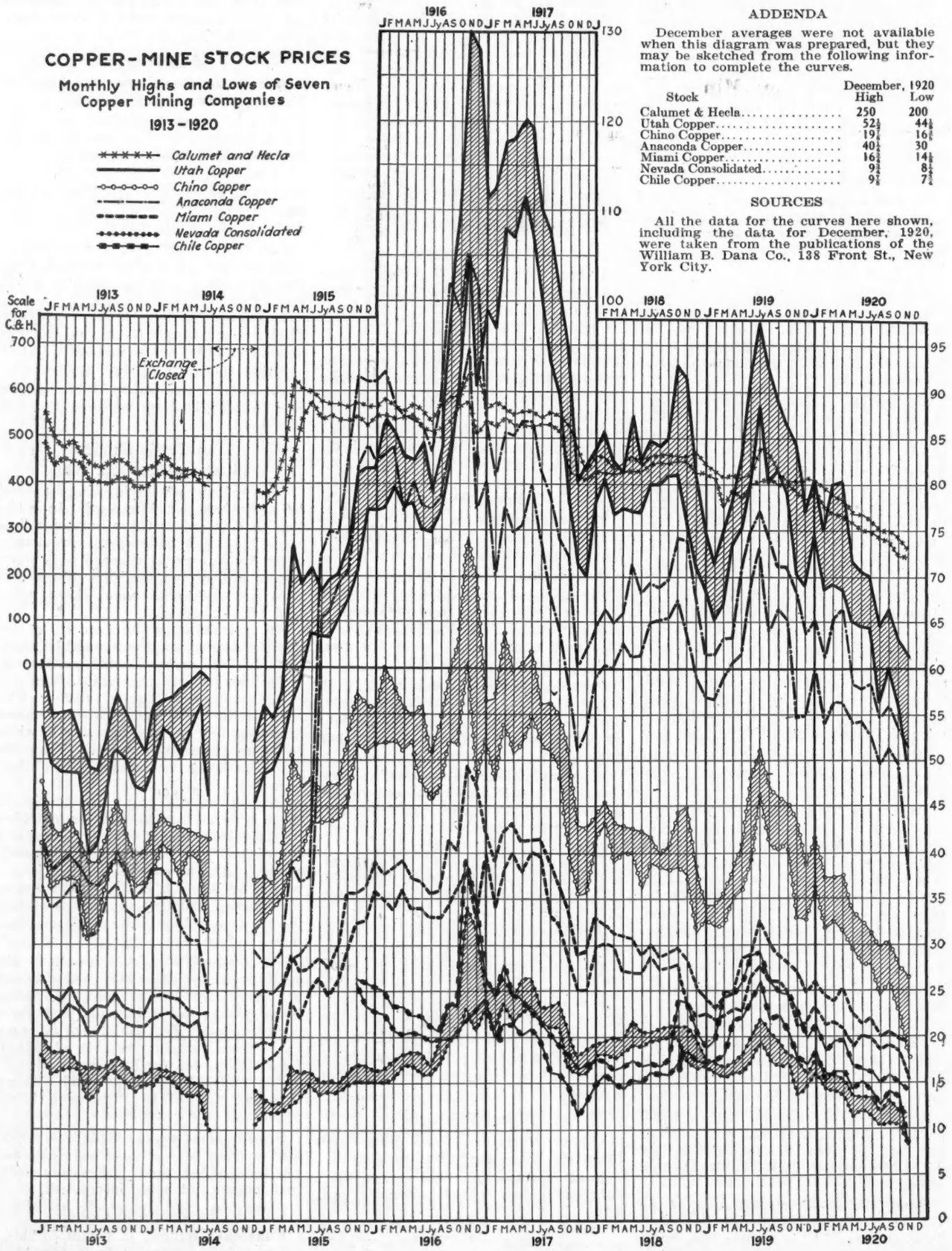
Charcoal and Coke

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

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

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

Eight Years' Stock Market Fluctuations in Copper Shares



ADDENDA

December averages were not available when this diagram was prepared, but they may be sketched from the following information to complete the curves.

