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July 7, 1923

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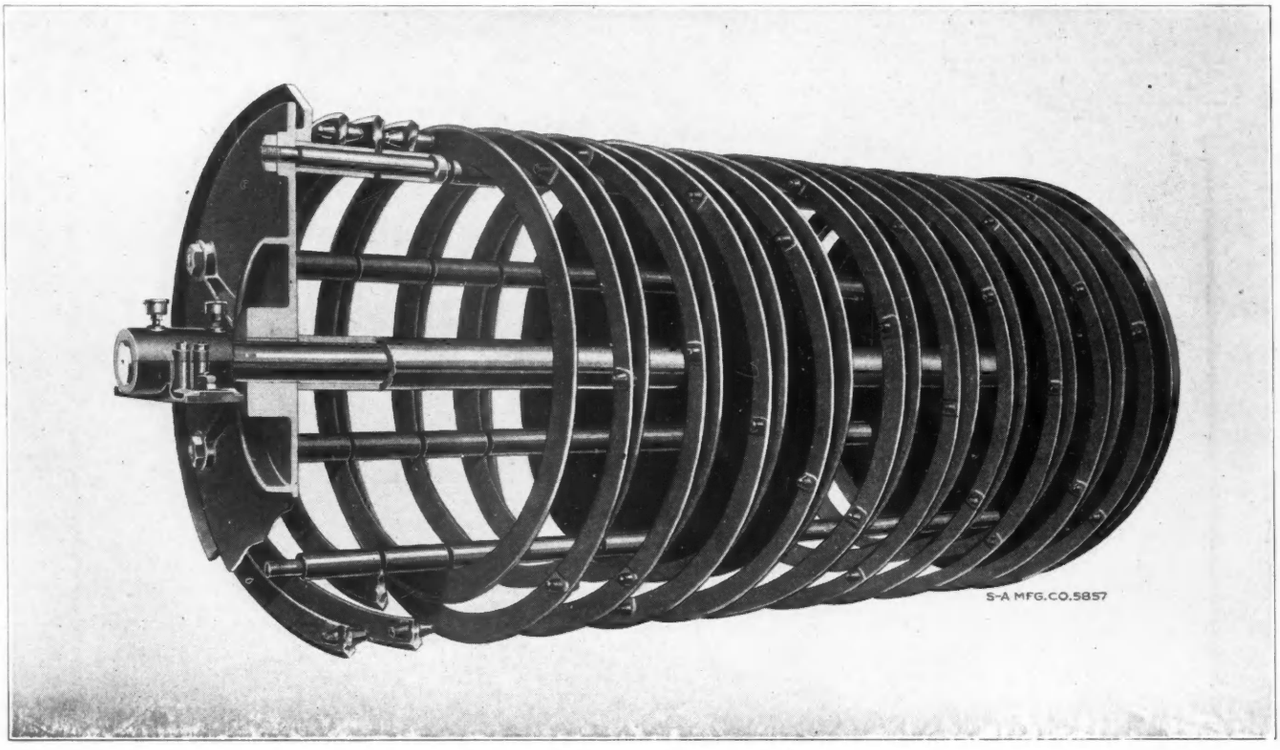

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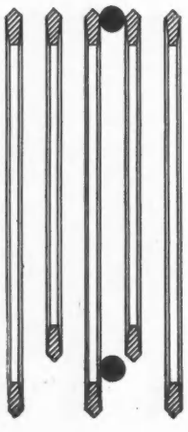

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ENGINEERING & MINING
JOURNAL-PRESS
JOSIAH EDWARD SPURR, Editor

Volume 116 New York, July 7, 1923 *Number* 1

Politics in the Interior Department

SECRETARY WORK of the Interior Department has done a questionable thing in ousting Director Davis of the United States Reclamation Service, an experienced engineer, and replacing him with a politician, also named Davis, formerly Governor of Idaho. The honesty of his intention is in doubt. Is he playing politics or not, and if he is, how far does he intend to pursue that meandering path? Opinion in Washington leans to the view that political use is to be made of the Reclamation Service. Besides having a net investment of $132,000,000 in various reclamation projects, the Government is investing $8,000,000 annually in new construction. In addition there is a revolving fund of $4,000,000 for maintenance. The service therefore offers abundant means for distributing plums and patronage. May not the Bureau of Mines and the Survey be treated in similar fashion?

The effect upon all engineers in the Government employ will be depressing. Many of the most able and efficient have left the Bureau of Mines and Geological Survey in the last few years for more lucrative positions in private employ, and this drain is still going on. Mr. Davis' discharge after many years of service with the Government will be a further incentive to others to get out and will also hinder recruiting.

Mr. Work is keeping his reasons for his act to himself. By a technical subterfuge to get around the Civil Service laws, he abolished the position of Director and styled the incoming head "Commissioner of Reclamation," thus making it unnecessary to give the discharged Mr. Davis a written statement as to why he was removed —rather a reprehensible procedure. Thus also he avoids telling wherein engineering control of the Service has failed. He simply has stated that he wished a business man in charge. But the Secretary, who only recently was Postmaster General and, before that, a physician, has been too short a time in office to know what is best for the Reclamation Service. It is quite evident that he acted upon advice, and it does not strain one's faculties to guess who his advisers were. Private power companies in the West had long been seeking Director Davis' scalp. Now it looks as if they had succeeded—a pleasing revenge to some of them, no doubt, whose plans he had not approved.

The discharged director is credited with the successful construction of all the big power dams built by the Service and in general with the success of reclamation. No small amount of business ability was here displayed. Why therefore the need for a business man? To the Secretary, a "business man" in this case is apparently one who thoroughly understands the business of practical politics and who is of the type that believes that no one can be expected to work for a party unless there is something in it for him. It is certain that the construction and administration of public works under such "business" control will cost citizens far more than they have under the supervision of engineers.

The "Leviathan"

BY THE NATURE of his work the mining engineer is a traveler and often spends considerable time at sea. To him, therefore, the ship that carries him and the flag it flies are matters of importance. Under his own flag he is at home, whatever be the skies. A short while since, the Stars and Stripes were scarcely seen afloat, save on warships, but the World War altered this. Today they are a more familiar sight and are carried by a merchant marine of which the country can be proud and which, given fair conditions, will never disappear again.

Queen of this fleet is the "Leviathan," built for the Hamburg American line, later a war prize, then a transport, and now so altered and improved that Herr Ballin himself would not know her. Re-equipped, redesigned and with different driving power, she is the fastest as well as the biggest ship in the world, as she proved on her recent trial run, when in twenty-five hours she ran 687 nautical miles and broke all records—a triumph for American naval engineers.

Liquid-Oxygen Explosives

SEVERAL TIMES during 1922 reports were heard of the wonderful success that was being obtained with liquid-oxygen explosives at Pachuca, and it was intimated by lovers of the sensational, as most of us are more or less, that dynamite would soon be out of date. The Germans had used the new type of explosives during the World War, but had not given away any of their secrets, and as nothing had been published about the work at Pachuca, the whole thing was very mysterious. Latterly, however, there has been more publicity. The *Journal-Press*, on Dec. 2, 1922, published an article describing what had been done at Pachuca in general terms; Alfred James and others, in the February and March *Bulletins* of the Institution of Mining and Metallurgy, disclosed what information could be collected about European practice; Kuryla and Clevenger prepared an excellent article, largely devoted to Pachuca practice, for the February meeting of the A.I.M.E.; and the U. S. Bureau of Mines has, in the last month or so, issued a bulletin on the progress of investigations made by that organization. So the present status of the use of liquid-oxygen explosives in mining is now pretty well understood by those who have been sufficiently interested to read what has been published.

For the benefit of those who have not followed the subject at all, it may be said that no new principle of creating an explosive force has been devised: both L.O.X. (as liquid-oxygen explosives have come to be known) and explosives of the ordinary type are essentially mixtures of a combustible substance and an oxidizing agent, with or without an absorbent, which is detonated usually by a highly explosive cap. Dynamite differs essentially from L.O.X. in that it is a permanent

product, made at a distant factory, and, generally speaking, good until exploded. L.O.X. is a home-made product, the liquid oxygen being made in a machine at or near the mine, mixed with the desired carbonaceous material, and exploded within an hour or so. If more than a half hour passes after the L.O.X. is put in the drill hole, it will not explode, owing to evaporation.

The chief advantages of L.O.X. over the ordinary type of explosive, as indicated by the work so far done, are (1) that it is cheaper. At Pachuca 0.87 lb. of L.O.X. does the same work as 1 lb. of 40 per cent gelatin dynamite. With the experimental plant employed, it costs 9.35c. per lb. to produce L.O.X.; with a larger plant, it is estimated that it would cost 3c. less. This does not include amortization or interest on the capital invested in the necessary plant, which seems to be an exceedingly variable figure. To equal the work of 1 lb. of dynamite it is necessary to produce, at Pachuca, 2.1 lb. of liquid oxygen. The liquid oxygen plant there used, whose capacity is 25 liters per hour, will produce enough liquid oxygen to make L.O.X. to take the place of about 650 lb. of 40-per cent gelatin dynamite per 24 hours. This will give an idea of the size of liquid-oxygen plant required. (2) L.O.X. is safer: there is little or no danger from preliminary explosion or from missed holes. (3) There is much less danger from noxious gases; good ventilation is promoted; men can return sooner to the working face; and their comfort and morale is increased. (4) No thawing of powder is necessary. (5) Theft of explosives does not occur. (6) A cheap supply of liquid oxygen is available for other purposes.

The chief disadvantages of L.O.X. are (1) that it is still in the experimental stage and equipment bought now may soon become obsolete. (2) A capital investment for a manufacturing plant is necessary. (3) The time for loading and firing is limited so that not more than twenty-eight holes have been fired in one round at Pachuca. (4) It is not so convenient as a permanent explosive. (5) It is particularly troublesome in wet holes. (6) Owing to its large flame, it is not adapted to dusty or gassy coal mines.

The use of liquid oxygen explosives promises to become wide and the development of proper and efficient equipment and material seems likely to be rapid. Much more efficient machines are being devised, so it is said; containers are being improved; and more effective combustibles and absorbents are being developed. At Pachuca, carbon black is placed in Kraft paper wrappers, and the cartridge soaked in liquid oxygen. The Bureau of Mines, in its investigations, has largely used diatomaceous earth as the absorbent, together with paraffin, wood pulp, starch, coal dust, vaseline, residuum oil, and naphthalene as the combustible, and paper toweling as the cover for the cartridge. The best combination for a given job is yet a long way from being found.

Even at the present stage of development, it would seem that experimentation by the larger mining companies is well worth while, and that the cost could be offset by the saving. For companies and individuals with smaller resources it would perhaps be just as well to sit in the grandstand for awhile and absorb the reports of what others are doing. They would do well to read at least two of the pamphlets already mentioned: "Liquid-oxygen Explosives at Pachuca," obtainable for 50c. from the A.I.M.E., 29 West 39 St., New York, and "Progress of Investigations on Liquid-oxygen Explosives," price 15c. from the Superintendent of Documents, Washington, D. C.

Oil and Economy

PETROLEUM PRODUCERS are not as happy as formerly. Oil prices have fallen. Overproduction, rather than a falling off in consumption, undoubtedly is the cause. For the first time since 1920 it has become necessary to cut down the pipe-line runs in the Mid-Continent field. The Prairie Oil & Gas Co. took the initiative on June 25 when it announced that it had pro-rated its run from field to refinery. The Sinclair and the Cosden companies took similar action on the following day. The cut, it is surmised will amount to 30 per cent. This is a wise step: production of more than can be currently sold means only a steadily weakening market.

