

March 18, 1922

# ENGINEERING AND MINING JOURNAL

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A Rugged Mining Region  
By George J. Bancroft

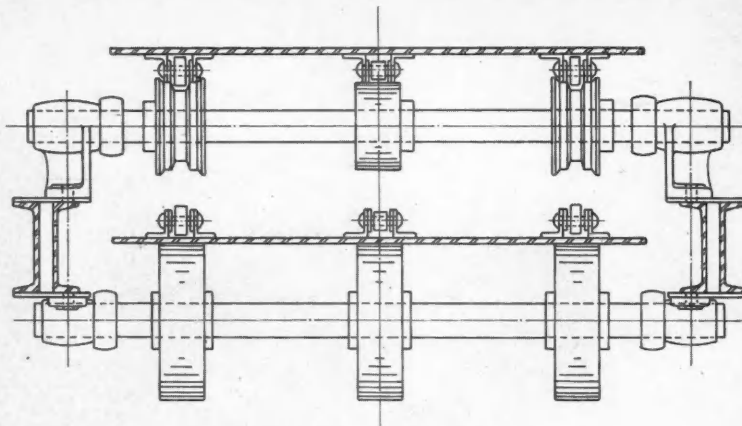
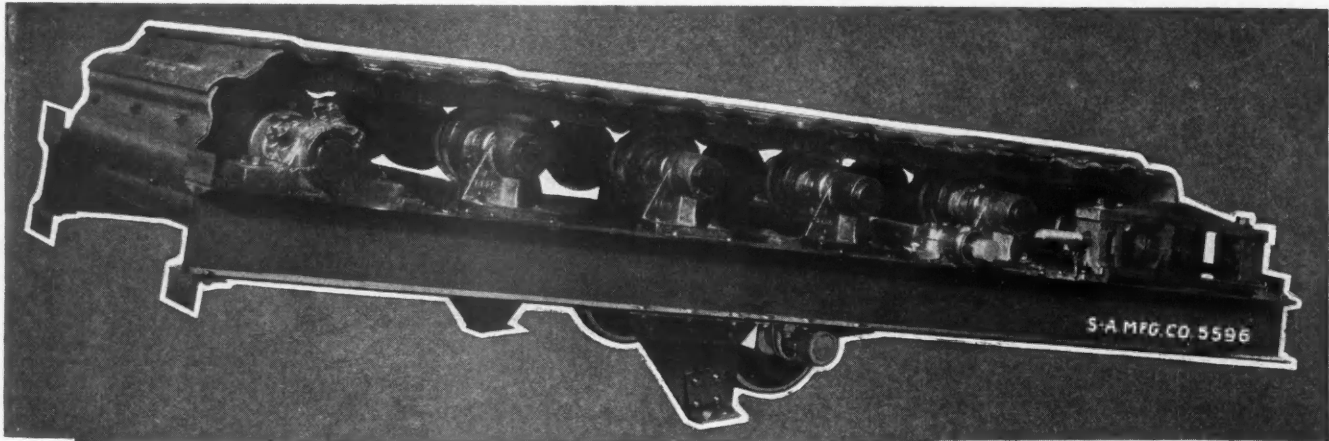
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*Central Idaho is the most inaccessible mining district in the United States*



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# Engineering and Mining Journal

*A Weekly Journal of the Mining and Mineral Industries*

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Number 11

## West and East

**T**HE WEST has been populated from the East; but there is no doubt that the amount of positive energy is greater per capita the further west you go—that is, after you have passed Omaha.

The Eastern ports are the great gateways of immigration. New York is a foreign city, an unwieldy, indescribable, undigested, sheer mass of mostly motley European or near-European arrivals. Boston is dominated by foreigners. New England is populated mainly by the races of Southern and Central Europe—the latest comers and not the most virile type.

In the process of filtration from the East coast to the West, an increase of individuality has resulted. The men of the West are more intense, more spontaneous in their reactions.

In Congress, in the Senate, men from states like Nevada and Oregon are commonly factors in lawmaking out of proportion to the population which they represent.

Take the mining industries—take the mining engineers, for example. The prominent mining engineers of the West will work enthusiastically for whatever will benefit their industry. In the East, mining engineers have more the tendency to remain apathetic and indifferent when they are subordinate; and to graduate into superciliousness and snobbishness as they attain what seems to them like dizzy heights of prominence.

The Pittman Act has been a wonderful thing for the mining industry. Its drawing up and introduction was properly entrusted to a Nevada Senator. The average Eastern mining engineer at his meetings proved unenlightened, suspicious, even superior to this problem.

There was a McFadden bill proposed some time ago. It is no longer advisable; but when it was proposed it was a good measure. The West was alive to the problem and interested in it, many favorably; the Eastern engineers, such as concentrate in New York, were amused and superior, yet without more than a suspicion of comprehension.

The mining engineer in the East starts out to enlighten the world about economics, the elimination of waste in industry. The economics of the mining industries? How to eliminate waste in the mining industries? Oh, Lord, no. The ready-made clothing industry, the boot and shoe industry. Why is it that there is such timidity about trying to improve our own business, take an intelligent interest in its underlying principles, discuss it, elevate it, make it more efficient? The East is for a Department of Public Works which would engulf the mining bureaus, and in which they would be lost; it is not interested in the practical problems of organization whereby our mining bureaus would have better organization and co-operation and be rounded out into a sub-department, or even a department. One would gather that such homely wisdom was something that concerned Eastern engineers not, or was beneath the level of their eagle gaze.

Does the Institute of Mining and Metallurgical Engineers stand for a progressive development of the industrial side of mining? It is not very noticeable. They have men in Washington—American Engineering Council—to do their thinking for them, and that Council thinks in terms of engineering, not of mining—and at that, with no clear conception of what engineering is, or what they should do about it. Is the Institute for or against a Department of Mines? Bless you, it doesn't know. It has not been educated that far. If Hoover will tell them what he thinks, then they will know. Otherwise, they rather instinctively feel that the subject is not quite in good taste. One has a certain social standing, you know.

Yes, we must look to the West for leaders in mining, at least out of all proportion to the number of mining engineers. Out of the West came Hoover. Pittman, of Nevada, has the glory of the preservation of the silver industry; Nicholson, of Colorado, a horny-handed, two-fisted miner, sees the necessity for a better representation of mining in the executive department, and is working for it.

If we are obliged to sense this finally as we do, we must also realize that the West has sensed it long ago; and the loud opposition to the proposed mining law, which arose in the West, represented nothing but an opportunity to vocalize the fixed and underlying distrust. The Far West was not adequately represented in the group which formulated the law; hence the Far West was suspicious and quite vociferous in its suspicion.

To the indifference or the superciliousness of the Eastern engineers concerning the vital questions of the mining industries, which questions absorb the attention of the West, the Western mining man responds with distrust of such measures as the East does condescend to propose. Shall we not get together?

## Gold and Money

**W**E ARE ACCUSTOMED to think of gold as the ultimate in money. When we have a ten-dollar gold piece weighting down our pocket we somehow feel richer than when a Federal Reserve note for the same amount is folded in our wallet. Suppose a contest is announced: do we ever see in the list of prizes, "Ten Dollars in paper money will be paid the winner," or even "A Ten Dollar Bill will be awarded"? No; it is always "Ten Dollars in gold," in this country at least. There seems an instinctive prejudice for gold as against a printed piece of paper. Still, gold as a medium of currency never became generally popular in this country except in the West, where, before the Great War, there was much gold in free circulation. For a time thereafter there was none to be had, but now it is again freely obtainable.

Most of us would think offhand that gold would be an ideal thing to carry to Europe should we plan a trip to that continent; that it would instantly be convertible

into the maximum amount of paper money in any country. This is not so, however, and travelers are often penalized for having it in their possession. Most European countries have enacted laws restricting the export of gold; and in exchanging it for paper it is actually often worth less than credit instruments payable in New York, or "paper." This is because of the greater ease in using such instruments in making payments of trade balances to this country. However, the wisdom of the gold standard is evident, and we have little doubt of its continuance so far as is possible among the nations of the world. We believe that gold producers have little reason to worry over any possible financial cataclysm that would make their product worthless except for manufacturing purposes.

The time is probably not far distant when the English paper pound will again be exchangeable for its old-time gold equivalent, and other countries will slowly follow. We do not mean that the currency of every country will go back to its former value. The German mark, now worth about one-half a cent, is never likely to be exchangeable for 23.82c. worth of gold as it was before the Great War. Some adjustment is likely to be made, and a new mark, or a coin of some other name, will be originated, which will have a definite gold value.

#### Treatment of the Technical Man By the Corporation

**W**E WONDER whether mining and other industrial companies are really appreciative of the wealth of human power that is turned out from our technical schools and placed in their hands. Have they ever considered the outcome were this flow to be turned to other channels? Are they sufficiently appreciative to reasonably reward these men? The cost of a technical education is roughly \$8,000, of which \$4,000 may be the approximate direct money outgo and \$4,000 the valuation of four years of suspended earning power. This investment is placed at the service of industry. Along with it goes a huge investment in schools and colleges and money outgo in excess of the student's input. Without more than nominal effort upon the part of industry these resources and the individual's investment have been secured.

Omitting the instances of spectacular remuneration and the remuneration of the consulting specialists, the question may well be raised as to the average compensation of the technical graduate. Does he really get out of industry a compensation commensurate with his input? We do not think that he does. We believe that industry has absorbed the technical graduate without due consideration to the individual's self-sacrifice. It has been able to do this principally because of the numbers of young men who have been attracted to technology. Whether this flow will continue is an important question that mining and other industries may well consider.

Industry has now no substitute for the technical graduate. There is danger that unless he is accorded a more cordial welcome in the form of adequate compensation, he will turn to newer fields and other forms of activity than the ones dictated by fashion and convention. The mining industry is at greater fault than others, and perhaps may feel the pinch soonest.

The present depression has its byproduct of individual questioning influenced by the experiences of men who have had to change their chosen field fundamentally.

We bespeak earnest thought upon this question and greater responsiveness on the part of those who have the responsibility of apportioning the compensation of the technical graduate.

#### Mining Education

**T**HE POLICY and course of study at mining schools are receiving nowadays a great deal of thought, as are, indeed, those of schools and especially of colleges and universities in general. The whole higher system of education is under fire. Is a college education—a general education—a help or a hindrance? Does it make more men than it cripples? Does it spoil many good artisans to make dependent and regretful pseudo-gentility; or are these noted cases exceptions, which are insignificant beside the men who have been raised by their college training to a higher degree of efficiency? We shall find such men as Ford and Edison and many others questioning the latter natural assumption; and there is, at any rate, enough of truth in their cynicism, and examples enough to support it, so that the applicability and efficiency of education should be honestly and frankly scrutinized and criticized. The colleges are the great examiners—they distinguish and classify men according to their academic standards, with calm and superior assurance of their divine right as judges. Let them without indignation and philosophically bear the reversed rôle, and submit to a rigid examination at the hands of the thinking public.

The faculties of the colleges—or at least the most valuable part of these faculties—are, indeed, among those who are most perplexed and inquiring; and our mining schools are no exceptions. It is for this reason that the reports of the committees and the discussions of the meetings of the Mining and Metallurgical Society of America have aroused such interest in the mining schools themselves; and that the series of critical articles on the various schools of mines which we are publishing in *Engineering and Mining Journal* are receiving such close attention. These articles are being written by an experienced, thoughtful, and unprejudiced writer; nevertheless, we get farthest and most safely from the exchange of many views, and we invite discussion from engineers and from the mining schools themselves. Part of the *Journal*—that succeeding the editorials—is devoted to an open forum, in which every thoughtful man may have his say, addressing the mining public.

#### The Webster Process

**T**HE ANNOUNCEMENT of the termination of the patent proceedings of the Webster process now releases this method to commercial exploitation. On p. 376 of the issue of March 4 the details of the operation of the process are given. It is applicable to oxidized copper ores and mixed oxidized and sulphide ores associated with gangue material insoluble in acid solvents. Gold and silver in the ore will be recovered with the copper. The process consists of, first, fine comminution of the ore; second, treatment with an acid solvent; third, precipitation of the dissolved copper by finely divided iron; fourth, recovery of the precipitated copper by flotation and tabling, the operations noted to be continuous. Preliminary work warrants the belief that the process will become a commercial success.

Oxidized copper ores have long represented an important metallurgical problem, particularly when they also contain gold and silver. Apparently, the most



acceptable method for their treatment has been the leaching of the ore in vats or heaps with sulphuric-acid solutions and the precipitation of the pregnant solutions by scrap iron or by electrolysis, as at Ajo. This process has been a metallurgical success as applied to those ores which contain no precious metals and in which the gangue is insoluble in sulphuric acid. Its limitations have been prescribed by the cost of acid, iron, power for precipitation and the degree of crushing necessary to liberate the copper minerals (though only slightly by the latter). Similar limitations will apply to the new process, with the additional element of cost in the application of flotation. This, however, is a nominal expense.

It is probable that in an endeavor to make the process a continuous one, it will be necessary to crush finer than for leaching. Some form of agitation vat will be necessary for solution and precipitation. If wet crushing is used, dewatering before applying the acid will be necessary, and after flotation the excess acid will entail more or less complicated steps for its recovery. The process will likely consist of dewatering after crushing, the addition of acid solvents, precipitation of copper in the pulp and its recovery by flotation, removal of excess acid solutions by dewatering appliances, and, finally, filtration of the concentrates in acid-proof filters. The equipment will closely parallel that used in the cyanide process.

In applying the method to mixed oxidized and sulphide ores, the solution and precipitation steps can be introduced in the mill circuit before flotation treatment or may be applied to the tailing residue after it has been dewatered. Probably in existing mill arrangements the latter plan will be used.

The process as a whole, in our opinion, will find definite applications where the cost of acid solvents and finely divided iron is not prohibitive. Somewhat over one pound of iron and two pounds of sulphuric acid will be necessary for each pound of copper precipitated. The iron needed will probably be obtained by the local reduction of roasted iron sulphide concentrate or of finely ground magnetite. Any copper or precious metals contained in this material will be recovered in part along with the valuable metals in the ore. The concentrate obtained will be higher in grade than sulphide concentrate and will contain a percentage of the gold and silver present in the ore.

### Safety First

IT RAINS at times in California. Of late, Californians have had a surplus of the waters of the skies, and even a little of the real chill of winter has descended from the high reaches of the blue and has graced Tamalpais and the Berkeley Hills with a mantilla of lacy white of a kind all too familiar to us in New York. Nevertheless, it is true that the sun does shine in California at intervals and that the glistening raindrops shimmying upon the evergreens bring a message of cheer and foretell the golden brown of the hills in the summer and the sweet perfume and acres of color in the spring. We delight to think of this in our dreams as some of us work at our steel desks upon a rubber-tired floor, over the clack of the linotypes and the undulating vibrations of the flat-bed presses beneath. In the midst of these cheerful dreams, interlarded with the humdrum of everyday materialism, we received a bit of manuscript, humbly knocking at our

doors and asking to be broadcast to our indulgent readers. It is entitled "California's Industrial Dead." It emanates from the California Industrial Accident Commission. Like a carrion crow upon the fence, this bit of safety propaganda tells us that

"There are reported in the files of the Industrial Accident Commission exactly 4,391 fatalities for the seven years, 1914-1920, inclusive. The same ratio for the remaining three years (of the decade) gives 6,000 deaths as a conservative estimate. It would take a strip of land 3.41 miles in length to bury this army of dead, allowing three feet for each grave.

"The commission has compiled some interesting information about the group of 6,000 dead. The average age was 37.8 years, and the life expectancy based on this average is 29.74 years, thus giving a total loss of 178,421 years for the 6,000. The average wage was \$23.69 a week, and the total wage loss, figured in possible future earnings, amounts to \$22,000,000.

"The dependents of the industrially killed numbered 7,696 as the result of 3,555 deaths. The total dependents were 2,502 widows, 3,665 children, and 374 under the heading of 'all others.' The number of partial dependents was 1,155. The number killed leaving no or unknown dependents was 2,445. The average age of the widows was 38.2 years, and the average age of the children 8.6 years."

This is a grewsome story to put over the gospel of "Safety First," but maybe it is needed. At any rate the commission thinks that it is. Perhaps if its statisticians had paralleled it with the list of fatalities and injured resulting from automobile accidents, a still more grewsome and oppressive picture could have been drawn.

Looking, however, at the table of statistics presented, we find that there were only 592 industrial fatalities in 1920, in a population of 3,427,536, and that there has been a perceptible diminution in the ratio. We are sanguine of a still further decrease not only in California but also in other states. Insistent application of safe practices and persistent work on the part of inspectors will wear down this ratio to a minimum.

We are not going to publish this manuscript, for we do not believe in taking all of the joy out of life. Rather do we believe that a little of the joy, a beam of cheer, a bit of humor along with the pathos and gloom, if they be necessary, would have won us over, and we would have been glad to have given our precious space to it. Just a little of that exuberant spirit, that scintillating optimism, that makes the desert bloom and brings the "white blood of the mountains" out upon the plains of the San Joaquin and the "white coal" to the cities, will, in our judgment, help to reduce this troublesome fatality ratio.

We ask the commission, now that the facts have been spread before us, what that body, whose members are the trustees of "Safety First" in California, is going to do about it. We don't want the members of the commission to tell us, however, but we do want them to jump into the game with all of the cheerful optimism that Californians exude, and do it.

### Professor Kemp, We Knew Better

Owing to an error which appeared in *Engineering and Mining Journal* of March 4th, in the biographical sketch of Prof. James F. Kemp, he was stated to have been past president of the American Institute of Mechanical Engineering, but, as all his friends and acquaintances know, the association mentioned should have been the American Institute of Mining Engineers.

## WHAT OTHERS THINK

### The Proposed New Mining Law

I have not been able to follow the discussion relative to the proposed new mining law, on account of frequently missing the regular mail service, but it would appear that much of it had failed to consider the more salient features.

We are not doing business on the actual mining code but on a code of decisions. The apex law went from Germany to Spain, from Spain to Mexico, and from Mexico to the United States. It has been set aside in certain districts by the Federal courts. Should we have a new code, years of litigation would be required to develop a new set of decisions; until then we would not know, as the Cornish say, "where we are to." It is possible that the best thing to do would be to abolish the lode claim and use the placer law, which has been threshed through the courts for some time.

Nature has not much use for mathematics. No law can be written to fit all contingencies. Undoubtedly, the law of the apex should be superseded by one of vertical lines. Some notable instances have occurred where a dipping orebody when it neared the vertical property line on the hanging side turned and went back.

A land company in Michigan once hired some of the best geological talent in the country to select "swamp lands." They selected all of the alternate sections along a certain range, being restricted by the terms of the grant to odd sections. These were colored red on the maps. When the orebodies were developed they twisted around through that checkerboard system so as to avoid the red sections and made some famous mines in the white. Such examples are simply interesting exceptions.

There will probably be a few more "grass-root" mines found in the United States, and only a few, for most of them were discovered years ago. The prospector has gone like the game that he largely depended upon for food. New mines will come trenching along vein outcrops to find ore chutes upon which to sink, drilling or sinking through oxidized zones, through soil, and through superimposed later strata (caps).

There is little prospecting done now. Venturesome corporations and exploring companies buy developed mines after spending thousands of dollars in scouring the country for something cheaper. Some companies have card catalogs of the known mines and prospects in the United States. There is plenty of venture money judging from the "get-rich-quick" failures that the newspapers make much of from time to time. What is most needed is a Federal incorporation law that will send the greater proportion of the money into the proposed enterprise, leaving a reasonable amount only for promotion. The oil people are now feeling the retardation in development due to the many stock swindles. The last mining boom nearly killed this department of the mining business except for the well-established companies.

When Cripple Creek opened it was fairly common practice to obtain a small fraction of a claim, well located, and an acreage outside of the district; then to advertise "our — claim adjoins the famous — mine. We have — acres," and so on. The same practice

went to Goldfield, Nev. There was an instance of a Maine corporation, a fraction in Goldfield, an acreage outside of the known district, an office in Denver, and fifty-seven girls answering letters and posting literature. No wonder the business slumped and with it legitimate mining. A large part of the public look upon mining men as swindlers. The postal laws are a help, but it is hardly the function of the Post Office Department to look after mine promotions.

A large proportion of the mining claims held now are held for speculation; some one locates the geology and waits for a miner or mine operator to reimburse him for being there first. To drive a bargain with these people is nearly a hopeless task. Few are willing to develop a claim when they must previously pay for the privilege. When the carnotite fields were opened, and it was evident that the ore was to be found in a certain sandstone stratum scarcely over two hundred feet thick, the cowboys soon learned a little geology and, knowing the country well, kept it located ahead of the miners.

The assessment law is the source of much evil; its temporary suspension has worked to the advantage of the speculator. Had some work been done some ore might have been discovered. It is rare that \$100 is spent in the bona-fide development of a claim. The various states require for the initial year that a fixed number of cubic feet be removed, and many men assume this also to be the Federal requirement. A 10-ft. hole is sunk in a soft place, regardless of whether it is advantageous to the claim or not; the law is supposed to be complied with. The more common practice is to contract the assessment done on a group of claims for a fixed sum, the contractor filing the affidavit of labor to the effect that he has done \$100 worth of work on each claim. The common price is \$35 per claim; often it is as low as \$25.

In Montana a Federal judge rendered a decision that caused the people in his district to play safe and spend a little more than \$100 in each claim. The Government needs the money, and \$100 per year, if the claim is any good, is not a severe tax. The practice, which is general, of doing title work regardless of its benefit to the property, is a sheer waste and in the aggregate amounts to a large sum of money. The Mexican system is satisfactory; in fact, the whole code is much better than that of the United States. We still have the one that Mexico abandoned about thirty years ago. The largest and best mine in Chihuahua went *caduca* (expired) because the owners did not wish either to pay taxes or develop the property. The best mine in Sonora was given to the watchman because he, and not the American owning company, was willing to pay the taxes and to search for some ore. The tax is a stimulant to an owner to make the ground productive.

The assessment law belongs to a considerable class of land laws that might be called laws to encourage perjury. It would be interesting to know how many iron mines are on land the title to which was obtained under the agricultural homestead law. The Duluth story apropos of this is worth repeating. A homesteader acquiring title to an iron mine on the Mesabi swore at the land office that he had built a house of the required dimensions, with a door, the right number of windows, and other stipulations, and had sowed two acres of land in turnip seed, the hardiest and lightest of all seed to pack, for there were no wagon roads. The clerk demurred, saying that it was during the month of March, there was two feet of snow on the ground, and



the thermometer was below zero. The homesteader called his attention to the fact that there was nothing in the land office rulings as to when the seed was to be sown. The same thing was true of timber claims and also the desert land claims located actually for oil.

The land laws have grown more strict of late years, and it is time that the mining laws should too. Incidentally, it might be interesting to know how the Mexicans switched from the apex law to that of vertical lines. They left no dipping claims located under the old law. Our neighbors to the south do some things better than we do.

H. H. TAFT.

El Paso, Tex.

Although expressions of opinion may be late regarding the proposed amendment to the mining laws extending quartz locations to 1,500 ft. square, with no lateral rights, I would like to say that I regard the suggested change as getting away from nature, even assuming that the location accords with the evident trend of the vein. In a well-mineralized locality, as you are aware, it frequently happens that a vein or veins of more value than the original discovery are found near the side lines, dipping off and therefore lost to the discoverer unless protected by an additional location. With a claim having 750 ft. each side of the vein the ore of the location vein might dip beyond the side lines as in the occurrences at a number of Sudbury's famed nickel mines. Of course, our Canadian neighbors play safe and secure an additional lateral extension, and the government is fair enough to protect original rights in granting possible conflicting concessions. We have no such benign rule as this, and, to our discredit, no department or commission to enforce a rule of that character. But the whole question of mere "dimension," as applied to the mineral fields of the United States, is aside from the mark, vain, and inconsequential in comparison with the real issue.

Instead of 1,500 ft. square (about fifty-two acres) why not a mile square (640 acres), at a mere nominal price for patent, providing that development work is carried on for five or ten years and a commercial orebody can be shown? It might not be a good policy, but it would at least be a consistent policy.

Are mining people in general aware that homestead grazing entries in mile-square and equivalent zigzag locations are being made by the thousands on some of the most valuable mineral lands of the West right to the very mountain tops? A vast mineral domain of unlimited potential value is simply gobbled up by "wise" homesteaders in 640-acre tracts, and patents are issued within three years from date of entry but at no cost to the entrymen aside from the mere filing fees, except the comparatively trifling cost of a habitable cabin and wire fencing to inclose the domain claimed.

Consider the great public mineral domain inclosed in a barbed five-wire fence and forever withdrawn and lost to the Government by act of Congress (stock-raising homesteads) Dec. 29, 1916! Very true, this deceptive act pretends to reserve the mineral on such grazing entries to the Government, and has a provision to that effect in the patent, but, whether overtly or through bucolic indifference, it is only pretense, as the experienced know full well. When a homesteader builds a barbed-wire fence around his mineral reserve, how, let me ask, is a prospector or mining man going to "inspect" for mineral, to say nothing of digging without being promptly placed under arrest for trespassing

inside an inclosure? The following paragraphs outline the manner in which it works:

The same act that gave away the mineral fields of the West specifies that the intending prospector for mineral may enter a stock-raising homestead by first putting up an available \$1,000 bond, "commercial bond," preferred, to cover any damage (real or imaginary) that the homesteader may feel inclined to demand, provided that the prospector formally and at great length files certain petitions and observes certain lapses of time and formalities that with competent legal advice may easily reach \$1,000 in addition to the expense of the bond itself. In the meantime, the homesteader, being fully advised, may do a little prospecting on his own account and block out the intending prospector altogether. The only other alternative is to "buy in" with the homesteader and give him, absolutely free of cost, an equal share in all mineral discovered. That's how! The lonely homesteader (?) is hardly to blame for taking everything in sight when Congress has given it to him simply for fencing up, and has pointed out just what to do to bring the prospector to terms.

The Canadian licensing system for prospectors, with its comparatively trivial fees, has been severely criticised, but it will be seen that a general license from the twenty thousand or more present and intending homesteaders on mineral land may easily reach a fabulous sum. In the various cities, large and small, adjacent to the mineral fields, including such important cities as Denver, Salt Lake, El Paso, San Francisco, Butte, and Spokane, there is a more or less active, red-blooded contingent of fully a quarter of a million of seasoned prospectors, not sissy-boys, ready for the field when the call comes. A license from the homesteader to each of these individuals to inspect a single homestead entry would involve a probable outright cost of \$350,000,000, with nearly as much more to be put up as bonds for "constructive" damages. A general license or permit to the entire prospective contingent from the "lonely" homesteader would likely reach six trillion dollars in initial expense money, and an additional five trillions in commercial bonds subject to forfeiture, making the rather neat sum, all told, of eleven trillion dollars—many times the cash valuation of the entire civilized world. And that is the terms of the "reservation." Class legislation? Well, I guess. Unconstitutional? No doubt; but it's the law and seems to be going through. If it stands, mining is suppressed and the flag is imperiled.

The situation is simply this: The Government by its representatives in Congress made an outright present of its vast mineral domains to stock raisers on the sole condition that they inclose it with barbed wire, yet pretending to reserve the mineral to the Government. Then the prospector, being perforce the sole and only representative of the Government, is forever debarred from entrance on its mineral domain by terms that cannot possibly be complied with. The great mineral domain has therefore been definitely legislated beyond the jurisdiction of the United States, where it is wholly inaccessible and might as well be in Darkest Africa or the interior of far-off Thibet. The knife of the "invader" is at the throat of the whole future of mining, as relates to any new discovery. The sole condition of his entry is that he "entrench" behind barbed wire and stand pat on his rights as made and provided. And the lamentable fact is in evidence that his entrance was by way of Washington, D. C.

Baker, Ore.

M. L. KEIZUR.

## Central Idaho—A Rugged Mining Region

Country Well Mineralized but Little Developed—Many Deep Gorges And Lack of Roads Make Travel Arduous—Erosion Proceeding Rapidly—Rock Falls and Landslides Common—Water Power Wasted

BY GEORGE J. BANCROFT

Written for *Engineering and Mining Journal*

CENTRAL IDAHO is probably less developed and open to exploration and travel than any other part of the United States except Alaska. Two other tracts of ground in the West have no railroads, but these regions have wagon roads. Central Idaho has little but trails, and poor trails at that. The district is interesting in several respects. It is a rough country; it has wonderful undeveloped water powers; it has considerable undeveloped mineral resources, and the geology is worth investigation and study because of the fact that it contains the great Idaho batholith of granite.

By far the most impressive topographical feature of central Idaho is the great canyon of the Salmon. For

tive to the scene and force home the immensity of the great abyss. These clouds, drifting up to the side canyons, bring out ramifications of the panorama which otherwise are obscured by the haze of the distance.

The Salmon has a swift but fairly deep current. It is now used for boating down stream. No one has yet successfully ascended the river in a power boat, but it is possible that it may be practicable with modern boats.