Stock	December, 1920 High	Low
Calumet & Hecla	250	200
Utah Copper	52½	44½
Chino Copper	19¼	16¾
Anaconda Copper	40½	30
Miami Copper	16⅜	14½
Nevada Consolidated	9⅜	8⅛
Chile Copper	9⅛	7¾

SOURCES

All the data for the curves here shown, including the data for December, 1920, were taken from the publications of the William B. Dana Co., 138 Front St., New York City.

The companies represented in the curves shown above include one Michigan producer, one Utah porphyry, two Arizona porphyries, one Montana deep-level, one Nevada porphyry, and one South American producer.

The curves aid interesting comparisons between the different shares. In general, all responded to the same rises and declines. The autumn of 1916 was the peak of the war boom in prices, and the summer of 1919 the peak in the post-war rise. Chile Copper Co.'s financial operations did not begin until the latter part of 1915, hence the apparent incompleteness of that curve.

COMPANY REPORTS

Utah-Apex Mining Co.

Zinc, Lead: Utah

The annual report of the Utah-Apex Mining Co., covering operations for the fiscal year ended Aug. 31, 1920, indicates that 109,578 tons of ore was produced, containing 2,731.58 oz. of gold, 352,663.1 oz. of silver, 22,300,652 lb. of lead, 788,142 lb. of copper, and 9,496,169 lb. of zinc. Gross returns amounted to $1,785,177.18 from this production. Profit and loss account follows:

DEBITS

To mining and milling expenses:		
Mining	$538,522.25	
Development	258,085.24	
Milling	73,111.12	
		$869,718.61
To insurance		27,080.80
To general expense, Bingham		39,065.49
To general eastern expense, including salaries, transfer agents' fees, legal and accounting fees, London agency expenses and sundries		36,651.49
To taxes		25,694.63
To depreciation of plant	30,387.69	
To reserve for depletion	63,199.03	
		93,586.72
To litigation expenses		132,479.59
To balance, being profit for year		55,285.51
Total		$1,279,562.84

CREDITS

By proceeds of sales of ore after deducting smelter charges	$1,263,980.52
By interest, discounts and miscellaneous receipts	15,582.32
Total	$1,279,562.84

The company is capitalized at 600,000 shares of $5 par, of which 528,200 shares are issued and outstanding.

Tonopah Belmont Development Co.

A condensed statement of operation of the Tonopah Belmont Development Co. for the quarter ended Sept. 40, 1920, follows:

RECEIPTS

Received and receivable for ore	$432,114.07
Mining, milling, and administration expenses	342,498.88
Net earnings for three months	$89,615.19
Miscellaneous income	8,105.71
Dividend from Belmont Surf Inlet Mines, Ltd	100,000.00
Total net income for three months ended Sept. 30, 1920	$197,720.90

AVAILABLE RESOURCES, SEPT. 30, 1920

Due from smelters	$174,984.80
Due from others	9,931.70
Liberty bonds	22,250.00
Cash in banks	166,783.65
Total	$373,950.15

The net earnings of the Belmont Surf Inlet Mines, Ltd., for the quarter ended Sept. 30, 1920, of which this company owns 80 per cent, were $68,639.98.

Davis-Daly Copper Co.

Copper: Montana

The report of operations of the Davis-Daly Copper Co. for the year ended June 30, 1920, states that 123,607 tons of ore was hoisted and 122,379 tons was shipped, with a metallic content of 319.33 oz. of gold, 902,978.717 oz. silver and 13,564,064 lb. of copper. Total ore returns amounted to $1,778,919.07, and total receipts to $1,944,600.31. Disbursements consisted of $1,079,593.17 for mining costs, $377,748.58 for depletion, $33,145.96 for depreciation, $65,276.55 for taxes, $71,844.06 for Butte expenses, and $24,813.29 for Boston disbursements, a total of $1,652,421.61. Net operating profit was $292,178.70.