The great productiveness of the new California fields, the output of the Tonkawa field in Oklahoma and the Smackover field in Arkansas, together with that of Wyoming and Montana wells, are largely responsible for this condition. The country's production of crude for the week ended June 23, according to the estimate of the American Petroleum Institute, was 2,135,450 bbl. as compared with 1,441,350 bbl. for the corresponding week a year ago. Of this California's contribution was 785,000 bbl. compared with 355,000 bbl. a year ago; Oklahoma, 513,250 bbl. as against 391,750 bbl.; Arkansas, 130,550 bbl. compared with 33,400 bbl.; and Wyoming and Montana 129,200 bbl., against 83,600 bbl. in the corresponding week last year. North and Central Texas fields produced 33,000 bbl. more in the same week than for the week ended June 24, 1922. Gulf Coast and North Louisiana fields alone showed a slight falling off. Stocks of crude in pipe lines and tank farms east of the Rocky Mountains increased 7,375,000 bbl. in May. In these figures all grades of crude are lumped together but they effectively tell the story.

Now is the time for economy on the part of producers. The oil business is notoriously wasteful in boom times when new production is being obtained in bonanza volume. Then the race is to get the oil before one's neighbors get it. The flow of money into the ground rivals that of the petroleum coming out. Supplies and labor are thrown away in ghastly fashion. It is only when the yield per acre has dropped to less proportions that the business becomes at all efficient. Let efficiency be introduced now. A dollar saved is a dollar earned and a dollar earned is approximately equivalent to one to two barrels of some of the lower grades of oil. Dollars earned and dollars saved all look alike when it comes to declaring dividends.

On Buying Mining Stocks

WE RECENTLY RECEIVED a letter from someone in a little town of New York state who wanted to know our opinion of an investment in the stock of a mine whose prospectus he enclosed. Naturally, having other work to do, we do not pose as consulting engineers and we are not prepared to go out in the field and inspect a property for the purpose of finding out whether shares of its stock are a good investment. Nevertheless, a very definite and in the majority of cases a not entirely erroneous idea of a mining company can be obtained by a study of its prospectus or report. It has always seemed to us that a company would be justified in paying well for technically sound descriptive literature, though probably the flamboyant appeal will attract more money.

When we receive an inquiry such as this one, we instinctively look to see who is behind the company and who the operating officials are, for possibly nothing is more important in young mines than good management. For the company in question, the president was the postmaster in this small town in the dairying district of New York State. The vice-president was a local dentist, and the secretary was connected with the local bank. Two of the directors were merchants, and the business of three could not be identified, though they lived in the vicinity. The mine was in Ontario in a district where there are known to be several prospects but where producing mines are not yet established. The name of the manager at the mine was given, but he was unknown to us and he was not a member of the A.I.M.E. nor of the Canadian Institute. Neither was he a subscriber to the *Journal-Press*. Doubtless he is an honest prospector without sufficient funds for what he no doubt considers the frills of technical achievement.

Our only answer to the inquiry was of course that without a personal knowledge of the property and management we could only advise against the buying of the stock despite the fact that the prospectus was apparently an honest statement of conditions and that the mine might be the one of a hundred such that would succeed. We wonder why it is that otherwise intelligent business and professional men think that the success of a mine depends entirely on whether or not ore is in the ground. Further, we are led to contemplate on the attraction of mining for the average citizen; why he so often thinks of putting his money in a mining prospect about which he knows nothing. Doubtless it appeals to an almost universal gambling instinct: the rewards to the winners are sometimes high, but with an unknown prospect the odds are very, very long.

Grinding Versus Calcining

AGRICULTURISTS are finding out that unburned limestone, if ground sufficiently fine, can be used effectively as a soil corrective in place of commercial lime. In other words, the effectiveness of the raw material is increased proportionately by grinding. Metallurgists have discovered in some instances that the isolation and roasting of refractory material may be avoided by the adoption of fine grinding. Construction engineers were reminded recently that the time-honored method of insuring plasticity of lime mortar by the preliminary calcination of the limestone may be superseded to advantage, if the researches of Mr. C. F. Willard, of San Diego, Calif., find practical application on a convincing scale.

It has long been known that some fine powders have the power of adhering tenaciously to the surface of other solids, a phenomenon known as adsorption. A familiar example of this is seen in the preparation of what is known as "shaker" salt, manufactured for table purposes. Salt is hygroscopic; if exposed to an atmosphere of average humidity, the particles will absorb water, cohere, and fail to "run" when required. To prevent this, a small amount of finely powdered chloride of magnesium, which is non-hygroscopic, is added; this coats the salt particles and prevents the absorption of water.

Mr. Willard has utilized the same fundamental principle in the preparation of the basic constituent of lime plaster. The unburned calcium carbonate, or marble, is ground exceedingly fine, mixed with a small amount of an inexpensive adsorptive, whereupon the product is said to equal, in adhesive and cementing qualities, the best grades of burned limestone.

The cost of burning in the preparation of commercial lime is considerable; the commercial developments of Mr. Willard's plan to utilize a well-known but little understood physical action, to avoid this, will be awaited with interest.

Spotting the Specimen

IN RESPONSE to an innocent question put by Martin Chuzzlewit to Mr. Pecksniff on the subject of the widower's daughters, the gentleman in question replied: "In the nose of my eldest and the chin of my youngest, Mr. Chuzzlewit, their sainted parent—not myself, their mother—lives again." Inherited traits and similarities in physiognomy, facial architecture as the facetious would term it, do enable the closely observant to sometimes detect a family connection between two persons.

Mineral specimens are not without their "family traits." The ores of a given district, or of a single mine, may present an approach to a uniform appearance such that either they may be recognized as coming from the district or the mine in question. Pyrite presents differences in crystalline structure, in color and size of crystals, and in luster. It is thus easy to recognize pyrite as such, and, where one has had the necessary experience, to recognize the district and sometimes the vein from which the specimen was derived. Just as facility in remembering names gives a person distinction of a certain order, so this ability to recognize mineral specimens at sight gives the person a reputation for mining knowledge that on final analysis may be found to be limited to a rather narrow horizon.

Almost every mining man has experienced the prospector who suddenly produces an ore or mineral specimen and asks him what it is. Much depends frequently upon the answer. Knowledge of all mining subjects is ascribed to him who nonchalantly gives the correct answer. To him who is so unfortunate as to hesitate, or to examine minutely the specimen, and who either confesses ignorance or gives the wrong answer, let him depart as quietly as possible, for he has become as the tarnish upon the metal and he has butchered his mining reputation past all redemption. Of course, the prospector who presents the specimen was once without knowledge of what the mineral was and had quite likely been told by some one. He thus has the advantage of his audience and of his victim. The victim might know that the prominent black mineral in the specimen could be one of a number of similar black minerals and hesitate to guess its name out of a desire not to mislead, but his inquisitor is like Shylock and the pound of human flesh. He gives no quarter and he is ready with his ax.

We are, however, glad to say that some prospectors and mining camp followers are more humane and willingly contribute their knowledge, small as it may be, to anyone who may appear to be a stranger to the camp. They judge the stranger's merits by something more substantial than spotting the specimen and are genial enough to prolong the contact in the hope that the stranger might contribute something toward solving their problems. This he frequently does, and thus the knowledge of both is enhanced, but, better than this, mutual respect is stimulated.

DISCUSSION

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

Canada's Regulations for Quartz Mining Claims

THE EDITOR:

Sir—The ill-functioning, in one respect, of Canada's Dominion Regulations for quartz mining claims deserves publicity. These regulations apply to mineral lands in parts of Canada not yet controlling their own natural resources, such as Manitoba, Saskatchewan, Alberta, the North-West Territories, and Yukon Territory. The point in question is the absence of requirement for location work, as distinguished from assessment work, and the effect thereof.

We are familiar with the discovery shaft of the United States, which has incited so many otherwise honorable locators to perjury. Ontario, having title to its own natural resources, has presumably improved upon us in this respect by Provincial Laws calling for thirty shifts of work per claim within ninety days of location, without reference to discovery. The Regulations on Dominion Lands, however, prescribe a claim normally 1,500 ft. square, and a $10 recording fee, without other required expenditure prior to annual assessment work. If a claim be located, therefore, and duly recorded, it may be held without further effort or outlay for one year and two weeks, by which time the locator must "satisfy the Mining Recorder" that work "to the value of $100" has been done. If desired, powers-of-attorney and relocation ordinarily make it possible to extend this period of control without ground-breaking.

Under this law a group of claim-stakers, calling themselves prospectors, has sprung up. To a large extent they live by their wits—by the selling of half interests to impecunious individuals, etc. In excitements or off-season most of the fur-trappers apparently become "prospectors."

The condition has been particularly noted by the writer in the mineral district north of The Pas, Manitoba, in which region it is to be assumed that you maintain an interest because of past successful experiences. For instance, during the recent gold excitement at Elbow Lake one "prospector" advised that he had staked thirty claims, about 2½ square miles, on which he had done no work. Having staked on snow in the mid-winter stampede, in all probability he had not since then gone over them carefully. A woman, living in The Pas, held two claims, each of which cost her $20. She had paid the recording fees; had paid the locator $10 for his two or three hours' work on each claim, and had never seen them. These individuals are but two of many; only those who were in the district last summer are likely to appreciate the extent to which the vicinity was blanketed, and the degree to which the holder's interest in his holdings was speculative.

From 1919 to 1922, little change was noted in the group of "prospectors," and still less in the rock exposures effected by them. It was possible, in places, to walk for hours linearly over staked ground, without seeing an exposure except as made at the moment by the hand-stripping of moss. Small salaried individuals in near-by towns must have contributed considerably to the maintenance of these "prospectors." There is no parallel to the condition in this country, and I have not noted it in Ontario.

Revision of Dominion Regulations to require actual and specified ground-breaking by the prospector shortly after location, thus giving him incentive to stake discriminately and to inspect his ground sufficiently to permit advantageous placing of such work is recommended. Because they encourage the tying up of large and critical areas, and discourage true prospecting thereon, the present regulations are, in my opinion, seriously retarding development of certain parts of the great Canadian frontier.

Due recognition is here given to the occasional sincere prospector operating under the conditions. Tom Creighton, "uncoverer" of Flin Flon, is one of these.

San Francisco, Calif. WILLIAM BURNS.

Bacteria, Ores, and Oil Deposits

THE EDITOR:

Sir—Your very interesting story in the June 9 issue on "Minerals Deposited by Bacteria in Mine Waters," by chief chemist John Parry, of De Beers Consolidated, revives an important subject—the influence of micro-organisms on ore deposits. Mr. Parry is to be congratulated on his painstaking labor in determining the bacteria origin of the specimens of lime carbonate which he examined.

I investigated the origin of many ore deposits and minerals through bacteria twelve years ago. Three articles on the subject appeared in 1911 in the old Chicago *Mining World*, since discontinued.

The "iron bacteria" were briefly discussed editorially (June 17, p. 1221). To aquatic bacteria of this type were ascribed certain bedded, oölitic iron ore deposits such as the great Clinton-formation iron ore of Alabama, New York, Nova Scotia and Appalachian America, and similar deposits worked in France and Scandinavia.

The well-known nitrate bacteria and the lesser-known sulphur bacteria were discussed in a second article, "Origin of Some Mineral Deposits by Bacteria," Aug. 12, pp. 289-291. Nitre deposits like those of Chile, India, and our West, and commercial stratified sulphur marls like those of Louisiana and Sicily, owe to bacteria, it is believed, the origin of their respective nitrate and sulphur minerals in former geologic times.

The immense, commercial, phosphate-bitumen formation of our West, covering near a million square miles from Alberta to Mexico, and Wyoming to California,

and from which was distilled the petroleum of some of Wyoming's oil fields (Lander), was discussed in a third article, with regard to bacteric origin: "Origin of Lander Oil and Western Phosphate," Sept. 30, pp. 631-633.

In the issue of the *Journal-Press* of June 16 (p. 1031) Professor Kirkman estimated 5,500,000,000 tons of $12 phosphate rock in Idaho, alone—and I take it he refers only to one single, worked, rich, oölitic stratum, not the whole phosphatic black shale formation. Alongside those figures, the bacteria that produced the Fleischman millions pale into insignificance.