Salmon City, near the eastern border of the state, is a pleasing little town on a railway which branches off the Oregon Short Line at Armstead. Measuring down the river to Lewiston, near the western border of the state, the distance is 305 miles. Between Salmon City and Lewiston there is a wilderness—and nothing else.

A man named Guleke builds barges at Salmon and floats down the river to Lewiston, where he sells his barge for old lumber and goes back by train to Salmon City. He takes supplies to the trappers and prospectors and brings pelts and "dust" out. It is a wonderful boat ride.

### FISH AND GAME PLENTIFUL

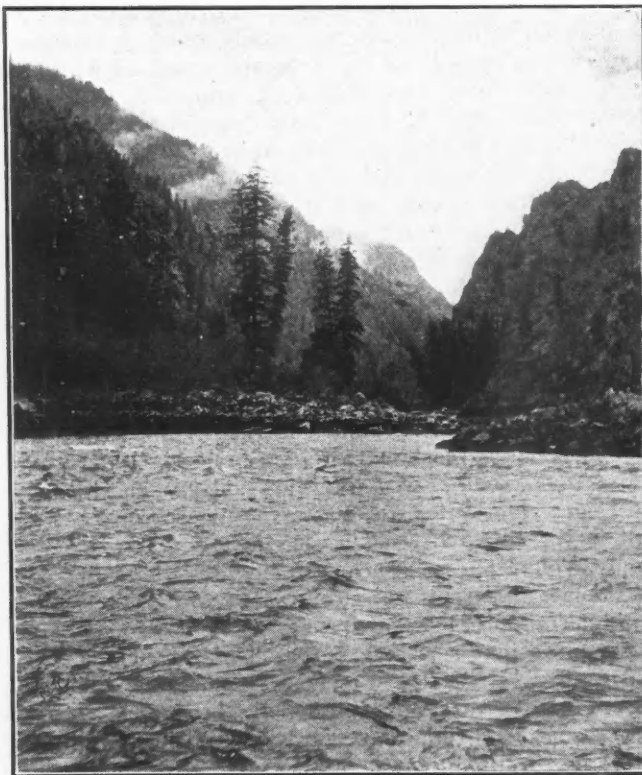
The country abounds in fish and game. In the bigger streams the fish grow to great size. They are locally known as salmon trout, bull trout, and dolly vardens. There is also the Salmon River pike, which is even a gamier fish than a trout. In the smaller streams one finds the ordinary trout in great numbers.

As for game, deer and grouse are the most plentiful. There are also bear, mountain lions, lynx, wildcats, coons, otter, martin, fishers, elk, mountain sheep and mountain goats, coyotes, and wolves.

### GORGES MAKE COUNTRY DIFFICULT OF ACCESS

The present topography of the country containing the Idaho batholith is that of a deeply dissected plateau. The higher summits range from 7,600 ft. (Mount Marshall) to 9,000 ft. (Buffalo Hump) above sea level. Buffalo Hump is, however, like a shark's fin sticking out of a plateau which is about 8,000 ft. high. As one stands on any of the high summits and gazes abroad, the country appears flat. One gets no idea of the deep gorges which render the region so inaccessible. The tops of the ridges are evidently not far below the old peneplane formed by the batholith, so their summits still preserve a semblance of a plane when viewed from a distance. If one then turns from gazing abroad and looks at the near-by surroundings, one is almost sure to look down into an awe-inspiring gorge, for the summits as a rule are narrow ridges. There are few patches of plateaus left that are over a few acres in extent. The Buffalo Hump plateau is an exception. It is a rough table land, ten miles long and a mile wide in places.

The streams are yearly cutting deeper. This is a condition not general in the West. In most districts



CANYON OF THE SALMON RIVER, CENTRAL IDAHO

260 miles, between walls which rise 4,000 to 6,000 ft. above the water, this majestic river rolls toward the sea. At places there are precipitous cliffs, but for the most part the slopes are clad with coniferous trees that lend a softness to the landscape which is often lacking in most of our Western scenery. The more one sees of this great chasm, the more impressive it becomes. Viewed for the first time on a clear day, it may be disappointing, but as one sees it clad in the snow of winter, and in the verdure of summer, in light and in shade, in moonlight and in daylight, in fog and in smoke, it becomes more and more awe inspiring. I think it is most impressive when small fog clouds lend a perspec-





1. ORO GRANDE, A CAMP IN THE HEART OF THE IDAHO BATHOLITH. 2. JUMBO MINE, ON THE FLANK OF BUFFALO HUMP

there are accumulations of silt, forming meadows and parks. Not so in central Idaho. The streams occupy the bottoms of V-shaped canyons. There are virtually no soil banks and no patches of flat land in the canyons of the main streams. The little ranches in the canyons are seldom more than a few acres in extent, and each one that I have seen was clearly caused by some other agency than the normal accumulation of silt.

Landslides are the most general geological basis for a ranch. The side of a mountain slips off, damming the stream, and a large lake forms, which in time becomes a meadow. Then, again, two torrential streams may enter a larger stream directly opposite each other. Their deltas will meet in midstream and build up, forming twin bars, which may become large enough for little farms.

FALLS OF ROCK FREQUENT

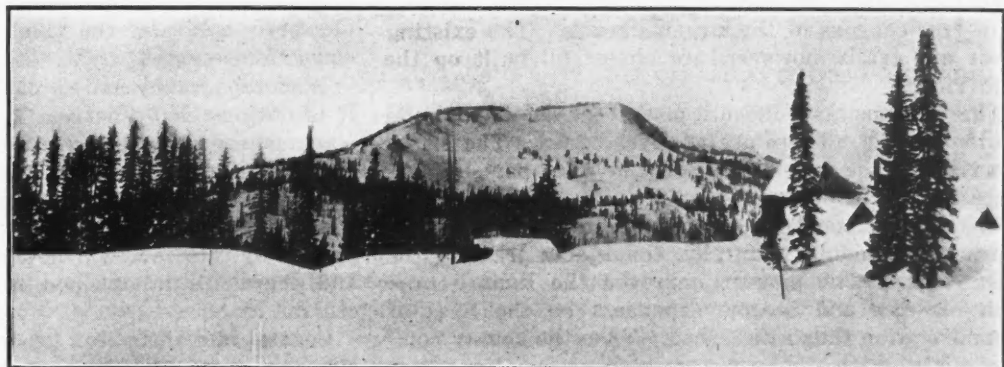
So great is the fall of the main streams, and so large the volume of water during the season of high water, that the thunder and rumbling of boulders traveling toward the sea is most impressive. One can often feel the ground shake when an extra big one goes visiting. During the spring of the year great quantities of rock come tumbling off the cliffs. Much livestock and some men are thus killed. One sees the same thing in all steep countries, as in the San Juan Mountains of Colorado, for instance; but nowhere have I seen so much rock fall as in the Idaho batholith. In a recent four-mile trip along the cliffs of the Salmon Canyon, I venture to say that I was never out of sight of the freshly fallen boulders, and in places it was evident that great masses had come down. Yet the great Salmon River moves all this material, every year, clear out of central Idaho and is ready next year for more. We are accustomed to regard erosion as a deduction of abstract reasoning. We can seldom actually see much erosion take place; but central Idaho is an exception in this respect as in many others. Here one can actually see material erosion take place from year to year. The central Idaho region is naturally the home of landslides. One sees them

every few miles. Some, no doubt, come down like snow-slides, attendant with terrible havoc, but most of them are relatively tame affairs. There are two kinds: one the creeping kind, the other the sluffing kind. The creeping landslides are the larger, so far as my observation goes. Sometimes they involve eighty acres or so. A steep sidehill will start to slide. Every spring it creeps a little further. During the dry season there is no movement, but in the wet season it groans and cracks and the trees tilt and fall; and altogether things look ominous. Then the dry season comes, and men cross it again with unconcern. All the east side of lower Bear Creek is involved in a slide of this type.

The sluffing type seems to be often caused by a vein or a moving fault fissure. The sulphate solutions from an oxidizing vein soften the rocks and, in favorable locations, they crumble and fall. There are numbers of these sluffing slides, and they are unpleasant to inspect because they are never inactive. Even in the dry season, showers of rock come tumbling down at intervals. Hence, my curiosity never prompted me to inspect more than two of them closely. One I located as a mining claim: it was caused by a vein which assayed \$10 per ton, and which had been exposed by the slide.

One of the most prevalent causes of loss of stock and even of men is called "rolling" in the local vernacular. By "rolling" is meant tumbling to death down the steep hill slopes. The winter of 1920-1921 was exceedingly bad for "rolling." Of the fourteen horses which wintered on Crooked Creek, six "rolled." This was caused by severe cold weather in November, which froze the ground so solid that even the southern slopes stayed frozen all winter.

Men sometimes "roll" as well as horses. I have heard



BUFFALO HUMP, CENTRAL IDAHO, IN WINTER

of three deaths from this cause, and mysterious disappearances are not uncommon.

With all the heavy fall of snow in the highlands, and the long steep slopes, snowslides are remarkably rare. I do not understand why this is. I have seen 12 ft. of snow resting on a 37-deg. slope half a mile long, which had no live timber upon it. In Colorado these conditions would almost surely produce a snowslide, but not in Idaho.

The winter of 1920-1921 was marked by a few serious snowslides, because of the early freeze. The Cracker



OUTCROP OF WAR EAGLE VEIN

Jack mill was carried away, and trees that were probably one hundred years old went with it. The slide must have been impressive. The mill was fully a third of a mile down a gulch of moderate slope from the center of the basin that slid in. A river of snow was formed that filled the gulch about 300 ft. wide and 60 ft. deep, and flowed to a point a little below the mill. Despite the bad conditions of last winter, there were relatively few slides, but those that did run were wicked.

#### ROADS AND TRAILS BUILT ON RIDGES

The foregoing description shows that the logical avenues of transportation in this country are the deep snow-free canyons of the larger streams. The existing roads and trails, however, are almost all built on the high ridges.

The canyons are difficult places in which to build roads or trails. There are no river banks. The slopes run right to the water's edge for the most part. Where there is a bank deposit, it is likely to be composed of great angular boulders, and is sure to be a tangle of brush and timber. Naturally, the Indian traveled the open ridges. The pioneer improved the Indian trails with his axe, and became dependent on the lines of communication thus established. Then the county commissioners, with their piecemeal appropriations, extended wagon roads cut along the pioneers' trails. Now,

as we look backward, we see that enough money has been spent on these ridge roads and in the yearly snow fight to have built first-class canyon roads in the first place.

The day of good road building has arrived, however, and this difficult country may soon cease to be inaccessible, and may then be a busy mining and lumbering center. At present, I believe that it is the most impenetrable part of the United States.

#### SEVEN STAGES TO THE WAR EAGLE MINE

I asked a wag as to the means of reaching the War Eagle mine, prior to my initial venture in central Idaho, and he replied: "You take the 'Limited' as far as you can, then you take a log train as far as you can, then you take the stage as far as you can, then you take a sleigh as far as you can, then you take a dog sled as far as you can, then you snowshoe as far as you can, and then you climb up a rope." In a measure this was correct. I took the limited to Nampa, a log train to McCall, a stage to Half-way House, a sleigh to Burgdorf, a dog sled to Warrens, snowshoes to the Salmon, which I crossed in a canoe, and the latter end of the trail approaching the mine was so steep that a rope was provided as an aid in climbing the incline leading to the property.

The central part of central Idaho has no roads at all, and the trails are not worthy of the name. They are at best a string of blazes through the omnipresent forest, and every trapper in the country considers it his personal privilege to blaze a line out to any trap he may set. So one can imagine the bewilderment of a stranger trying to pick out the right string of blazes from the maze of trappers' and prospectors' blazes. Of course, after a bit one learns that the main trails will follow the main ridges in the direction intended, and this fact often helps one to pick the right string of blazes from the wrong one.

The climate of central Idaho is chiefly characterized, from a utilitarian standpoint, by the enormous snowfall on the higher levels. For instance, the snow lies 8 ft. to 15 ft. deep on the level at Mount Marshall and Buffalo Hump, while at the same time there will be no snow at all on the southern exposures near the bottom of the canyon of the Salmon River, which lay 5,000 ft. below.

The climate of the Pacific Northwest is characterized by a long stormy winter and a dry summer. Central Idaho is no exception to this rule. In the winter it will sometimes storm for two months steadily, and in the summer time it will often be cloudless for a similar period. It is at the end of the long dry summer that forest fires are such a menace. The dense smoke is most depressing to the spirits. The sun looks like a blood-red ball, and the light (or darkness) is about equal to moonlight.

With topography and climate such as those described, it is obvious that this is a locality prolific in splendid water-power sites. I have not investigated the power features of the main streams, but have measured some of the smaller ones. Minimum flows of 75 sec.-ft. and falls of 600 ft. to the mile are not uncommon. A stream of this sort will develop 4,000 hp. to the mile, and there are miles upon miles of such streams in central Idaho.

Central Idaho has been generously mineralized. Gold, silver, copper, lead, zinc, molybdenum, tungsten, and radio-uranium deposits have been found. The predom-





INTERNATIONAL MINE, NEAR ORO GRANDE, CENTRAL IDAHO

inant metal is gold so far as explorations have gone. There are great numbers of large outcrops, similar to those at Butte, which may develop into copper or zinc mines below the zone of leaching, but these prospects must of necessity await the development of the country. The little work being done is chiefly gold mining.

During the period of readjustment following the Civil War this country proved a godsend to the Union, for it produced \$150,000,000 in gold during those lean years. The gold came from small rich placers, soon exhausted.

The lode mines have not as yet proved as profitable as the placers. The placer miners, even the Chinamen who followed the whites, cleaned up their claims, and, finding nothing which they could work at a profit, abandoned the country. So it is again a sparsely inhabited wilderness.

The gold-bearing veins are many, and the values are such that many of the veins could be profitably worked under more favorable conditions than those which have existed heretofore. A few high-grade mines have paid handsomely, but high grade in central Idaho is like high grade elsewhere—it is limited in quantity.

Around the rim of the Idaho batholith are the following mining camps: Payette Lake, Boise Basin, Rocky Bar, Atlanta, Thunder Mountain, Yellow Jacket, Salmon City, Shoup, Elk City, Peirce, Newsome, Florence, Mount Marshall, Seven Devils, and New Meadows. In the heart of the batholith are Warrens, Oro Grande, War Eagle, and Buffalo Hump.

With the building of new roads in the bottoms of the snow-free canyons, which is now under way; with the opening of the Salmon River to down-stream navigation, which was done by Harry Guleke with the financial aid of William H. Day, Jr., of Dubuque, Iowa, and with the general lowering of working costs which is now in progress, it is safe to say that central Idaho is at the dawn of a period of increased mining activity.

### Rolled-Zinc Production Declined in 1921

The output of rolled zinc in the United States in 1921 fell off nearly one-half, as shown by reports made to the U. S. Geological Survey by producers. The market quotation on rolled zinc, in mill lots at the smelters, at the beginning of 1921, was 11.5c. per lb., with the usual discounts, but the quotation declined to 8.50c. per lb. at the close of the year.

The notable feature of the year in the rolled-zinc industry was the importation of large quantities of sheet zinc, for only a few tons had been imported each year since 1915. From April 1 to June 30, 1921, there was imported and entered for consumption 4,245 tons of sheet zinc, having a declared value at the foreign mills of \$277,830, or 3.27c. per lb. In the first quarter also the imports were large, but during the last half of the year they were small. The declared valuation in the last half of the year was larger by 2 to 3c. per lb., and at the same time the domestic price fell off 3c. from the price at the beginning of the year, so that at the close of 1921 the price of American sheets was less than that of the foreign.

ROLLED ZINC IN THE UNITED STATES, 1920-1921.

	1920	1921
Sheet zinc not over one-tenth inch thick:		
Quantity, lb.....	56,812,989	28,580,904
Value.....	\$6,625,660	\$2,844,406
Average price per lb.....	\$0.117	\$0.100
Boiler plate and sheets over one-tenth inch thick:		
Quantity, lb.....	3,950,489	2,545,755
Value.....	\$402,035	\$192,987
Average price per lb.....	\$0.102	\$0.076
Strip and ribbon zinc:		
Quantity, lb.....	45,704,052	29,673,527
Value.....	\$5,262,538	\$2,902,815
Average price per lb.....	\$0.115	\$0.098
Total rolled zinc, lb.....	106,467,530	60,800,186
Total value.....	\$12,290,233	\$5,940,208
Average price per lb.....	\$0.115	\$0.098
Sheet zinc imported and entered for consumption:		
Quantity, lb.....	7,572	13,375,245
Value.....	\$614	\$496,445
Declared value per lb. at foreign mills.....	\$0.081	\$0.037
Rolled zinc exported:		
Quantity, lb.....	23,704,197	3,631,647
Value.....	\$2,832,993	\$425,618
Average price per lb.....	\$0.12	\$0.117
Available for consumption, lb.....	82,770,905	70,343,784

### Reactions in the Purification of Copper-Sulphate Solutions

At the Pacific Station of the U. S. Bureau of Mines, at Berkeley, Cal., in the study of the purification of copper-sulphate solutions, it has been definitely proved that some active form of oxygen is formed when ferrous-sulphate solutions are blown with air in the presence of suspended finely divided lime rock. In solutions containing both ferric iron and aluminum under the same conditions, the calcium carbonate is converted into almost pure calcium sulphate containing hardly any iron or aluminum, the latter forming colloidal hydroxide, deep brown and clear in solution.

### Hardwood Creosote on Differential Flotation

In the course of flotation experiments being conducted by the Moscow, Idaho, field office of the U. S. Bureau of Mines, in co-operation with the Simon Silver-Lead Co., of Mina, Nev., it has been found that hardwood creosote alone gave a fair differential separation of the galena and sphalerite. In combination with sodium dibasic phosphate, a marked flotation of the galena in preference to the sphalerite was given. Sodium carbonate and creosote gave better results than creosote alone, the same being true for potassium permanganate.

## Costs of American Copper Production, 1909-1920 Inclusive\*

Wide Fluctuations Indicated by a Survey of the Average Production Expense Of the Principal Porphyry, Vein, and Lake Mines, Reduced to a Common Basis—Porphyries Are the Dominant Group, Followed by Vein Mines

BY H. A. C. JENISON

Written for *Engineering and Mining Journal*

THE COST of copper production has been a subject of much discussion and varying opinions for many years. During the war, when both the selling price and the costs of production of copper reached such high levels, the subject of costs and profit was of still greater interest, and yet, so far as I have been able to learn, no general analysis covering the costs of operations reduced to a single basis has been published.

The Super-power Survey of the U. S. Geological Survey, in its study of the possible general electrification of industrial plants and railways on the eastern coast of the United States, found it essential to know what the average cost of production and the selling price of copper had been for the last decade, so as to formulate some basis upon which to calculate the probable price of copper required by that project. No such data were available, and I was designated to make an analysis of costs and selling price. The results were so largely a confirmation of the opinion of those familiar with the industry, and of such apparent interest, that their publication was requested for the general information of the public.

### MINES OF THREE GENERAL CLASSES

To determine the relative costs and market influence of the various mines, they have been roughly divided into three natural groups: (1) The vein and replacement group, which embraces the mines of the Butte, the Copper Queen, the United Verde, and United Verde Extension, and Calumet & Arizona and other types; (2) low-grade disseminated ore mines of the (a) open-cut type, such as Utah, Nevada, and Chino, and (b) under-ground disseminated ore mines of the Inspiration, Ray, Miami, Shannon, Arizona Copper Co., Moctezuma, and similar type; (3) the Lake mines, which include all mines in the Lake Superior district. There is no fundamental difference in the character of the Lake mines and the Western disseminated ore mines so far as grade or the necessity for the beneficiation of ore is concerned, but the geographical occurrence, the long intimate association in the public mind, the depth and unique genesis, and the mineralization of the Lake ore make a separate grouping advisable.

Eleven of the principal vein and replacement mines, eleven of the principal disseminated ore mines (loosely known as porphyries), and twenty of the principal Lake mines are included in this analysis. All but two of these mines are in the United States; one is in Alaska, and the other in Mexico. The Mexican mine included is operated by an American company, and the operations of the Mexican and American branches of this company are so intimately related that they cannot be satisfactorily separated. Only one of the important producers

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of copper from domestic ores has been omitted. This omission was necessary, as the available data upon costs by this company are reported in such terms that they could not be satisfactorily reduced to the basis employed in this analysis.

Under normal conditions there probably is no appreciable difference between the average costs at the forty-two mines herein considered and the total average cost of copper from domestic ores.

This assumption is supported by the fact that the production by these mines since 1909, with the exception of 1920, has been a high and fairly constant percentage of the total production of copper from domestic ores.

### PRICE AVERAGE FAIRLY CONSTANT

Furthermore, though the same selling price has not been obtained by every company, except when fixed by the Federal Government, the individual variation from the average selling price has been slight. Under pre-war conditions the difference between the average cost of production and the average selling price was fairly constant. An increase or decrease in cost of production by these mines was with few exceptions quickly reflected in the average yearly selling price, and a decrease in average yearly selling price was soon followed by a decrease in production.

These conditions clearly indicate that the mines considered in this analysis dominate and regulate the copper-mining industry of the United States, and therefore largely control the copper industry of the world. It is evident, then, that the costs of production by the mines herein considered must determine the costs at which the small domestic mines may operate at a reasonable profit, under normal competitive business conditions. During the war, however, the demand was so much greater, and the selling price so much higher, that the industry no longer operated upon a normal competitive basis. Consequently, the principal mines no longer determined the costs at which the smaller mines could profitably operate, and temporarily the control of the industry largely passed out of the hands of the principal companies.

As soon, however, as the war demand was terminated and the copper market became commercial and industrial again, the selling price declined to a figure which represented the average cost of production by the principal mines plus a profit nearly equal to the pre-war profit. This condition was evidently truer in 1920 than in 1919. The difference between average cost and average selling price in 1920 was about 3.5c. per lb., or somewhat less than the average difference for the pre-war period, but about equal to the difference during four of the six pre-war years, and indicated a willingness upon the part of the principal producers to accept a profit comparable to the pre-war profit.

The decrease in price in 1919 and 1920 was followed



by the closing down of many small mines, and the 1920 production showed that a higher percentage of the total production was derived from the principal mines than in any previous year. Many small mines which together had made a considerable production during the war could not profitably operate any longer, and the control of production and selling price was returned in a great measure to the principal mines.

The data upon which these costs have been calculated have been obtained in nearly all instances from the companies' annual reports. Companies which published no annual reports, or those which are engaged in such a variety of metal production that the annual reports contain too little data to determine the costs of copper production separately, supplied confidentially their costs of copper production or sufficient supplementary data to make it possible satisfactorily to determine them from their annual reports.

**COSTS BROUGHT DOWN TO A COMMON DENOMINATOR**

In this analysis all costs have been reduced to a common basis, which consists of mining, milling, smelting, refining, transportation, and selling costs, general administration charges, depreciation of plant and equipment charges, and state and local taxes. Federal income and excess profits taxes and depletion charges are the only items excluded. These items and their influence upon profits are discussed separately and in general terms only, on account of inadequacy of data.

In considering production where precious metals were recovered from the treatment of copper ores, their value has been credited to the costs of copper production, as has also miscellaneous income actually incident to copper-mining operations. Such miscellaneous income embraces all income derived not from the production and sale of metals but from other operations or enterprises which were maintained as a necessary auxiliary part of mining operations and which would probably cease to exist immediately upon the discontinuance of mining operations, such as the profit realized on the smelting of small quantities of custom ore by a company which maintains a smelter for the sole purpose of smelting its own ore and to which the smelting of custom ore is purely incidental, and the income realized from the sale of small quantities of power by a company which maintains a power plant for the sole purpose of supplying power and light to its mines, mills, and smelter.

**SELLING AND DELIVERY CHARGES REQUIRED SPECIAL TREATMENT**

During 1919 and 1920 many companies produced more copper than they sold, and in their annual reports they indicated the cost of production of all copper produced, and to this cost was added the selling and delivery cost of copper actually sold and delivered. To arrive at satisfactory total costs for the total production of such companies, it was necessary to consider all copper as sold and to add to the production costs of the unsold part of the year's production proportional selling and delivery costs which would have been incurred had the unsold copper been sold.

It is not to be supposed that the figures contained in this analysis represent absolutely the costs of production of the individual mines, of the three groups, or of the three groups combined. Such an analysis could not be made from the data available, especially as there is no exact uniformity in accounting practice. However, the results obtained in this analysis are believed to

approximate closely enough the actual costs to present a fairly correct summary of the industry during the time considered.

The following tables and diagrams summarize the costs of production and the cost and production relations between the various groups and the total smelter production:

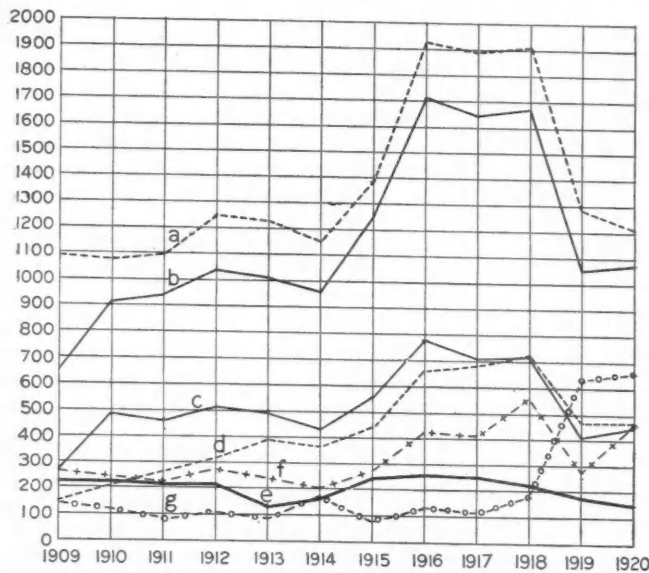
**AVERAGE COSTS OF PRODUCING COPPER BY THE PRINCIPAL VEIN, LAKE, AND PORPHYRY MINES IN THE UNITED STATES, FOR THE YEARS 1909 TO 1920, INCLUSIVE.**

Year	Vein		Lake		Porphyry	
	Production, Pounds	Average Cost Per Pound, Cents	Production, Pounds	Average Cost Per Pound, Cents	Production, Pounds	Average Cost Per Pound, Cents
1909.....	272,830,408	8.97	226,575,286	9.9	154,089,208	9.2
1910.....	487,289,463	8.2	218,272,734	9.9	205,593,242	8.4
1911.....	463,322,929	8.8	213,093,306	9.6	263,284,521	8.1
1912.....	510,801,542	9.0	215,859,751	10.7	314,037,391	8.7
1913.....	492,092,409	10.1	130,487,378	13.8	389,239,696	9.3
1914.....	428,435,453	9.8	159,278,415	11.5	365,445,511	8.3
1915.....	557,696,842	9.5	243,802,361	9.6	442,126,316	7.9
1916.....	787,443,989	10.7	259,511,319	12.4	665,469,103	9.3
1917.....	712,239,051	12.2	253,769,681	15.6	680,700,041	12.7
1918.....	723,478,901	13.6	226,901,556	18.9	724,069,192	13.98
1919.....	408,348,013	14.6	177,463,610	18.4	467,695,747	14.6
1920.....	450,760,285	14.2	153,021,787	18.2	470,250,341	14.6

**AVERAGE COST OF PRODUCING COPPER BY PRINCIPAL MINES DURING THE PERIODS 1909 TO 1914 INCLUSIVE, PRE-WAR YEARS; 1915 TO 1918 INCLUSIVE, WAR YEARS; AND 1919 AND 1920, POST-WAR YEARS.**

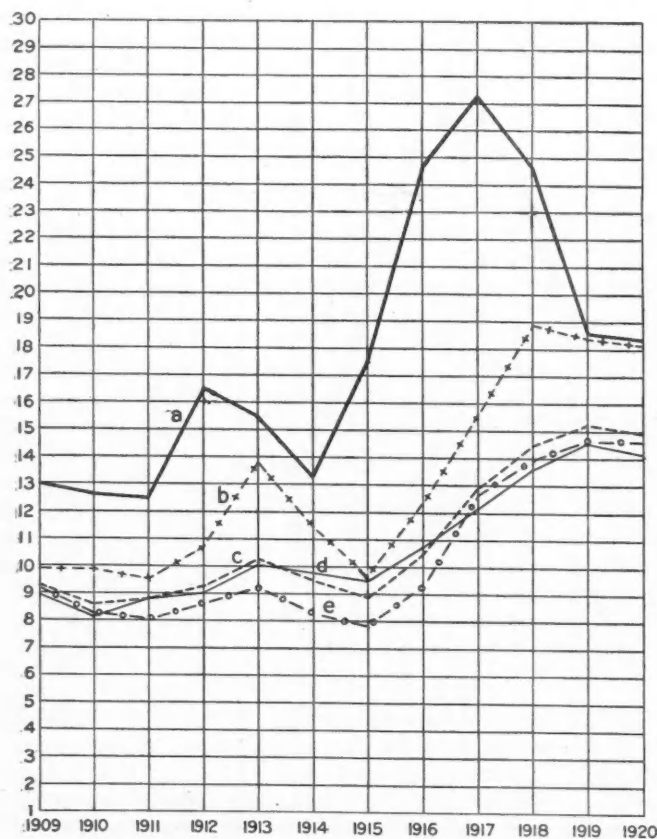
Year	PRE-WAR PERIOD		Average Price Received Per Pound, Cents	Average Cost Per Pound, Cents			
	Total Smelter Production in the U. S., Pounds	Production by Principal Mines, Pounds					
1909.....	1,092,951,624	653,494,902	13.0	9.3			
1910.....	1,080,159,509	911,155,439	12.7	8.6			
1911.....	1,097,232,749	939,700,756	12.5	8.8			
1912.....	1,243,268,720	1,040,698,684	16.5	9.3			
1913.....	1,224,484,098	1,011,819,483	15.5	10.2			
1914.....	1,150,137,192	953,159,379	13.3	9.5			
Average cost.....			6,888,233,892	5,510,028,643	14.0	9.3	
Difference between average price received and average cost.....						9.3	4.7
Year	WAR PERIOD		Average Price Received Per Pound, Cents	Average Cost Per Pound, Cents			
	Total Smelter Production in the U. S., Pounds	Production by Principal Mines, Pounds					
1915.....	1,388,009,527	1,243,625,519	17.5	8.9			
1916.....	1,927,850,548	1,712,424,411	24.6	10.4			
1917.....	1,886,120,721	1,646,708,775	27.3	12.9			
1918.....	1,908,533,595	1,674,449,649	24.7	14.5			
Average cost.....			7,110,514,391	6,277,208,352	23.2	11.9	
Difference between average price received and average cost.....						11.9	11.3
Year	POST-WAR YEARS		Average Price Received Per Pound, Cents	Average Cost Per Pound, Cents			
	Total Smelter Production in the U. S., Pounds	Production by Principal Mines, Pounds					
1919.....	1,286,419,329	1,053,507,370	18.6	15.2			
1920.....	1,209,061,040	1,074,032,413	18.4	14.9			
Average cost.....			2,495,480,369	2,127,539,783	18.5	15.1	
Difference between average price received and average cost.....						15.1	3.4
Grand Total			16,494,228,652	13,914,776,778	18.65	11.35	
Average cost.....						11.35	7.30
Difference between average price received and average cost.....						7.30	

It is apparent that the copper industry realized a great operating surplus during the war, particularly during the years 1916, 1917, and 1918, but the actual profit realized during the period was much less than the operating surplus. The operating surplus indicated by the costs herein shown is exclusive of depletion charges and Federal income and excess profit taxes. Though depletion charges have not been carefully calculated, they probably averaged for the last six years the equivalent of about 3c. per lb. of copper produced. Some of the largest producers have been allowed a depletion charge equivalent to almost 4c. per lb. of copper produced and a few of them less than 2c. per lb. of copper produced.