The company is capitalized at 670,000 shares at $10 par, of which 600,000 shares have been issued, with a paid-in subscription of $5,100,000.

Coniagas Mines, Ltd.

Silver: Ontario

The annual report of the Coniagas Mines, Ltd., for the year ended Oct. 31, 1920, indicates that 994,235 oz. of silver was produced from 97,634 tons of ore. A price of $1.25 was realized for the silver sold. The cost of mining and concentrating the ore amounted to 48.98c. per oz., which includes overhead, royalties, and miscellaneous expenses. Smelting, refining, and marketing costs amounted to 7.35c. per oz.

During the year five dividends of $100,000 each were paid. Profits amounted to $512,380.83, without allowing for depreciation. The company is capitalized at $4,000,000, consisting of 800,000 shares of $5 each, fully paid.

Tomboy Gold Mines Co.

Gold, Silver, Zinc, Lead: Colorado

After twenty years of continuous profits the annual report of the Tomboy Gold Mines Co., Ltd., for the year ended June 30, 1920, shows a loss of £4,894 6s. 10d. A total of 146,066 tons of ore was milled, producing bullion to the value of $811,989.55 at a cost of $815,855.06, resulting in a loss of $3,865.51. Average working costs were $5.586 per ton. A profit and loss statement for the year follows:

DEBITS

	£	s.	d.
To mining, milling, cyaniding and general expenses in America	206,369	8	2
To directors' fees	700	0	0
To agency and consulting engineer's fees, legal expenses, cables, postages, traveling expenses, and general expenses in London	1,657	14	0
To interest	198	6	1
Total	£208,925	8	3

CREDITS

	£	s.	d.
By bullion and concentrates recovered	202,997	7	9
By sundry receipts	1,033	13	8
By balance carried to balance sheet	4,894	6	10
Total	£208,925	8	3

The company is capitalized at £310,000, consisting of 310,000 shares of £1 each, fully paid.

United Eastern Mining Co.

Gold: Arizona

In a report covering the operation of the United Eastern Mining Co. for the year 1920 it is stated that 94,051 tons was milled of a gross value of $1,998,275.63. Operating costs were $857,001.83; tailing loss was $63,904.45; operating income, $1,077,369.37; operating income per ton, $11.455.

Latest Rand Gold Production

In December the output of gold at the mines of the Rand was 632,215 fine ounces, compared with 633,737 fine ounces in November and 662,472 fine ounces in October. The following table summarizes Rand gold production since 1917:

RAND GOLD OUTPUT 1917–1920, IN FINE OUNCES

	1920	1919	1918	1917
Jan.	670,503	676,059	714,183	782,634
Feb.	625,330	636,728	659,759	721,321
March	707,036	712,379	696,281	787,094
April	686,979	694,944	717,099	742,778
May	699,041	724,995	741,217	729,385
June	715,957	702,379	727,696	759,724
July	736,099	725,497	736,199	757,890
Aug.	702,083	706,669	740,210	756,658
Sept.	682,173	698,558	708,206	738,231
Oct.	662,472	723,722	679,764	751,290
Nov.	633,737	677,970	658,701	722,839
Dec.	632,215	650,191	641,245	722,419