Vast aggregations of bacteria in submarine slimes or oozes in Upper Carboniferous time secreted the phosphate. The bitumen with which the black phosphate formation reeks appears to be the underground distillation of the gelatinous bodies of the bacteria or slimes, buried undersea, immersed in sediment, and thus sealed away from the air and oxidation. Where sealed anticlines, suitable pressure and drainage and other favoring geologic factors helped squeeze or draw the bitumen out of a wide area, and concentrate it under pressure in anticlinal pools, oil pools like those near Lander are developed.

Mr. Parry's reference to Drew's work in 1920 on the lime-bacteria marine oozes between Florida and Bahama is especially apropos.

There is a surprisingly profuse literature on the subject of bacteria and their mineral deposition, but unfortunately it is locked up, as I found to be the case, in extremely out-of-the-way botanical, agricultural, physiological and biochemical learned tomes far off the beaten tracks which mining men and students of ore deposition travel in their accustomed avenues of research and "sources." May I suggest that this subject of mineral-active bacteria, and pelagic or other aquatic slimes and oozes, is one of much practical value in the origin of many commercial ores and oil pools, and is well worth following up? C. L. BREGER.

New York, N. Y.

The Prospector at the Pearly Gates

THE EDITOR:

Sir—I once had a partner, "Whistling Joe" was his name. He has left. We worked for grub stakes in hard and wet shafts, and when our pack boxes were full and the burros were fat, we trapped over the hill in search of the golden jack. Old Joe had a great ambition. He longed for a mansion in some valley all green, for his girl. We prospected down the Yukon River, and the rapids, whirlpools, and danger would make you shiver. We climbed the mountain tops searching for the golden stuff, and the dangers flirting with death we put up with would make any man with a yellow streak say "enough." They tell me Old Joe sits at the pearly gates and waits and hopes for his pardner to escape, for this old world is pretty well located and he thinks we are more or less not wanted.

Now, Old-Timer, if after reading these rough and coarse words on this paper, you want to have some fun seeing Heaven and Hell deserted, just send a message to my old pal by some honest Sky Pilot, and say the old original high river channel has been spotted, and that all the old prospectors of the West have gone loco and are stampeding to the great pay streak in Arizona. E. B. FOSTER.

Goldroad, Ariz.

Use of Magnetite in Iron Blast Furnaces

THE EDITOR:

Sir—In the June 16 issue of the *Journal-Press*, in re inquiry on the above subject, you make the following statement, which I think you will find to be incorrect: "Less than 5 per cent of the country's iron ore production is magnetite and nearly all of this is mined in eastern Pennsylvania and western New Jersey."

Leaving out my personal knowledge of the subject, I quote from *Mineral Industry* for 1919. According to the above publication, in 1916 Pennsylvania mined 493,004 tons of magnetite; New Jersey, 363,000 tons; and New York, 1,342,518 tons; total, 2,198,522 tons. New York State thus mined 61 per cent of the total of the three states.

In 1919 the following amount of magnetite was mined: Pennsylvania, 547,000 tons; New Jersey, 409,000; and New York, 858,000; total, 1,814,000 tons. In 1919, therefore, New York State mined 47 per cent of the total magnetite of the three states.

West Haven, Conn. FRANK L. NASON.

Surface Tension and Flotation Phenomena

THE EDITOR:

Sir—In reply to A. H. Fahrenwald's criticism in the *Journal-Press* of Dec. 9, 1922, of the article entitled "Surface Tension and Flotation Phenomena," by Leeke and Jarvis: There should at no time be any doubt as to the surface tension phenomena involved. Mr. Fahrenwald seems to have avoided the issue, inasmuch as he offered no explanation that would demonstrate how that force which is manifested at the air-water interface only is either balanced by an opposite and equal force, or entirely eliminated, due to some physical condition. The way in which this surface tension phenomenon which functions at the air-water interface only is eliminated, is described as follows. Quoting from "The Principles of Flotation," by T. A. Rickard, p. 72:

> "A particle of mineral and a bubble show mutual attraction and if the mineral particle is minute it becomes drawn into the interface of the bubble film. That may be why larger particles are not floated easily; they are too big to be enveloped in this way. The mineral particles are carried within the bubble film; they are not attached to it outside. That may explain why fine pulverization is essential to the success of flotation."

When a slight amount of oil is added to a flotation cell in actual plant operation, the sulphide particles refuse to adhere to the few bubbles which are produced. The cell is said to be underoiled. Upon the addition of more oil, large bubbles which are armored with sulphide particles are the result. Repeating what Mr. Rickard says: "The mineral particles are carried within the bubble film; they are not attached to it outside." At the surface of an underoiled flotation cell the films of the few bubbles which are formed are not of such magnitude that a sulphidic particle could be carried within the bubble film; consequently the sulphidic particles will not adhere to the bubbles. The magnitude of a bubble film must be such that the mineral particles are carried within it. The surface tension phenomenon under discussion is an air-water interface phenomenon, and since a sulphidic particle must lie within the bubble film, and not at the air-water interface. this phenomenon is eliminated in actual flotation practice. R. H. JARVIS.

San Francisco, Calif.

The Retirement of Mr. Yale

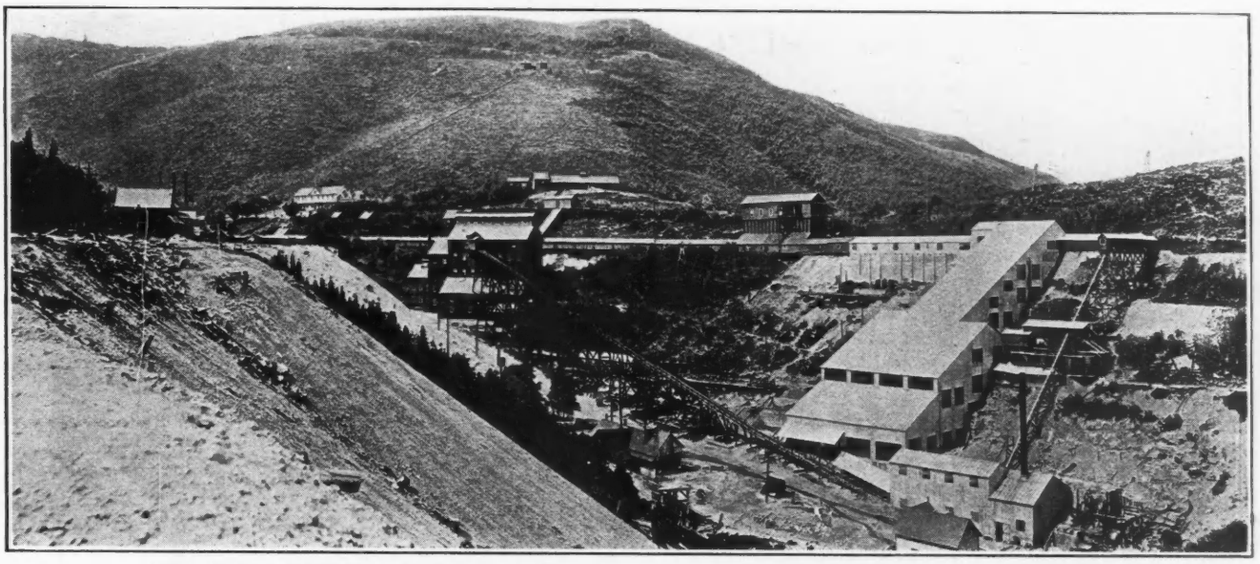
BY T. A. RICKARD

THE complimentary dinner given to Mr. Yale on May 23 by the San Francisco section of the American Institute of Mining and Metallurgical Engineers made public the fact that he has retired from active service, and gave his many personal friends an opportunity to record their respect for the work that he has done during a long and useful career all of which has been spent in California. The dinner took place in the red room of the Bohemian Club, and was attended by a number of Mr. Yale's fellow Bohemians, who, by speech and song, contributed greatly to the charm of the affair. Mr. Edward H. Benjamin presided, felicitously. Many telegrams, notably from officers of the U. S. Geological Survey, were read by the chairman, as well as several letters, the most interesting of which was from that veteran mining engineer, Mr. Ross E. Browne. Testimony was given to Mr. Yale's many endearing qualities, to his high character when editor of the *Mining and Scientific Press*, to his courtesy as representative of the Geological Survey in San Francisco, and to his never-failing willingness to help others.

Charles Gregory Yale was born at Jacksonville, Fla., in 1847, and came to San Francisco in 1851, so that his career runs with the development of mining on the Pacific Coast. Throughout his long life he has taken an active part in all that concerns the best interests of the mining industry. He was educated at the City College of San Francisco. He started as an assayer and a prospector, but early showed a bent for the literary and statistical work by which he won a national reputation. In 1871, when twenty-four years old, he started his official career by contributing to the reports of Dr. R. W. Raymond, the U. S. Commissioner of Mines. In 1880 he began to contribute to the Mint reports, and in 1893 he was appointed statistical clerk at the San Francisco Mint, his particular duty being to prepare the chapters on Alaska, California, Oregon, and Washington. This connection with the Mint lasted until 1921. But he had time for many other activities, not all of them technical; he has been ever a helpful and co-operative type of man, willing to aid in any good work. From 1893 to 1907 he was statistician to the California Mining Bureau. For twenty-three years, from 1871 to 1894, he was editor of the *Mining and Scientific Press;* concurrently for sixteen years he was secretary of the San Francisco Yacht Club and for two years he was president of the Pacific Coast Amateur Rowing Association. This suggests both his virility and his sociability. For five years he was secretary of the Technical Society of the Pacific Coast. He and Mr. Benjamin induced the California Miners' Association to take up the matter of conservation and control of flood waters in California; and this led to the organization of the California Water and Forest Society, which took a prominent part in the establishment of the irrigation bureau of the Department of the Interior.

His part in journalism was multifarious, although he takes most pride in his long editorship of the *M. & S. P.* From 1895 to 1898 he was mining editor of the San Francisco *Examiner* and in 1897 he was sent by that paper to the Klondike to describe the great gold rush. For ten years, 1901-1911, he was Pacific Coast correspondent for the *Engineering and Mining Journal.* He was head of the Pacific division of the Mining Census of 1890, in which connection Dr. David T. Day, his chief in this work, said: "Mr. Yale's results, in point of time, accuracy, and phenomenally low cost, can only be accounted for by his utter disregard of stenographic and other assistance." He writes rapidly in a small neat hand, and has the journalist's knack of being able to apply his mind to any given subject at a moment's notice. He would pull the stub of a pencil out of his pocket and start to write forthwith. However, his most important work was done as an officer of the U. S. Geological Survey. He began this connection in 1882 by contributing to the "Mineral Resources," and in 1904 he was placed in charge of the San Francisco office of the Survey as Mining Statistician. This appointment he resigned at the end of 1922, at which time the Director of the Mint wrote to thank him for "a service of loyalty, good fellowship, and mutual esteem." Indeed, Mr. Yale's office in the Custom House building was an institution; if anybody needed information on mining in the West, he went thither, being sure of a courteous reception and an effective interview. His individual service added to the prestige of the Survey and made the public appreciate the many useful functions that it so ably performs in behalf of the mining industry.

The record of his activities, incompletely as I have given it, indicates his versatility with the pen, but it suggests something even more attractive, and that is the eminently social quality of taking part in human affairs, of joining with others in anything that makes for progress or enlightenment, of putting a shoulder to the wheel when the grade is heavy and the team needs a boost. When the debris legislation menaced hydraulic mining in California, he took an active part in organizing a dignified protest. He prepared the appeal to the public that was sent from Auburn in 1891 in behalf of the hydraulic miners, and presided at the first meeting in San Francisco of the California Miners' Association in 1892. In that year he was appointed to represent the miners in the controversy with the farmers over the debris question and wrote a memorial to Congress, which resulted in the Caminetti Act, of 1893, whereby the miners were enabled to resume their hydraulic operations under specific restrictions and under the supervision of a commission of Federal engineers. His friends tell how he fought for a whole night to have the word "material" inserted before "injury" in the phrase: "Whenever the same [hydraulicking] can be carried on without injury to the navigable streams, or the lands adjacent thereto." His persistence prevailed, and for that the miners of California owe him thanks. He was the brains of the California Miners' Association and the perpetual chairman of the committee on resolutions; indeed, if any resolution on any subject had to be phrased carefully his friends would go to him, and he never failed them, although always averse from having his name appear in print. Many are the kind things he has done without recognition. Many were the reports that he wrote for which others have received credit. He has lived a life rich in useful activity and generous helpfulness. May the evening of his day be serene and happy.