PRODUCTION AND STOCKS OF COPPER

- a—Total smelter production of the United States from domestic ore.
  - b—Total production of principal mines (all groups).
  - c—Production of principal mines (vein and replacement group).
  - d—Production of principal mines (porphyry group).
  - e—Production of principal mines (Lake group).
  - f—Stocks of blister and materials in process of refining at end of each year.
  - g—Stocks of new refined copper in hands of refiners at end of each year.
- Note—Vertical scale is in millions of pounds.



AVERAGE SELLING PRICE AND COSTS OF COPPER PRODUCTION

- a—Average selling price per pound.
  - b—Average cost per pound Lake group.
  - c—Average cost all groups.
  - d—Average cost per pound vein and replacement mine group.
  - e—Average cost per pound porphyry group.
- Note—Costs include mining, milling, smelting, refining, transportation, selling costs, general administration costs, depreciation of plant and equipment charges and all taxes except Federal income and excess profits taxes. Depletion charges not included. Value of the precious metals recovered and miscellaneous income incident to actual mining operations are credited to costs of production. Vertical scale is cents per pound.

The depletion charge is transferred from operating income to depletion reserve, and the operating income applicable to dividends is reduced that amount—roughly 3c. per lb. of copper produced for the entire industry.

In addition to the reduction of apparent profit on account of depletion charges, there are the Federal income and excess profit taxes, which further reduce the operating income applicable to dividends. It is at this time impossible to determine the amount of such taxes which must be deducted from operating income, as many of the companies have not yet had final adjustment of the 1918 taxes, and the 1919 and 1920 taxes are almost without exception still subject to adjustment.

A second condition which must be taken into consideration is that of arrears in development work. During the war many mines, on account of the high cost, shortage, and inefficiency of labor, the high cost of material, the great demand for copper, and the high selling price thereof, curtailed development work to that which was essential to early ore extraction. Under the circumstances it was safe and necessary to curtail development, but the abnormal curtailment reduced development costs per ton of ore mined and per pound of copper produced during the last three years of the war.

DEVELOPMENT CHARGES INFLUENCE POST-WAR COSTS

The making up of these development arrears was undertaken largely in 1919 and 1920, but the cost thereof properly belongs to the war period. The costs of this work appeared in 1919 and 1920, and in a number of instances prevented a material reduction in costs during the last two years. Though the cost of making up the arrears in development should be added to the war costs, it cannot be distributed and will serve only to prevent in a measure the reduction of production costs by the companies which have it to do, thereby making their post-war profits smaller for a time than they otherwise would be.

Another consideration to be taken into account is the considerable production costs by one large mine and numerous small mines which do not appear in this analysis. During the war the principal mines were unable to supply the entire copper requirements of this country and the allied nations, and the deficiency was made up by numerous small mines. The cost data available upon these mines is too meager to make a satisfactory determination of them possible, but it is sufficient to indicate clearly that their costs were much higher than those of the principal mines.

It is more than likely that in numerous operations the high selling prices during 1917 and 1918 were necessary to permit numbers of small mines to continue at even a small profit. During 1920 the production by the principal mines exceeded the previous year's production, but the total smelter production from domestic ore was much less than the previous year's production, which indicates that numerous small mines were unable to produce copper profitably at 18.4c. per lb., and probably, not having a sufficient surplus to attempt to continue operations until conditions improved, had closed down. There appears to be no doubt that a large part of the metal produced by these small producers during the war was derived from ore which they cannot profitably mine under normal conditions. If the costs of such production could be satisfactorily determined, they would no doubt materially increase the average costs of production for the war period as here shown.

The comparative costs and production by the three



groups are interesting, as they indicate governing factors of the industry and shed some light upon the question of low cost by the porphyry copper-producing group.

It is difficult to determine whether or not as a group, for a long period of years, the porphyries can produce copper at a lower cost than the vein mines can. The porphyries operated at a capacity worthy of their reserves for such a short time before the war that the low costs they attained can hardly be considered more than an indication. They did, however, demonstrate that so long, at least, as the vein and replacement mines were the dominant factors in production, and their reserves could be maintained at the grade worked before the war, they could, by treating a sufficient tonnage, produce copper at a lower cost than the Lake or vein mines could.

**PORPHYRIES REACHED MAXIMUM PRODUCTION DURING WAR**

Had not the war upset normal competitive production, it is more than likely that the difference in cost between the vein and porphyries would have been maintained and perhaps increased in the porphyries' favor for some time longer. In 1916, however, the war demand upset all normal tendencies, and the lowering of costs became of less importance than increasing production. Prior to the war, the porphyries had not reached their maximum capacity or efficiency and were treating only such ore as they could be sure of profitably treating under the existing conditions. In most operations the ore was of higher grade than the principal part of the reserves, and it is certain that if average-grade ore had been treated the costs would have been much higher. It is doubtful if much of what is now considered reserves could have been profitably mined prior to the war. The accompanying table, which represents the weighted averages of the seven most important porphyries, indicates these conditions clearly.

During the pre-war period, the total average costs of production more closely approximated the costs of production of the vein group than either of the others. During the war the relation changed, and the porphyries became roughly equal to the vein group, and cost and selling competition was largely eliminated. However, it appears that prior to the war when the vein group was the dominant factor in the market its average costs largely determined the grade of ore which the porphyries could mine profitably.

It appears from the tables that despite greatly increased recoveries in 1919 and 1920, the porphyries cannot operate at a greatly curtailed capacity as economically as can the vein mines. Had the 1919 and 1920 porphyry group production been at capacity and

the same high recoveries been attained, it is certain that their costs would have been less than the vein mine costs. Some of the porphyries can operate at capacity reduced almost one-half without increasing their costs greatly, but as a group production must be made at nearly full capacity to decrease costs.

If under normal conditions the porphyries continue the tendencies manifested before and during the war, and the costs of labor and supplies come down, it will be only a short time until the porphyries are dominant factors in the market, determining largely the selling price of copper and thereby the grade of ore the other groups can profitably mine.

The Lake mines have ceased to be an important factor either in production or costs. Lake production has become so small compared to that of the other two groups that it no longer influences the market greatly. The Lake mine costs have indicated a steady tendency to increase, which has been interrupted only three times since 1909. The high costs in 1912 and 1913 were due largely to labor troubles, which augmented the tendency to increase, and therefore cannot be considered as truly indicating conditions. During the war the costs at the Lake mines reached a higher level than those of any of the two other types under consideration, and the greater increase compared to the vein mines was due to the same conditions which caused the relatively greater porphyry cost. These conditions when reversed should have the same effect upon the Lake costs as upon the porphyries, except that the maximum possible production from the Lake group or individual mines may not be great enough to realize materially the advantage of the reversal of such conditions. If the Lake mine production could be materially increased in the future it would perhaps result in a material reduction in costs of operation.

**IDEAL PRODUCTION COSTS AND SELLING PRICE DEFINED**

The great increase in the number of pounds of copper recovered per ton of ore treated in 1920 could not at the limited rate of production effect a material reduction in costs. Two things, however, are certain: the Lake mines must in the future effect a material reduction in costs, and must operate at nearly full capacity in order to make such a reduction.

It appears that the ideal situation for the copper producers in general is about 15c. per lb. selling price and a cost of about 11c. per lb. Under such conditions it is probable that copper would experience the least competition from substitutes, the largest market, and make the maximum production with the greatest net profit. It is certain that the producers will endeavor to create such conditions, and the chances for success are much better than generally supposed.

GROWTH AND OPERATIONS OF THE PRINCIPAL PORPHYRY MINES ( ), 1909-1920

Year	Ore in Reserve, Tons	Average Copper Content, Per Cent	Total Copper Content, Tons	Ore Milled, Dry Tons	Average Content, Per Cent	Copper Content, Tons	Recovery, Per Cent	Total Recovered by Mills, Pounds	Pounds Recovered Per Ton	Net Refined Production, Pounds	Cost Per Pound, Cents
1909.....	119,000,000	1.80	2,142,000.0	3,757,180	1.81	68,004.96	66.54	90,322,607	24.04	85,032,581	8.272
1910.....	243,860,823	1.6749	4,084,424.9	6,577,273	1.72	113,129.10	67.79	153,184,688	23.29	147,274,817	7.63
1911.....	492,870,487	1.76	8,674,520.6	9,145,598	1.69	154,560.61	68.53	211,629,138	23.14	202,376,519	7.807
1912.....	546,810,524	1.699	9,290,310.8	11,894,830	1.641	195,194.16	66.89	261,091,519	21.95	249,712,570	8.615
1913.....	560,289,576	1.67	9,356,835.9	16,025,309	1.55	248,392.29	66.45	330,281,618	20.61	314,636,019	9.194
1914.....	585,056,240	1.635	9,565,669.5	14,542,093	1.646	239,362.85	67.48	323,212,362	22.23	309,234,720	8.164
1915.....	691,035,064	1.6276	11,247,597.4	18,931,562	1.641	310,722.03	67.17	416,711,649	22.01	398,628,110	7.619
1916.....	768,956,864	1.571	12,080,356.8	28,501,741	1.587	452,386.36	68.74	618,760,669	21.71	599,861,127	8.631
1917.....	816,032,667	1.559	12,723,973.9	30,086,587	1.479	444,980.83	67.91	601,959,445	20.01	590,009,375	11.607
1918.....	814,140,979	1.537	12,514,224.2	32,425,668	1.436	465,696.17	68.91	636,613,359	19.63	628,265,818	12.105
1919.....	795,752,000	1.533	12,195,967.4	18,453,710	1.502	277,209.01	75.75	416,765,462	22.58	407,305,108	14.264
1920.....	790,818,949	1.477	11,676,999.7	20,278,611	1.392	282,321.97	76.33	427,610,499	21.09	416,434,944	13.984

(a) Statistics cover operations of two companies in 1909 and 1910; five companies in 1911, 1912, 1913, and 1914; six companies in 1915 and 1916; and seven companies from 1917 through 1920.

## Promoting Efficiency in Drilling and Blasting\*

More Care Advocated in the Selection, Testing, and Use of Explosives  
By Mining Companies—Burning Rates and Preparation of Fuses—Use  
And Care of Blasting Machines—Delay Explosives—Detonator Tests

BY B. F. TILLSON

Written for *Engineering and Mining Journal*

THE ART OF BLASTING ROCK has perhaps not been given the careful engineering scrutiny and research that its importance in mining should warrant, and it is hoped that the following comments may be instrumental in producing a freer discussion of this subject. Do not engineers and executives entrust the proper selection and use of mining explosives to men who have only the background of experience to guide them and do not have the time or equipment for determining the suitability of materials or methods? This practice is unjustifiable under the present conditions, when all operations should be given careful scrutiny so as to achieve the much-needed increases in efficiency. The tendency of the workman is quite properly to use more explosive than is necessary, to avoid wasting the time, labor, and power involved in drilling the rock, on the ground that it is better to use a few pounds too much of dynamite than to run the risk of exploding fifty or one hundred pounds with no useful effect, and, in fact, only to be hindered in the recovery of all the other work which has been performed in preparing the round. This condition persists because of the lack of basic knowledge which might permit the specification of the most efficient use of explosives for varying conditions.

To be more specific, it may be well to present a number of queries, as follows:

1. What relation has the diameter of the drill hole to the burden which it may carry?
2. For every 10 per cent reduction in the diameter of the drill hole, what percentage increase in the strength of the explosive should be made to permit the burdens to remain equal?
3. What influence has the rate of detonation of an explosive in increasing its effectiveness for mining?
4. Can any approximate tabulations of strengths and rates of detonation be made for uniform classes of sound rocks?
5. What correlation may be made of the rate of detonation and the initial shock produced by an explosive?
6. What are the minimum sections of strings of explosives of various strengths which will permit a proper propagation of the wave of detonation?
7. What are the respective efficiencies of propagation through explosives, air, water, tamping, cylinders of wood which nearly fill the bore hole, or pieces of powder box which may be spaced between the sticks of explosive in a hole?
8. What effect has the period of time for chemical reaction upon the effective mining strength and rate of detonation of an explosive?
9. Should not this maximum initial force be exerted for an interval long enough to stress the rock beyond its elastic limit?

10. How long should this interval be for various rocks?

11. What effect has the coefficient of heat conductivity of a surrounding rock upon the effectiveness of an explosive?

12. What forces are involved in the blasting of rock?

13. Is the contention justified that as much of the explosive as possible should be placed in the bottom of the drill hole, or is it preferable to distribute the explosive as much as possible in the rock burden? When?

14. Can tests made in mortars, on steel plates, in lead blocks, by ballistic pendulums, with pressure gages, or crushing tests be relied upon to give either a true or a comparative index of the merits of various explosives, for mining purposes?

15. What tests would give a better understanding of the instantaneous rupturing force of an explosive, excluding its heaving or propelling force?

16. Will a detonator placed in an explosive at right angles to the axis of the bore hole produce a greater effect than one placed axially?

17. What length column of explosive can be successfully detonated by a No. 6 detonator and what by a No. 8?

18. Will not the fineness of grinding of the nitrates and other ingredients of an explosive shorten the period of chemical reaction and thus produce a higher rate of detonation and greater effect in blasting rock? If so, should not standards for this be established?

19. Is it not possible to obtain a greater useful effect from a given explosive by charging it in a column of a different shape than the cylindrical form in general use?

### RENDERING EFFECT PRODUCED BY STRESSES

Let us consider the ramifications in this last query and seek any fallacy which may be involved in such a supposition. The explosive effect is a resultant of three prime factors: (1) The amount of gases formed from a given weight of explosives (the gas volume of course being estimated at a standard temperature and atmospheric pressure); (2) the temperature of the gases resulting from its detonation (which is in turn dependent upon the amount of heat of instantaneous chemical reaction, the specific heat of the gases and other products of combustion, and the temperature and heat conductivity of the surrounding medium); (3) the reciprocal of the time of gas evolution. It seems that rock is broken by an explosive when the latter produces such a violent wave of compressional and resulting tensional stresses as to strain it beyond its elastic limits both in tension and shear. Therefore, no matter how great the force, it must be applied for a sufficient distance to exceed the expansion of the rock within its elastic limit. Once the rock is ruptured from the solid, the attraction of gravity will cause its displacement, and so the propelling force of an explosive is of relatively little value to most mining operations. Although it is unlikely that the Trauzl lead block test correlates so well

\*Two other articles by Mr. Tillson, "Promoting Efficiency in Drilling Ore and Rock" and "Increasing Efficiency of Mine Labor," appeared in the issues of Jan. 21, 1922, and March 11, 1922, respectively, of *Engineering and Mining Journal*.



with the instantaneous rupturing power as with the total amount of energy liberated by an explosive, it may be of profit to try some of the following experiments with such a test.

#### INITIAL FORCE PROPORTIONATE TO AREA

The force exerted by an explosive, as represented by the gas pressure in pounds per square inch at the temperature of explosion, is independent of the quantity of that explosive and depends solely upon its composition and the relative size of the container to the volume of the explosive. The area of surface bounding any given volume depends solely upon the form assumed by the volume and is a minimum in a sphere, although if the form be limited to bodies whose surface is generated by a straight line moving parallel to itself, a cylinder will have the least area of surface per unit of volume. The total initial force resulting from the detonation of an explosive in a container of a volume equal to the bulk of such explosive is equal to the unit gas pressure developed multiplied by the total area of bounding surface. Therefore, a greater total initial force will be developed by an explosive if its container be so designed to present a greater area of surface. A practical demonstration is suggested, using a Trauzl lead block.

Place a standard charge of explosive in a cylindrical hole of  $\frac{1}{2}$ -in. diameter, confine with standard weight of tamping, and detonate, producing a chamber with a certain increased volume which should be measured. Compare with this the increased volume due to the detonation of a similar charge of the same explosive, confined by tamping of a similar weight, in a rectangular volume  $\frac{1}{2}$ -in. thick by 0.7854 in. wide and therefore of an equal area of cross section ( $0.1943\frac{1}{2}$  sq.in.).

#### MEASUREMENT OF EFFECTIVE WORK

As in the first test the area of the lead block exposed to the force of explosion equals the area of one end ( $0.1943\frac{1}{2}$  sq.in.) plus the area of the curved surface (1.5708 in. times the length of charge), and in the second test equals the area of one end ( $0.1943\frac{1}{2}$  sq.in.) plus the area of the four sides (2.0708 in. times length of charge), if we use a column of explosive 2 in. long, the respective areas of affected surface in the first and second tests will be  $3.3359\frac{1}{2}$  sq.in. and  $4.3359\frac{1}{2}$  sq.in. Therefore, the relative increase in the volume of the resulting chambers should be as  $3.3359\frac{1}{2}$  is to  $4.3359\frac{1}{2}$ , or about as 1 is to 1.3, and the increase in effective work done in the second test because of the shape of the hole would approximate 30 per cent. The limit with a charge infinitely long is 31.8 per cent.

The conclusions stated are based on the assumption that the modulus of elasticity of lead permits a Trauzl lead block test to indicate properly the initial rupturing force of the explosion, and that the useful work performed by an explosive is due to the total initial force exerted. This supposition disregards the element of time due to the resistance of the tamping, which permits some work to be done by the gases after they have expanded to a pressure lower than the initial pressure. As the increased volume of cavity due to the initial force of the explosion in the second test should be greater than that in the first, the pressure operative during the period of time taken to throw the tamping from the hole should be less, so that the useful work performed by this latter cause would be less than in the first test, and the total useful work would not be quite 30 per cent greater in the second test.

In the practical application of explosives to mining, there is a line of least resistance, and the useful work is measured by the amount of material disrupted or distorted in the direction of a face, so that a more representative demonstration would be given if the explosive were detonated in a hole placed parallel to the face of a lead block, and as close to the same as the tensile strength of the lead would permit, so as to cause a maximum deformation toward such face without actual rupturing of the material.

#### EXPERIMENTS MADE TO DETERMINE "USEFUL WORK"

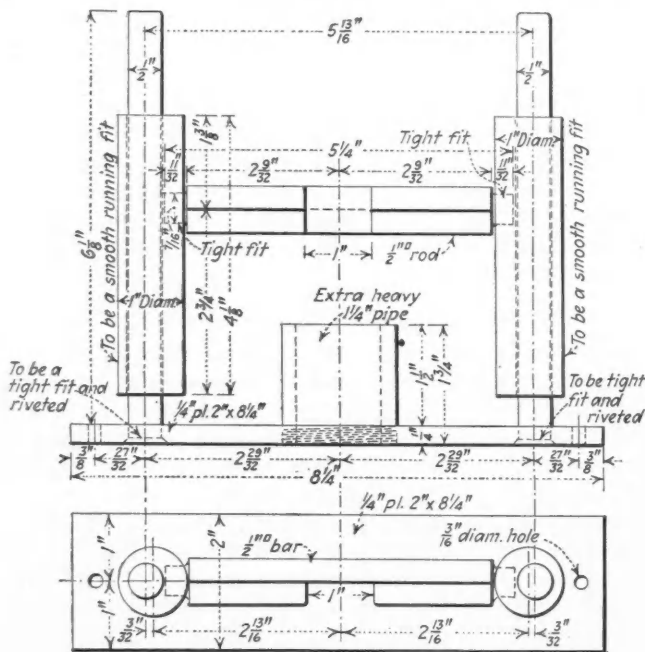
I do not suggest that the law of conservation of energy does not hold true nor that the work done by an explosive varies for any given quantity, but rather that the "useful work," for breaking rock from the solid, may vary with the shape of the drill hole or method of loading it. Field experiments made several years ago seemed to support this theory. Sticks of gelatine dynamite were stripped of their wrappers and split longitudinally; these half sticks were each placed in a tamping bag backed with a semi-cylinder of plastic clay. The sticks were loaded in the drill holes so that the explosive half faced in the direction toward which the holes were supposed to break. A heading of a drift was continued for a month with the holes loaded in the above manner, and a saving of 40 to 50 per cent of explosive was made. A similar experiment was tried in some back stopes, in which the holes were pointed upward with an angle of about 50 deg. to the horizontal. The work was not carefully supervised in regard to powder control, and as a result the miners drilled their holes so as to carry less than the normal burdens, and accordingly less tonnage of ore per unit of labor was broken in a month. So the experiment ceased, being an unprofitable venture. However, it would be interesting to hear what results others may have obtained on similar tests.

It is quite possible that the mining man has not given sufficient attention to fuses, as these are sold throughout the country with widely different burning rates. This may result in an unpleasant or disastrous experience to miners who change from one mining camp to another; for they may get accustomed to a certain time allowance for the lighting of fuses for a round of holes, only to find out too late that they have been using a more rapid fuse.

#### FUNCTIONS OF THREAD IN FUSES

There seems to be a popular belief that the thread in the powder train in the center of the fuse controls the rate of travel of fire in the fuse. This is erroneous, as the function of this thread is only a mechanical one—namely, to assure the even carrying of powder from the overhead hopper to the center of the strands as they are twisted to surround the powder train. There are no grounds for the suspicion that a fuse in which this thread is missing will burn with greater speed. However, the speed of a fuse varies with a number of conditions, such as the compounding of the powder, the amount of hygroscopic moisture (therefore the humidity of the room in which it is made), also the pressure exerted by the tape and various plies of wrappings, and whether paper wrapped or jute.

In general, it may be stated that the greater the pressure exerted upon a fuse, the slower the flame will travel in it. It therefore is evident that the portion of fuse tamped in a drill hole will burn at a slower rate



CAP TESTING DEVICE

than that in the free air. A more impervious covering, as a paper tape, or a double or triple tape, will better confine the gases of combustion, increase their pressure, and produce a slower burning rate. Fuse will therefore burn faster at high altitudes than at sea level. If the end of a fuse is not inserted all the way in a detonator so as to touch the fulminate of mercury, the crimping may increase the gas pressure at this point so that it will spit a rather feeble flame and may not cause the cap to detonate.

#### BURNING RATES OF FUSES

The manufacturers of fuse claim the privilege of a 10 per cent variation in the burning rate above or below its rating, thus making a total variation of 20 per cent possible. This seems entirely too much, for such a variation would seem to be fruitful of inefficient work and hazard. The danger is not in the question of time available for the lighting of fuses—for miners should allow themselves a greater factor of safety than this—but in the probability that the holes may be exploded out of rotation and unexploded powder be thrown into the muck pile. This condition has been experienced, but, on the other hand, tests over a period of several years have indicated that it was possible to obtain fuses with a burning rate of about 90 seconds per yard which did not vary more than one second per yard more or less than this rate. It would seem possible to require the fuse manufacturers to lessen considerably their 10 per cent allowance and perhaps they could meet a 2½ per cent variation guarantee if the demand were great enough to warrant their humidifying the rooms in which such fuse is manufactured. If smaller variations were specified, it would also be necessary to standardize the conditions of testing and the correction factors for altitudes and other variables, but this does not offer a difficulty which has not been met in power-plant specifications and other fields of engineering.

The cutting of fuse to proper length and the crimping of the detonators upon them is now done by many mines at a central point on the surface. In some mines both ends of each length of fuse are dipped into a water-

proofing compound, such as a thickened black asphaltum paint, and this practice helps to standardize the work of blasting and tends to increase the efficiency. It is, however, highly important that the free end is waterproofed, or else the humidity of the mine air will give some of its moisture to the powder train of the fuse and will cause irregular burning. The fuse should not be roughly handled when it is unusually cold, for the waterproofing impregnation is then likely to be brittle and so the fuse may receive cracks through its waterproofing. The temperature of a fuse will also affect its burning rate.

The use of electric exploders with a blasting machine (magneto) is well adapted to some conditions, such as blasting the V cuts in a drift heading, where the simultaneous detonation of a number of holes produces the maximum useful effect, but does not cause a loose back in the near-by working places. But in most of the stopes and other workings it is usually necessary to have rounds of holes fired in sequence, so if ordinary fuse is not used one can employ the electric ignition of a delay acting exploder or especially slow fuse. The delay acting exploders are made in five delay periods, and really contain a short piece of unusually slow fuse. The electrically ignited delay fuses can be obtained in several lengths, such as 4 in., 8 in. and 12 in., and intermediate time periods may be arranged for by cutting off certain amounts. These fuses require that usual detonators be crimped on them. They are preferred to the delay acting caps because they permit a greater range of time intervals.

#### THE GALVANOMETER IN CIRCUIT TESTING

Considerable dissatisfaction may result from either of these electrical delay fuses if one important factor is not observed. They should never be wired with instantaneous electric exploders, for the detonation of the latter may tear away the wires of the former before they are properly ignited. In general, the use of electric blasting is not satisfactory underground where power circuits are not convenient and where a number of rounds must be fired in succession or it is preferable for all of the holes to go in rotation, for the lead wires are badly messed up by each blast, and recovery of them wastes time.

Too frequently the use of old lead wires with damaged insulation causes blasting troubles and delays. A galvanometer test should always be made of the circuit before connecting to the blasting machine. There are portable galvanometers with calibrated scales permitting a check of the actual against the calculated resistance of the circuit, but in general a simpler form of galvanometer tester will prove satisfactory. This device has a hand with a disk marked O.K., and when the O.K. shows it is an indication that the circuit is unbroken. Electric exploders should never be connected in parallel, as their variation in resistance will cause the shunting of the blasting current chiefly through those of the lowest resistance, and the other holes will probably misfire.