MINING STOCKS

Weeks Ended January 15 and 22, 1921

Stock	Jan. 15 High	Jan. 15 Low	Jan. 15 Last	Jan. 22 High	Jan. 22 Low	Jan. 22 Last	Last Div.	
COPPER								
Adventure	....	....	*60	....	....	*60	....	
Ahmeek	52	50	52	56	50	54½	Sept. '20 Q	$0.50
Alaska-Br. Col.	⅛	1/16	⅛	⅛	⅛	1/16	....	
Allouez	22½	20	20	21	20	21	Mar. '19,	1.00
Anaconda†	38⅞	37	37⅛	40½	37⅛	38½	Nov. '20, Q	1.00
Ariz. Com'l	8⅛	7⅞	8	8⅛	8	8⅛	Oct. '18,	.50
Big Ledge	1/16	1/16	⅛	1/16	1/16	⅛	....	
Bingham Mines	....	....	9½	8⅛	8½	8⅞	Sept. '19, Q	.25
Calumet & Ariz.	50½	48	48	50	49	49	Dec. '20, Q	1.00
Cal. & Hecla	250	240	245	245	240	245	June '20, Q	5.00
Canada Copper	....	....	*13	....	....	*13	....	
Centennial	....	....	7	9¼	9¼	9¼	Dec. '18, SA	1.00
Cerro de Pasco	31⅛	29½	30½	32½	30	30½	Dec. '20, Q	1.00
Chile Copper	11⅛	11⅛	11¼	12½	11⅛	11⅛	....	
Chino	22⅛	21	22	23½	21⅛	22⅛	Sept. '20, Q	.37½
Columbus Rex	*42	*36	*39	*36½	*33	*34	....	
Con. Aris.	....	....	1/16	....	....	1/16	Dec. '18, Q	.05
Con. Copper	....	....	2¼	2½	2¼	2½	....	
Copper Range	33¼	31⅛	32	34	32	33¼	Sept. '20, Q	.50
Crys. Cop.(new)	*38	*35	*38	*38	*35	*38	....	
Davis-Daly	7½	6⅞	7	7	6¾	7	Mar. '20, Q	.25
East Butte	10	9	9	9½	9½	9½	Dec. '19, A	.50
First Nat'l	1 1/16	*77	*90	*90	*80	*85	Feb. '19, SA	.15
Franklin	3	2⅜	2⅜	2½	2½	2½	....	
Gadsden Cop	....	....	*25	....	....	*25	....	
Granby Consol.	23	22	22	24⅛	22⅛	23½	May '19, Q	1.25
Greene-Cananea	22⅛	22⅛	22⅛	22⅛	22½	22⅛	Nov. '20, Q	.50
Hancock	3½	3½	3½	....	....	3½	....	
Howe Sound	....	....	2⅛	....	....	2⅛	Jan. '21, Q	.05
Inspiration Con.	36½	34½	34½	35⅞	34½	35	Oct. '20, Q	1.00
Iron Cap	9	6½	6½	7	7	7	Sept. '20, K	.25
Isle Royale	22½	20	20	21½	19⅛	20⅛	Sept. '19, SA	.50
Kennecott	20⅛	19⅞	19⅞	21	19⅞	20	Dec. '20, Q	.50
Keweenaw	1½	1½	1½	....	....	1½	....	
Lake Copper	2⅛	2½	2½	3	2½	3	....	
La Salle	....	....	1¼	....	....	1¼	....	
Magma Chief	....	....	*21	....	....	*21	....	
Magma Copper	21	20	20⅛	....	....	20⅛	Jan. '19, Q	.50
Majestic	....	....	*8	....	....	*8	....	
Mason Valley	1⅛	1½	1⅛	1½	1½	1½	....	
Mass Consol.	3½	3	3	3	3	3	Nov. '17, Q	1.00
Mayflower-O. C.	5	4½	4½	5	4⅝	4⅝	....	
Miami Cop	19	18¼	18½	18⅞	18⅛	18¼	Jan. '21, Q	.50
Michigan	3	3	3	....	....	3	....	
Mohawk	46	45	46	47	45½	46½	Nov. '20, Q	1.00
Mother Lode	5½	5½	5½	....	....	5½	....	