New Silver King Coalition mill, built in 1921 to replace the old plant destroyed by fire

Mining Camps of North America

Park City: a Lead-Silver District, in Utah

Has Produced $200,000,000 Without Making Much Noise—First Discovery in June, 1872—Interesting Geological Study—Ore in Beds and Lodes—Recent Development of Large Rich Orebodies in Eastern Section

By Guy R. McKay
Geologist and Mining Engineer, Park City, Utah

IN MANY RESPECTS Park City is unique among western mining camps. It is more than fifty years old, yet none of the important mines of the district have been worked out. It has a production record of $200,000,000, from an area about two miles square, and has paid dividends of approximately $50,000,000; yet it has never had a boom. It has never been a high-wage camp, and it has never had any serious labor troubles.

There are also a number of geological anomalies: A high water table, with oxidation proceeding to great depths; lode deposits which favor profound faults; bedded deposits which almost invariably occur immediately above or in beds of quartzite or sandstone.

The affairs of the camp have always been conservatively managed, and because of this, and because much of the money made in Park City has stayed in Utah, or has gone west instead of east, the district has had little publicity, and is not well known outside of Utah.

Prospecting started in this district about the time that the Union Pacific Ry. connected Utah with the manufacturing centers of the East, in 1869. The early records of the camp are meager and unreliable, and the discoveries of the first three years were of importance only as they attracted attention to the presence of mineralization and led to the finding of the big mines.

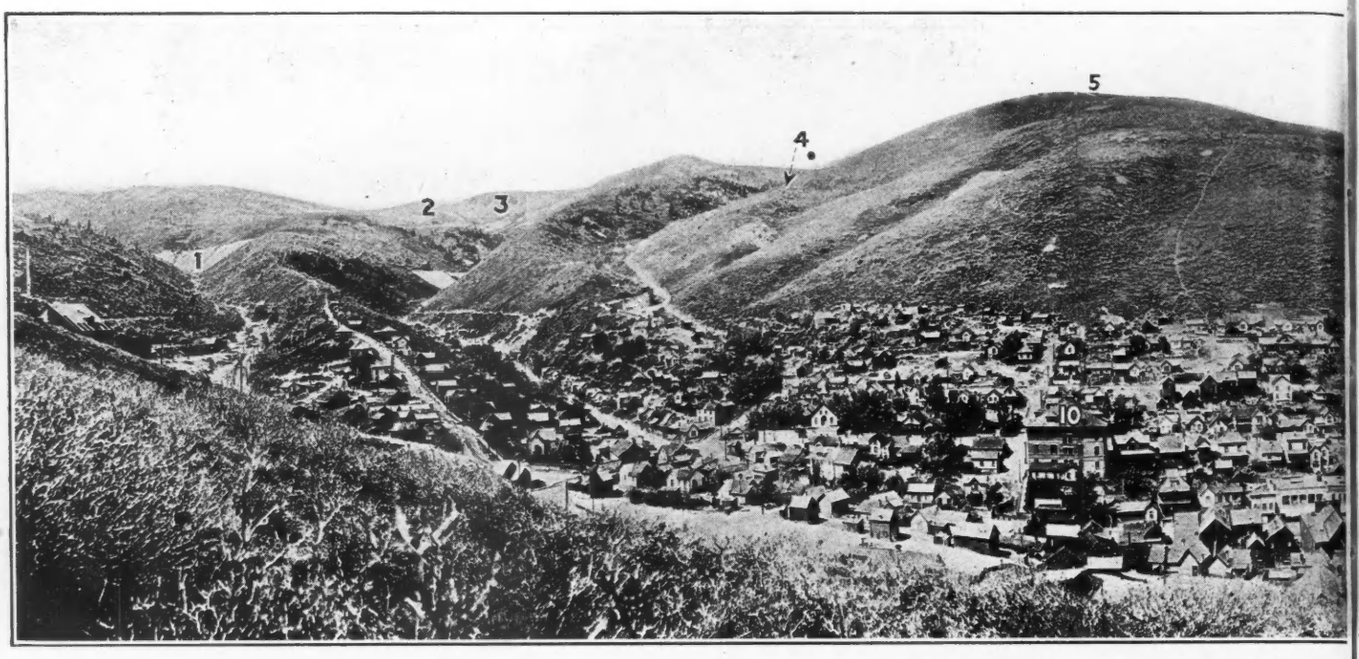
The history of the district really starts with the discovery of the Ontario mine, in June, 1872. The original locators sold the property in August of that year to George Hearst for $27,000, and in the succeeding five years $1,000,000 worth of ore was sold. The production to date approximates $50,000,000, out of which about $15,000,000 has been returned in dividends. The mine is still producing, and the company owns valuable territory which is yet unprospected.

The discovery of the Ontario greatly stimulated prospecting. John J. Daly took up twenty-four claims on the western extension of the Ontario lode, and in 1885 organized the Daly Mining Co. He spent $200,000 in prospecting before there were any earnings, but the mine became a regular shipper in January, 1886, and now has a production record of $10,000,000 with dividends of $3,000,000.

Later, the Daly West and Judge properties were incorporated still farther west on the Ontario lode. These companies were recently consolidated, and are now known as the Park City Mining & Smelting Co. Their combined dividends exceed $10,000,000.

North of these properties, on a parallel system of veins, lies the property of the Silver King Coalition Mines Co., a consolidation of numerous small warring properties whose history extends back to the earliest days of the camp. It is a history largely concerned with litigation covering disputes over apex, titles, trespass, water rights, and almost every other mining question about which there can be a difference of opinion. The present management has lately cleaned up the last of these troubles, and, I think for the first time in its turbulent history the Silver King finds itself at peace with its neighbors. It has a magnificent production record, and has paid dividends in excess of $16,000,000.

To the north and west of the Silver King Coalition lie the holdings of the Silver King Consolidated Mining Co. This company has produced a little from ground



Panoramic view showing the western portion of the mi

1. *Ontario shaft.*
2. *Daly shaft.*
3. *Daly West shaft.*
4. *Silver King Coalition shaft (concealed by hill.)*
5. *Treasure hill.*

surrounded by the property of the Silver King Coalition, and is now engaged in developing at depth holdings in Thaynes Canyon, where good orebodies were mined near the surface in the 90's.

These are the important properties in the older part of the camp. They are surrounded by numerous small groups, many of which have produced ore in a modest way. Most of them are idle for various reasons, the chief of which is no doubt loss of faith by those who were putting up the development money. Some of them merited but little faith.

The later history of the camp has been one of great consolidations. Now three groups control all of the producing mines. The Ontario company, the stock of which is widely scattered, is controlled by the Bamberger family, of Salt Lake City, which also controls several smaller groups. The Daly and Park City properties are dominated by, and are under the personal management of G. W. Lambourne, of Salt Lake City, who is president of both companies. The Silver King Coalition is principally owned by the Keith and Kearns estates, of Salt Lake City. Recently a remarkable bonanza has been opened by the Park-Utah Mining Co. This I shall discuss in some detail later on in this article.

On account of the irregularity of the orebodies, no single method of mining is applicable to all of the various underground conditions found in the Park City district. The orebodies take two general forms: Lode deposits, having an inclination of 45 to 90 deg. from the horizontal and averaging about 65 deg., and bedded deposits with a flat dip averaging about 20 deg.

Mining in the bedded deposits is comparatively simple. Though the orebodies are often large in extent—100 ft. or more in width and thousands of feet long—the thickness seldom exceeds 10 ft., and the walls are uniformly hard and massive. Timbering is generally confined to round stulls of the soft native timber locally called "polygamy pine," to distinguish it from the denser Oregon fir. Infrequently it is necessary to support unusually broad expanses with cribbed bulkheads of framed timber. Pillars of ore are very uncommon.

Drifts are run under the bedded deposits, and connected with them by numerous raises, through which the ore is drawn to the haulage levels. In the stopes the ore is handled either in wheelbarrows, small stope cars, or with "slips," or scrapers, attached to small timber hoists, depending upon the local conditions. Unmounted jackhammers and stopers are used for drilling the ore, and 35 per cent low-freezing gelatine for blasting. All mucking is hand work, except in the rare cases when scrapers can be used for collecting the ore.

The lode deposits present an entirely different set of conditions. Mining operations are frequently hampered by troublesome flows of water, and often the vein matter tends to swell when exposed to the air. In extreme cases the heaviest timbers are crushed and broken within forty-eight hours after they are placed. In wide stopes, sometimes 50 ft. or more between walls, there has been considerable difficulty and danger in holding this wet, swelling ground long enough to get out the ore.

In the Judge mine a modified top-slicing system is used with satisfactory results in this kind of ground, as it combines safety with maximum extraction. This method is illustrated in the accompanying sketch.

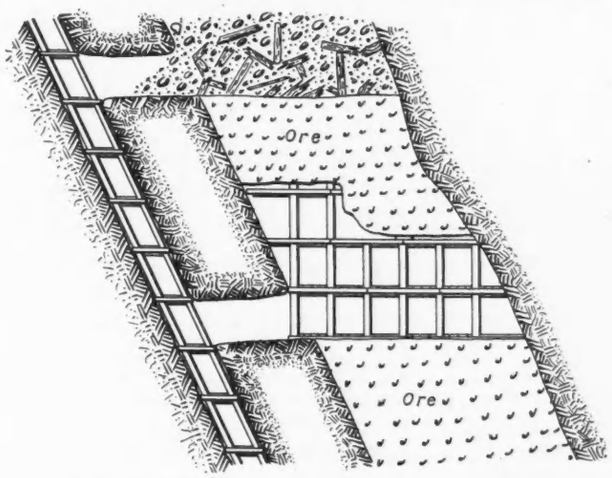
A raise is driven 15 or 20 ft. in the footwall of the vein, and crosscuts are driven into the ore every fourth, fifth, or sixth set, the interval depending upon the width and weight of the ore. Generally sections six sets (30 ft.) wide on either side of the raise are worked as units. The upper slice is worked out and allowed to cave, and then the second slice is attacked and worked up to the gob of the first slice, and so on down the raise. Filling is sometimes practiced where the ground does not cave readily, by driving waste raises into the hanging wall.

Adjoining sections along the fissure are generally

ning district and the town of Park City, Utah

6. *Spiro Tunnel portal.*
7. *Silver King Coalition tram terminal.*
8. *High school.*
9. *Grammar school.*
10. *Grammar school.*

worked from footwall drifts and raises, except where it is possible to hold drifts open in the orebody. When the pressure is mostly from the side, this can often be done for short intervals by using finger pins between the posts and lagging. These are wooden pins about 4 in. long, pointed on one end and about 1½ in. square on the other. They are set with the square end against the post and the point against the lagging. The gradual



Sketch showing method of top-slice mining in the Judge mine

pressure of the ground forces the pin through the lagging without splitting it, and thus takes the weight off the post. When the lagging advances to a point where the post is threatened, the pins are chopped out, the lagging is removed and the ground picked out sufficiently to make room for new pins and lagging.