#### CARE OF BLASTING MACHINES

The proper handling of a blasting machine is a rather tricky matter, for, unless it is securely set upon a level floor so that the push rod may be vigorously pushed down without any side thrust to give a binding tendency during the stroke, the magneto will not receive the sharply accelerated rotation which seems to produce a



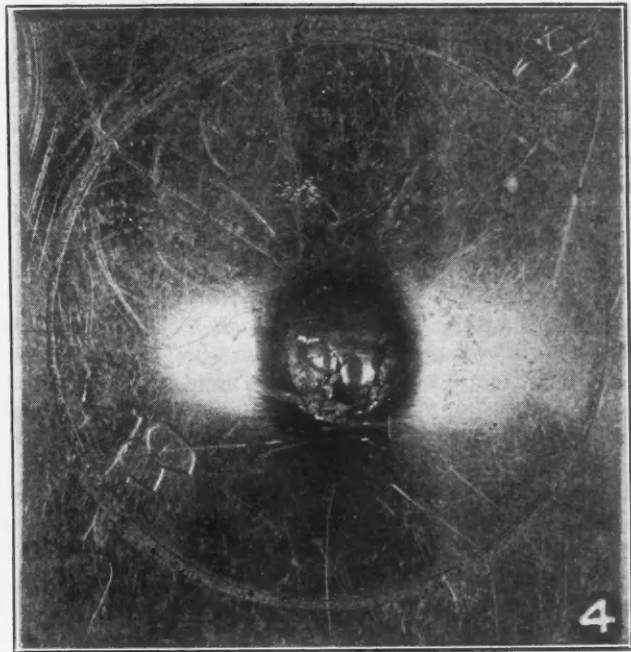
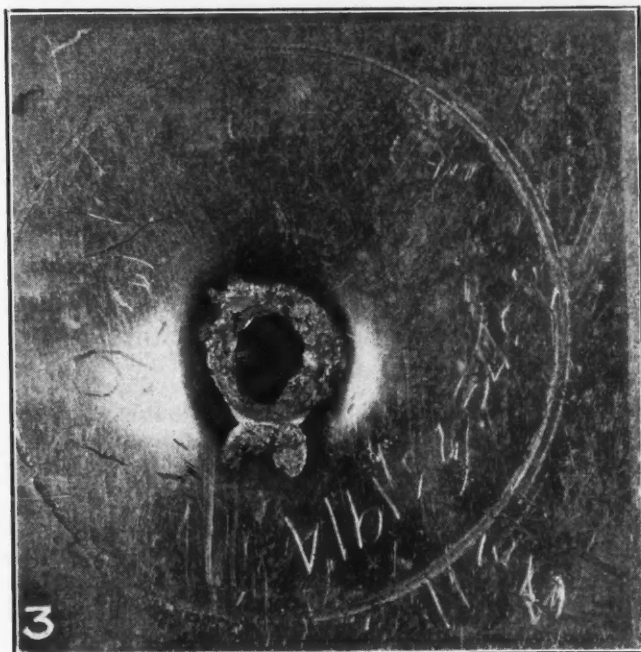
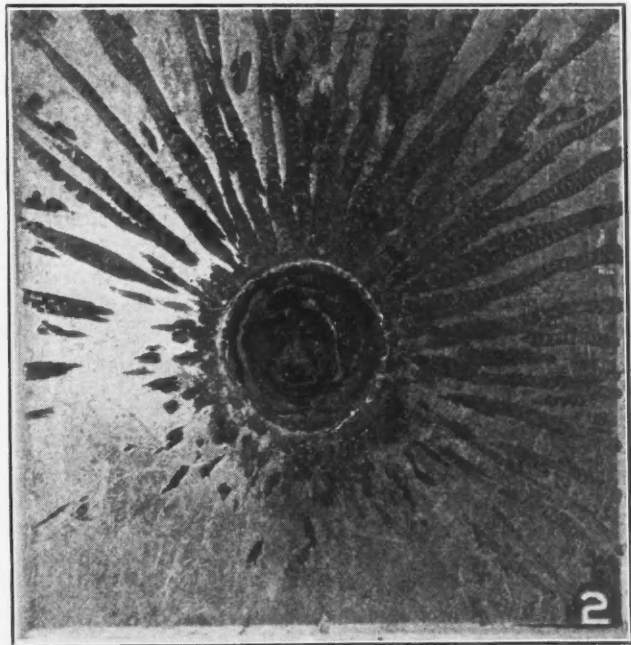
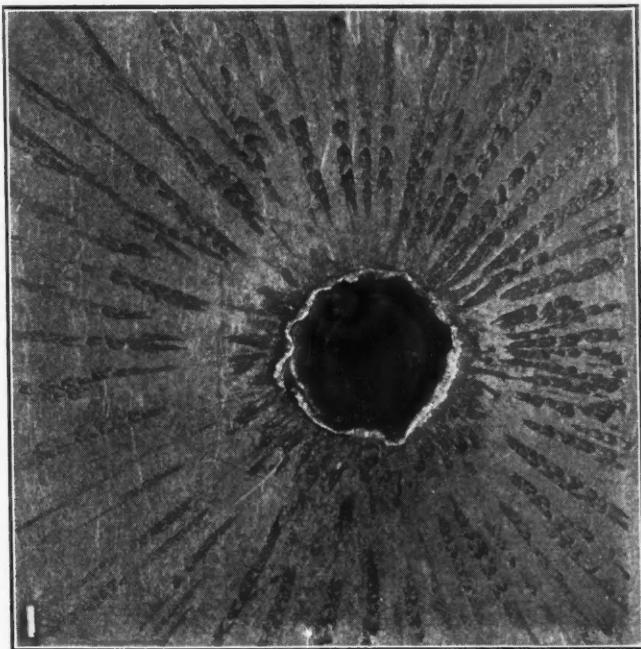
maximum potential and current. Under such conditions there is often sufficient variation in the resistance of the bridge wires in the electric exploders to cause some of high resistance to be heated enough to produce detonation of the fulminate of mercury or ignition compound, though the others will not be ignited. This condition may more frequently exist with the delay action exploders. Another practice should be borne in mind to help obviate difficulties in blasting by magneto. Before connecting the magneto to the circuit, the operating handle should be raised and pushed down vigorously several times so as to increase the residual magnetism in the field of the generator.

It would seem that improved types of blasting machines might be developed and more generally used. For instance, the magneto might be driven by a small, high-speed, compressed-air turbine; or the magne'o

might be driven through a train of gears from a large, heavy coiled spring, which could be wound up with a crank and released when the shots were to be fired. Such designs would eliminate much of the personal equation of the miner and reduce most of the unsatisfactory performances which now prevail.

ALUMINUM PREFERRED IN DETONATOR TESTS

Detonators should be tested from time to time by the mine managements to assure the operator that they equal the desired strength. The accompanying illustration shows the design of a simple device for making tests in the commonly accepted manner. A piece of aluminum plate 1½ in. x 1½ in. x No. 8 gage (0.12849 in.) is laid on the ring, and the detonator is placed upright upon it with the beveled edge of the weight resting upon the edge of the detonator where it is crimped upon a



RESULTS OF TESTS ON NO. 6 AND NO. 8 BLASTING CAPS  
Observe sides of No. 6 and No. 8 shown in 1 and 2; reverse, in 3 and 4

piece of fuse. The amount of depression put in this plate or the size of the hole torn through it by the explosion of a detonator is considered an index of its strength comparatively with the results produced by other detonators in similar tests. Lead plates have commonly been used for such tests, but it is difficult to obtain the sheet lead with as uniform physical properties as the aluminum, so the latter is preferred.

As an example of the value of such tests the following experience may be cited and illustrated by the accompanying photograph:

With the belief that more efficient results would be obtained from a 50 per cent low-freezing blasting gelatine if No. 8 detonators were used in place of No. 6, the former were adopted at an added expense. After they had been used for some time it was thought that the results were inferior instead of being superior, and such a testing machine was built and applied. It was found that many of the No. 8 detonators did not rupture the aluminum test plates as severely as the No. 6 caps. So a return to the use of No. 6 detonators was indicated and adopted with more satisfactory results and less cost.

The No. 8 detonator is slightly larger in diameter and has a deeper charge of fulminate than the No. 6, but it is questionable whether the greater depth of charge produces useful results. If it does, perhaps the above noted method of testing is not a true index. This matter should be investigated, or, if decisive investigations have been made, the mining fraternity should be advised of the results.

It seems, also, that we should have available more definite data of the useful effects produced by various diameters of detonators with various charges of fulminate of mercury upon explosives of different compositions and strengths; also, the effective length of a column of explosives for which different detonators are adapted, of course varying with the composition and strength of the explosive. Does the detonator need to do more than detonate the explosive surrounding it, and should the wave of detonation propagated by the explosive itself be relied upon to explode the remainder of the charge? If not, then it would seem that the more general application of a denoting fuse is indicated and our underground blasting practice should be revolutionized. What data may be offered to make out a case for the detonating fuse (*cordeau détonant*), and what is the minimum length of a column of explosive in which it will show a saving which will warrant its use, although its cost is greater?

### Cadmium Production Declined in 1921

Figures obtained from producers by the U. S. Geological Survey show that the total production of metallic cadmium in 1921 was 65,101 lb., a decrease of 64,182 lb. or about 50 per cent, as compared with the production in 1920. On the other hand, the production of cadmium sulphide in 1921 amounted to 65,446 lb., an increase of 33,313 lb., or more than 100 per cent, over the production in 1920.

The value of the metallic cadmium produced was \$63,799 and that of the cadmium sulphide was \$71,336, making a total value of \$135,135, as compared with \$188,535 in 1920, a loss of 28 per cent. The average selling price of metallic cadmium in 1921 was 98c. per lb., as against \$1.17 in 1920, and that of cadmium sulphide was \$1.09 per lb., as against \$1.16 in 1920.

A noteworthy development of 1921 was the extension of the use of cadmium electroplating for preventing rust.

### Compressed-Air Blowers in Metal-Mine Ventilation

Compressed-air blowers should never be used in lieu of a permanent ventilation system, according to Richard V. Ageton in *Reports of Investigations*, U. S. Bureau of Mines. Probably the most common error made in placing dependence on compressed-air blowers as an aid to underground ventilation is the tendency to over-rate their cooling efficiency. It is a common but natural error to assume that compressed air which issues freely from a blower is of the same temperature as the compressed air which issues freely from the exhaust port of a rock-drilling machine. A number of readings were taken in different mines of the temperature of the rock-drill exhaust, of the compressed air flowing from the blowers, and of the surrounding air. In general, the temperature of the rock-drill exhaust was from 10 to 30 deg. below that of the surrounding air, in many instances being slightly below freezing, 32 deg. F.

In some of the larger mines visited, the compressed air used by the rock-drilling machines and by compressed air blowers constituted 10 to 20 per cent of the total air in circulation, and in some of the smaller mines, as much as 90 per cent. It has been considered by some that the exhaust air from the drills, with an occasional blowing of the face by compressed air from the hose, is sufficient to ventilate the drifts and stopes. In some mines, however, special blowers are used, and considerable time and thought has been devoted to their construction.

Compressed-air blowers are an aid to metal-mine ventilation in that they do increase the cooling power of the mine air in the immediate vicinity of the blower, and will dilute the noxious gas content of the mine air to a certain extent. The capacity of one of these blowers, approximately 80 cu.ft. per minute, though as much as that of a rock-drilling machine, is not sufficient to remove the fumes caused by blasting, nor is the cooling effect of the air felt at distances of more than 50 ft. from the blower, and then only when directly in the line of the compressed-air stream used for ventilation.

On the other hand, a small, self-contained, electric fan, forcing from 1,000 to 2,000 cu.ft. of free air per minute either through a canvas or galvanized pipe, gives instant relief from heat and humidity, and, if a galvanized pipe is used with a reversible fan, the fumes and powder smoke can be quickly removed, to the expedition of the work and the increased comfort of the miners.

### Pure Acetylene Not a Precipitant of Gold or Silver

The U. S. Bureau of Mines is continuing, at Reno, the investigation of various precipitant reagents, proving that pure acetylene does not precipitate silver or gold from cyanide solution. Acetylene, as ordinarily generated, contains some hydrogen sulphide, which will precipitate silver, but if this gas be removed by passing through a sodium-hydroxide solution, the purified acetylene will not precipitate either silver or gold from cyanide solution, but does precipitate silver from aqueous solution of silver nitrate in the form of a white acetylde, which is an explosive chemical when it is dry.



## Mining Engineers of Note

### Horace Pomeroy

**M**Y TRAINING and experience have been rather ordinary," says Horace Pomeroy. This is a common complaint among mining engineers who have made enviable records in the profession, many of them seeming to think that it requires a narrow escape from voracious cannibals in the African tropics, the successful administration of the technical and business affairs of a great mine, or a rise from a struggling shoelace peddler to the affluent presidency of a reasonably sized mining corporation to entitle the engineer to any recognition. Although perfectly true that the operators of large mining properties are usually well known by name to fellow engineers, it is no less equally true that the engineers of smaller mines have problems just as momentous and difficult to solve. Inasmuch as fewer people are financially interested in the smaller ventures, it is not surprising that engineers connected with them do not receive as much publicity as the fellow members engaged in larger operations. Horace Pomeroy was born in Pennsylvania in 1875—nothing out of the ordinary in that. His

father, who was a mining engineer, took his family out West when Horace was but a few years old. We hate to think what would have happened had father Pomeroy remained in Pennsylvania—Horace would probably have gone into coal mining, and the War Minerals Relief Commission would have been without the services of a valuable member. However, he received a grammar and high-school education in Portland, Ore., and was graduated from the engineering department of Leland Stanford, Jr., University in 1897. The love of an outdoor life which he acquired and his fondness for athletics undoubtedly had something to do with his stay at the university for a year after graduation as graduate manager whose duties involved a supervision of athletic funds.

For five years Pomeroy worked with his father in various gold-dredging and gold-mining operations. He occupied himself with different engineering tasks and ultimately became engineer for the King of Arizona mine, at Kofa, Ariz. In 1903 he was made general

superintendent and for five years remained in charge. The King of Arizona was a low-grade gold mine, with fuel and water scarce and situated forty-five miles from a railroad. In other words, one of those mines—there are many in the United States—far off the beaten track

and requiring much perseverance and skill to overcome unusual operating conditions. That he managed to make a good profit on \$6 ore under those circumstances is surely nothing ordinary. In 1906 Pomeroy resigned to become the general manager of the Black Mountain mine, in Sonora, Mexico, a gold-silver property, where he stayed until 1911. The mine was equipped with a 1,000-ton plant, and mining, milling, and cyaniding were done under \$2 per ton. "Conditions, of course, were all in our favor," modestly says Mr. Pomeroy, which, if correct, is also out of the ordinary. The Black Mountain mine closed down in 1911, and he took up consulting and examination work for about five years. He then directed the operations of the Mammoth mines, at Schultz, Ariz., as general manager, a mine producing molybdenum and being developed into

a gold mine. He remained there from 1917 to 1919, when he was called to Washington to act as a commissioner on the War Minerals Relief Commission, filling the vacancy caused by the death of Dr. Foster, one of the three commissioners originally appointed. Mr. Pomeroy quickly made his presence felt in the expedition of the work of the commission. He never forgot his role of a public servant and discharged his duties and contributed his opinions from that standpoint. He was true to the training of judicial decision and prompt impartial action which alone can make a successful mine operator and hence is the best preparation for a man for public service. When we compare men of this type with those who come into public service through the school of law and politics, and observe how the latter have come to forever act with an ear to the ground for an unfavorable reaction against their decisions, and a hand swift to retract, alter and conciliate any and every faction, we heartily wish that we could fill up the public service with mining engineers.



HORACE POMEROY

## CONSULTATION

### Further Comments on Ground Silica

"I have read the article on the uses of finely ground silica in your issue of Jan. 28, which is of some interest to me as I have located a large deposit of decomposed silica of which I think over 50 per cent will come under a 300 mesh. It comes in a moist state and when dry is as white as snow. I have shown this to a few persons in Denver who use it in small quantities and who pronounce it fine, but there is not enough of it used in this district to justify equipping the property of the company with which I am connected to handle it properly, and the freight rates at the present time are too high, I fear, to warrant trying to supply Eastern manufacturers. I am not familiar with the locations and quantities of this product over the country, and it may be that there are good deposits nearer the large users of it which would make it useless for our company to try to compete with other producers.

"Your article seemed to be in answer to an inquiry, and it struck me that you might be kind enough to furnish us a little information along the same line. If in your opinion you think we have something worth while and think we might be able to supply some of the heavy users of the product, we would greatly appreciate it if you would give us the names of some of the manufacturers who use it in large lots."

Without an inspection of a mineral property and its products it is impossible to state whether it has any commercial possibilities. In general, the mining and marketing of the non-metals should be attended with careful supervision of the uniformity of the product. Nothing is so disastrous to cordial relations between producer and consumer as shipments that vary widely in chemical or physical properties. Silica is a common non-metallic, and is produced by many localities in practically every state in the Union, although most of it comes from the South and Middle West. Before attempting to produce it, the local market should be investigated, as it ordinarily controls the disposition of the product. Only exceptionally pure minerals or those with special properties can stand high freight rates to distant points.

Supplementing the article on silica in our issue of Jan. 28th, the following remarks, taken from a recent Bureau of Mines report by R. B. Ladoo, will give additional details regarding the preparation of silica for the market and specifications:

"Methods of mining the various siliceous materials vary widely, dependent on the form of the material, nature and location of deposits, and type of product to be made. However, most of the deposits are worked by open-pit or quarrying methods, often in a crude way. Sand deposits may be worked by hydraulicking, by dredging, or by the use of a steam shovel. Vein quartz is often obtained as a by-product in the mining of other materials. Pegmatite quartz is almost always obtained as a byproduct in working pegmatite dikes for feldspar or mica.

"The mining, preparation, and utilization of tripoli and of diatomaceous earth are rather specialized, and these subjects are covered by Bureau of Mines publications.

"No true flint is mined in this country, either for grinding pebbles or for ground flint, and all flint marketed is imported, chiefly from Europe. Much of the material sold to the pottery trade as ground flint is either ground quartz or ground sand, although considerable true flint is found in this country, chiefly for ceramic purposes.

"In the grinding and preparation of silica for market several methods are in use, dependent upon the type of raw material, the character of the product desired, and the progressiveness of the producer. For ceramic use silica is ordinarily ground to pass through a 140-mesh sieve, but for paint, polishes and fillers, much finer grinding is necessary, a 200 or even 300 mesh product being required. For sandpaper much coarser grains are needed, and these grains must be carefully graded by size.

"Massive flint and crystalline quartz are exceedingly hard and tough. Crushing the crude rock is difficult and expensive, and to obviate this it is often calcined before crushing. Calcination is usually done in a small vertical kiln, resembling a lime kiln, fired with wood or coal, in which are placed alternate layers of rock and fuel. As the fuel burns away the charge slowly sinks in the kiln, the heated rock being removed at the bottom and quenched with water. The calcined rock may then be broken down by hand, and fed to 'chaser mills' or crushed in jaw crushers, possibly followed by 'chaser mills.' Fine grinding may be done either wet or dry. Wet grinding may be accomplished in conical mills, short tube mills, in long tube mills, or in wet grinding pans. If a wet grinding process is used, the finished product is usually sized by some system of water classification. Dry grinding may be done in conical mills, short pebble mills of the intermittent type, or long tube mills. In dry-grinding methods, sizing of the finished product is not common, but in some instances air separation may be used. The wet-ground product may be dried by steam in open tanks or over steam-pipe racks or in rotary driers.

"The present tendency is toward grinding less flint and vein quartz and more glass sand, loosely consolidated sandstone and tripoli, on account of the high cost of pulverizing the massive forms of silica.

"Few standard specifications and tests have been formulated for finely ground silica, but most products are sold on sample. For ceramic use, most consumers require a product 99 per cent of which will pass through a 140-mesh screen. They also require that the iron content be low (sometimes less than 0.05 per cent). Amorphous silica in the form of ground flint is often preferred by the pottery trade. For paint and for fillers a 200-mesh product is usually required, although for some uses a product as fine as 350 mesh is demanded. Angular grains are often preferred to rounded grains for use in paint and fillers. For abrasive purposes the grain size varies from a coarse sharp sand (for coarse sandpaper) down to an impalpable dust (for fine polishes). It is important that abrasive silica have sharp angular grains, rather than rounded grains."

The demand for ground silica is smaller than the supply. We have no list available of the largest and most important consumers, but suggest that the prospective producer of fine silica communicate with near-by manufacturers of scouring soaps, tooth powders, filter mediums, paint, wood fillers, rubber, and pottery as possibly being interested in his commodity.

A better understanding of the non-metallic products and experiments to determine their characteristics are constantly opening new uses for them. Additional experimentation and research promises to widen the field. The lack of complete knowledge on the part of some consumers of non-metals reacts upon the producers. A present tendency toward standardization promises greatly to benefit both interested groups, assuring the consumer the most economical material for his purpose and permitting the producer to supply it.



# HANDY KNOWLEDGE

## Leakage in Compressed-Air Lines

BY THEODORE SIMONS

Written for *Engineering and Mining Journal*

With the object of calling attention to the startling magnitude of energy losses caused by seemingly insignificant leaks in air lines, the following method of approximate calculation is suggested, that may be used in the absence of accurate measuring appliances such as were described by W. S. Weeks in the Jan. 7 issue of the *Engineering and Mining Journal*.

The escape of air from an orifice (leak) in the pipe line is due to the pressure of the air flowing through the pipe. The volume of the escaping air is a function of the area of the orifice and the velocity with which the air flows through this orifice, thus:

$$q = vA \tag{1}$$

in which

$q$  = quantity of escaping air in cu.ft. per second

$v$  = velocity of air in ft. per second

$A$  = area of the orifice, in sq.ft.

The theoretical velocity of the escaping air is:

$$v = \sqrt{2gh} \text{ ft. per second} \tag{2}$$

in which  $h$  = height, in feet, of a column 1 sq.in. in cross section, and consisting of air of uniform density. The density in this instance corresponds to the average gage-pressure ( $p$ ) of the air in that portion of the pipe where the leak occurs.

The volume of this air column is expressed in the formula

$$\text{volume} = \frac{1}{144} h \text{ cu.ft.} \tag{3}$$

Obviously, the weight of the air column must be  $p$  lb. to exert a pressure of  $p$  lb. on its base, which is 1 sq.in. in area. Assuming an average temperature of 60 deg. F., and knowing that 1 cu.ft. of atmospheric air at sea level (atmospheric pressure = 14.7 lb.) and at 60 deg. F. weighs 0.0764 lb., the weight of 1 cu.ft. of air, having a gage-pressure of  $p$  lb. at a locality where the atmospheric pressure is  $P_a$  lb.

is: 
$$W = 0.0764 \frac{p + P_a}{14.7} \text{ lb.}$$

As the air column under consideration weighs  $p$  lb., it follows that

$$p = \frac{1}{144} h \times 0.0764 \frac{p + P_a}{14.7} \text{ lb.}$$

whence

$$h = 27,707 \frac{p}{p + P_a} \text{ ft.}$$

Introducing this value of  $h$  in equation (2) gives

Theoretical velocity  $v = 1,336 \sqrt{\frac{p}{p + P_a}}$  ft. per second.

Owing to friction and other resistances, the actual velocity is, of course, much smaller. For pressures up

to 200 lb. it may be taken to be approximately one-half of the theoretical velocity. Calling the area of the leak or leaks  $A$  square feet, the volume of compressed air escaping per minute is:

$$V_1 = 60 \frac{1,336}{2} A \sqrt{\frac{p}{p + P_a}}$$

or

$$V_1 = 40,080 A \sqrt{\frac{p}{p + P_a}} \text{ cu.ft. per minute} \tag{4}$$

Its free-air equivalent is:

$$V_a = V_1 \frac{p + P_a}{P_a}$$

Introducing value of  $V_1$  from (4) gives:

$$V_a = \frac{40,080 A}{P_a} \sqrt{p(p + P_a)} \text{ cu.ft. of free air per minute.}$$

Example: From various leaks in a pipe line aggregating 1 sq.in. in area, air at an average pressure of  $p = 90$  lb. gage escapes into the atmosphere, in a locality where the atmospheric pressure is  $P_a = 12$  lb. per sq.in.

(a) What is the volume of the escaping air, expressed in cu.ft. of free air per minute?

(b) What is the loss of energy, expressed in horsepower?

(a)

$$V_a = \frac{40,080}{12} \frac{1}{144} \sqrt{90(90 + 12)} = 2,220 \text{ cu.ft. per minute.}$$

(b) Assuming two-stage compression, the theoretical horsepower required to compress 2,220 cu.ft. of free air per minute from 12 lb. to 102 lb. absolute is

$$HP = 2 \frac{144 n P_a V_a}{33,000 (n - 1)} \left[ \left( \frac{P_2}{P_a} \right)^{\frac{n-1}{n}} - 1 \right]$$

in which

$$n = 1.406$$

$$P_a = 12 \text{ lb.}$$

$$V_a = 2,220 \text{ cu.ft. per minute}$$

$$P_2 = (90 + 12) = 102 \text{ lb.}$$

whence theoretical horsepower = 290.

Adding 15 per cent for resistances and mechanical imperfections, the actual loss is 333 hp.

Such glaring waste of energy due to what might appear to be an insignificant leak points to the importance of stopping leaks as soon as discovered and of preventing escape of air from valves left open without serving a useful purpose.

## Repairing Jackhammer Handles

BY HENRY WARRINGTON

Written for *Engineering and Mining Journal*

Do you have trouble with the threads in the handles of your jackhammers wearing to such an extent that the spud of the water hose connection will not stay tight? If so, have a small male and female bushing made, the male end fitting into the jackhammer handle and the female taking the spud at the end of the water-hose connection. These spuds can be easily and cheaply removed and discarded when worn, leaving the handle as good as new.

Some time ago there were picked up at the plant of a California mining company at least a dozen jack-hammer handles which had been thrown to one side as useless simply because the threads had become so worn that the miners could not keep the spud tight. The superintendent had them tapped out and a bushing put in, thus reclaiming \$100 worth of handles. These bushings are now put into the company's new machines before sending them underground, and the men have no more trouble from this source.

### Hoisting Ropes

Written for *Engineering and Mining Journal*

Five types of steel-wire ropes are used in hoisting—the ordinary lay, the Lang lay, the non-spinning, the lock coil, and the flat rope. The ordinary lay and Lang lay ropes are most used for hoisting. Non-spinning ropes are used for bucket hoisting. The lock-coil rope is used to a considerable extent in England but not in the United States. It is non-spinning and could be used for bucket hoisting. Flat ropes are used with reel hoists. The rope most used in American mining practice is the ordinary lay. Some Lang lay ropes are used as well as the flattened strand. Non-spinning ropes are not much used.

The ordinary lay rope consists usually of six strands twisted about a hemp center. The strands are composed of seven, twelve, fifteen, or nineteen wires. Flexibility is obtained by increasing the number of wires in an individual strand. Ropes with a greater number of wires to the strand than nineteen are not used in hoisting, as they wear rapidly. The standard for hoisting is six strands, nineteen wires to a strand. Maximum wear is obtained by using wires of large diameter, and this limits the number of wires to a strand. Ropes made of strands containing seven to twelve wires are less flexible, but wear longer, and are used for haulage.

Strands are constructed of circular or oval section. The "flattened strand" rope is made of strands of oval section. In still another type, the strands are of approximately triangular section and give a rope of the same characteristic as the flattened-strand rope. Such ropes present a greater number of wires on the crown of the strand and thus will withstand a greater amount of wear than the circular strand. In ropes of ordinary lay, the wires in the strand are twisted in one direction and the strands in the opposite when made into a rope. The rope is in more or less equilibrium, although it will untwist when loaded and requires a rope attachment which prevents turning. The length of lay or twist in the strand is one-third that of the lay of the rope. Ropes of ordinary lay cannot be used for bucket hoisting, as they cause the bucket to spin.

In ropes of Lang lay the twist of the wires in the strand and the strands in the rope are both in the same direction. The rope is not in equilibrium, and the attachment must be such as to prevent untwisting. Such ropes cannot be used for bucket hoisting. Lang lay ropes have proved in practice to give greater resistance to wear and greater freedom from weakening through bending. They give excellent service in haulage work.

Non-spinning ropes are used for sinking operations where bucket hoisting is necessary. They are made of two sets of strands, an inner set of ordinary strands which are twisted in one direction and an outer set twisted in the opposite direction. The rope is "dead"—that is, it will not untwist under load.

Lock-coil ropes are constructed of an inner core of round wires and three outer layers of wires of a special section which admits of locking the wires together. A smooth outer surface like that of a solid bar is presented. Such ropes are flexible enough for hoisting, are non-spinning, and wear excellently. They weigh more per unit of length and are stronger than round ropes of equivalent size. The lock-coil rope has a section of solid metal equivalent to 90 or more per cent of the area of the circle inclosing the rope, the flattened strand about 70 per cent, and ropes of ordinary lay from 50 to 60 per cent.

Flat ropes consist of a series of strands of opposite lay laced together with soft iron wire. The lacing wears rapidly, and such ropes have to be relaced at quite frequent intervals. The maintenance cost and the necessity for rope-repairing equipment are the principal reasons for the restricted use of flat ropes. They are still used in some mining districts. They are also used for counter-balance ropes in the Koepe system of hoisting. Their greater weight for equal strength is another objection to exclusive adoption, the excess weight ranging from 12 to 20 per cent more than that of round ropes.