Nevada Con	11	10⅜	10⅞	11⅜	10⅜	11⅛	Sept. '20, Q	.25
New Arcadian	....	....	2½	....	....	2½	....	
New Baltic	....	....	3	....	....	3	....	
New Cornelia	16½	15½	16	16½	16	16	Aug. '20,	.25
Nixon Nev	....	....	*5	....	....	*5	....	
North Butte	12⅛	11	11	12	11¼	11⅞	Oct. '18, Q	.25
North Lake	*30	*30	*30	....	....	*30	....	
Ohio Copper	....	....	1/16	....	....	1/16	....	
Old Dominion	21	19½	19½	20	20	20	Dec. '18, Q	1.00
Osceola	28½	27	28	29	26	29	June '20, Q	.50
Phelps Dodge	†175	†150	....	†175	†160	....	Jan. '21, Q	2.50
Quincy	41	40	41	40	39	40	Mar. '20, Q	1.00
Ray Con	14	12⅞	13¼	14¼	13¼	13½	Dec. '20, Q	.25
Ray Hercules	....	....	*50	....	....	*50	....	
St. Mary M.L.	33⅜	31	31½	34	33	33	June '20, K	2.00
Seneca Copper	20	19	19	20½	20	20½	....	
Shannon	1⅜	1 1/16	1 1/16	1¼	1	1⅛	Nov. '17, Q	.25
Shattuck Ariz.	6½	6	6⅛	6⅞	6⅛	6⅛	Jan. '20, Q	.25
South Lake	....	....	1	2	1	1	....	
Superior Cop.	4	4	4	....	....	4	Apr. '17,	1.00
Sup. & Boston	2	1 1/16	1½	1⅛	1⅛	1 1/16	....	
Tenn. C. & C.	8⅞	8½	8⅝	9½	8½	8½	May '18, I	1.00
Tuolumne	*56	*49	*56	*60	*54	*54	May '13,	.10
Un. Verde Ex.	29½	27	28	28½	27	27½	Nov. '20, Q	.50
Utah Consol.	5	4	4½	4½	4½	4⅝	Sept. '18,	.25
Utah Copper	56	52½	53⅛	59½	54	55⅛	Dec. '20, Q	1.50
Utah M. & T.	1½	1½	1½	1½	1⅛	1½	Dec. '17,	.30
Victoria	1⅞	1½	1⅞	2	2	2	....	
Winona	*60	*48	*60	....	....	*60	....	
Wolverine	12	11½	11½	12½	11½	12½	Jan. '20, Q	.50
NICKEL-COPPER								
Int. Nickel	15¾	15	15	16	14⅜	15	Mar. '19,	.50
Int. Nickel, pfd.	....	....	75	....	....	75	Nov. '20, Q	1.50
LEAD								
Nat. Lead	73	71	71¾	74	71½	72½	Dec. '20, Q	1.50
Nat. Lead, pfd.	105	105	105	102½	102½	102½	Dec. '20, Q	1.75
St. Joseph Lead.	13	12⅜	13	12½	12½	12⅜	Dec. '20, QX	.50
Stewart	....	....	*6	....	....	*6	Dec. '15,	.05
ZINC								
Am. Z. L. & S.	9⅜	9	9	9⅜	8½	8½	May '17,	1.00
Am.Z.L. & S.pf.	33	31½	33	33	29½	29½	Nov. '20, Q	1.50
Butte C. & Z	5⅜	5⅛	5⅛	5⅜	5⅛	5⅛	June '18, I	.50
Butte & Sup	13½	12	12⅛	14⅜	12½	12⅛	Sept. '17,	1.25
Callahan Z. L.	7⅛	6½	6½	7	6½	6½	Dec. '20, Q	.50
New Jersey Z.	....	....	135	158	155	157	Nov. '20, Q	4.00
Success	*3	*2	*2	....	....	*2	July '16,	.03
Yellow Pine	....	....	*45	....	....	*45	Sept. '20, Q	.03
GOLD								
Alaska Gold	1⅛	⅞	1	1⅛	⅞	1⅛	....	
Alaska Juneau	1⅛	1⅛	1⅛	1⅛	1⅛	1⅛	....	