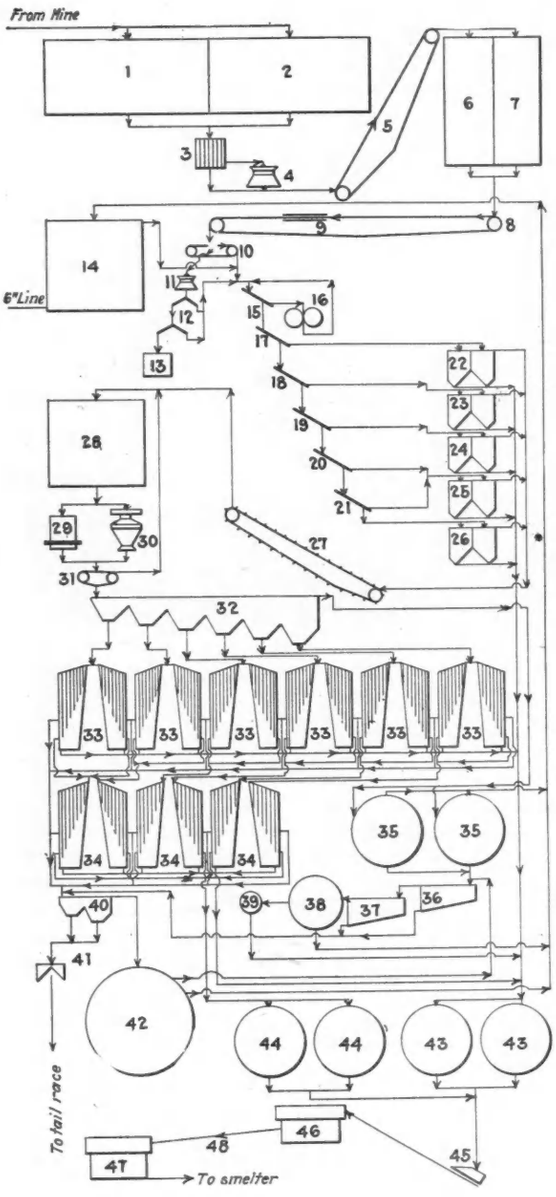
The timber used in the stopes consists of 8x8-in. caps 10 ft. long (Oregon pine) and round native posts 6 ft. long set at 5-ft. centers, unless closer spacing seems advisable. Two-inch planks are spiked to the under side of the caps as spreaders between the posts, and 6-in. round collar braces connect the sets. Floors of 3-in. plank are used when necessary. This style of timbering combines strength and economy with flexibility, as additional posts and bracing may be installed at any time. No special framing is required, as posts, caps, and collar braces are all cut square and spiked in place. No timber is salvaged except the 3-in. floor planks.

Table and Flotation Concentration Combined

After many years of experimentation on all kinds of methods, the milling practice of the camp has finally settled down to the usual wet concentration with flotation applied to lead-bearing slimes.

At the present time only two mills are in operation in the camp—the Judge mill of the Park City Mining & Smelting Co., and the Silver King Coalition mill. The former treats the ores of the Judge, Daly West, and Daly mines. This mill has grown up with the mine, and it is badly housed and cramped for room. As many as six different types of ore are treated, and on account of lack of bin room, it is frequently necessary to change from one type to another in the middle of a shift. The specific gravity of the zinc blende varies in different parts of the mines, and the tables must be reset every time the ore changes. The recoveries made are remarkable, considering these difficulties, but the flow sheet is complicated and the mill is unsatisfactory to operate.

The Silver King mill is a new fireproof structure, replacing an old mill, which burned about two years ago. The new mill has been in operation for about a year. It is well lighted, roomy, and carefully designed, and a comparison between it and the old mill which it replaced makes one wonder if a fire may not sometimes be a blessing.



Flow sheet of the new Silver King Coalition concentrator

Key to Flow Sheet

1. Carbonate ore bin; capacity 1,000 tons.
2. Sulphide ore bin; capacity 1,600 tons.
3. 2-in. grizzly
4. Blake gyratory crusher to 2 in.
5. 18-in. chain-bucket elevator.
6. Carbonate bin; 600 tons.
7. Sulphide bin; 800 tons.
8. 18-in. belt conveyor.
9. Merrill belt weigher.
10. Pan-feeder sampler; ½ sample.
11. Sample crusher to ¼ in.
12. Jones dividers, cutting ½ sample.
13. Sample bin.
14. Water tank with float valve.
15. ½-in. Hummer screen.
16. 42 by 16 Allis-Chalmers rolls to ½ in.
17. ⅛-in. Hum-mer screen.
18. ⅛-in. Hum-mer screen.
19. ⅛-in. Hum-mer screen.
20. ½-in. Hum-mer screen.
21. ⅛-in. Hum-mer screen.
22. Bull jig.
23. No. 2 jig.
24. No. 3 jig.
25. No. 4 jig.
26. Sand jig.
27. Drag-elevator and dewaterer.
28. 300-ton mill bin.
29. Marcy rod mill 4 by 8.
30. 7 ft. by 22 in. Hardinge mill to 16 mesh.
31. 16-mesh duplex callow screen.
32. 6-spigot classifier.
33. 12 Wilfley tables No. 11-D.
34. 6 Plato tables.
35. 2-30-ft. Dorr thickeners.
36. Callow rougher cell.
37. Callow cleaner cell.
38. 20-ft. Goldfield thickener.
39. 6-ft. American filter.
40. 2-spigot classifier.
41. Tailings sampler.
42. 46-ft. Goldfield thickener.
43. Lead-concentrate bins.
44. Iron-middling bins.
45. Skip to sampler.
46. Sampler.
47. Loading station at railroad.
48. 1½-mile rope tramway.

The flow sheet of the Silver King mill is shown. It is much simpler than the Judge flow sheet, because the Silver King ore contains very little zinc, and no attempt has been made to save it. Arrangements are now being made to re-treat the table tailings and save the zinc, but it is thought that the amount saved will not exceed a ton a day. The mill operates on two shifts of eight hours each, and treats 330 tons of ore in this time. It is said that the recovery of lead and silver exceeds 90 per cent.

One other metallurgical process deserves mention. During the war the Judge electrolytic plant was built to treat the zinc concentrate from the Judge mill. At the present time only the roaster of the plant is in operation, and the calcines are shipped to Oklahoma for further treatment. The reason for this is the high cost of electricity.

At the time the plant was built the Judge company was working under a favorable power contract with the Utah Power & Light Co. This contract had been entered into in good faith at a time when the Judge company was contemplating the erection of its own power plant, and the zinc plant was built to take advantage of the favorable terms of this new contract. In October, 1920, this and many other contracts for industrial and mining power were canceled by the State Utilities Commission, and a uniform power contract for all consumers of the same class was substituted. The zinc plant was closed down on the day that this contract went into effect, and it has not been operated as a whole since.

Considerable experimental work has been carried on during the period of inactivity, and it is said that many refinements of the process have been worked out and some former difficulties have been overcome. The plans of the company with regard to this plant are not known, but no dismantling has been permitted, and it is unlikely that the shutdown is permanent.

It is not the purpose of this article to give a detailed account of the historical and structural geology of the district, even if the limitations of space would permit. The subject is admirably treated in Professional Paper 77, "Geology and Ore Deposits of the Park City District, Utah," by J. M. Boutwell, published by the U. S. Geological Survey. A few general statements, however, will aid in an understanding of the present article and of the district.

The geologic column consists of a series of conformable Carboniferous and Triassic sediments which have been invaded by quartz-diorite and diorite-porphyry intrusions. The lowest sedimentary member consists of a great thickness of Mississippian limestone beds (Madison). The best exposures lie to the south of the district proper, where the Snake Creek tunnel crosscuts these beds for about two miles before entering the Clayton Peak diorite stock. They also appear in the lower 500 ft. of the Ontario mine, below the 1,500 level, where considerable bodies of low-grade ore have been extracted from lode deposits.

Overlying these (locally called) Wasatch limes is the Pennsylvanian "Weber Quartzite," a dense, massive, homogeneous quartzite of great thickness, with minor intercalated beds of siliceous lime. No accurate determination of the thickness has been made in this district, but it exceeds 2,000 ft. Locally it has been called the Ontario Quartzite, after the Ontario mine, where it forms the wall rocks of great lode deposits.

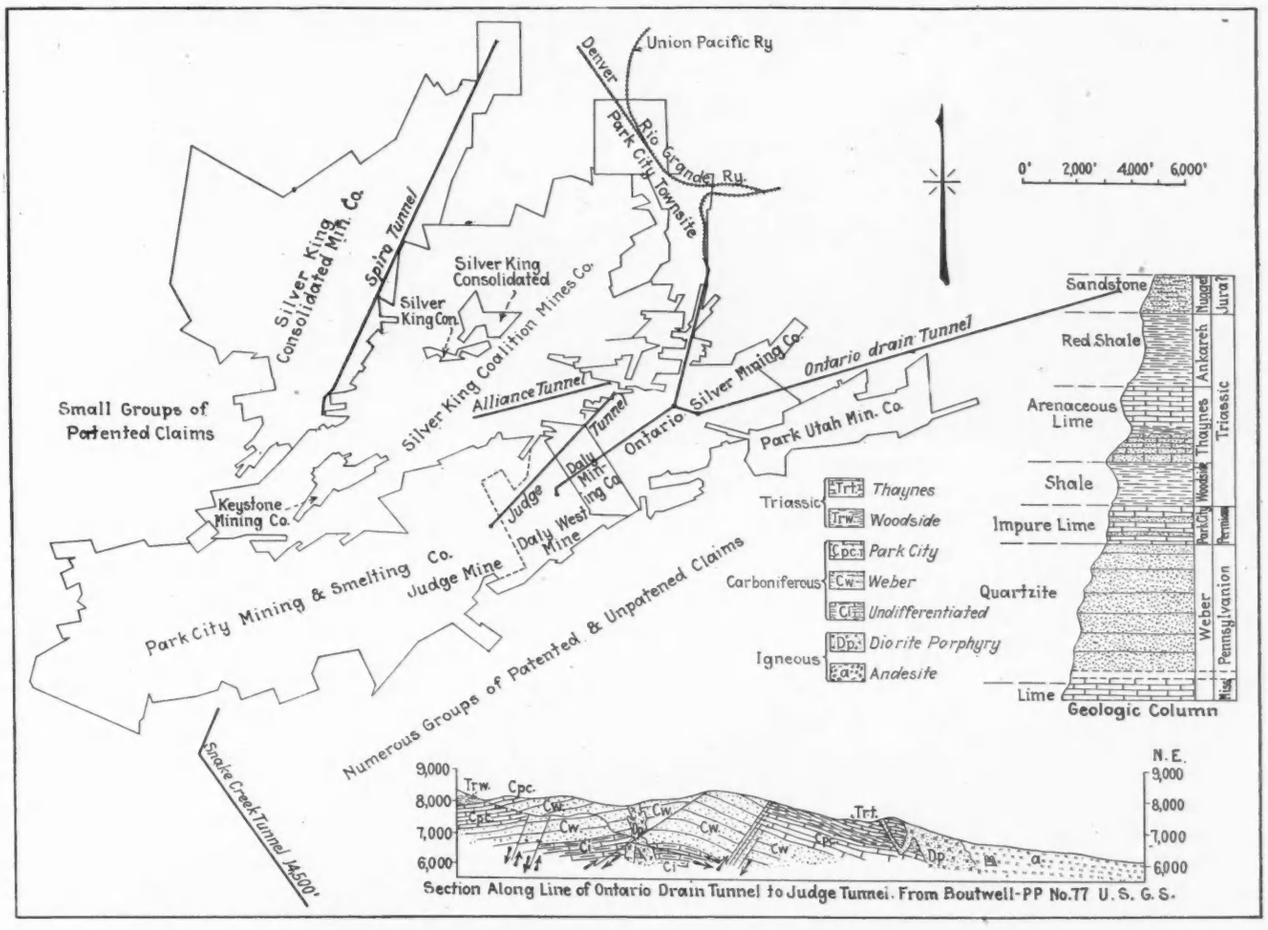
The Weber Quartzite is overlain by the Park City

formation, a series of impure lime beds containing a number of bands of quartzite and sandstone. The age is referred by Boutwell to the Permian. The thickness, which I determined in the Daly West mine, is 582 ft. To the north of this point the thickness seems to be somewhat greater. The Silver King Consolidated shaft is said to have penetrated Park City limestone for 800 ft. The beds dip about 30 deg. to the northwest, making the thickness at this point about 700 ft.