The material used in the construction of wire ropes is iron, ordinary steel, crucible steel, plough steel, and steels of special quality. The wire used will range from a tensile strength of from 100 to 135 tons per sq.in. The grade most used has a tensile strength of 120 tons per sq.in. In some rope manufacture steel of a tensile strength of 150 tons is used. The wire is hard-drawn and is subjected to tensile, torsion, and bending tests. The number of flexures under standard conditions for new wire is from twelve to twenty. (The wire is clamped in jaws the edges of which are rounded with a radius of 5 mm. The wire is bent through an angle of 90 deg. and back for each flexure.) The number of twists for new wire under the torsion test is from twenty to forty.

Galvanized steel wire is used for the construction of ropes which are to be used where the conditions causing corrosion are severe. Galvanizing weakens the wire. As an example, a galvanized wire gave 2.5 per cent less tensile strength, 25 per cent fewer bends, and 20 per cent fewer torsions than the ungalvanized. Such ropes last longer under severe conditions. One writer gives as his experience that the life of a galvanized rope is 50 per cent greater than that of a bright steel rope. (*Mines and Minerals*, February, 1912; p. 405.)

Commercial sizes of wire rope range from  $\frac{1}{4}$  to  $\frac{3}{4}$  in. in diameter, by increments of  $\frac{1}{16}$  in. and from  $\frac{3}{4}$  to 2 in. in increments of  $\frac{1}{8}$  in. Above 2 in. the diameter increment for different sizes is  $\frac{1}{4}$  in. Flat ropes are  $\frac{3}{8}$  to  $\frac{1}{2}$  in. thick and from 3 to 7 in. wide in increments of  $\frac{1}{2}$  in. The weights per foot and other details can be readily obtained from manufacturers' catalogs.

### Hoisting Speed

Written for *Engineering and Mining Journal*

Safe hoisting speeds are determined primarily by the depth of the shaft and are for depths of 500 ft., or less, 1,200 ft. per minute; for 500 to 1,000 ft. depth, 1,600 ft. per minute; for 1,000 to 2,000 ft., 2,000 ft. per minute; for 2,000 to 3,000 ft., 2,500 ft. per minute, and over 3,000 ft. up to 3,000 ft. per minute. These are conservative maximum speeds and are recommended in Bulletin 75, p. 112, of the U. S. Bureau of Mines.



# THE PETROLEUM INDUSTRY

## The Oil Supply of the World\*

**T**HE QUESTION is often asked, Why is the United States, whose petroleum market is now depressed because of a slight excess of oil supply, especially concerned about how much oil there is in our own country and the world? The concern of the public in the economic problem of oil supplies arises from the following outstanding features of the situation, which give the question an incisive significance to every American user of oil:

To date the United States has furnished nearly two-thirds of all the oil yet taken from the ground in the world—5.5 billions of barrels out of a total of 8.5 billions. Our American fields are now pouring out 62 per cent of the world's annual supply while our country is using over 75 per cent of that total supply. In other words, the United States requires over 115 million barrels more than it produces; for, whereas our output now approximates 470 million yearly, our requirements, even during the business stagnation of 1921, called for 525 millions.

### HOW ABOUT THE FUTURE?

Where will the oil to satisfy these requirements come from year after year, and how long can we keep up the pace? These are plain, common-sense business questions, predicated on our present oil requirements as an established fact and on the suggested possibility that our prodigal spending of our petroleum heritage may cause its too rapid depletion if not its early exhaustion in the midst of our spendthrift career, and at some untoward moment send us as beggars to foreign countries for the precious fluid necessary not only to satisfy our extravagant habits but even to sustain our industrial prosperity, our standards of living, and our civilization.

Obviously, the first thing to be done is for the nation to proceed in the nation's business just as the business man proceeds under similar conditions in his private business—namely, to take account of stock, to find out how much oil there is left in the United States, and then to learn as nearly as possible how much oil there is in the rest of the world and where the principal deposits or reserves are situated, due consideration being given to probable availability and conditions of production of these reserves.

No apology, therefore, is needed for the searching appraisal and careful estimate recently made of the oil reserves remaining in the ground recoverable by present methods in the United States nor for its publication for the information and advice of the industry and the country at large. The justification of the formulation of estimates of the oil reserves in other countries, based upon long and painstaking studies of the available data relating to the oil reserves and relative oil possibilities

of those other regions of the world, is evident. Such information is indispensably requisite for understanding the present economic situation, for the development of that perspective and breadth of vision necessary for the formation both of domestic and of foreign policies, and for the more effective safeguarding of the future of our country.

### WORLD'S TOTAL OIL RESERVE SEVENTY BILLION BARRELS

The oil reserves to be found in the regions of the earth where oil has already been proved to exist in commercial amounts were in 1920 estimated by Eugene Stebinger and myself at 43 billions of barrels. The consideration of the geology of other regions in which oil has not yet been proved to be present in commercial amounts led to the formulation of an additional estimate of 17 billion barrels for these regions, placing the total estimate for the world's oil reserves in the ground and recoverable by present methods at 60 billions of barrels. From data subsequently reviewed and on consideration of further information in hand I am disposed to regard an estimate of 70 billion barrels for the world's total resources as conservative.

The most important oil regions outside of the United States are believed to be in Mexico, Venezuela, Colombia, Bolivia, Argentina, Russia, Mesopotamia (together with western Persia), Assyria and Arabia, the East Indies, China and eastern Siberia (including northern Sakhalin), the Japanese empire, India, and probably northern Africa.

Inaccessibility of the oil regions, lack of transportation and other industries essential to oil exploitation, and remoteness from all important markets, will deter for long periods the discovery as well as the development of many of the oil fields in both hemispheres. Further, periods of glutted markets may recur, but it seems to me more probable that, in general, oil-field development is likely to be led by competitive demands arising from the inevitable enormously expanding world markets.

Considering the economic situation of oil as it affects this country, we find that in the United States we have at the present moment produced a total of 5½ billion barrels of oil. We have therefore used up more than one-third of our estimated original heritage of oil. Contrasted with our more than 5 per cent rate of annual depletion, the rest of the world withdrew in 1921 not much over 280 million from its store of over 60 billion barrels, or less than one-half of 1 per cent of its reserve recoverable by present methods. In other words, the reserves of the rest of the world would stand the present rate of drain for over two centuries. From the standpoint of the world distribution of oil and the economic relations of our reserves to those of the rest of the world, an error of two or three billion barrels—four to

\*Abstract of a paper by David White presented at the Engineering Congress on the Petroleum Industry at Kansas City, Mo., March 6.

six years' supply—in the estimate of the oil reserves of the United States, is comparatively insignificant.

The co-operative committee expressly affirms that not all the oil pools in the United States will have been discovered a generation hence. On the other hand, the committee takes great pains to point out that though our reserves would not meet our present rate of consumption demands for twenty years, if they could be taken out of the ground fast and cheaply enough to supply our market (a conditioning clause that has generally been lost sight of by the press and the public), this country will be producing oil for as long as seventy-five years to come.

#### PRODUCTION PEAK IMMINENT

As oil cannot so rapidly be located and taken from the ground, it follows with certainty that, according to the laws of oil production, the annual oil output of the United States must at an early date pass its peak and enter upon a long-drawn-out period of general though fluctuating decline to ultimate exhaustion; except so far as fields in great numbers may be rejuvenated by better methods of mining. Opinions differ as to how soon the production peak will be passed, but most geologists believe that within a few years, perhaps less than five, we shall in the normal course enter on a period of waning fields in increasing numbers, with discoveries more infrequent and in general more costly.

A large portion of the public does not yet fully recognize that the United States is already dependent upon foreign oil to meet its still growing requirements. Our oil importations, 18 million barrels in 1913, grew to 38 millions in 1918, 53 millions in 1919, 106 millions in 1920, and 125 millions in 1921. A small part only (less than 9 millions) of this amount is offset by exportation of crude petroleum from the United States. In short, in a period of industrial depression, we have imported one-fourth as much as we produced. Nearly all of this oil comes from Mexico, and that is why Americans are so profoundly interested in Mexican oil.

The present production in Mexico, amounting to about 195 million barrels in 1921, is mostly drawn from a relatively small number of wells situated along a single axis of folding in which a thick limestone, the Tamasopo, is caverned by solution and, in the structurally high points, gorged with gas and oil under most tremendous pressure of salt water. No wells of such enormous production are known in any other part of the world. It is practically certain that, though some new discoveries of Tamasopo oil may come to the aid of the rapidly failing pools, sooner or later the production of oil from world-record-breaking Tamasopo limestone gushers will wane, and the remaining portion of Mexico's 4 to 5 billion barrels of oil reserves, as estimated, must be won by the sweat of the oil operator's brow from wells of the ordinary type.

The magnitude of the task of developing enough oil fields of the "common or garden variety" in Mexico to take over the load of an annual production of 195 million barrels, which was produced from less than 300 wells in 1921, may be inferred from the fact that in 1908, when for the first time the production of oil in the United States amounted to so much as 175 million barrels, over 140,000 wells contributed to that output. This number is, of course, subject to radical discount for rapidity of development and freshness of production. It would take over ten Haynesvilles or a group of four Mexias or

fourteen Salt Creeks, all running full blast, simultaneously, and all continuously maintaining their January rates of production, which, of course, is impossible. It is difficult to estimate the oil price stimulus necessary to develop a production of 200 million barrels of oil in Mexico from wells of the ordinary type under existing transportation, climatic, and industrial conditions, within five years. The prices requisite would certainly be most encouraging for the production of oil from shale in this country.

#### DISADVANTAGES OF OIL SHORTAGE

The collapse, or, better, the great slump in Mexican production which seems, sooner or later, inevitable, can hardly fail to react on our own oil-field production, probably driving it to the limit; and it is likely that in the early period of this strain the annual output of petroleum in the United States will pass its peak. Beyond this point our need for more foreign oil is likely to spring from our decreasing domestic production more than from further growth of our consumption requirements. In this period relief must come from other foreign oil fields and from the production by distillation of shale oil, on whose adequacy and on whose yet undetermined cost we may be obliged to rely for protection against transoceanic importation at transoceanic prices beyond our control. Too great an advance in price will, of course, check our use of oil and bring it nearer within the bounds of practicably available supplies from all sources, at prices then viewed as practicable. The oil we cannot afford to buy we will do without.

Among the constructive economic deductions to be drawn from a review even so superficial and elementary as this summary of the high points of the situation as to oil resources it is to be seen that:

1. The need of foreign oil reserves available for continued use in the United States is obvious.
2. Waste in producing, in transporting, and in using oil should be prevented or curtailed as far as economically practicable. The problems are insistently pressing. Large results are known to be immediately possible.
3. Increased concentration of thought and experimentation on the more efficient use of the oil now available and on the production of commodities of greater efficiency are economically urgent. On every occasion consideration should be given to the general abandonment of oil to generate steam, in favor of the three times as efficient Diesel motor or some other still more effective substitute.
4. More intense and more widespread researches in the production of liquid hydrocarbons through processes—so-called low-temperature carbonization—aimed at the more efficient use and the wider adaptation of our bituminous and lower-grade coals, are important.
5. The development on a commercial scale of an oil-shale industry deserves more earnest and wiser consideration. The deposits of rich shale in Colorado, Utah, Wyoming, and Nevada alone are sufficient, if fully used, to generate more than seven times the oil estimated to remain in the ground in the United States recoverable by present methods.
6. The recovery of a much larger portion of the oil in the reservoir rocks than is obtained by present methods is an imperative necessity, demanding the faithful, the intelligent, and the immediate consideration of the states and of the Government as well as of the oil industry.



## Book Reviews

**Metallurgy of Zinc and Cadmium.** By H. O. Hofman, E. M., Met. E., Ph.D. Cloth; 6 x 9; pp. 341. McGraw-Hill Book Co., New York. Price, \$4.

Professor Hofman's book will be welcomed by all zinc metallurgists, as no comprehensive work on the subject has been published in English for many years. The general plan is that of his other works, and, like them, gives a host of references to current publications that will be invaluable to those desiring fuller details than can be given in the space available.

The first five chapters take up the history, properties, commercial grades, industrial uses, and compounds of zinc, and cover the subject as fully as can be done in the space allowed. The ores are next taken up, the principal varieties are described briefly, and examples are given of the formulas sometimes used for determining prices. These are all in the form of a more or less elaborate calculation, based on the market price of spelter, assumed smelting losses and treatment costs, ending with an arbitrary deduction according to the buyer's fancy. As a matter of fact, outside of the Joplin district there is no recognized basis, each contract depending mainly on the individual desires of the buyer and seller.

The next section, which occupies about half the book, treats of the smelting of ores. Calcining and roasting are first taken up, and the furnaces actually used in this country are fully described and their performances given. Most of the dead matter commonly given in books on this subject has been omitted, and little space is given to furnaces that have not proved acceptable for work under American conditions. The same may be said of the descriptions of smelting furnaces and practice. The furnaces and methods described are those in present-day use. The comparison of results is not as complete as might be desired, as little if any allowance appears to be made for the great differences in the quality of fuels and ores in different locations. These differences are often the controlling factors, as when the old Bertha works, at Pulaski, smelted a refractory silicate in direct-fired furnaces, using Pocahontas coal, with less fuel per ton than is used in regenerative furnaces smelting Joplin ores in the West. The chapter ends with short notices of the attempts that have been made to smelt in blast furnaces and electric furnaces. As Professor Hofman says, none of these have been successful, and none show much probability of being successful under present conditions.

Electrolysis is next discussed, the general principles being first clearly described and then the three plants that alone show probability of continued existence on this continent are taken up in detail. The necessity of extreme

purity in the solutions is pointed out, although perhaps hardly enough emphasis is given to it and to the difficulty of obtaining it. Much information is given on the effects of different variables on current efficiency. This chapter gives the most complete description of this most important process that has yet been published.

A brief chapter follows on the manufacture of zinc oxide. It gives a short and rather unsatisfactory account of the French process, regarding which scarcely any information is available. In this the order of quality of the three commercial grades is given as White Seal, Red, and Green, whereas it should be White, Green, and Red. The discussion of the two modifications of the Wetherill processes that are in use is excellent.

The second part of the book treats of cadmium, and gives a more complete account of its properties and metallurgy than has heretofore been published. It is a difficult subject on which to obtain information, as there are few producers, and they are not communicative.

On the whole, Professor Hofman has given us the best work on the metallurgy of zinc that has been published in English. If in places it is not as full as we could have wished, the zinc smelters have only themselves to blame. If all of them had given information as freely as a few of the larger ones did, Professor Hofman would have had the information that would have enabled him to write an even better book. Unfortunately, the proofreading has not been as carefully done as it should have been, and there are numerous typographical errors that may cause trouble.

G. C. S.

**The Mining Manual and Mining Year Book for 1922.** By Walter R. Skinner. Cloth; 5½ x 8½; pp. 1,000. Published by W. R. Skinner, 15 Dowgate Hill, London, E. C. 4. Price, foreign post paid, 21s. 6d.

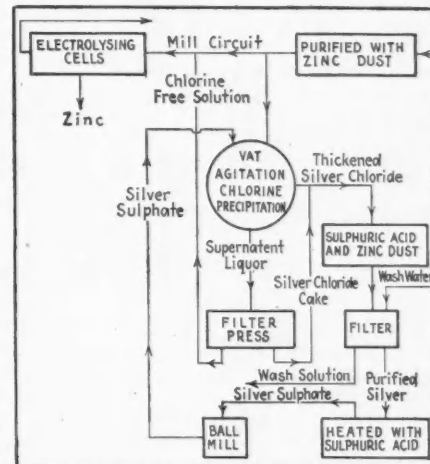
Mr. Skinner's red book is too well known among mining engineers to require extensive comment. It is somewhat on the order of our American publication, sponsored by Walter Harvey Weed, though an important item of difference is that the English work is published promptly every year. It gives particulars regarding about 1,400 mining companies in all parts of the world, including gold, diamond, silver, copper, tin, iron, and coal companies, thus having a wide scope, though in general only the most important companies are listed. The information given is largely that which is sought by financiers or investors, rather than matter which would be of interest to the purely technical man. It is without doubt the best digest of up-to-date information on foreign mining companies obtainable.

The present edition has no new features, but the data have been brought up to date. A list of mining directors and a tabular summary of the tons of ore crushed and gold recovered by all British producers are included in the book.

## Recent Patents

**Copper Converting**—No. 1,403,235. J. J. Dawson, Globe, Ariz. The patent covers a system of introducing fuel oil into the compressed-air pipe of a copper converter.

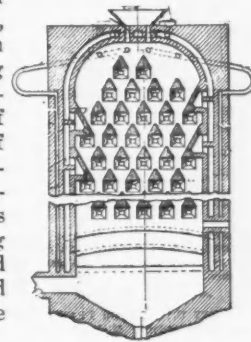
**Electrolytic Zinc**—No. 1,403,065. David Avery, Melbourne, Victoria, and R. H. Stevens, Hobart, Tasmania, assignors to Electrolytic Zinc Co. of Australasia Proprietary, Ltd., Melbourne. A method of removing chlorine



from the zinc-bearing solution prior to electrolysis for the purpose of reducing the corrosion of the electrodes during the electrolysis of the solution.

**Chloridizing**—No. 1,402,732. David Avery, Melbourne, Victoria, assignor to Amalgamated Zinc (De Bavay's), Ltd., Melbourne. Leaching chloridized material containing lead and silver with a cold brine solution saturated with lead chloride and containing ferric chloride.

**Roasting Furnace**—No. 1,399,046. F. J. Bowman, Cleveland, assignor to the Grasselli Chemical Co., Cleveland. An ore-roasting furnace consisting of a plurality of triangular heated elements. Means for introducing finely divided ore and heated oxygen are provided.



**Grinding Mill**—No. 1,400,123. George Wolff, Paterson, N. J. Design for sectional grinding plates for attrition mills.

**Flotation**—No. 1,400,308. D. D. Moffat, Hayden, Ariz. A method of introducing the flotation agent by volatilizing it in heated compressed air which is afterward passed through the porous bottom of a pneumatic flotation cell. The process described has proved useful at the Ray Consolidated mill.

## ECHOES FROM THE FRATERNITY

### Columbia Section, A. I. M. E., States Objection to Arentz Bill

The Mining Law Revision Committee of Columbia Section, A. I. M. E., has prepared a detailed critique of the so-called Arentz Bill, and has issued the following statement:

"In general the committee does not believe the present law is so perfect that no improvement is possible, and it therefore favors the enactment at this time of the following portions of the proposed law: (1) The provision for recording of claims in the United States Land Office, the burden to be placed, however, on the county or district recorded and *not* on the prospector; (2) the disqualification from relocation for one year; (3) the specification that monuments shall govern descriptions, and (4) with certain reservations, the plan for allowing extra land in lieu of the present mill sites.

"The committee is opposed to the following clauses: (1) The requirement for orientation of claims; (2) the certification of discovery by a mineral surveyor; (3) the restrictions on locations in Alaska (Why pick on poor Alaska?), and (4) the proposal for the creation of a mineral development fund, and all cash payments upon which it would be based."

The following general comments are made:

"Your committee further feels that it is no reflection upon the eminent gentlemen who compiled the proposed law to say that their point of view is radically different from that which actuated the makers of the law of 1872, and the framers of the 'Miners' Rules and Regulations,' upon which it was built. We are forced to the conclusion that the present framers have most naturally, in large measure, and with considerable justification, ignored the individual locator and prospector, and framed a law designed mainly for acquisition and exploration by organizations of considerable capital. It is evident, of course, that much of the prospecting of the future will be of a kind beyond the scope of the prospectors of the past; at the same time your committee does not believe that we have yet reached a place in our development where the small man can be entirely relegated without detriment to the mining industry.

"Concomitantly with this it seems to us the bill contemplates a further extension of the regulatory powers of the Land Office and similar organizations, and to your committee, all of whom have lived and operated within the confines of the national forests, further extension of the exasperations and annoyances, opposition and apathy, inflicted upon persons engaged in mining development in these areas appears suicidal.

"All of us deplore the decline of prospecting. To encourage it requires helpful stimulation, not further regulation and restriction by unsympathetic and uncomprehending jacks-in-office. The

wild free days of the early West are of course gone forever, but we need not swing from that extreme to one of officialdom bristling with 'verbotens' of one kind and another.

"In conclusion, it appears to your committee that one of the greatest difficulties connected with mining litigation is the method of court procedure, and we, as a constructive measure, desire to embody as a rider to this report the suggestion put forward by the chairman of this committee with regard to a modification of present procedure, with the earnest recommendation that serious consideration be given to the best method of putting it into practice."

### British Columbia Boards of Trade Discuss Mining and Smelting

Statements made by J. J. Warren, president of the Canadian Consolidated Mining & Smelting Co., at the recent annual meeting of the Associated Boards of Trade of Eastern British Columbia, at Nelson, B. C., indicate that the lead surplus of that company has been sold out, that the smelting costs of the treatment of eastern British Columbia silver-lead-zinc ores now are so low that the company can fearlessly compete with the world in the production and sale of lead and zinc, and that the lead refinery at Trail is to be enlarged from a capacity of 90 tons to 150 tons a day.

The meeting was attended by many of the mining operators of the Kootenay districts as well as by business men representing those sections of the province. The opinion was expressed on all sides that the indication of a new and progressive policy on the part of the company would have an immediate and a beneficial effect on the mining industry of the Canadian West.

Admitting that he preached cutting costs, Mr. Warren said the Consolidated company had first practiced what he now preached, for it had cut the costs of production of lead and zinc to such a point that it did not fear competition. Lead and zinc were down in price, but in spite of that, owing to the progress made in treatment, the company would be able to sell them at a price sufficient to enable it to keep going.

Mr. Warren said the Consolidated had found a way by which it could accept shipments of zinc-silver-lead ores, paying shippers a reasonable sum for the metal contents of all three ores. Formerly the zinc operated as a penalty. In a short time the company would be able to accept and treat the zinc and give full value for it.

A number of questions relating to the mining industry of the province were also discussed at the meeting. Resolutions were passed asking for "adequate duties on all base metals entering Canada up to the point where metals can be supplied by Canadian producers," and

advocating adequate duties on "copper rods, copper wire bars, zinc sheeting, sulphate of lead, and fluorspar." Regarding fluorspar F. W. Bingay, of the Canadian Consolidated Mining & Smelting Co., said that Canada imported that article both from England and Kentucky, and that Eastern manufacturers using that product have plentiful supplies in Ontario to draw from and would not be injured. It also was urged by resolutions that "The same duties on scrap copper, zinc, and brass be imposed as upon the virgin metal."

A resolution from the Northwest Mining Association, in convention at Spokane, asking support for reciprocal free re-entry of lead bullion to the country of its origin, was almost unanimously opposed. This was offered by the Nelson Board of Trade, although it had not been indorsed by that board.

### Accident Rates for Mineral Industries

The safest branch of the varied mineral industries in which to work would appear to be the sandstone and blue-stone quarries, according to data of the comparative accident rates for all divisions of these industries compiled by the U. S. Bureau of Mines for the year 1920. The lowest fatality rate was found to be for this class of quarries, which employ a relatively small number of men and in which all work is done in daylight, free from many dangers that are inherent in underground mining. For the same year, the highest fatality rate was that for gold, silver, and miscellaneous metal mines, a group that includes all metal mines except those producing copper and iron and those in the Mississippi Valley that produce lead and zinc.

No reports of non-fatal accidents at coal mines are received by the Bureau, but for all other branches of the mineral industry the highest injury rate was that for the lead and zinc mines of the Mississippi Valley, and the lowest was that for marble quarries.

Since the enactment of compensation laws by nearly all of the states, increased importance attaches to the accuracy and completeness of the statistical publications on industrial accidents. The insurance premiums that operators of metallurgical plants, mines, and quarries have to pay are determined largely from a study of statistical reports relating to accidents in these industries. It is highly advisable, therefore, that full and accurate data concerning accidents be reported promptly by operators, not only to aid in the study and prevention of such accidents, but also to assist state compensation commissions and other insurance bodies in establishing fair premium rates.



As the practical usefulness of statistical reports is increased or diminished by the promptness or tardiness with which the figures are published, the Bureau hopes that its annual inquiries relating to accidents may be filled out by all operators and returned promptly, so that the value of the reports of the Bureau on this subject may not be diminished by unnecessary delay in their publication.

## MEN YOU SHOULD KNOW ABOUT

**J. B. Tyrrell**, of Toronto, left for London last week.

**E. J. Collins**, of Duluth, is in Arizona on professional business.

**D. W. Brunton** sailed for Tahiti from San Francisco on March 3.

**Fred J. Siebert**, consulting engineer of Reno, has been in Randsburg, Cal., on professional business.

**W. H. Williams**, discoverer of the California Rand Silver mine, at Randsburg, is in San Francisco.

**E. P. Mathewson** arrived in San Francisco on March 13 from a six months' business trip to India.

**Walter A. Rukeyser** left last week for The Pas, Manitoba, en route to the Elbow Lake district in Canada.

**Major H. H. Armstead** returned to Talache, Idaho, the first of March, after spending the winter in New York.

**C. W. Purington** has been at Vladivostok during January and February and has now returned to Yokohama.

**J. E. Spurr**, editor of *Engineering and Mining Journal*, addressed the San Francisco section of the A. I. M. E. on March 6.

**George D. Carpenter**, of St. Louis, vice-president of the St. Louis Smelting & Refining Co., was recently in San Francisco.

**H. S. Munroe**, general manager of the Granby Consolidated Mining & Smelting Co., Ltd., has left Canada on a visit to California.

**Burt G. Shields**, of New York, has been nominated as assayer of the New York assay office, succeeding **George R. Comings**, deceased.

**R. C. Gemmell**, general manager of the Utah Copper Co., accompanied by **J. E. Cawley**, left Salt Lake City for New York on March 2.

**W. C. Browning**, general manager of the Magma Copper Co., Superior, Ariz., is visiting New York and other Eastern points on a business trip.

**J. W. Sherwin**, general manager of the West End and Halifax companies, in Tonopah, is in Tonopah, having come from his headquarters in Oakland.

**W. C. Fellows**, manager of the Ben Harrison mine, in Grant County, Ore.,

returned to Oregon recently from a three months' sojourn in Kentucky.

**Julius M. Cohen**, consulting engineer of the Elbow Lake mines in The Pas district, Manitoba, has gone to the property to arrange for preliminary development work.

**Bulkeley Wells**, president of the Metals Exploration Co., left Denver on March 10 for the New York office of the company, where he will remain until about April 1.

**Norman Carmichael**, former general manager of the Arizona Copper Co., Ltd., has been named to represent the interests of that corporation on the Phelps Dodge directorate.

**C. B. Manville**, of the Johns-Manville Co., of New York, accompanied by **Robert Malcolm** and **John S. Everts**, was a recent visitor to the Thumb Butte property, in Mohave County, Ariz.

**L. S. Cates**, assistant general manager of the Utah Copper Co. and general manager of the Ray Consolidated Copper Co., and **D. D. Moffat** left Salt Lake City on March 2, for Arizona, on an inspection of the company's properties.

**Charles V. Safford**, administrative assistant to **A. B. Fall**, Secretary of the Interior, was in Denver on March 10 and 11, conferring with heads of the General Land Office, Reclamation Service, National Park Service, and Bureau of Mines.

**Harmon F. Fisher** has been appointed as engineer, connected with the research division, of the American Petroleum Institute. Mr. Fisher has been a consulting engineer and was previously engineer in charge of operation at the Government helium plant No. 3, Petrolia, Tex.

**Charles S. Herzig**, of New York, made an inspection of mining property in Montana the latter part of February; from there going to the Coeur d'Alenes, where he made an examination of the Independence Lead Co.'s property above Mullan, Idaho, and the Rex Consolidated, north of Wallace.

**D. A. Rossell** has resigned the superintendency of the Iron Cap mill, at Globe, Ariz., to take charge of the milling department of the Mineral Products Co., with headquarters at Boston. He will be succeeded at Globe by **W. H. Rith**, who has been in charge of the C. O. D. mill, in Mohave County.

**Dr. J. D. MacKenzie**, head of the British Columbia Branch of the Canadian Geological Survey, has left Vancouver for Ottawa to confer with **Charles Camsell**, deputy minister of mines, and other officials regarding the plans of the Canadian Geological Survey for field work in British Columbia during the coming summer.

**Carl Sparks**, a mining engineer who has been specializing in placer mining at the Fairbanks, Alaska, station of the Bureau of Mines, is returning to the

United States and will be stationed at Berkeley, Cal., until the end of the fiscal year, where he will be engaged upon a report of the results of his work. After July 1, he will return to the mine-rescue division, in which he formerly served.

**H. Foster Bain**, director of the Bureau of Mines, was elected president of the Joseph A. Holmes Safety Association at its annual meeting at Washington, D. C., last week. **Charles D. Walcott**, secretary of the Smithsonian Institution, was named first vice-president, and **Samuel Gompers**, president of the A. F. of L., second vice-president. **George S. Rice**, chief mining engineer of the Bureau, and **James Lord**, of the mining department of the A. F. of L., were elected directors.