Carson Hill	....	....	22½	....	....	22½	....	
Cresson Consol.	....	....	1¼	....	....	1¼	June '20, Q	$0.10
Dome Ex	*43	*43	*43	....	....	*43	....	
Dome Mines	12	11½	11⅞	12⅛	11⅛	11½	Jan. '21, Q	.25
Golden Cycle	‡	....	*73	‡	....	*73	Dec. '20, Q	.02
Goldfield Con.	*8	*6	*7	*8	*6	*8	Dec. '19,	.05
Hollinger Con.	6.25	5.80	6.25	6.30	6.19	6.26	Dec. '20, BM	.05
Homestake	50½	50	50	50½	50	50	Sept. '19	.50
Kirkland Lake	*49½	*47	*47	*48½	*47	*48	....	
Lake Shore	1.19	1.07	1.15	1.22	1.15	1.20	Jan. '21, K	.02
McIntyre-Por.	1.83	1.82	1.82	1.89	1.82	1.89	Jan. '21, K	.05
Porcupine Cr.	*21	*18½	*20	*23	*20½	*23	July, '17,	.03
Portland	‡	....	*60	....	....	*60	Oct. '20, Q	.01½
Reorgan. Booth.	*4½	*3	*4½	*5	*3	*5	May '19,	.05
Silver Pick	*11	*7	*10½	*11	*8	*8½	....	
Teck Hughes	*11	*11	*11	*11½	*10½	*10½	....	
Tom Reed	1.20	1.10	1.16	1.16	1.14	1.14	Dec. '19,	.02
United Eastern	2½	2½	2 1/16	2 1/16	2½	2 1/16	Oct. '20, Q	.15
Vindicator Con.	‡	....	*18	‡	....	*18	Jan. '20, Q	.01
W.Dome Consol.	*8½	*7	*7½	*9½	*8¼	*9½	....	
White Caps	*9	*5	*8½	*9½	*7	*9½	....	
Yukon Gold	....	....	*50	*60	*60	*60	June '18,	.02½
SILVER								
Arizona Silver	*20	*19	*20	*36	*20	*29	Apr. '20, M	.03
Beaver Con	*31½	*31	*31½	*38	*32	*35	May '20, K	.03
Coniagas	2.18	2.00	2.18	1.90	1.90	1.90	Nov. '20, Q	.12½
Crown Reserve	*18	*18	*18	*18	*16	*18	Jan. '17,	.05
Kerr Lake	3½	2½	2⅞	....	....	2⅞	Jan. '21, Q	.12½
La Rose	*31	*31	*31	*33	*33	*33	Apr. '18,	.02
McKinley-Dar.	*29	*29	*29	*29½	*29	*29½	Oct. '20, Q	.03
Mining Corp.	1.05	1.10	1.13	....	....	1.13	Sept. '20, Q	.12½
Nipissing	8⅛	7½	8⅛	8⅛	8	8⅛	Jan. '21, QX	.50
Ontario Silver	5⅛	5	5⅛	5	4⅞	4⅞	Jan. '19, Q	.50
Ophir Silver	1/16	⅛	⅛	⅛	⅛	⅛	Jan. '12,	.10
Peterson Lake	*12	*11½	*12	....	....	*12	Jan. '17,	.01½
Temiskaming	*25	*25	*25	*25	*24	*24	Jan. '20, K	.04
Trethewey	*20	*18½	*19	*20½	*19	*19	Jan. '19,	.05
GOLD AND SILVER								
Atlanta	*2	*1½	*2	....	....	*2	....	
Barnes-King	‡	....	1.11	....	....	1.11	Aug. '20, Q	.05
Bost. & Mont.	....	....	*63	....	....	*63	....	
Cashboy	*7	*5	*7	*7½	*6½	*7	....	
El Salvador	⅛	⅛	1/16	1/16	⅛	1/16	....	
Jim Butler	*18	*16	*17	*18	*16½	*17	Aug. '18, S.A.	.07
Jumbo Exten.	*6	*5	*6	*7½	*5	*7½	June '16,	.05
Louisiana Con.	⅛	⅛	⅛	....	....	⅛	....	
MacNamara M.	1/16	*17	*18	*18	*17	*18	May '10,	.02½