The Park City formation is the locus of the great bedded deposits for which the camp is famous. It is overlain by about 3,000 ft. of Triassic sediment. The lower member, the Woodside shale, varies considerably in thickness, and perhaps averages 700 ft. It has no economic value. It is overlain by the Thaynes formation, somewhat over 1,000 ft. thick, a series of arenaceous lime and shale beds. Considerable ore is found in this formation, both in lodes and in bedded deposits. The overlying formations, the Ankareh shale and the Nugget sandstone (Jurassic?), have no economic value in this district.

The principal structural feature of the district is a broad, flat anticlinal arch, the axis of which extends in a general north-south direction and passes a few hundred feet east of the Ontario shaft. It is cut by numerous faults striking approximately N. 70 deg. E., with vertical displacements varying from a few feet up to 1,500 or more. The great majority of these are mineralized. The smaller ones commonly act as feeders to bedded deposits, and the more profound faults carry lode deposits. Later post-mineral faulting took place in a northwest-southeast direction.

Numerous dikes of diorite porphyry meander in a general east-west direction without any close adherence to the fault lines. The intrusion evidently came after the earliest faulting, but probably preceded a second period of movement along new lines. Mineralization followed the porphyry intrusion, but the relationship between the dikes and the orebodies is not particularly clear. In some cases great bedded deposits parallel the dikes for hundreds of feet, and seem to be intimately associated with them. Then suddenly they will diverge, as if the proximity were accidental or the result of



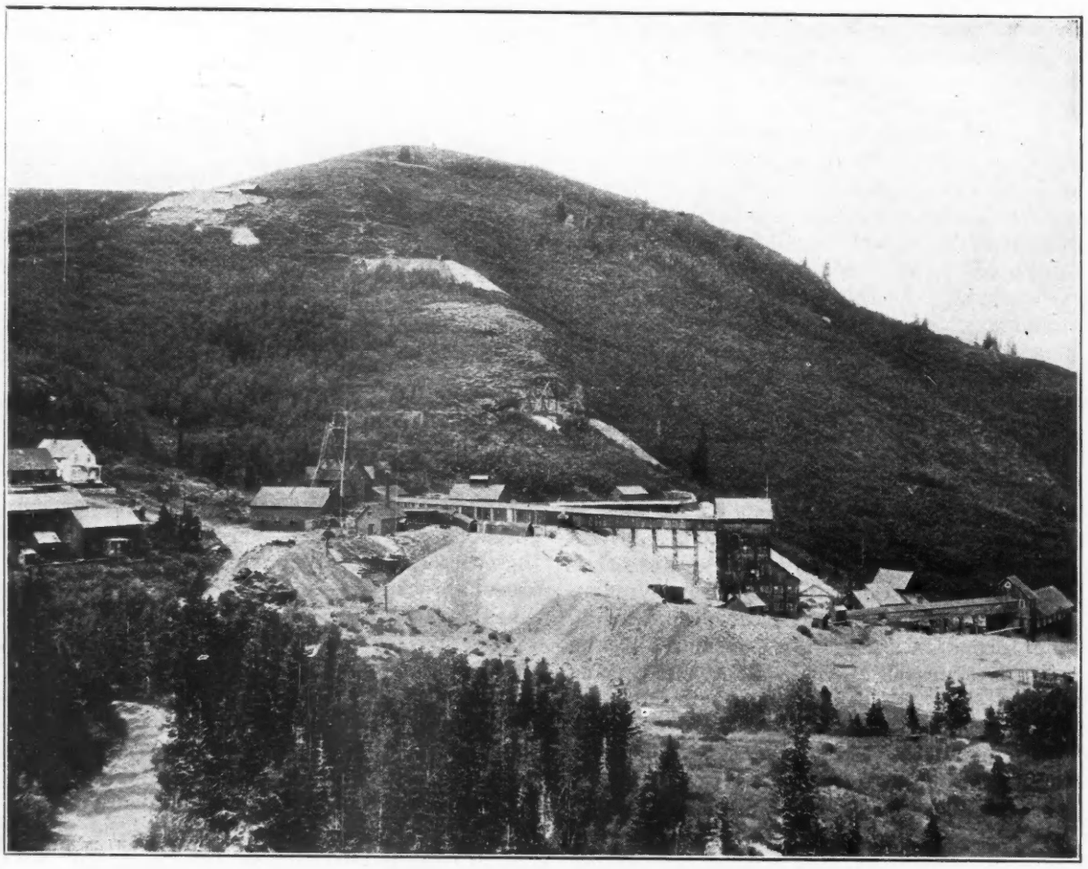
Geological sections and property map of the Park City district

damming of the ore solutions by the impervious decomposed porphyry. In other cases, deposits as large as those described occur hundreds of feet from any known igneous rock, and seem to have no connection with dikes.

The ores are typical lead-silver, copper, zinc and iron sulphide mixtures. In their primary state they occur as the minerals galena (PbS), tetrahedrite, ($Cu_4Sb_2S_7$), sphalerite (ZnS), and pyrite (FeS_2). Considerable jamesonite ($Pb_2Sb_2S_5$), associated with pyrite and galena, was found in the Daisy stope, on the 1,500 level of the Judge mine. Silver, and very small quantities of gold are carried by the galena, tetrahedrite, and jamesonite. So far as my own observations extend, the sphalerite and pyrite carry practically no silver values.

A large part of the primary lode ores are treated by

Judge concentrator in Empire Canyon



Daly West mill and hoisting works

ordinary wet concentration methods, with slime flotation. A typical milling ore from the Judge mine would carry the following: Lead 10 per cent, silver 10 oz., copper ½ to 1½ per cent, zinc 10 to 15 per cent, iron 5 to 20 per cent.

These primary ores oxidize into a complex mixture of oxides and carbonates of lead, copper, and iron, in which it is usually difficult to segregate individual minerals. The zinc carbonate, smithsonite, is comparatively rare. The secondary ores generally carry high silver content, and are nearly all shipped directly to the smelters without preliminary treatment. A typical ore of this nature from the Daly West mine would assay as follows: Lead, 10 per cent; silver, 50 to 100 oz.; copper, 2½ per cent; gold, 0.05 oz.; zinc, none.

The ore occurrence takes two forms, lode deposits and replacements along favorable beds in the Park City and Thaynes formations. The lode deposits favor faults of large displacement, and occur typically in the Weber quartzite and along the contact between the Weber and Park City formations. Above these horizons a particularly favorable condition occurs where the Thaynes formation lies opposite the Park City, as in the Daly fault in the Judge mine. Here, the ore lies in shoots and chimneys which develop typically at the intersection of the main fault with hanging wall breaks. In the Daly West mine a long oreshoot, extending the full width of the property, about 3,000 ft., follows the contact between the Weber and Park City formations on the hanging wall of the fault.

The one outstanding fact in connection with the bedded deposits is their intimate association with quartzite or sandstone beds. The character of the lime overlying the quartzite seems to be immaterial. If the lime was favorable for replacement, the ore lies in the lime bed above the quartzite; if not, the ore solutions frequently replaced the quartzite itself.

This fact indicates that the solutions were hot and exceedingly alkaline. They did not rise vertically from the depths, but came from the west, from the direction of the Clayton Peak diorite stock, and proceeded along the tops of the more siliceous beds, using connecting fissures as passageways. Continuous deposits thousands of feet long, 3 to 30 ft. thick, and often more than 100 ft. wide formed along these horizons, and attained their greatest dimensions at the intersections of several fissures. To the west the deposits gradually become less rich. Iron and zinc minerals increase, and lead, silver, and copper values get smaller. Barren spots become more common, and the cost of prospecting finally becomes prohibitive. To the east, copper and silver values increase. The deposits reach the surface before the limit of mineralization is reached.

The preceding outline, though far from complete, will serve as an introduction to Park City geology, and will help to give an understanding to the future possibilities of the camp, a consideration of which involves three items: Geographical expansion, geological expansion, and the expiration of the Pittman Act.

A consideration of the first item necessitates a return to the early history of the camp. The Ontario company followed its orebody to the east in the early days, and lost it. It encountered great porphyry dikes and a north-south fault which cut off its vein. Considerable money was spent exploring in heavy, wet, swelling ground without finding any ore, and the company finally came to the conclusion that it had come to the end of the mineralization. As this work penetrated well into the eastern limb of the anticline, a corollary to the above conclusion became established, and it was the commonly expressed conviction that the eastern side of the district was not extensively mineralized. Naturally, prospecting was discouraged.

These eastern Ontario workings have been inaccessible for many years, and no work of any consequence was done beyond them until after J. M. Boutwell's report on the district was published in 1912. In his report Mr. Boutwell called attention to an occurrence of the Park City formation which does not outcrop, but is buried under Triassic sediments on the north side of the McHenry fault directly east of, and on line with, the Ontario vein. Of this fact Mr. Boutwell says, "The economic possibilities of this great ore-bearing formation, particularly in the vicinity of intrusive rocks and fissures, warrant the special mention of this occurrence." (p. 51.)

This hint was not acted upon until 1916, when George D. Blood, a local geologist, took the matter up and associated himself with interests headed by G. W. Lambourne, at that time general manager of the Judge Mining & Smelting Co. Together they organized the Park-Utah Mining Co. Work was started from the Ontario drain tunnel, at a point 8,500 ft. from the portal, and a crosscut was driven 1,700 ft. to the south to intersect the McHenry fault.

The result of this work is the latest sensation of the district. Enormous bodies of high-grade lead-silver ore, comparable to any hitherto found in the district, have been exposed, and their limits are still a matter of conjecture. The company paid $500,000 in dividends in 1922, besides constructing an extensive surface plant and electrifying the Ontario drain tunnel for five miles. Already this year $350,000 has been paid and the company had cash assets of $900,000 on June 1.

The discovery of this new mine definitely proves that the eastern limb of the anticline is not barren, but that under proper conditions of fissuring in the favorable formations, as extensive orebodies may be expected as have been found in the western limb. Active prospecting is now being carried on in a number of favorable spots, and the present year should disclose some interesting developments. Local interest is closely following the operations of the Sphinx Mining Co. on the Cottonwood fault in the southeast corner of the district. This fault is complementary to the McHenry fault at the Park-Utah mine, and has about the same vertical displacement. The Park City and Weber formations both come to the surface on the hanging wall of this fault, and the proximity of extensive igneous intrusions makes this a peculiarly favorable location.

On the opposite side of the camp from the Sphinx operations, the Silver King Consolidated Mining Co. has driven the Spiro tunnel about 15,000 ft. along the northwestern edge of the productive area. The tunnel has entered ground in which orebodies of considerable size were mined from the Thaynes formation in the 80's and 90's. The more favorable Park City and Weber formations are deeply buried here, and these are now being prospected from the Spiro tunnel. The work is being carried on under the management of H. A. Lee, with J. M. Boutwell as consulting geologist.

This portion of the district and a part still farther to the northwest merit close study and the expenditure of some money. Considerable scratching has been done on the surface, and orebodies of some magnitude have been found and mined out without penetrating to the

more favorable formations. This area is northwest and off the line of the master faults and vein systems of the rest of the camp, but the proper conditions exist for the development of parallel vein systems, and there has been an abundance of igneous activity.

To the northeast of the developed area of the district a small amount of work is being done by the Hanson brothers on the Frog Valley fault. This is a thrust movement at right angles to the other mineralized faults of the district. Some mineralization has been found, but the work has not yet reached a stage of development sufficient to determine the value of this fault. The proper formations are present, however.

To the southwest, along the line of the developed veins, the chances of opening up extensive orebodies seem less favorable than in the other outlying portions of the district. Present data indicate that the conditions of heat and pressure at the time of ore deposition were such that the solutions passed through this area leaving only minor traces of mineralization, principally bodies of pyrite with small amounts of galena and blende. The logical way to develop this territory is through the Snake Creek tunnel, a 14,500-ft. adit owned by the Park City Mining & Smelting Co. It was closed down during the war, while still in quartz-diorite, and has not since been opened.