Mining and metallurgical engineers visiting New York City last week included: **L. C. Fopeano**, Kannarock, Va.; **Alma Ek**, Chile, S. A.; **T. B. Counselman**, Babbitt, Minn.; and **John T. Reid**, Lovelocks, Nev.

## OBITUARY

**Benjamin Magnus** was found dead in Poughkeepsie on March 13. Mr. Magnus was a graduate of the Columbia School of Mines and for many years was connected with the Mount Morgan Copper Co. in Australia.

**Dr. John Casper Branner**, noted geologist, and for a time president of Stanford University, died recently at his home in Palo Alto. Dr. Branner was known principally for his researches in the geology of Brazil. As an inspiring teacher, he did much to develop the department of geology at Stanford.

**William H. Nicholls**, a pioneer of the Cascade range, in Michigan, died on March 7 at the age of eighty. Captain Nicholls came to America from England about forty years ago, and was first employed at the Jackson mine, Negaunee. Later he took charge of the Star West mine, at Palmer, for the Corrigan-McKinney interests.

**Alexander M. Gow**, assistant chief engineer for the Oliver Iron Mining Co., Duluth, Minn., died at his home on March 8. Mr. Gow had been connected with the Oliver Iron Mining Co. for the last seventeen years, during which time he had complete charge of its mechanical activities on the Mesabi and the Michigan iron ranges. The introduction of larger type machinery in open-pit work and underground mining on the Lake Superior iron districts was due in great measure to his effort and foresight. Mr. Gow was greatly esteemed by all who knew him and was distinguished in his profession. He was a graduate of Washington and Jefferson University and also took a post-graduate course at the University of Ohio.

# 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

Violence amounting to open warfare has characterized the strike situation at the gold mines on the Rand, in South Africa.

The Old Dominion Copper & Smelting Co. is milling 500 tons daily at Globe, Ariz. The International smelter at Tooele, Utah, chiefly a lead plant, is said to be preparing to resume.

British zinc smelters are complaining that the government's policy with regard to Broken Hill concentrates practically amounts to subsidizing the Australian enterprise.

Coal miners in the Crow's Nest Pass district of the Northwest have threatened to strike April 1 unless their wage demands are granted. Ordinarily this would affect mining and metallurgical operations.

Another attempt to secure further suspension of assessment work has been made at Washington by Senator Stanfield.

Back taxes on Mexican mining properties will be canceled under certain conditions. A decree to this effect has been promulgated by President Obregon, according to advices from Washington.

### International Smelter at Tooele Preparing To Resume

#### Utah Consolidated Expected To Start Production of Milling Ore for New Concentrator

It has been announced by William Wraith, general manager of the International Smelting Co., that the company is preparing to resume operations at its plant at Tooele, Utah. The date will depend upon a number of factors, including the amount of ore contracted for and consigned to the smelter, and it will probably be about the end of spring when the furnaces are blown in. At present stockpiles are being built up and will be added to for from sixty to ninety days. Existing ore contracts have been kept up during the time that the smelter was closed since last June, by transferring the ore to other smelting plants, and a number of new ore contracts have recently been acquired. A sufficient tonnage is assured.

When the International opens it will be possible for the Utah Consolidated, in Bingham Canyon, which has not yet operated its new mill near the Tooele smelter, to start production of lower grade ore, a large tonnage of which is developed. When smelting operations are resumed it will give employment to between 300 and 400 men. When operating at full capacity the plant can handle about 1,500 tons of ore daily. In 1918 a tonnage of 560,579 tons of ore was smelted, and in 1920, the last complete year of the plant's operation, 104,210 tons of copper ore and 200,787 tons of lead ore were treated.

### Carmichael a Phelps Dodge Director

Normal Carmichael, formerly general manager of the Arizona Copper Co., has been nominated by the shareholders to represent them on the board of the Phelps Dodge Corporation. This is equivalent to election.

### Steel Companies Get Injunction Against Trade Commission

The controversy arising over the demand of the Federal Trade Commission for reports of business relative to many of the iron and steel companies has been temporarily won by the companies. An injunction has been granted twenty-two of the steel companies by Judge T. J. Bailey, of the Supreme Court of the District of Columbia, which prevents the commission from demanding these reports.

### Strike of Coal Miners Looms in Colorado

Coal miners' unions in various coal fields of the state have served notice upon the Colorado Industrial Commission that unless a new wage scale and working agreement is negotiated between the coal operators and the "proper officials of the United Mine Workers of America" a strike will take place April 1. With the large reserves and independent mines, it is believed that the strike, unless greatly prolonged, will not affect smelting or metal mining companies that are operating in Colorado.

### U. S. Smelting Leases Balaklala Property

A mortgage release involving \$1,000,000 has been recorded by the Balaklala Consolidated Copper Co. at Redding, Shasta County, Cal. The bonds held by the Windsor Trust Co., of New York, have been paid, resulting in the cancellation of the mortgage. A fact of additional interest is the leasing of the Balaklala property to the U. S. Smelting, Refining & Mining Co., which owns the Mammoth mine and smelter, in the same district. The terms of the lease have not been made public, nor have any definite plans been announced for resumption of mining at either the Balaklala or the Mammoth.

### Violence Marks Strike at Mines on Rand

#### Armed Whites Clash With Police and Government Troops—Workmen Dominated by Radicals

So serious had the strike situation become at the gold mines on the Rand in South Africa during the first week in March, that martial law was declared on the tenth of the month. Violence, amounting almost to actual warfare, marked the conflicts between the strikers and the police. Many points along the Reef fell into the hands of the former and for a certain period a large part of Johannesburg was dominated by the "commandoes," mounted and unmounted, who struggled desperately to gain control of the town before the arrival of the government forces. Many casualties were reported on both sides and a large number of prisoners were said to have been taken by the troops. The situation is now controlled by the latter.

Conditions leading up to the strike and that have obtained since the gold mines shut down about the first of the year, have been described in the *Engineering and Mining Journal* by its Johannesburg correspondent, John Watson, in the latter's weekly letters. Summed up briefly, the cause is threefold—namely, radicalism, the absolute necessity for cutting labor costs and the talk of removing the "color bar." Under date of Feb. 7 Mr. Watson wrote:

"The gold mines of the Rand have now been idle for four weeks, through the strike of white workers. We read on Feb. 1 that the Germiston Strike Committee had passed a resolution suggesting the appointment of an arbitration court to settle the present strike. The resolution expressed a desire to meet General Smuts to lay their proposal before him. It was understood that the Prime Minister was willing to receive such a deputation next morning. Next day, we read that the proposals of the Central Strike Committee had excited the keenest opposition



among a section of the Germiston strikers and that section had made a demonstration at the offices of the Central Committee and told the members they would not be allowed to leave the office until they had changed their plan about proceeding to Pretoria to interview the Premier. It was only when the strike committee gave their word of honor not to proceed to Pretoria that they were allowed to leave the room. The Rand gold industry has been the milch-cow of South Africa. If we take three of the low-grade mines, the restarting of which will now be extremely doubtful, the average monthly wages paid have been:

	Whites	Natives
Roodepoort United	£5,254	£4,303
New Goch	5,310	4,125
Luipaards Vlei	6,200	5,495

It must also be remembered that the expenditure in stores and material reaches a big figure, now withdrawn from circulation.

"A special feature of this strike has been the formation of commandoes, both infantry and mounted, of strikers. In several cases these commandoes have marched to mine-shafts and warned, or 'pulled-out' officials engaged on essential services, such as pumping to dewater deep-level mines. The Commissioner of Police is now warning the strikers that the use of such bodies of men, or commandoes, to pull out officials constitutes a crime of public violence, and the police have been instructed to take action in such cases."

A little before this, on Jan. 31, Mr. Watson wrote:

"So far, the strikers have been orderly in their behavior. Unfortunately, there appears to be a disposition on the part of the younger and less responsible section to interfere with essential services, such as pumping, which are being carried out on several of the mines by samplers and mine officials. Yesterday, some hundreds of strikers collected at Fordsburg, went through certain drilling evolutions and then marched in column of fours to No. 7 shaft of the Crown Mines. A force of union police stood by while the strikers interviewed the mine officials. It is understood these officials were told that if they worked after yesterday, Jan. 30, the responsibility would be theirs for anything that might occur. The body of strikers paid a similar visit to No. 5 and No. 1 shafts and then returned to Fordsburg."

### Hollinger Appeals From Decision in Power Case

An appeal has been entered by the Hollinger Consolidated Gold Mines, Ltd., of Porcupine, Ont., against the recent decision of Justice Middleton. The latter dismissed the company's action for over \$1,000,000 against the Northern Canada Power Co. for failure to supply power.

### Snake Creek Tunnel Co. Appeals to Supreme Court

The Snake Creek Mining & Tunnel Co. has filed a brief in the U. S. Supreme Court asking that its right to percolating waters in Utah, which are contested by the Midway Irrigation Co., be affirmed.

### Old Dominion Milling 500 Tons Daily at Globe

No Merger With Iron Cap Pending, Says Manager of Latter—Coal and Coke Rates Cut

The Old Dominion Mining & Smelting Co., of Globe, Ariz., started its mill recently and is handling 500 tons of ore a day. No date has been set for starting the smelter, which has two weeks' supply of coke on hand and which has been kept in good condition. There is a distinct shortage of good miners, 200 being needed by the company, which now has 400 at work. Only a few new hands were needed at the mill. It is denied, however, that shortage of miners has had any material effect in delaying smelting.

A feature of benefit locally has been a reduction of coal and coke rates. Coal freight from Gallup now is \$7 a ton, and reductions from Colorado and New Mexico points average about \$1.50 a ton. Old Dominion is the only coke user of the district and benefits by a cut in freight from Dawson from \$8.88 to \$6.85 a ton.

F. A. Woodward, general manager of the Iron Cap Copper Co., denies the report that his company is about to consolidate with Old Dominion. It is locally believed that the report is based upon merger plans that have been considered for a long time between Old Dominion and Arizona Commercial, whose properties adjoin and are connected on several levels. These two companies have close financial relations, and it is said, could be operated as a whole with economy and efficiency.

### Part of Force Quits on Wage Cut by Simon Silver-Lead

Operations at the Simon Silver-Lead Mines Co.'s property at Simon, Nev., have been somewhat curtailed since March 1, owing to lack of labor. The wage scale was cut to \$4 for muckers and trammers and \$4.50 for miners on March 1, the result being that about one-half of the crew quit. The mine and mill are operating at partial capacity, but it is expected that a new crew will be obtained soon.

P. A. Simon, president of the company, has stated that the company's zinc smelter at Harbor City, Cal., is an assured success. He says that the entire zinc product of the mine can be successfully handled, converted into marketable form, and disposed of at a profit.

### To Make Motorists Help Copper Market

In Arizona it is proposed to amend the motor travel law so as to help the copper market. License plates are to be of copper, of somewhat smaller size than ordinarily used, and are to be accepted at metal value when turned in at the end of the year. It is planned to use Arizona electrolytic copper.

### Mount Lyell Co. Reduces Working Forces

By Cable From Reuters to "Engineering and Mining Journal"

Melbourne, March 9—The Mount Lyell Mining & Railway Co., of Tasmania, has discharged 272 men at the Mount Lyell mine, which has been shut down.

(By Mail)—Alterations in treatment carried out last year now prove that North Mount Lyell concentrates can be smelted without adding Mount Lyell pyrites. To get the full economic benefit of concentration treatment, the board of directors has decided to enlarge the concentrating plant to a capacity of 10,000 to 12,000 tons of North Mount Lyell ore monthly. During construction, the output will be limited to the present capacity of about 7,000 tons. The alterations will cost between £15,000 and £20,000 and will take six months.

### Gold Production of India and New South Wales

By Cable From Reuters to "Engineering and Mining Journal"

London, March 13—The production of gold in New South Wales during January and February totaled 5,692 oz.

The gold output of India during February amounted to 31,270 oz.

### Lead Mines in Cumberland To Resume

By Mail From Reuters

According to Lloyd's List, the Threlkeld lead mines, in Cumberland, England, are to be opened after being idle for twelve months. The difficulties of working the mines are accentuated by the fact that half the product—namely, zinc concentrates—cannot be produced except at a loss compared with the price at which the government is selling Australian concentrates.

### Canadian Royalty Regulations Issued

Regulations fixing the royalty to be collected by the Canadian government on sales of the products of quartz mining locations on Dominion lands have been published. The royalty is fixed at 2½ per cent on a scale of values laid down as follows: Gold, \$15 per oz., royalty 37½c.; silver, 60c. per oz. royalty 1½c.; copper, 12c. per lb., royalty 30c. per cwt.; zinc, 4c. per lb., royalty 10c. per cwt.; lead, 4c. per lb., royalty 10c. per cwt.

### Date Set for Butte & Superior Accounting Hearing

The hearing on the accounting proceedings between the Butte & Superior Mining Co. and Minerals Separation Limited is expected to be resumed in New York on March 28 next. Last November, at the hearing held then before the master, Minerals Separation put in a claim for \$11,904,913.95. Adjournment followed and since then further hearings have not been held. A hearing set for Feb. 14 was postponed.

## NEWS FROM WASHINGTON

By PAUL WOOTON  
Special Correspondent

### Hearings on Ore Freight Rates Before I. C. C.

#### Southern Pacific Attorney Argues That Lower Metal Prices Have Not Increased Demand

Reduced freight rates on mining products were advocated recently by various witnesses in the closing arguments in the rate investigation before the Interstate Commerce Commission. Secretary James F. Callbreath, of the American Mining Congress, favored a general rate reduction on metals, coal, and other raw mine products; H. W. Prickett, speaking for Western interests, advocated lower rates on ore. Reduced petroleum rates were advocated by F. B. Dow and Clifford Thorne, and lower pig-iron rates were favored by F. L. Ballard. R. C. Allen, of the Lake Superior Iron Ore Association, recommended lower ore rates, as did also Charles S. Belsterling, F. B. James, and others.

Referring to ore rates in general before the I. C. C., F. H. Wood, attorney for the Southern Pacific railroad, in arguing against reductions, said that exhibits filed in the case show that there had been a progressive and continuous drop in the prices of metals and metal products since September, 1920, the drop being manifestly largely in excess of the decrease demanded in freight rates, but that it has had no apparent stimulating effect upon demand.

The commission has sustained the complaint of the United Verde Extension Mining Co., that the rates on coal from Dawson, N. M., to Clarkdale and Jerome, Ariz., were unreasonable. It has prescribed reasonable rates for the future and awarded the company a refund on previous shipments overcharged.

In the complaint of C. G. Chevalier, the I. C. C. held that the rate on manganese ore from First Ford, Va., to Pittsburgh and Sharpsburg, Pa., was unreasonable and reduced it to \$4.50 a ton from the former rate of \$5.52.

In the complaint of the General Chemical Co., the commission decided that the rate on bauxite ore from Republic, Ga., to Chicago Heights, Ill., was not unreasonable.

### L. & N. Must Continue Service to Pinkney, Tenn.

On the ground that it will prevent development of ore in the vicinity of Pinkney, Lawrence County, Tenn., the Interstate Commerce Commission has denied the application of the Louisville & Nashville railroad to abandon a part of its branch line extending from West Point to Pinkney.

### Another Bill To Suspend Assessment Work Introduced

A joint resolution to suspend the requirements of annual assessment work on mining claims in the United States, but not in Alaska, during the years 1920 and up to and including June 30, 1924, has been introduced in the Senate by Senator Stanfield, of Oregon.

### Back Taxes on Mexican Mines Canceled

President Obregon of Mexico has issued a new mining decree which cancels all back taxes on mining properties if the owners will pay, before Sept. 1, the full amount of taxes due for the twenty months previous to that date. The action was taken, according to semi-official advices reaching Washington, on the ground that heretofore it had been impossible to extend the protection necessary, in many regions, to make possible the working of mining properties.

### First-Aid Work in Oil Fields To Be Continued

Preliminary work in first-aid training in the oil fields has been so successful that the Bureau of Mines has under consideration the permanent extension of its first-aid training work to the petroleum industry. With the exception of the tentative work that has been conducted recently, first-aid instruction has been confined to coal- and metal-mining industries. On close examination, it was found that the hazard in the petroleum industry is higher than was supposed.

### Industrial Moving Pictures Will Be Censored

A board of censorship for technical and industrial moving pictures has been set up by the Bureau of Mines in conjunction with the Department of Commerce. T. T. Reed is the representative of the Bureau of Mines on the board and Oliver P. Hopkins represents the Department of Commerce. These two members are to select a third member, who is to be a specialist in the activity with which the picture deals. In each instance at least two additional persons familiar with the subject of the picture are to sit with the committee in an advisory capacity. Though only the pictures prepared in the Interior and Commerce departments will be subject to the board's jurisdiction, it is believed that other departments and outside agencies preparing industrial moving pictures will seek to have films reviewed by the board.

### Alaska's Mineral Resources Considered in New Bill

#### Sutherland Measure Provides \$5,000,000 Development Fund—Bureau Concerned With Territory

Following the recent suggestion of Albert B. Fall, Secretary of the Interior, for development of mineral resources in Alaska under a revolving fund, Delegate Sutherland, of Alaska, introduced in the House a bill to put the plan in effect. His bill creates a \$5,000,000 Alaskan development fund and authorizes the Interior Department to explore, prospect, or drill for oil or other minerals upon public lands, and in the event of discovery of minerals to dispose of them through competitive bidding. The bill provides for the construction and operation of smelters and ore reduction plants, pipe lines, and other facilities for mining and disposing of the minerals, and also for road construction to operating mines. The measure also authorizes the lease or acquisition of docks, wharves, terminal and other facilities incident to carrying on exploration, prospecting, and drilling for minerals. The Shipping Board is authorized to make vessels available for the Alaskan service. All receipts from operations under the plan would go into the development fund for continual use. Co-operation with territorial authorities or private individuals or corporations in carrying out the new plan has been authorized.

The statement of Secretary Fall, referred to in the foregoing, is as follows:

"In Alaska the non-metalliferous minerals lie more deeply underground, and the investment of capital in prospecting is necessary, which is true also of such deposits in the United States. Under the leasing bill, the permit provisions are not sufficiently liberal to justify expectation of immediate development of the great known oil, coal, and other non-metalliferous mineral deposits of Alaska. In deep prospecting in Alaska it will be necessary for Congress either to liberalize the laws, to the end that private capital may be invited with an opportunity to earn sufficient rewards to justify taking the gambler's chance, or, in lieu thereof, provide a revolving fund to be used by some department of the Government in the sinking of experimental oil wells and in prospecting for other non-metalliferous mineral deposits. The result of such prospecting would be to enable us to operate under the second provision of the leasing act and to sell or lease upon bonus and royalty and surface rental basis, the lands in oil fields, coal fields, shale fields, potash and phosphate and other fields, recommended to be developed. Either capital must have the speculative chance or the risks of prospecting must be assumed directly by the Government. A small revolving fund would do the work. The same



policy should be pursued upon the public lands of the United States."

Mine inspection in Alaska will probably be conducted in the future on a co-operative basis. The matter has been the subject of conferences between Governor Scott Bone of Alaska and Director Bain of the Bureau of Mines. Consolidation of all of the Bureau's work in Alaska has also been effected, for which an increased appropriation will be available July 1. This appropriation is in the form of a lump sum and will permit of the assignment of a first-aid miner exclusively to work in Alaska.

Unusual need is said to exist for first-aid training at Alaskan mines, owing to the fact that there are many small operations scattered over a vast territory, in which there are but few physicians. This work will be in charge of J. E. Willcox, who has been foreman miner on the mine rescue car stationed in the Butte district. Mr. Willcox plans to conduct first-aid classes at the various Alaskan mines just as rapidly as he can reach them.

Decline of gold mining in Alaska, because of high operating costs, was referred to by E. Lester Jones, director of the Coast and Geodetic Survey, in recent testimony before the House Appropriations Committee. "Due to the cheap price of gold, many people engaged in placer mining have been driven out of Alaska, as they could not afford to pay high wages and could get nothing out of it," he said. He looked for improved mining conditions, however.

### Engineering Methods Changing for Valuing Mines

The U. S. Bureau of Mines is taking cognizance of an important change in engineering methods in valuing mines. In the old days, engineers determined the probable value by estimating returns through a series of years. This was done by figuring production costs and estimating future prices of the metal or metals concerned. Owing to the uncertainties which have grown out of the war situation, there is no longer great confidence in estimates of cost of production or as to the future selling prices of metals. The standards long used in making valuations have been lost, just at a time when they are more urgently needed than ever. To meet this situation, engineers are coming more and more to use a figure based on the margin necessary to keep the property in operation. For instance, if it can be ascertained that a margin of 2c. per lb is necessary to keep a particular copper mine in operation, this amount must remain constant, whether the mining costs go up or down.

Although this method cannot be applied universally, it can be used where there are large quantities of material which do not vary widely in grade in regions which dominate the situation as do the Lake Superior iron mines and the porphyry copper properties.

### Oppose Dismissal of Ewert Case Involving Indian Lands

Attorneys for Oklahoma Indians have filed a motion in the U. S. Supreme Court in opposition to the motion of Paul A. Ewert to dismiss the case in which the Indians seek to set aside a sale of zinc lands in Oklahoma to Ewert on the ground that he was disqualified to purchase because of his connection with the Indians as a representative of the Department of Justice. In the new brief of the Indians they say that there is due them from Ewert \$56,000 in royalties on the land, and deny the legality of contracts said to have been entered into by Ewert with certain representatives of the Indians for payment of additional sums for the land. Ewert had purchased the lands for \$18,000, and the transaction had been approved by the Department of the Interior.

Argument was heard in the case last week. A stipulation was then filed with the court to strike the case from the docket on a reported agreement between the parties to the suit, under which the sale to Ewert would be approved upon the payment by him of \$18,000 additional for the land. It is this motion that is now opposed in the manner stated.

### Ducktown Company To Restrict Discharge of Sulphur Fume

In the suit of the State of Georgia against the Ducktown Sulphur, Copper & Iron Co., of Isabella, Tenn., in the Ducktown district, which action seeks to restrain damages to crops by reason of the alleged discharge of sulphur gases, a stipulation has been filed in the U. S. Supreme Court by both parties under which the company agrees not to permit the escape into the air of sulphur-dioxide gases which have a sulphur content of more than 40 tons a day, and to furnish the state a report as to the tonnage of ore smelted and acid made. The agreement also calls for a board of arbitration of one representative of the state and one of the company to supervise operations and to ascertain damages caused to citizens by the gases.

### Bureau Officials To Meet at Rolla

Superintendents of the Eastern mining experiment stations of the Bureau of Mines, with the principal clerks of those stations, will meet at the Rolla, Mo., station on April 17 to discuss the technical and administrative problems arising in the conduct of their work. On that occasion the cornerstone of the new building which will house the Rolla station will be laid. The Eastern stations, so called to distinguish them from the Far Western stations of the Bureau, are those at Pittsburgh, Columbus, Ohio; Urbana, Ill.; Tuscaloosa, Ala.; Bartlesville, Okla.; Minneapolis, and Rolla.

### To Consider Mining Industry If Tariff Commission Is Changed

Frelinghuysen Bill Proposes Transfer to Department of Commerce—Advisors for Each Interest

Under a bill introduced by Senator Frelinghuysen, of New Jersey, to transfer the Tariff Commission to the Commerce Department, it is proposed that the Secretary of Commerce shall appoint from each interest, including the mining industry, advisors to the commission, such additional representatives of such interest to serve without compensation, to assist in determining the conversion cost of articles produced or manufactured in the United States and in competing countries. Those appointed from each industry interested would be from each section of the country where such interest has substantial existence.

### Fish Can Stand Some Pollution of Waters, Commission Says

Warning was given Congress by the U. S. Fish Commission not to injure industry by proposed legislation to prohibit the discharge of oil and other acid wastes into navigable streams in an attempt to save fishes from the effect of polluted waters. Officials of the fishery bureau pointed out that the pending bills before Congress against pollution would practically wipe out some industries on the theory that all pollution was injurious to fisheries, whereas, as a matter of fact, it was not known that it is so injurious.

### Says Bureau of Mines Is Duplicating Work on Clays

Director Stratton of the U. S. Bureau of Standards, in testimony before the House Appropriations Committee, stated that the U. S. Bureau of Mines was duplicating work of his bureau on heavy clay products, including cement and concrete. His attention had been called, he said, to numerous activities of the Bureau of Mines in investigations being conducted by the Bureau of Standards, and officials of the latter were wondering how it happened that other bureaus got appropriations, although his bureau failed to get them. He said that the Standards Bureau was handling work on heavy clay products and that there was no need for provision being made elsewhere. Dr. Stratton declared that he was surprised the Bureau of Mines had asked for funds for work on cement and concrete, as the Standards Bureau had done that work with a fair degree of thoroughness.

### Government's Silver Purchases Close to 100,000,000 Oz.

Purchases of silver by the Bureau of the Mint during the week ended March 11 amounted to 3,128,000 fine ounces. This brings the total purchases under the Pittman Act to 98,871,628 fine ounces.

## NEWS BY MINING DISTRICTS

### London Letter

**Zinc Smelters Complain Broken Hill Is Subsidized—Rio Tinto's Position Uncertain—Two Rand Companies Recalculate Reserves**

By W. A. DOMAN

London, Feb. 28—When the war was in progress, the British government entered into an arrangement with the Broken Hill mining companies to purchase their output of zinc concentrates for a series of years. This was to prevent the great German metal "octopus" from again securing control of spelter. The price at which the contract was arranged was not generally known, but the fact of its conclusion was lauded. The government now has 800,000 tons on its hands, and is offering it in Swansea at £3 15s. per ton. As £4 10s. a ton is being paid in Australia, and freight and other charges amount to about £3 a ton, the price received by the government is only about half the cost. Smelters in this country, consequently, are raising a loud voice of complaint, the burden of it being that the Broken Hill mines are being subsidized at the expense of home works.

It is estimated that during the twelve months ended March, 1923, the loss to the government may exceed £1,000,000. The government, however, is expected to stand by its agreement. Economy is the order of the day in national finances, and interested parties would like to see either the abrogation of the contract or some arrangement by which they will be able to resume smelting at a profit. The market price of spelter has declined so seriously that the costs of production in this country are prohibitive.

The Geduld Proprietary and the Modder Deep have made a recalculation of their ore reserves as at Dec. 31 last. The position disclosed in each case is remarkably good. This can be seen by comparing the following figures:

		Geduld Proprietary			
Dec. 31	Tons	Value Per Ton	Width Inches		
1921	3,545,000	34s. 5d.	62		
1920	3,220,000	34s.	61		
		Modder Deep			
Dec. 31	Tons	Value Per Ton	Width Inches		
1921	4,375,000	39s. 7d.	77		
1920	4,100,000	39s. 11d.	77		

If to the above be added the tonnage milled by each company in 1921, that is, 500,000 tons and 509,300 tons, respectively, capital progress has been made. The gold content is set down at the normal price of metal. One interesting point is the great stoping widths.

In the early days of the Eastern Rand, the Reef was thought to be quite narrow, something not much in excess of the Main Reef Leader, in the Central Rand. There are one or two mining companies working much further to the southeast that seem to trade on these widths and values, and issue rather fantastic estimates of ore reserves and profits, putting, in fact, the New Modderfontein and the Modderfontein "B" into the shade. Unfortunately—or is it fortunately?—the public does not appear keen on subscribing to these companies. The backers of the undertakings allege that the South African finance "Houses" purposely ignore the district. This, I think, is a mistake, for with one or two exceptions, the Nigel neighborhood has been tested by representatives of the "Houses," and results have proved far from satisfactory to those who have ventured their money.

The Rio Tinto position is not yet regularized. Some of the directors have left London and proceeded to the property to study matters on the spot and see whether economies can be effected. Rio Tinto has felt the changed condition of affairs as seriously as other companies, and, as I mentioned recently, there is a rumor that additional capital will have to be raised.

### Free List for Manganese Brings Protest From Leadville

A vigorous protest was wired recently to the Colorado representatives in Congress by the Leadville Chamber of Commerce against the action of the Senate Finance Committee in placing manganese on the free list. The house bill provides for a tariff of 1c. per lb. on all manganiferous ore containing more than 30 per cent manganese.

Former Governor Jesse F. McDonald, manager of the Down Town Mines Co., said: "During the war, Leadville produced 1,000 tons of manganese ore daily until the signing of the Armistice automatically canceled the contracts. By conservative estimate 2,000,000 tons remain as known manganese orebodies of the district. A tariff of 1c. a lb., as proposed by the House bill, would enable many of the manganese mines of this district to resume, which they cannot do under direct competition with ore mined with cheap labor in outside mines and transported to this country.

### To Take Gold from New York's Atmosphere

Experiments to recover particles of gold carried into the air by smoke and dust escaping from the molten gold are being carried on by the Mint Service at the New York Assay Office.