N. Y.-Hond. R.	†10½	†9	....	†10½	†9	....	Oct. '20, QX	.50
Tonopah-Bel.	1 1/16	1⅛	1⅛	1 1/16	1	1 1/16	Jan. '21, Q	.05
Tonopah-Div.	1⅛	1⅛	1 1/16	....	....	1 1/16	....	
Tonopah Ex.	1⅛	1 1/16	1 1/16	1⅛	1⅛	1⅛	Jan. '21, Q	.05
Tonopah Min.	1⅛	1⅛	1⅛	1⅛	1⅛	1 1/16	Oct. '20, SA	.05
West End Con.	1 1/16	1	1 1/16	1	1	1	Dec. '19, SA	.05
SILVER-LEAD								
Caledonia	*16	*14	*16	*17	*15	*15½	July '20, M	.01
Chief Consol.	2⅛	2⅛	2⅛	2⅛	2⅛	2⅛	Nov. '20, Q	.10
Consol. M. & S.	19½	18	18	19	18½	19	Oct. '20, Q	.62½
Daly Mining	....	....	1.95	2.50	2.50	2.50	July '20, Q	.10
Daly-West	3⅛	3⅛	3⅛	4⅛	3⅛	3⅛	Dec. '20, Q	.25
Eagle & B. B.	....	....	2⅛	....	....	2⅛	Dec. '20, K	.25
Electric Point	*5	*5	*5	*5½	*5	*5½	May '20, SA	.03
Fed. M. & S.	8⅛	8⅛	8⅛	....	....	8⅛	Jan. '09,	1.50
Fed. M. & S. pf.	28½	27	27	28½	27	28½	Dec. '20, Q	1.75
Florence Silver	*15	*14	*15	....	....	*15	Apr. '19,	.01½
Grand Central	....	....	*37½	....	....	*37½	June '20, K	.03
Hecla Mining	4½	3½	3⅞	4½	3½	4	Dec. '20, QX	.15
Iron Blossom	1/16	*17	1/16	*20	*15	*20	Apr. '20, Q	.02½
Judge M. & S.	....	....	3.00	....	....	3.00	Sept. '20, Q	.12½
Marsh Mines	*8½	*7	*7½	*8	*7	*8	....	
Prince Consol.	1/16	⅛	⅛	1/16	⅛	1/16	Nov. '17,	.02½
Rambler-Carib.	*8½	*8	*8	*8	*7½	*7½	Feb. '19,	.01
Rex Con	*5	*4	*5	*5	*4½	*5	....	
South Hecla	....	....	*65	*65	*60	*65	Sept. '19, K	.15
Stand. S. L.	1/16	1/16	1/16	....	....	1/16	Oct. '17,	.05
Tam.-Custer	2.00	1.90	1.95	1.90	1.80	1.90	Jan. '21, K	.04
Tintic Stand.	3.35	3.15	3.20	3.37½	3.25	3.30	June '20, Q	.10
Utah Apex	2⅛	2⅛	2⅛	2⅛	2⅛	2⅛	Nov. '20, K	.25
Wilbert Min.	*3	*2	*3	*3	*2	*2½	Nov. '17,	.01
QUICKSILVER								
New Idria	....	....	*95	....	....	*95	Jan. '19,	.25
TUNGSTEN								
Mojave Tung	....	....	*5	....	....	*5	....	
VANADIUM								
Vanadium C.	41	34⅛	38⅛	40⅜	36⅛	37⅛	Jan. '21, Q	1.00
ASBESTOS								
Asbestos C.	....	....	79½	82½	79	80½	Oct. '20, Q	1.50
Asbestos C., pf.	94½	90	92	95	94	94½	Oct. '20, Q	1.75
MINING, SMELTING AND REFINING								
Am. S. & R.	39⅛	36⅜	37½	39⅛	37⅛	37⅛	....	
Am. S. & R., pf.	82	79½	82	83	81½	82	....	
Am. Sm. pf. A	64½	63	64	66	66	66	Jan. '21, Q	1.50
U. S. S. R. & M.	34⅛	33	34⅛	35⅛	34	34	Jan. '21, Q	.50
S. R. & M., pf.	44	42½	43½	43½	42½	43½	Jan. '21, Q	.87½

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