Summarizing the preceding paragraphs, the outlying portions of the district are extremely favorable for new discoveries in two directions: To the east and southeast, and to the northwest. The northern area is less surely favorable, and the southwestern area rather unfavorable, according to present data. These outlying territories are, for the first time, being given the benefit of exact geological knowledge. The first effort along these lines has been a marked success, and there is every reason to think that other successes will follow it.

The new geological discoveries of the last few years, and the intensive development of the Park City formation in the older mines which has resulted from these discoveries, are of equal importance to the district. Formerly it was considered that practically all of the bedded deposits of the Park City formation lay in a single geological horizon, and that if ore was not found in this horizon it was useless to look elsewhere. Lately it has been discovered that there are several favorable horizons in this formation, and a new outlook which means much to the camp has come with this discovery.

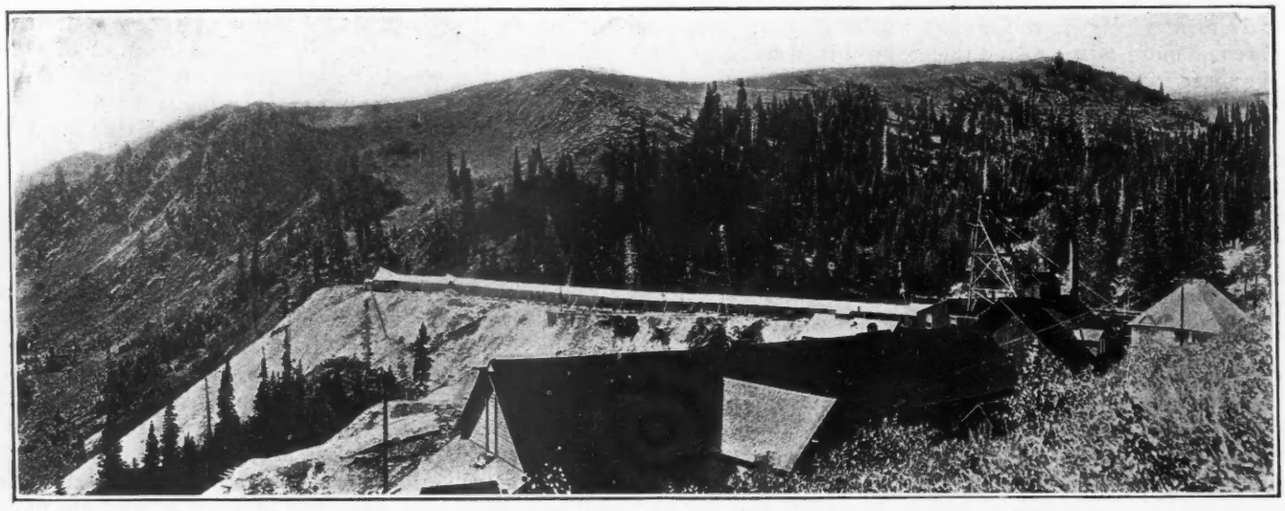
Any forward looking at this time, in a camp which produces silver, must take into consideration the expiration of the Pittman Act.

This law has been of inestimable value to Park City. At a time when labor was scarce and inefficient, and when the prices of all of the base metals were so low that they could not have been marketed at a profit, the stabilization of the price of silver at $1 per ounce made it possible to continue operations at full capacity. Hence Park City has had no after-the-war slump. Unlike the copper camps, many of which suffered a complete suspension of operations, Park City has enjoyed an activity as great as at any normal time in its history. Hence, the expiration of this law concerns Park City operators rather closely. That it will have an adverse effect is obvious, unless there is a sudden change in the conditions governing the price of silver. Though such a change would be most welcome, Park City operators are not sitting idly and waiting hopefully for it. They are holding down dividends to the minimum and building up their treasuries in anticipation of the lean times which seem to be coming.

Park City is fortunate, however, in not being entirely dependent upon the silver content of its ores. The separation and saving of the base metals, lead, copper, and zinc, has reached a high state of efficiency, and the readjustment which comes with new price conditions in the silver market will no doubt be directed to a further saving and a more profitable marketing of these metals.

I believe, however, that the silver market is essentially in a favorable position, and that the efforts now being directed toward a stabilization of the price of silver will have some effect. I do not expect the recent prosperity to continue during the period of readjustment, which may last for several months or for several years, but I do not look for any prolonged period of inactivity. The present condition of the producing mines is unusually good, and most of them can continue to make money on metal prices considerably lower than are anticipated.

Considering all things, the future of Park City is far from dark. The extension of the limits of the productive area, both geologically and geographically, has given a new lease of life to the district. The expiration of the Pittman Act can have no more than a temporary effect, and I believe that it will be some decades yet before Park City is a "ghost camp."



Hoisting plant at Judge shaft

Speed of Moving Men in Mine Shafts

State Laws Specify 800 Ft. as Maximum—Frequently Exceeded —Physiological Effects of Rapid Hoisting or Lowering —Rate of Acceleration Important

BY M. W. VON BERNEWITZ

AT A RECENT MEETING of the Engineers' Society of Western Pennsylvania at Pittsburgh, H. D. James, of the Westinghouse Electric & Manufacturing Co., stated, while replying to the discussion on his paper on "Vertical Transportation"—in other words, elevators—that 600 to 800 ft. per minute, about the fastest speed for elevators, was slow when compared with 3,000 ft. per minute employed when hoisting men at mines. With this I disagreed, saying that in most of the states the regulations forbade more than 800 or 1,000 ft. per minute for men; also, that the physiological effect was more or less serious upon men being hoisted or lowered at a rate higher than that. Personally, 1,000 ft. per minute is plenty for me. On looking up the latest regulations in states where important mines are operated I find the limitations given in the following table. Where no figure is given there is no provision in the statutes:

State	Speed, Feet per Minute	State	Speed, Feed per Minute
Alabama	...	Montana	600
Arizona	800 hoist or lower	Nevada	...
Arkansas	...	New Jersey	800
California	200 to 500 in bucket 800 in cages	New Mexico	...
		New York	200 to 500 in bucket
Colorado	600	Oklahoma	...
Idaho	600	Oregon	...
Illinois	500 to 800	Pennsylvania	900 (bituminous coal)
Indiana	600	South Dakota	...
Iowa	400	Tennessee	...
Kansas	...	Utah	...
Kentucky	...	Virginia	...
Maryland	600	Washington	600
Michigan	400 (coal mines)	West Virginia	...
Minnesota	...	Wisconsin	...
Missouri	500		

In several of the States—Utah for instance—mine superintendents are permitted to fix the maximum speed, subject to the approval of the State Mine Inspector.

So much for the state regulations. I then asked a number of engineers what had been their observations in the field, and received a number of replies. Rudolf Kudlich, assistant mechanical engineer for the U. S. Bureau of Mines, said:

"In the anthracite mine shafts no restrictions are placed by law on the speed at which men may be hoisted, except that the engineer shall operate his engine with great care while hoisting men. There I have observed maximum speeds as high as 3,100 ft. per minute when hoisting men in a 600-ft. shaft. In Indiana, where the legal maximum speed is 600 ft. per minute, I have observed a maximum speed of almost 1,800 ft. per minute in a 300-ft. shaft. The mine inspector allowed this on the interpretation of the mining law that the speed of the piston, not of the cage, shall not exceed 600 ft. per minute. It is pretty generally the case that the legal speed is taken not as the maximum speed, but the average speed for the entire hoist, which brings the maximum speed for a shaft about 300 or 400 ft. deep up to 1,000 or 1,200 ft. per minute, where the average speed is only 600 ft. per minute."

Daniel Harrington, supervising mining engineer for the U. S. Bureau of Mines, said:

"It seems to me that Mr James, of the Westinghouse company, is wrong in his statement that 3,000 ft. per minute is the rule in speed of hoisting and lowering men in shafts. As a matter of fact, I do not know of any place where the speed of hoisting of ore in shafts is as high as 3,000 ft. per minute, and the speed of hoisting of men is ordinarily much below 2,000 ft.; and in fact I am inclined to be in accord with your estimate of 1,000 ft. or under as being the average for hoisting men. It is my recollection that some of the larger hoists in the Butte district have safety attachments which restrict speed of hoisting to 2,500 ft. per minute or less, and this 2,500 ft. per minute would, of course, be the limit in case of hoisting of ore. I think men would be carried at a less rapid speed.

"The above discussion involves chiefly vertical shafts; and where the shaft is an incline, the hoisting speed is materially less than where vertical shafts are in use. A velocity of 2,000 ft. per minute in a perfectly straight and perfectly free vertical shaft almost takes one's breath away, while a speed of anything like 2,000 ft. in shafts which have moved or which have various inclinations would be distinctly unsafe."

J. W. Paul chief coal-mining engineer for the U. S. Bureau of Mines, said that he believed that 800 ft. per minute was about the average maximum speed, and related how once when he took down a shaft an aviator, who had been accustomed to speeds of 88 ft. and over a second (a mile a minute), this man was much perturbed when he was lowered at about 1,000 ft. a minute.

Captain Duncan, instructor of the National Guard aviation field, near Birmingham, Ala., told Dr. F. V. Meriwether, of the Bureau of Mines, that it is common practice for aviators to ascend at a speed of 1,000 to 5,000 ft. per minute. The ascension from 5,000 to 10,000 ft. is at the rate of about two minutes per 1,000 ft., growing slower as the air becomes more rarified. The descent from 5,000 ft. to the ground is covered in two minutes. This would give an ascent of 1,000 ft. and a descent of 2,500 ft. per minute. There is no other effect felt than wind blowing on the exposed surface of the body, but at a greater speed, deafness is experienced; while at distances above 5,000 ft. the descent is very rapid, and men experience dizziness, deafness, and sometimes serious impairment caused by rupture of blood vessels in the head. One aviator who descended from an altitude of 20,000 ft. in four minutes experienced a rupture of a blood vessel in his head. It is generally conceded that aviators have considerable physiological reaction in rapid descent, but not in ascent.

Alex J. Nicht, Jr., engineer for hoisting equipment for Allis-Chalmers Manufacturing Co., at Milwaukee, said:

"A good many of the states, as you know, now have laws limiting the speed at which men may be hoisted or lowered. In some states this is 600 ft. per minute and in others it is 800 ft. per minute. In offering our man hoists we are guided in each individual case by the laws applying in the state where the hoist will be operated. It is possible that in some cases men may be handled at a higher speed than those provided in the law, during some portion of the trip, but in such instances the average speed is probably calculated from the depth and the total time taken in hoisting the men. I do not believe, however, that there are many cases where men are handled much above 800 ft. per minute. In emergency, there might be times when men are handled at much higher speeds. I believe I saw some records where at the time of the fire at the Tamarack mine, the men were hoisted at almost 5,000 ft. per minute. The rope speed for ore in this same mine is somewhere in the neighborhood of an average valu[illegible] of 4,000 ft. Some

of the coal mines hoist coal at speeds from 1,000 ft. to in the neighborhood of 3,000 ft. per minute. The new Homestake hoist which we recently installed operates at a rope speed of 2,000 ft. per minute.

"The physiological effect on men being hoisted or lowered depends a great deal upon the rate of acceleration and the smoothness of acceleration; also, the effect is more pronounced in lowering than in hoisting. I know of a case of an office building having two sets of elevators; one set operated at a rope speed of 600 ft. per minute and the other set at 800 ft. per minute. One of the operators told me, at one time, that he noticed that the stenographers invariably tried to use the high-speed elevators. This aroused his curiosity, and he made inquiry as to the reason. He was told by them they selected the high-speed elevators because they did not run as fast as the others. As a matter of fact, as stated above, they were operating at a speed of 200 ft. per minute faster, but due to the special control equipment the acceleration was so uniform that it did not produce the same physiological effect as the slower elevators, causing the stenographers to believe that they were actually running at slower speed.

"This is a subject which might lead to considerable discussion, and while I know there are cases where men have been hoisted at speeds in excess of 1,000 ft. per minute, it is not the general practice anywhere, nor is it permissible by law in those states where they now have legal regulations. I believe that if a uniform law is ever enacted for all states, it will limit the man speed to 800 ft. per minute."