### AUSTRALIA

#### Queensland

**Gold Output for 1921 Low—Market for Sapphires Better—Treatment Plant Under Erection at Cloncurry Cobalt Mine**

From Our Special Correspondent

Brisbane, Jan. 30—The gold yield of Queensland for 1921, as was to be expected with Mount Morgan closed down for nine months of the period, shows a serious decline. The yearly production of gold from Mount Morgan was worth nearly £390,000, or more than 78 per cent of the total gold output of the state. The official returns for last year are not yet complete, but the output was approximately only 38,471 fine ounces, valued at £164,561, which is less by 75,440 oz. and £320,400 respectively than for 1920.

Apart from the special circumstances that have operated adversely in Queensland, the figures for last year for the whole of the commonwealth show that the falling gold output disclosed for 1920 was continued during last year, with the result that the total Australian yield for the latter period was 757,430 oz., as against 943,890 oz. for the preceding twelve months. The falling off not only in this state but throughout Australia would have been considerably greater had it not been for the operation of the Australian Gold Producers' Association, which has distributed monthly among its members large sums derived from premiums on the sale of gold.

Recently there has been considerable dullness on the Anakie sapphire field, caused entirely through a lack of buyers for the gems produced, but during the last month or so some signs of revival have been apparent. In December the recorded output was worth only about £1,000, but early in January two buyers arrived, and in three days gems to the value of £4,000 were purchased, as much as £400 being realized for a single parcel. A number of miners had been holding their stone, some for as long as twelve months, for a better market, which they are now finding. A green sapphire, with the Alexandrite property of showing red in an artificial light, was recently obtained and weighed 13 dwt., and a red zircon of 18 dwt. was also unearthed.

The company owning the cobalt mine in the Cloncurry district is doing little in the way of mining pending the erection of its treatment plant, which is well under way. The work being done is in the south shaft, where nothing but bagging ore is being taken out. The south drive from this shaft is in about 170 ft., showing a nice body of ore all the way, with an average width of about



3 ft. During the last two months a further lot of ore, consisting of about 80 tons, has been sent to England, making a total forwarded to date of about 530 tons. Nothing has been made public as to what this ore has realized. There is about 1,000 tons of ore on top awaiting the completion of the treatment plant.

A report on this mine by a government geologist, published a few months ago, shows that the cobalt occurs exactly on the contact of diorite and schists, which are of Silurian age. The schists form noticeable outcrops on the area, and the diorite is apparently intrusive in the schists, as it does not show evidence of the regional pressure to which the schists have been subjected, and, moreover, close to the contact line, indurated masses of schists are outcropping. Samples taken at the time that the geological report was made averaged 12 to 19 per cent cobalt. This is the second deposit of cobalt to be worked in Queensland; the first one, at Kilkivan, near Gympie, proved too low in grade to warrant its continued working.

The Chillagoe state smelters, which closed down on Nov. 20 last, are still idle, and there is a good deal of doubt as to when operations will be resumed. It is probable that the government has accumulated at these works as much copper, awaiting a better market, as it cares to carry.

## CANADA

### British Columbia

#### Premier To Ship Bullion — Florence Silver May Resume—Strike Threatening at Crow's Nest Pass

**Stewart**—The newly installed tramway of the Premier Mining Co. has been operating satisfactorily, 120 tons of ore being brought to seaboard every eight hours. The ore is graded at the bunkers, that containing the lesser values being deposited in an ore bunker for shipment to the smelter at Anyox, the higher grade being shipped direct to the Tacoma smelter. There are yet some details to be completed in connection with the tramway system, but these are of minor importance.

The company intends to construct this summer a number of houses for the use of married men in its employ. An assay office is being built next the cyanide plant, and in this will be installed a plant for the conversion of precipitates into bullion. This will not be pure gold bullion, as it will contain all the minerals that are in the Premier ores. As soon as this equipment is complete, the shipment of the product will start, and it will be the first bullion ever sent from the Portland Canal mining district.

Reports from Bitter Creek are to the effect that the L. L. and H. claims are showing up well on development. A tunnel has been driven about 15 ft., and is still in ore. New work on what is known as the second lead has proved it to be at least 60 ft. wide, and carrying gold and silver values.

**Ainsworth**—It is likely that the Florence Silver Mining Co. will resume operation in a few weeks. Improved marketing condition for output, as a result of the Consolidated Mining & Smelting Co.'s acceptance of customs ore on what is practically a cash settlement basis, makes such resumption possible. The mine has a large ore reserve sufficient to keep the mill running at capacity for several years. Values are chiefly in lead, with a limited amount of silver. Some production has been maintained by leasers for the last few months. It is anticipated that about fifty will be employed.

**Fernie**—The Crow's Nest Pass region, which produces the bulk of the coal used in the southern part of interior British Columbia and supplies all of the coke used in metallurgical treatment of the ores of East and West Kootenay, faces one of its periodical strikes. Unless a settlement of the difficulties between the operating companies and the coal miners of District No. 18, U. M. W. A., is soon effected, a walk-out will probably be ordered for April 1, as the agreement now in force between operators and the unions expires on March 31. The operators have definitely announced that the present contract will not be renewed, and have posted notices of wage decreases running from 30 to 50 per cent.

## Ontario

### Merger of Montreal Kirkland and Ontario Kirkland Ratified—Atlas Property at Shining Tree To Be Drilled

**Cobalt**—La Rose has encountered good ore at 600 ft. depth on the Violet property. Milling ore as high as 60 oz. a ton in car lots is being stoped on the 530 level.

The Castle Trethewey stock offering was oversubscribed to the extent of 1,000,000 shares. Work on the property will be resumed soon.

On March 4 the Coniagas shipped to London forty-six bars of bullion containing 47,000 oz. of silver.

It is understood that operations on the Colonial are about to be resumed.

**Kirkland**—Wright-Hargreaves has declared a dividend of 2½ per cent, payable April 1 to shareholders of record March 17.

The amalgamation of the Ontario Kirkland with the Montreal Kirkland has been ratified by the former company and will come up for ratification by the Montreal Kirkland in the near future. The new company will immediately proceed to sink the main shaft and explore at greater depth.

**Porcupine**—The McIntyre shaft has reached a depth of 2,000 ft., where a new main haulage way will be driven.

Clifton Porcupine shareholders are being asked to pool their stock until Dec. 31, 1922, to facilitate the sale of treasury shares. The company wants to raise \$75,000 to \$100,000.

A contract has been let for 3,000 ft. of diamond drilling on the Atlas property in Shining Tree.

## CALIFORNIA

### Shasta County Denied Rehearing in Tax Case—Applications for Patent Increase

*San Francisco Correspondence*

**San Francisco**—Car No. 1 of the U. S. Bureau of Mines will be stationed at Taft, Cal., from March 13 to April 6. The car is in charge of E. D. Gardner, assisted by R. E. Donovan and J. J. Delahide.

In northern California, it is expected that the new zinc-oxide refinery of the Shasta Zinc & Copper Co., at Winthrop, will be completed some time in May. At present seventy-five men are employed at the mine and smelter.

The U. S. Circuit Court of Appeals has denied the motion of Shasta County asking for a rehearing of the tax cases against the Mountain Copper Co. and the Balaklala Copper Co. This practically settles the controversy and makes possible the return to the companies of taxes paid under protest during 1919. Other cases are pending covering taxes paid under protest in 1920 and 1921.

On March 1, three miners were imprisoned by a cave-in on the 1,000 level of the Idaho-Maryland at Grass Valley, in the north central part of the state. Prompt work rescued them uninjured about fourteen hours after the cave-in. An air pipe served as a means of communication between the three men and the rescue squad. John Fulton, manager, directed the work, and when the miners at last reached the surface they were greeted with cheers by a large crowd of their fellow townsmen which had gathered at the shaft.

Preliminary work has been started on the Bullion group, south of Grass Valley. The Galena shaft is to be unwatered to a depth of 1,500 ft. Discovery of a 4-ft. ledge is reported by the operators of the South Star mine on their 100 level.

The Plumas-Eureka Annex has purchased the Jamison group of claims for \$12,000, according to a deed recently filed at Quincy, Plumas County. The Calnan group, near Genesee, is to be prospected from an adit on the Keystone claim. A compressor and drill equipment will be installed by M. J. Calnan for the initial work.

At the Land Office in Sacramento, John C. Inf, the register, reports that the number of applications for patents received recently is larger than for many years. This is a reflection of the greater activity which prevails.

In the Mother Lode region, the Belmont-Shawmut, at Shawmut, is reported to be operating at the rate of 200 tons per day. The shaft of the Moore mine, near Jackson, is to be sunk an additional distance of 250 ft., and the erection of a twenty-stamp mill has been decided upon at a recent directors' meeting. The Old Elephant gravel mine, near Volcano, is now being operated after a shutdown of short duration.

## NEVADA

**Influenza at Tonopah—Tonopah Divide Meeting Postponed—Conditions at Round Mountain Favorable***From Our Special Correspondent*

**Tonopah**—About 1,200 tons of ore per day is milled in this district. The principal contributors to this tonnage are as follows: Tonopah Belmont, 350 tons; Tonopah Extension, 300; West End, 250; Tonopah Mining, 200; and miscellaneous small producers about 100. The West End is making preparations to increase tonnage to about 300 per day. The Tonopah Belmont reported normal development for the week ended March 4, with work performed on the 700, 800, 900, 1,000, 1,100, 1,200, and 1,400 levels. Operations in this district have been hampered by an epidemic of influenza. Taken as a whole the cases are not serious, but many men have been obliged to temporarily quit work. This necessitates breaking in new men and is attended by additional loss of time and some expense.

**Round Mountain**—Conditions in the lode and placer mines of the Round Mountain Mining Co. are favorable for a successful year in 1922. More water is available this year than last, and many operating improvements have been made. In the hydraulic mine it is expected that 200,000 cu.yd. of gravel will be moved, as against 110,700 cu.yd. in 1921, with the value per cu.yd. about the same. The gross recovery in 1921 was \$120,845.70, or at an average value of \$1.09 per cu.yd. Underground conditions in both the Fairview and Round Mountain lode mines are said to be better than for several years.

**Divide**—On account of the inability of the president, Carl Brougher, to attend the annual meeting of the Tonopah Divide Mining Co., scheduled for March 7, it has been adjourned to March 30.

**Virginia City**—The Middle Mines group at Virginia City, which was recently taken under option by Dr. R. M. Ward, of Philadelphia and New York, is organized under the name of the Paramount Comstock Mines Co. The previous option held by the Boericke interests was dropped. The group involved includes the Best & Belcher, the Gould & Curry, the Savage, the Chollar, Hale & Norcross, the Potosi, and the Bullion. It includes the surface and underground to the 1,000 level of each of the mines named, with the exception of the Bullion, in which instance the option extends to the Suto tunnel level. Certain conflicting interests were taken care of in the merger. The present work consists of driving drifts from the old Hale & Norcross tunnel in the Comstock fissure. The work is preliminary and for the purpose of opening up the ground preparatory to thorough sampling. It is rumored that about \$150,000 is to be spent in doing work of this nature.

## IDAHO

**Armstead Mill Being Tuned Up—Much Interest Evinced in Central and Southern Idaho**

**Talache**—Preliminary runs were given to the new 150-ton mill of the Armstead Mines early in March. Reports are that the plant is measuring up to expectations.

**Boise**—All indications point to an influx of prospectors, miners, capitalists, and mining engineers into central and southern Idaho during the spring. Much interest is being manifested in different sections, including some of the old camps, which were heavy producers of placer gold in the early 60's and for some time later. Negotiations involving large amounts of capital were consummated last year, and there is much promise of activity this season.

**Moscow**—People in and out of Idaho are writing to the state Bureau of Mines and the University of Idaho School of Mines for information regarding mining possibilities in such large numbers that a big revival in prospecting throughout Idaho this season is looming up as a possibility, according to Dean Francis A. Thomson of the University School of Mines. "The number of inquiries so far received this year exceeds any previous record," Dean Thomson stated.

## WASHINGTON

**To Prospect Iron Lands Near Tekoa—Will Drill for Gas in Benton County**

**Prosser**—Following the discovery of natural gas and the determination of its existence in large quantities in Benton County, interests of Pittsburgh, Pa., are reported to have been in negotiation lately with property owners with a view to securing a suitable site for a gas well and a glass-manufacturing plant.

**Tekoa**—As soon as the snow disappears, Spokane interests who acquired a large acreage of iron lands in this vicinity plan to resume active prospecting with a view to determining definitely the extent of the deposit. The ore is classed as a good grade of iron, and much of it contains manganese, it is said.

**Chewelah**—The Washington Marble Products Co. has completed its organization, and officers have been elected as follows: Albert I. Kulzer, president; Louis A. Conyard, vice-president; and Roy A. Hatstrup, secretary-treasurer.

## OREGON

**Ben Harrison Company To Sink Shaft This Spring**

**Whitney**—The Ben Harrison Mining Co., a close corporation, owned by Kentucky interests, with property in the Greenhorn Mountains, in Grant County, will sink a 1,000-ft. shaft this season, according to a recent announcement. The cost of the work is estimated at \$150,000. The work cannot be started until snow disappears from the higher levels.

## ARIZONA

**U. V. Extension Finds Ore on Jerome Verde Boundary—C. & A. Starts Small Force in Junction Shaft**

BY JAMES H. MCCLINTOCK

**Jerome**—At about the division line between the two properties, the drift on the 1,100 level of the United Verde Extension is in ore that evidently extends over into Jerome Verde ground, under which the latter company, in its Maintop chute, believed it had cleaned up all ore. This was only 200 ft. above the new Extension drift, of which the face is in solid ore, some of it 65 per cent glance. No lateral work has been done, and the drift will be pushed forward for an indefinite distance. The work has already added much to the ore reserves of the Extension and is believed locally to have established the value of the Jerome Verde ground on its Extension side.

United Verde steam shovels are digging through a body of gold-silver-copper ore of low grade, but valuable for converter lining.

Verde Central is installing new hoisting and pumping equipment. The shaft is about 50 ft. below the 650 level, and is in soft material, carrying good value in copper, gold and silver.

Application has been made for dissolution of the Venture Hill Mining Co., whose property was sold on execution in November, 1920. This mine, years ago, was considered one of the most promising in the district.

A mill has been installed at the Pocahontas mine, south of Mayer. Electric power is used from the Arizona system. About 75,000 tons of commercial ore is said to be available.

**Oatman**—Tom Reed is diamond drilling its Red Cloud property from the 725 level and is cutting the green quartz in which its best values have been found. For about 100 ft., a new orebody above the 500 level of the company's Aztec mine is in \$15 ore. United American and Telluride are ready to supply twenty-five tons a day each to the Tom Reed mill. The former has ore opened on three levels and expects to have a gross daily revenue of \$1,500 from its mill shipments. Telluride ores are expected to mill above \$30 a ton, taken from the 500 and 300 levels, from a vein of from 3 to 5 ft. wide.

**Miami**—Inspiration Consolidated has secured a right of way from its main workings for a distance of a mile up Webster Gulch to the new Porphyry shaft.

**Bisbee**—A night shift of about fifty men has been started in the Calumet & Arizona Junction shaft. Otherwise there are few indications of increase in local operations in the last week. Little change is noted in the Copper Queen, and no indications of activity are visible around the new mill or Sacramento Hill.



## NEW MEXICO

**Silver Mountain Metals Co. Starts New Mill—Eighty-five Mine Advertises For Workers**

BY JAMES P. PORTEUS

**Chloride**—The new 50-ton concentration mill of the Silver Mountain Metals Co. was started on its regular run on Feb. 28 and is producing a high-grade silver concentrate. The ore is first broken in a jaw crusher, then passed through a ball mill of special design made by the El Paso Foundry & Machine Co., then going into a Dorr classifier, the slimes going to the flotation machine and the sands to a Wilfley table. Two 40-hp. boilers will supply steam power for operations. About 2,000 tons of ore is reported broken ready for milling.

The Midnight & Tidal Wave Mining Co. is erecting a fifty-ton concentration flotation mill on its property about seven miles west of the Silver Mountain Metals Co.'s property.

**Lordsburg**—Though there is an ample supply of common labor for mining purposes, skilled miners and machine men are scarce, and the shortage is delaying the resumption of operations to some extent. The Eighty-five mine of the Calumet & Arizona Mining Co. is advertising for 100 experienced men, which will give that company an underground force of 200. The drums for the main hoist, which is being installed, will, it is thought, be in place within a week, and full production is looked for by March 15. Ore shipments will continue regularly to Douglas, Ariz.

The Last Chance silver mine has been examined during the last two weeks by J. D. Harlan, of Kingman, Ariz., acting for Denver interests. Since the death of Jack White the property has been under the direction of J. G. Nicholas, of Denver.

**Hillsboro**—It is reported that the Snake and Opportunity mines have been purchased by El Paso interests, who will contract with leasers to work the numerous high-grade silver showings.

**Magdalena**—The Old Soldier Mining Milling & Development Co., of Magdalena, with a property 14 miles up Mill Canyon, has resumed operation after four years' inactivity. Work will be done in the belief that the ore will prove of milling grade.

## COLORADO

**Down Town Mines Preparing To Resume**

**Denver**—Jesse F. McDonald, manager of the Down Town Mines Co. at Leadville, was in Denver during the recent hearing on wage schedules before the State Industrial Commission, and stated that his company was preparing to resume operations and already had a small force engaged in retimbering the shaft. Before closing down, this company was the largest employer of labor in the Leadville district.

## UTAH

**High-Grade Silver-Lead Ore Opened in Emma Mine, at Alta—Alta T. & T. Co. Shipping—Chief Consolidated's Development Work***From Our Special Correspondent*

**Bingham Canyon**—The Montana-Bingham shows a production in 1921 of 416 cars of ore, or 24,525 tons, of a gross value of \$192,027 and a net smelter value of \$140,188. Most of this ore was a relatively low-grade fluxing iron-sulphide ore carrying copper. Officers and directors elected at the recent annual meeting were H. H. Green, president; C. E. Adderly, vice-president; and J. H. Brain, secretary and treasurer. Imer Pett continues as general manager of the property.

**Eureka**—Ore shipments from the Tintic district for the week ended March 3 amounted to 122 cars, compared with 148 cars the week preceding. Shippers were: Tintic Standard, 43 cars; Chief Consolidated, 36; Eagle & Blue Bell, 9; Grand Central, 6; Iron Blossom, 5; Colorado, 5; Victoria, 5; Centennial-Eureka, 2; Swansea, 2; Alaska, 2; Empire Mines, 1; Eureka Mines, 1; Tintic Drain Tunnel, 1.

At the Chief Consolidated two headings are being driven on the 1,440 level of the Water Lily shaft, which is just above water level. In the No. 2 shaft a station has been cut on the 1,400 level and drifting has been started. This is the third level opened from this shaft, the two others being at the 1,600 and 1,800-ft. points. Drifting will be done to the east on the 1,400 level to prospect one of the favorable limestone beds which is ore-bearing in other parts of the mine. The Godiva ore zone is a short distance south and east of the No. 2 shaft at a higher level than any work so far done in the No. 2 shaft of the Chief. West of the No. 2 shaft is the Tetro ore channel, which will also be prospected in this section.

A shipment of bullion was made by the Tintic Milling Co. the last week in February. Operations at the mill have been retarded by winter weather.

**Park City**—Shipments for the week ended March 3 amounted to 3,032 tons, compared with 2,841 tons the week preceding. Shippers were: Judge allied companies, 1,597 tons; Silver King Coalition, 885; and Ontario, 550.

**Alta**—Twenty inches of high-grade silver-lead ore has been opened in the Emma mine by a raise from the Bay City tunnel level. There is also 3 ft. of lower-grade material.

Shipments of ore are being made from the Alta Tunnel & Transportation Co.'s property in Big Cottonwood, despite the heavy snows. During the last week eighty tons of first class was added to the stockpile part way down the canyon, and fifty tons was taken through to the smelter. A new raise is being driven from the haulage level to the stope workings to facilitate the handling of ore. Much ore is exposed here, making on the limestone bedding and in three of the raises.

## JOPLIN-MIAMI DISTRICT

**Missouri-Kansas-Oklahoma****Indian Commissioner's Visit Awaited—Kanok Metal's New Mill Burned**

BY P. R. COLDREN

**Joplin**—Local zinc-ore producers are awaiting with much interest the coming to this district of representatives of Indian Commissioner Burke, of the Interior Department at Washington, to consider applications for leases on the Quapaw Indian lands in the Picher camp. Following a decision at Washington recently in which he refused all applications that had been made by different individuals and companies, Commissioner Burke announced he would have special representatives at Miami by March 15 to hear each application separately. The applications adversely affected included offers of substantial bonuses for the leases, with royalty up to as high as 10 per cent. Operators had hoped they might get the lands for 7½ per cent royalty and without bonuses. The lands to be released hold probably 90 per cent of the production in the Picher camp.

Fire believed to have originated from electric wiring completely destroyed the McBee mill of the Kanok Metal Co., about twelve miles northwest of Joplin and two miles east of Crestline, Kan., on March 6. The mill was completely modern and was practically new, having been run only about six months. It had been idle for several months, and was recently put in condition for renewed operation, and would have been turned over March 7. The loss is estimated by A. M. Gaines, manager of the company, at about \$45,000, most of which was covered by insurance. The office, pump house, and other outbuildings were not destroyed. The company will immediately rebuild the mill.

The Kansas Line Co. has lost a field derrick and hopper by fire of unknown origin. The property, which is just across the state line, northeast of Picher, was saved by prompt work by the Picher fire company. The loss is estimated at about \$5,000.

An unusually bad accident resulting from the striking of a descending tub against the side of the shaft was recorded at the Cortez mine in the Picher camp on March 9, when two men were killed and two others injured.

The Black Hawk Mining Co. has taken over the Monarch mine and mill, in Kansas, just east of the Blue Mound property, and will operate it. G. N. Williams is manager for the Black Hawk company, which has operated the mine by that name, situated just south of the main portion of Picher, since 1917, and which has proved a rich property. The Monarch mill was completed and the mine opened up last fall.

H. H. Hartzell, formerly manager of the Ramage properties in this field, has been made manager of the Huttig properties, succeeding B. E. Brown. There has been a reorganization in the Huttig company recently, caused by financial reverses to the Huttig interests.

# THE MARKET REPORT

## Daily Prices of Metals

Mar.	Copper, N. Y., net refinery* Electrolytic	Tin		Lead		Zinc
		99 Per Cent	Straits	N. Y.	St. L.	St. L.
9	12.65	28.125	29.00	4.70	4.40	4.65
10	12.50@12.75	28.625	29.50	4.70	4.40	4.65@4.675
11	12.50@12.75	28.25	29.25	4.70	4.40	4.65@4.70
13	12.50@12.75	27.875	28.75	4.70	4.40	4.65@4.70
14	12.50@12.75	28.125	28.875	4.70	4.40@4.45	4.675@4.70
15	12.50@12.75	28.50	29.125	4.70	4.40@4.45	4.70

\*These prices correspond to the following quotations for copper delivered: March 9th, 12.90c.; 10th to 15th, inc., 12.75 @ 13c.

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

Mar.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
9	60 $\frac{3}{8}$	61 $\frac{3}{8}$	67 $\frac{1}{2}$	142	144	20 $\frac{3}{8}$	20 $\frac{5}{8}$	25 $\frac{3}{8}$	25 $\frac{3}{8}$
10	60 $\frac{1}{2}$	61 $\frac{1}{2}$	67	145	147	20 $\frac{3}{8}$	20 $\frac{5}{8}$	25 $\frac{3}{8}$	25 $\frac{3}{8}$
11	...	...	...	...	...	...	...	...	...
13	60 $\frac{1}{2}$	61 $\frac{1}{2}$	67	143	144 $\frac{3}{8}$	20 $\frac{7}{8}$	20 $\frac{3}{4}$	25 $\frac{3}{8}$	25 $\frac{3}{8}$
14	60 $\frac{3}{8}$	61 $\frac{3}{8}$	68	142 $\frac{3}{8}$	144 $\frac{3}{8}$	21	20 $\frac{7}{8}$	25 $\frac{3}{8}$	25 $\frac{3}{8}$
15	60 $\frac{1}{2}$	61 $\frac{1}{2}$	67 $\frac{3}{4}$	143 $\frac{3}{8}$	145 $\frac{3}{8}$	21 $\frac{5}{8}$	21 $\frac{1}{2}$	25 $\frac{3}{8}$	25 $\frac{3}{8}$

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

## Silver and Sterling Exchange

Mar.	Sterling Exchange "Checks"	Silver			Mar.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
9	435 $\frac{1}{2}$	99 $\frac{5}{8}$	64 $\frac{1}{4}$	33 $\frac{1}{2}$	13	431 $\frac{1}{2}$	99 $\frac{5}{8}$	63 $\frac{7}{8}$	33 $\frac{3}{8}$
10	435 $\frac{1}{2}$	99 $\frac{5}{8}$	65 $\frac{1}{4}$	33 $\frac{3}{8}$	14	428	99 $\frac{5}{8}$	63 $\frac{1}{8}$	33 $\frac{1}{2}$
11	435	99 $\frac{5}{8}$	64 $\frac{1}{4}$	33 $\frac{1}{2}$	15	433 $\frac{3}{4}$	99 $\frac{5}{8}$	63 $\frac{5}{8}$	33 $\frac{3}{8}$

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

## Metal Markets

### New York, March 15, 1922

The week has been a featureless one in the metal markets. Prices show little variation from previous quotations.

### Copper

The week has been marked by an excellent export business, which has overshadowed domestic sales. The prices realized were also better than could have been obtained from local buyers, most of the metal netting producers here around 13c., f.o.b. refinery. Demand was well diversified among the European countries and the Orient, and the business was largely placed through the Copper Export Association, outside

interests reporting an unsatisfactory market abroad. Not much export business has been done in the last two days, however, by anybody.

The domestic market has been unsteady, some producers, in fact most of them, holding for 13c. delivered, though others have sold copper for as low as 12.75c. The export demand lately has taken so much copper off the market that producers generally have not cared to attract domestic trade by price cutting. A fair tonnage has been sold in small lots at the 13c. figure; considerably more has been sold at 12 $\frac{1}{2}$ c., two or three comparatively large lots changing hands at this figure for March-April delivery. In two or three instances, where the delivery rate was

low and where prompt delivery was acceptable, contracts have been closed by large manufacturing interests at 12.75c., delivered, though this price could not have been done in more than one or at most two directions. A weighted average of domestic sales for the week would probably show a realized price of about 12 $\frac{1}{2}$ c., f.o.b. refinery. There was some buying of importance in which consumers did not figure.

### Lead

The official contract price of the American Smelting & Refining Co. continues unchanged at 4.70c., New York, and for desilverized, 4.50c. at St. Louis.

The market has been quiet but firm the last few days; business appeared to slump a little over the week-end. Demand has been well diversified, and many of the sales have been for car-load lots. The automobile business is exhibiting a seasonable improvement, and this is reflected in increasing demands for lead for this purpose. Improved railroad buying is also reflected in a better demand from mixed-metal manufacturers and dealers. The market has been somewhat more active in the Middle West than in the East. Quotations of 4 $\frac{3}{8}$ c. St. Louis are no longer heard, and consumers would even have some difficulty in finding sellers at 4.40c. today. In fact, two of the largest lead producers are generally quoting 4.45c., though but little metal has brought this price so far. The increased strength has been caused by the fact that producers are well sold up on March production. Sales at New York continue at 4.70c., though this price has been bettered in some instances and a slight advance may come soon.

### Zinc

Business has been more active, and prices have advanced to 4.70c., East St. Louis, which is the level at which producers are generally holding the metal. Statistics issued by the American Zinc Institute show an improvement in the zinc position during February. Stocks declined from 65,678 tons on Feb. 1 to 64,124 on Feb. 28. Production during February was 22,513 tons; shipments were 24,067. Average number of retorts operating for the month, 44,867. Forward zinc is bringing a premium of about 5 points for each month. New York prices are generally 35 points above the St. Louis quotations. High-grade zinc, though active, has not been sold as heavily as earlier in the year.

### Tin

Tin has been much unsettled by the wide fluctuations in sterling. Demand has been of fair volume, both dealers and consumers being in the market. The large amounts now being delivered



in this country are generally in strong hands, and little or none is being pressed on the market. Forward deliveries have been quoted at the same prices as for spot to  $\frac{1}{2}$  c. less.

Arrivals of tin, in long tons: March 1st, Liverpool, 50; 7th, Straits, 50; 8th, London, 150; Straits, 1,800; Liverpool, 25; 11th, London, 25; 13th, Australia, 95; London, 150; 14th, London, 25; Liverpool, 40; Australia, 25.

**Gold**

Gold in London: March 9th, 95s.; 10th, 95s.; 13th, 95s. 9d.; 14th, 96s. 9d.; 15th, 96s. 4d.

General stock of money in the United States, Feb. 1, 1922: Gold coin and bullion, \$3,680,882,401; standard silver dollars, \$357,481,851; subsidiary silver, \$272,541,512; United States notes, \$346,681,016; Federal Reserve notes, \$2,560,887,510; Federal Reserve Bank notes, \$11,140,400; National Bank notes, \$749,611,367; total, \$8,079,226,057. On March 1 there was: Gold coin and bullion, \$3,720,755,655; standard silver dollars, \$360,401,851; subsidiary silver, \$272,380,601; United States notes, \$346,681,016; Federal Reserve notes, \$2,518,443,360; Federal Reserve Bank notes, \$105,525,400; National Bank notes, \$752,035,482; total, \$8,076,223,365. During February the stock of gold and silver increased by about \$43,000,000 and the amount of outstanding paper decreased by about \$45,000,000.

**Foreign Exchange**

Somewhat disconcerting political news from South Africa, Egypt, England and India was probably the spark which touched off the reaction that has occurred in the foreign exchanges during the last few days. Such a movement was not unexpected after the recent continued advances. On Tuesday, March 14, francs were 8.915c.; lire, 5.05c.; and marks, 0.3725c. New York funds in Montreal, 3.626 per cent premium.

**Silver**

The silver market has been erratic in the last week, London fluctuating  $\frac{1}{2}$  d. and New York 2c. per oz. The Indian bazaars and China have operated on both sides of the market, and America and the Continent have sold. These conditions, together with the violent changes in sterling exchange, are responsible for the fluctuations in silver, and the market is likely to continue uncertain for the present.

**Mexican Dollars**—March 9th, 49 $\frac{1}{2}$ ; 10th, 49 $\frac{3}{4}$ ; 11th, 49; 13th, 48 $\frac{3}{4}$ ; 14th, 48 $\frac{1}{2}$ ; 15th, 48 $\frac{1}{2}$ .

**Other Metals**

Quotations cover large wholesale lots unless otherwise specified.

**Aluminum**—20c. per lb. for 99 per cent grade; 19c. for 98@99 per cent; 18c. for 94@98 per cent. Outside market nominal at 17@18c. for 98@99 per cent virgin grades.

**Antimony** — Chinese and Japanese brands, 4.25c.; market dull. W.C.C.

brand, 5@5 $\frac{1}{2}$ c. per lb. Cookson's "C" grade, spot, 9c. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 5.25c. per lb.

**White antimony oxide**, Chinese, guaranteed 99 per cent Sb<sub>2</sub>O<sub>3</sub>, wholesale lots, 6 $\frac{1}{2}$ @7c.

**Arsenic**—7@7 $\frac{1}{2}$ c. per lb.

**Bismuth**—\$2@\$2.10 per lb.

**Cadmium**—\$1@\$1.10 per lb., in 1,000-lb. lots. Smaller quantities, \$1.10@\$1.25 per lb.

**Iridium**—Nominal, \$170@\$190 per oz.

**Nickel**—Standard market, ingot and shot, 41c.; electrolytic, 44c. Small ton-nages, spot, nominal at 32c.

**Palladium**—Nominal, \$55@\$60.

**Platinum**—\$85@\$90 per oz.

**Quicksilver**—\$51 per 75-lb. flask. San Francisco wires \$49.30.

The prices of **Cobalt, Molybdenum, Monel Metal, Osmium, Rhodium, Selenium, Thallium and Tungsten** are unchanged from the prices in the issue of March 4.

**Metallic Ores**

The prices of **Bauxite, Chrome, Manganese, Tungsten, Molybdenum, Tantalum, Uranium, Vanadium, and Iron Ore, Zircon and Zirkite** are unchanged from the prices in the issue of March 4.

**Zinc and Lead Ore Markets**

**Joplin, Mo., March 11**—Zinc blende, per ton, high, \$30.70; basis 60 per cent zinc, premium, \$27.50@\$27; Prime Western, \$27@\$26; fines and slimes, \$25; average settling price, all grades of zinc, \$26.44.

Lead, high, \$64.10; basis 80 per cent lead, \$60; average settling price, all lead ores, \$62.86 per ton.

Shipments for the week: Blende, 8,928; lead, 1,919 tons. Value, all ores the week, \$356,680.

Sellers asked for a higher price level and withheld sales until the buyers found it necessary to advance offerings or secure a light tonnage. With a firm demand for ore, sellers won advances of \$1 to \$2 per ton. The existing association of producers keeps well informed on all market conditions, and asks all the market will bear.

**Platteville, Wis., March 13**—No ore sales or shipments from Wisconsin district last week.

**Non-Metallic Minerals**

**Barytes**—Crude, \$6@\$8 per ton, f.o.b. mines. Ground, white, \$17@\$23; off-color grades, \$13@\$21 per ton, f.o.b. mills. Foreign importations of crude are being laid down at Atlantic ports for \$7.80@\$8.25, c.i.f.

**Fluorspar**—Fluxing lump, \$20; fluxing gravel, \$17.50; No. 1 ground, \$50@\$55, No. 2 ground \$40 per ton, f.o.b. Illinois mines. Market dull.

There are no price changes from those indicated in the market report of the issue of March 4 covering **Asbestos, Borax, Chalk, China Clay, Emery,**

**Feldspar, Fuller's Earth, Graphite, Gypsum, Limestone, Magnesite, Mica, Monazite, Phosphate, Pumice, Pyrites, Silica, Sulphur, and Talc.**

**Mineral Products**

**Sodium Nitrate**—\$2.85 per hundred-weight, ex vessel, Atlantic ports.

The prices of **Copper Sulphate, Potassium Sulphate, and Sodium Sulphate** are unchanged from issue of March 4.

**Ferro-Alloys**

**Ferromanganese**—Domestic, 78 to 82 per cent, \$62@\$64, f.o.b. furnace.

**Ferrovandium**—\$3.55 per lb. of V contained, according to analyses and quantity.

The prices of **Ferrotitanium, Ferrocium, Ferrochrome, Ferromolybdenum, Ferrosilicon, Ferrotungsten and Ferrouanium** are unchanged from issue of March 4.

**Metal Products**

The prices of **Copper Sheets, Lead Sheets, Nickel Silver, Yellow Metal, and Zinc Sheets** are unchanged from the issue of March 4.

**Refractories**

The prices of **Bauxite Brick, Chrome Brick, Chrome Cement, Firebrick, Magnesite Brick, and Silica Brick** are unchanged from the issue of March 4.

**The Iron Trade**

**Pittsburgh, March 14, 1922**

Pig-iron production in 1921 is officially reported at 16,688,126 gross tons, the smallest in thirteen years, 55 per cent under the production of 1920 and 58 per cent under that of 1916, the record year. The present rate is 30 per cent over the average in 1921.

Steel-ingot production in February was at an average rate of about 27,000,000 gross tons a year, representing a rise in the rate from about 25,000,000 tons to about 29,000,000 tons, the rate having undergone no material change since the end of February.

Steel prices show weakening in some quarters and strengthening in others. The \$2.40 price on nails is shaded more frequently than formerly, and there is considerable shading in tubular goods. Sheets maintain their stiffness, and predictions are that the next price change will be an advance. The local independent in bars, shapes, and plates has advanced its price to 1.50c., and other sellers in consequence, whereby 1.35c. is less common than formerly and 1.40c. is probably the closest approximation to the general market.

**Pig Iron**—A sale of 600 tons of basic at \$18 is reported. Small lots of foundry bring \$19. The market remains at \$19 to \$19.50 for bessemer, \$17.75 to \$18 for basic, and \$18.75 to \$19 for foundry, f.o.b. Valley furnaces, freight to Pittsburgh being \$1.96.

**Coke**

**Connellsville**—Furnace, \$3.25@\$3.50; foundry, \$4.25@\$4.75.

## Germany Buys American Copper

### Imports Handled Differently Than in the Pre-War Period—German Electrical Industry Now Looking to Russia for a Market

SPECIAL FOREIGN CORRESPONDENCE  
Written for *Engineering and Mining Journal*

**D**URING the first year after the Armistice, Germany was supplied for domestic needs, as far as the requirements of metal were concerned, by scrap. A number of smelting and refining plants, started during the war, controlled the market. The imports of copper in 1919 were insignificant. After peace was concluded, business connections with the outside world were gradually re-established, and importation of fresh copper was resumed. The American Smelting & Refining Co. was one of the largest copper importers of pre-war times, but its business in Germany was wound up during the war. This business was re-established on Jan. 1, 1920, under the name of the Copper Import Company, which now represents the American Copper Export Association. The other large dealers in copper also resumed foreign business.

In spite of the vast supplies of scrap still on hand in 1920, copper importations, chiefly from the United States, assumed considerable dimensions during that year, the American imports amounting to about 55,000 tons, or a fourth part of the supply of 1913. In 1921 copper imports increased largely and amounted in the total to 130,000 tons, compared with 225,000 tons in 1913. The bulk of these imports, or 110,000 tons, came from the United States; 5,000 tons came from Belgium, over 2,000 tons from Great Britain, and about 13,000 from other countries. These imports do not constitute the total consumption of copper, which, if an estimate on the amount of copper recovered from scrap is included, will probably amount to 170,000 tons per year. At least one-half of the total supply was consumed by the electrical industry, chiefly for cables. The state railroads, also, were large consumers (as they needed large quantities of copper for the replacing of steel fire boxes), and post and telegraph companies were important purchasers. The rest of the business was distributed among metal-working industries.

The Copper Import Company supplies consumers only. The dealers obtain their supply from other sources, as far as American imports are concerned from those outside of the Copper Export Association, chiefly the American Metal Company. The latter company maintains close connections with the Deutsche Metall Gesellschaft, which in volume of business stands second to the Copper Import Company. The English firm of Brandeis, Goldschmidt & Co. is also handling a fair amount of American copper imports to Germany. Its German business is conducted by one of the partners in the company, William Brandeis, who resides in Berlin.

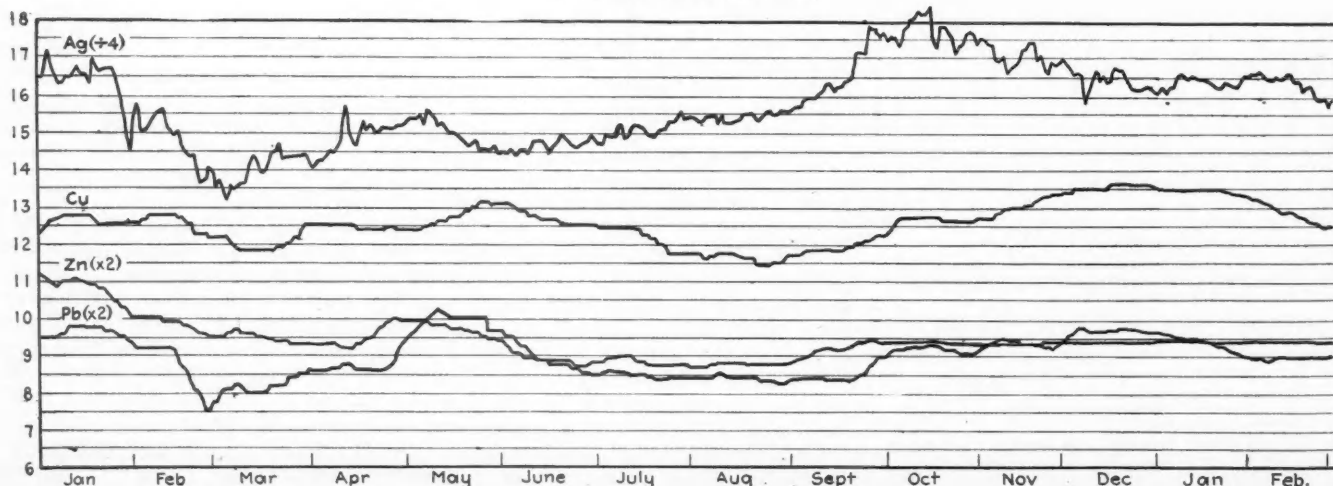
The prices at which contracts are concluded fluctuate with the market quotations in New York and London. It can, however, be noted that prices quoted by the large dealers, apart from the Copper Import Company, are frequently a fraction lower than those of the latter, especially when buying is slack. For this reason the Copper Import Company has not been able to establish control of the import market. In trading circles it is estimated that about half of the imports are handled by the Copper Export Association and the other half by independent sources.

The outlook upon the current year is unanimously considered to be fair, although business to the extent of that transacted last year is not expected. The electrical works are still employed to their fullest capacity with orders booked last year, especially for vast new hydro-electric plants which are being built, and for extension works, but new orders are coming in sluggishly. The requirements of copper, as far as the work in hand is concerned, is presumably covered by last year's purchases. The state railroads and the telegraph administration have also made all copper purchases for renewals and extensions, and are now buying only for their normal requirements.

A strong propaganda has been started in favor of aluminum as a wiring material, but no effects are so far noticeable of an increased use of this metal. Metal-working industries are noticeably holding back with orders, pending the outcome of the Genoa conference, which it is commonly believed may have serious consequences on market conditions if it should result in an improvement or stabilization of the rate of exchange. Much of the copper business of this year will depend on the future exchange situation. A decided improvement of the mark will no doubt react strongly on business, and in the first instance produce a slump. If, on the other hand, concerted action should succeed in stabilizing the mark, this will promote business, as a strong latent demand is kept in check by fluctuations.

Two other open questions of vast import will also have a strong bearing on the copper market—the reconstruction work for France and the opening of Russia. In the latter respect expectations are twofold. A vast amount of copper scrap is supposed to be lying idle in Russia, and efforts are being made at present to utilize it. A Berlin firm of copper merchants is working in conjunction with the Soviet government for conveying metal scrap of all descriptions to the German smelting works, and although no copper scrap has so far crossed the frontiers, considerable quantities are expected in the course of the year. On the other hand, the opening of Russia, especially the reconstruction of her transportation system, would call for an immediate supply of copper which could not nearly be covered by the scrap still in Russian possession. Moreover, opinions are strongly divergent as to the estimates of the quantities of scrap available. Those able to judge from personal observation are not optimistic.

## Prices of New York Copper, Silver and Lead, and St. Louis Zinc 1921 and 1922





## COMPANY REPORTS

### Barnes-King Development Co.

A report of operations of Barnes-King Development Co. for 1921 states that the net profit for the year was \$35,764.28, compared with \$2,739.39 for the year 1920. The Shannon mine was operated continuously during the year, with slightly lower costs per ton of ore than in the previous year. The opening of an ore shoot on the lowest level, the 600, with the indication of its going down, was an encouraging development for the year. The Piegan-Gloster mine was not operated. The North Moccasin mine was operated by leasers. Work on three new properties was done, under option, during the year. On two of these, work has been stopped. Quite a number of other new properties were examined, but owing to either unfavorable conditions or terms, or both, nothing further was done regarding them. No dividends were paid during the year.

General profit and loss account follows:

INCOME FROM OPERATIONS	
Profit, Shannon property.....	\$82,444.90
Loss, North Moccasin and Kendall power plant.....	\$7,285.78
Less profit on sale of supplies.....	285.35
	\$7,000.43
Loss Piegan-Gloster property.....	11,035.59
Loss Kendall mine.....	485.74
	18,521.76
Property net earnings.....	\$63,923.14
Interest received.....	\$1,474.49
Interest received on Liberty Loan bonds.....	2,125.00
Recovery from used materials.....	321.93
	3,921.42
Total earnings.....	\$67,844.56
EXPENSES	
Development of Strawn option.....	\$7,779.85
Development of Black Hawk option.....	6,024.91
Betsy Baker option and development costs.....	7,093.86
	\$20,898.62
Examination of new properties.....	\$4,962.77
Taxes paid:	
Net proceeds.....	2,628.95
Capital stock tax.....	443.00
Metal mines license tax.....	819.48
Extraordinary expenses.....	2,327.46
	32,080.28
Total expenses.....	32,080.28
Net profit for year 1921.....	\$35,764.28

#### Surplus account follows:

Surplus:	
Balance Dec. 31, 1920.....	\$41,317.45
Deduct depletion for 1920.....	6,421.95
	\$34,895.50
Add tax adjustment.....	10.00
Surplus as adjusted, Dec. 31, 1921.....	\$34,905.50
Net profits for year 1921.....	35,764.28
	\$70,669.78

Current liabilities on Dec. 31, 1921, were \$22,738.67; current assets, \$220,150.69. The company is capitalized at \$2,000,000, consisting of 400,000 shares of \$5 par value. Production of the Shannon mine was 36,570 dry tons of average assay value of \$9.74.

### Arizona Copper Co., Ltd.

A report of operations of the Arizona Copper Co., Ltd., for the year ending Sept. 30, 1921, states that the transfer of the company's business in the United States to Phelps Dodge Corporation, on the terms set forth in the agreement which was confirmed by the shareholders at the extraordinary general meeting on Oct. 3, 1921, was carried through on Oct. 5.

The dividend on the A preference shares of the company for the half year to Sept. 30, 1921, was paid prior to the

transfer of the business on Oct. 5. In terms of the agreement, Phelps Dodge Corporation placed the company in funds to meet the dividend on the preference stock for the half year to Sept. 30, and that dividend was paid on Nov. 1, 1921.

On Jan. 4, 1922, Phelps Dodge Corporation paid a dividend of 1 per cent to its shareholders for the quarter to Dec. 31, 1921, making the dividend for the year to that date 4 per cent. The company's share of this quarterly dividend, being the first dividend it is entitled to under the agreement, was \$50,000. The sterling equivalent received was £11,918 19s., which amount is subject to payment of British taxes. By the agreement, Phelps Dodge Corporation became bound to retire both the A preference shares and the preference stock within five years. The corporation has already retired the A preference shares; the necessary resolution reducing the capital of the company in respect of these shares has been passed and confirmed by the shareholders; and a petition to confirm this has been presented to the court.

For the present, and so long as the preference stock is outstanding, the company must continue, but the expenses of management will be materially reduced. The directors estimate that these expenses will not exceed £3,500 per annum, which would include the running of the office, the transfer department, the directors' fees, and the fee to be paid to the company's representative on the board of Phelps Dodge Corporation.

After the preference stock has been retired, the shareholders will be in a position to consider whether the company should be continued, or the Phelps Dodge Corporation shares disposed of en bloc, or distributed among the shareholders.

The revenue account for the year to Sept. 30, 1921, was as follows:

Copper company's operations	
Loss on copper and stores, less rents received.....	£182,028 17 4
Shut down expenses exclusive of interest and taxes.....	27,165 5 3
	£209,194 2 7
Add	
Expenses of administration at Clifton.....	£18,430 14 4
Interest paid in the United States, less received.....	49,800 19 1
Taxes in the United States, paid and accrued.....	98,481 3 0
	£166,712 16 5
Public subscriptions in Arizona.....	2,103 19 8
	£168,816 16 1
Charges and expenses in Edinburgh (less received for transfer fees, £279, 9s. 0d.).....	10,977 10 0
	179,794 6 1
Deduct	£388,988 8 8
Sums received in respect of holdings in other companies— interest and dividends for the year.....	21,516 17 9
	£367,471 10 11
Interest received, less paid.....	3,857 19 5
	£363,613 11 6
Add	
Amount carried to reserve for contingent liabilities.....	9,056 3 11
Amount carried to reserve account for capital outlay.....	12,000 0 0
Deficiency.....	£384,669 15 5
Dividend on A preference shares for year to Sept. 30, 1921.....	£2,374 0 0
Dividend on preference stock for year to Sept. 30, 1921.....	22,157 2 0
	24,531 2 0
Deficiency for year, after paying preferential dividends.....	£409,200 17 5
Deduct	
Balance to the credit of the profit and loss account Sept. 30, 1920.....	65,110 5 10
Balance to the debit of profit and loss Sept. 30, 1921.....	£344,090 11 7

# MINING STOCKS

Week Ended March 11, 1922

Stock	Exch.	High	Low	Last	Last Div.	Stock	Exch.	High	Low	Last	Last Div.	
<b>COPPER</b>						<b>GOLD</b>						
Ahmeek.....	Boston	63	61	62	Sept. '20, Q	\$0.50	Alaska Gold.....	New York				
Alaska-Br. Col. new.	N. Y. Curb	23	21	21			Alaska Juneau.....	New York				
Allouez.....	Boston	26	25	25	Mar. '19	1.00	Carson Hill.....	New York	13	12	13	
Anaconda.....	New York	49	48	49	Nov. '20, Q	1.00	Cresson Consol. G....	N. Y. Curb	2	2	2	
Arcadian Consol.....	Boston	2	2	2			Dome Extension.....	Toronto	*85	*85	*85	
Ariz. Com'l.....	Boston	9	9	9	Oct. '18, Q	0.50	Dome Mines.....	New York	24	24	24	
Big Ledge.....	N. Y. Curb	*23	*18	*22			Florence Goldfield....	N. Y. Curb	*25	*22	*24	
Bingham Mines.....	Boston	13	13	13	Sept. '19, Q	0.25	Golden Cycle.....	Colo. Springs	*77	*77	*77	
Calumet & Arizona..	Boston	59	57	59	Dec. '21, Q	0.50	Goldfield Consol.....	N. Y. Curb	*4	*4	*4	
Calumet & Hecla.....	Boston	260	277	279	June '20, Q	5.00	Hollinger Consol.....	Toronto	9.15	8.75	9.05	
Canada Copper.....	N. Y. Curb	*21	*15	*15			Homestake Mining....	New York	61	60	60	
Centennial.....	Boston	10	10	10	Dec. '18, SA	1.00	Kirkland Lake.....	Toronto	*39	*35	*38	
Cerro de Pasco.....	New York	35	34	35	Mar. '21, Q	0.50	Lake Shore.....	Toronto	1.85	1.65	1.80	
Chile Copper.....	New York	17	16	17			McIntyre-Porcupine..	Toronto	14.80	14.55	14.65	
Chino.....	New York	27	26	27	Sept. '20, Q	0.37	Porcupine Crown.....	Toronto	*27	*23	*25	
Columbus Rexall....	Salt Lake	*30	*30	*30			Porcupine V. N. T....	Toronto	*26	*25	*25	
Con. Arizona.....	N. Y. Curb	*2	*2	*2	Dec. '18, Q	0.05	Portland.....	Colo. Springs	*36	*35	*36	
Con. Copper Mines..	N. Y. Curb	1	1	1			Schumacher.....	Toronto	*47	*45	*46	
Copper Range.....	Boston	44	42	43	Mar. '22, Q	1.00	Silver Pick.....	N. Y. Curb	*6	*6	*6	
Crystal Copper.....	Boston Curb	*57	*52	*57			Teck Hughes.....	Toronto	*38	*36	*37	
Davis-Daly.....	Boston	8	7	7	Mar. '20, Q	0.25	Tom Reed.....	Los Angeles	*78	*73	*75	
East Butte.....	Boston	11	10	11	Dec. '19, A	0.50	United Eastern.....	N. Y. Curb	2	1	1	
First National.....	Boston Curb	*65	*61	*65	Feb. '19, SA	0.15	Vindicator Consol....	Colo. Springs	*21	*20	*21	
Franklin.....	Boston	†2	†1	†1			White Caps Mining....	N. Y. Curb			*3	
Gadsden Copper.....	Boston Curb	*50	*50	*50			Yukon Gold.....	N. Y. Curb	1	1	1	
Granby Consol.....	New York	29	28	29	May '19, Q	1.25						
Greene-Cananea....	New York	27	26	27	Nov. '20, Q	0.50						
Hancock.....	Boston	2	2	2								
Howe Sound.....	N. Y. Curb	3	3	3	Jan. '21, Q	0.05						
Inspiration Consol..	New York	40	39	40	Oct. '20, Q	1.00						
Iron Cap.....	Boston Curb	†8	†7	†7	Sept. '20, K	0.25						
Isle Royale.....	Boston	24	23	24	Sept. '19, SA	0.50						
Kennebec.....	New York	29	28	29	Dec. '20, Q	0.50						
Keweenaw.....	Boston	1	1	1								
Lake Copper.....	Boston	2	2	2								
La Salle.....	Boston	1	1	1								
Magma Copper.....	N. Y. Curb	30	29	29	Jan. '19, Q	0.50						
Majestic.....	Boston Curb	*8	*8	*8								
Mason Valley.....	Boston	2	1	2								
Mass Consolidated..	Boston	2	2	2	Nov. '17, Q	1.00						
Miami Copper.....	New York	27	27	27	Feb. '22, Q	0.50						
Michigan.....	Boston	2	1	2								
Mohawk.....	Boston	59	57	59	Feb. '22, Q	1.00						
Mother Lode Coa...	N. Y. Curb	8	7	7								
Nevada Consol.....	New York	14	14	14	Sept. '20, Q	0.25						
New Cornelia.....	Boston	18	17	17	Feb. '22, K	0.25						
North Butte.....	Boston	12	11	12	Oct. '18, Q	0.25						
North Lake.....	Boston			*25								
Ohio Copper.....	N. Y. Curb			*9								
Old Dominion.....	Boston	25	24	25	Dec. '18, Q	1.00						
Oscoda.....	Boston	34	32	33	June '20, Q	0.50						
Phelps Dodge.....	Open Mar.	†171	†168		Jan. '22, Q	1.00						
Quincy.....	Boston	44	44	44	Mar. '20, Q	1.00						
Ray Consolidated..	New York	14	14	14	Dec. '20, Q	0.25						
Ray Hercules.....	N. Y. Curb	*4	*3	*3								
St. Mary's Min. Ld..	Boston	46	44	46	Dec. '21, K	1.00						
Seneca Copper.....	Boston	14	13	14								
Shannon.....	Boston	*90	*80	*80	Nov. '17, Q	0.25						
Shattuck Arizona..	New York	8	7	8	Jan. '20, Q	0.25						
South Lake.....	Boston			*80								
Superior & Boston..	Boston	1	*99	1								
Tenn. C. & C. cis..	New York	11	10	10	May '18, I	1.00						
Tuolumne.....	Boston	*50	*49	*50	May '13, Q	0.10						
United Verde Ex...	Boston Curb	28	27	28	Feb. '22, Q	0.25						
Utah Consol.....	Boston	2	1	2	Sept. '18, Q	0.25						
Utah Copper.....	New York	64	62	64	Dec. '21, Q	0.50						
Utah Metal & T....	Boston	1	1	1	Dec. '17, Q	0.30						
Victoria.....	Boston	2	2	2								
Winona.....	Boston	*35	*35	*35								
Wolverine.....	Boston	12	10	11								
<b>NICKEL-COPPER</b>						<b>SILVER</b>						
Internat. Nickel....	New York	13	12	12	Mar. '19, Q	0.50	Batopilas Mining....	New York				
Internat. Nickel, pfd	New York	67	64	65	Feb. '22, Q	1.50	Comagias.....	Toronto	*31	*29	*30	
<b>LEAD</b>						<b>GOLD AND SILVER</b>						
National Lead.....	New York	89	89	89	Dec. '21, Q	1.50	Cash Boy.....	N. Y. Curb	*5	*5	*5	
National Lead, pfd..	New York			112	Dec. '21, Q	1.75	Dolores Esperanza...	N. Y. Curb	*98	*81	*98	
St. Joseph Lead....	New York	13	12	12	Dec. '21, Q	0.25	El Salvador.....	N. Y. Curb	*4	*2	*4	
<b>QUICKSILVER</b>						<b>SILVER-LEAD</b>						
New Idria.....	Boston	*40	*40	*40			Caledonia.....	N. Y. Curb	*5	*5	*5	
<b>ZINC</b>						<b>VANADIUM</b>						
Am. Z. L. & S.....	New York	13	13	13	May '20, Q	1.00	Vanadium Corp.....	New York	37	34	37	
Am. Z. L. & S. pfd..	New York			37	Nov. '20, Q	1.50	<b>ASBESTOS</b>					
Butte C. & Z.....	New York	5	5	5	June '18, Q	0.50	Asbestos Corp.....	Montreal			54	
Butte & Superior..	New York	26	25	25	Sept. '20, Q	1.25	Asbestos Corp., pfd..	Montreal	74	74	74	
Callahan Zn-Ild....	New York	6	5	6	Dec. '20, Q	0.50	<b>SULPHUR</b>					
New Jersey Zn.....	N. Y. Curb	146	139	146	Feb. '22, Q	2.00	Freeport, Texas.....	New York	20	16	19	
Yellow Pine.....	Los Angeles			*50	Sept. '20, Q	0.03	Texas Gulf.....	New York	44	43	43	
*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.						<b>MINING, SMELTING AND REFINING</b>						
Toronto quotations courtesy Hamilton R. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.						Amer. Sm. & Ref....						
						New York						
						50						
						47						
						50						
						Mar. '21, Q						
						1.00						
						92						
						40						
						91						
						Mar. '22, Q						
						1.75						
						89						
						89						
						Jan. '22, Q						
						0.50						
						36						
						34						
						Jan. '21, Q						
						0.50						
						43						
						Jan. '22, Q						
						0.87						