B. V. Nordberg, executive engineer for the Nordberg Manufacturing Co., at Milwaukee, said:

"The rate of speed at which men are hoisted is usually less than 800 ft. However, often in emergencies this speed must be increased, and we have in mind an instance where men were actually hoisted at a speed of about 5,000 or 6,000 ft. per minute, in order to clear out a mine in which there was a fire. The writer has on several occasions seen station-tenders hoisted and lowered at the regular speed used to hoist and lower ore, but as stated above, these are irregular conditions.

"As to the psychological effect of the speed upon the men, this we are not in position to discuss very thoroughly. It is evident that the case stated above—when men were hoisted from a burning mine at a rate of speed above 5,000 ft. per minute—proved to be intense relief to the men. When standing in a cage and being hoisted through a dark shaft it is impossible for a man to judge what speed he may be hoisted at, so whether he be hoisted at high or low speed would not make a great deal of difference psychologically. Physiologically, however, they may suffer from too high a speed. We do not recall that this was the case even in the instance stated above. It is also well to note that these men were hoisted from a depth of approximately 4,800 ft."

R. V. Ageton, a metal-mining engineer with the U. S. Bureau of Mines, who, with Dr. F. V. Meriwether, made some investigation on blood pressure below sea level while in the Michigan copper country, said:

"It was shown that the sudden descent below sea level (from 1,220 ft. above to anywhere between 1,220 and 3,541 ft. below sea level) with increased atmospheric pressure, is accompanied by a fall in systolic (maximum) pressure and a rise in diastolic (minimum) pressure, with a resulting low pulse pressure (between systolic and diastolic). This hypotension remains throughout the shift, and the systolic does not return to normal. In 8,000 examinations of men made by a surgeon of one of the mining companies, where blood pressures were taken of each man, 160 mm. is now considered normal for systolic pressure for men with previous underground experience in dry mines working below sea level.

"In order to determine if the systolic pressure would rise again without work (after coming underground), one subject was given a comfortable position, 1,220 ft. below sea level, and blood-pressure readings were taken every hour for three hours. No change was noted from the blood pressure which was taken immediately on coming to the station."

These data were taken at slow hoisting speeds—500 ft. per minute or less.

Dr. Meriwether states that he has noticed men who rode on the bail of the skip at a high speed, yet he never heard any complaint from them. He therefore feels that unless the speed is greater than 2,000 ft. per minute, there is not sufficient physiological reaction to cause any damage to the men unless they are physically defective: suffering from high blood pressure, tuberculosis, arterio-sclerosis, or other weakness. Such men hoisted at this speed would possibly rupture a blood vessel on descending, and might experience faintness and dizziness or collapse. Therefore, to be on the safe side, it is his opinion that the hoisting speed when men are being handled should not exceed 1,000 ft. per minute.

Regarding the point as to whether it makes any difference to men being hoisted or lowered through a dark shaft, Dr. Meriwether argues that sufficient data have been secured to show that the vision does not produce the physiological reaction occurring with rapid descent, and that it is due to the rapid change in barometric pressure which would take place in a dark shaft as well as in the light, and therefore the speed of the cage would make a decided difference whether the cage was operated in a dark shaft or in an office building. He concludes as follows:

"It is my personal opinion from experience with increased barometric pressure in mines, and from information gathered from contact with aviators, that on account of rapid descent, the atmospheric pressure per square inch is rapidly increased, causing congestion of blood vessels in the bony cavity of the skull, which in some instances causes rupture of these vessels, and permanent physical damage; also a fall in systolic blood pressure of the body. This was noted in our work in deep mines. Where descent is slow, this physiological reaction is compensated for by vasomotor nerves of the body; but where descent is very rapid, the vasomotor nervous system has not time to adjust itself to the changes, resulting in the conditions that have been mentioned."

On the other hand, it is held by several mining engineers that where a shaft is in good order, a speed of 1,500 to 2,000 ft. is safe, and that the physiological effect on men is almost a negligible matter, as in one or two trips men become accustomed to a regular speed and give it little thought.

Again, you will hear of cases at mines where men have been lowered too fast; they immediately "bell" the cage or skip, return to the surface, and give the hoist engineman a little choice language, showing that experienced underground men do not like being lowered too fast.

I would also refer to the article, "Hoist for Men and Supplies at the United Verde Mine," by R. E. Donovan, in the *Engineering and Mining Journal* for Jan. 14, 1922. The shaft at this mine was 2,400 ft. deep, and the engine had an acceleration period of six seconds and retardation of five seconds, with a maximum rope speed of 800 ft. per minute—the state limit. When the speed exceeded this rate, an overspeed safety device applied the brakes. Obviously, of course, there are three periods in hoisting—namely, acceleration, maximum velocity, and retardation.

Although the average hoisting speed at mines is around 800 ft., and there must have been some reason for fixing it at this rate, I have never seen any discussion on the physiological effects on men from high speeds of hoisting or lowering. Perhaps other engineers may have some data on this point. It is well known that many men have become dizzy during hoisting or lowering, and have fallen onto the cage bottom or out of the cage; so apparently there is some physiological effect on the human system, more or less depending upon the acceleration, rush of air, and vision of the man in the cage.

A Silver Export Association

New Legislation Necessary—Statistical Data—Obscure Relation Between Price and Production—Functions of an Association—Co-operation of Government and Financial Interests Desirable

BY F. H. BROWNELL
First Vice-President, American Smelting & Refining Co.

THE SUBJECT of a silver export association has recently received much consideration by those interested in silver and is likely to remain a subject for most serious discussion during the remainder of the year. In a pamphlet published last spring, I expressed the opinion that, under present conditions of the law, any association of this sort would not be legal; and, if legal, could not be financed. So long as the laws remain as at present, I see no reason for changing that opinion, but I now believe there is an opportunity to effect such a change in the law as to make financing possible, if an association can be organized along lines that will appeal to a sufficient number of silver producers. The reason for this belief is because of the very important fact that the United States Senate has recently appointed a committee to investigate and report to Congress by Jan. 1, 1924, upon the following matters:

1. The causes of the continuing decrease in the production of gold and silver.

2. The causes of the depressed condition of the gold and silver industry in the United States.

3. The production, reduction, refining, transportation, marketing, sale, and uses of gold and silver in the United States and elsewhere.

4. The effect of the decreased production of gold and silver upon commerce, industry, exchange and prices.

The members of the committee are: Senator Oddie, of Nevada, chairman; Senator Pittman, of Nevada; Senator Walsh, of Montana; Senator Gooding, of Idaho; and Senator Sterling, of South Dakota.

The committee is quite likely to consider carefully the frequent suggestion that a silver export association is a promising means of improving the situation. Their attention has doubtless been called to the fact that, under the present Webb Act, such an association might (if not would) be deficient in power in respect to:

(1) Acts avowedly intended to control, and, if possible, increase, the price of silver in the United States, and which therefore would be in contravention of the Sherman Law.

(2) Ability to include in its operations silver produced from territory outside of the United States.

It is reasonable to suppose, however, that, if the present law is inadequate, Congress, on the recommendation of the committee, will pass a law giving all the necessary powers.

NEW LEGISLATION REQUIRED

I shall, therefore, assume in this paper that a silver export association can be organized, having all the powers required and having no fear of the Sherman law or any other of the present statutes prohibiting combinations of any kind. This assumption, to my mind, required new legislation on the part of Congress.

Assuming that such an association is formed, the following questions naturally arise:

(1) How much of the world's production of silver can such an association reasonably hope to handle?

(2) What steps can such an association take to enhance and stabilize the price of silver?

(3) What financing will be necessary?

I shall take these up in order.

How much of the world's production of silver can such an association reasonably hope to handle? The world's production of silver and its principal sources from the years 1901 to 1922, inclusive, is shown in Table 1, which follows:

Table 1. World's Production of Silver in Millions of Ounces

Year	United States	Mexico	Canada	South America	Australasia	Other Countries	Total
1901	55.2	57.6	5.2	18.6	10.2	26.2	173.0
1902	55.5	60.2	4.3	16.1	8.0	18.7	162.8
1903	54.5	70.5	3.1	13.0	9.7	17.1	167.7
1904	57.7	60.8	3.7	12.8	14.5	14.7	164.2
1905	56.1	65.0	6.0	10.5	15.0	19.7	172.3
1906	56.5	55.2	8.6	11.3	13.9	19.6	165.1
1907	56.5	61.1	12.8	15.9	18.0	19.9	184.2
1908	52.4	73.7	22.1	17.0	17.2	20.7	203.1
1909	54.7	74.0	27.5	16.0	16.4	23.5	212.1
1910	57.1	71.4	32.9	14.5	21.6	24.2	221.7
1911	60.4	79.0	32.8	14.4	16.6	23.0	226.2
1912	63.8	74.6	31.6	16.1	14.7	25.6	226.4
1913	66.8	55.5	31.5	14.3	17.1	25.3	210.5
1914	72.5	26.1	28.4	10.4	14.7	24.7	176.8
1915	75.0	22.9	26.6	13.7	8.8	26.0	173.0
1916	74.4	29.8	25.5	15.6	9.7	25.1	180.1
1917	71.7	42.0	22.2	15.5	10.1	25.9	187.4
1918	67.8	62.5	21.4	14.7	10.7	27.1	204.2
1919	56.7	65.9	16.0	14.8	7.6	20.8	181.8
1920	55.4	66.5	13.3	14.6	2.2	21.2	173.2
1921	53.7	64.5	13.0	15.5	5.4	19.8	171.9
1922	55.5	81.1	17.6	17.7	12.0	22.2	206.1
Averages for period	60.4	60.0	18.5	14.7	12.5	22.3	188.4

It will be noted that the percentages of world's production are as follows:

Country	Per Cent of Total
United States	32.06
Mexico	31.85
Canada	9.82
South America	7.81
Total North and South America	81.54

Three companies now sell between 50 and 60 per cent of the world's total new production; they are the American Smelting & Refining Co., the Anaconda Copper Mining Co., and the United States Smelting, Refining & Mining Co. From 15 to 20 per cent additional is probably sold by the following American companies: American Metal Co., Bunker Hill & Sullivan Mining & Concentrating Co., Cerro de Pasco Copper Co., Nichols Copper Co., Nipissing Mines Co., and Phelps Dodge Corporation.

I believe that the more important and possibly all of the companies above named would go into a silver export association of unquestionable legality and organized along lines appealing to them. Probably great diversity of requirement would be found. I will suppose them reconciled each with the other; then the

association might easily start with possibly 70 per cent of the world's total output of silver; if successful, most of the companies producing the remaining silver would be induced to join and in a few years the association might hope to control around 80 or 90 per cent of the world's net production.

What steps can such an association take to enhance the price of silver? Let us set out some pertinent facts before answering this question. Table 2 gives the prices of silver in New York City for the last twelve years showing how it has ranged.

Table 2. Monthly Average Prices of Silver in New York, in Cents per Ounce

	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920[1]	1921	1922
January	53.79	56.22	62.93	57.57	48.85	56.77	75.63	88.70	101.12	132.83	65.95	65.45
February	52.22	59.04	61.64	57.51	48.48	56.75	77.58	85.72	101.12	131.29	59.32	65.31
March	52.74	58.37	57.87	58.07	50.24	57.93	73.86	88.08	101.12	125.55	56.03	64.38
April	53.33	59.23	59.49	58.52	50.25	64.41	73.87	95.35	101.12	119.53	59.34	66.57
May	53.31	60.88	60.36	58.17	49.91	74.27	74.74	99.50	107.11	102.58	59.85	71.15
June	53.04	61.29	58.99	56.47	49.03	65.02	76.97	99.50	110.44	90.82	58.51	71.15
July	52.63	60.60	58.72	54.68	47.52	62.94	79.01	99.62	106.39	91.93	60.26	70.24
August	52.17	61.61	59.29	54.34[2]	47.16	66.08	85.41	100.29	111.37	96.18	61.60	69.40
September	52.43	63.08	60.64	53.29	48.68	68.51	100.74	101.12	114.54	93.65	66.15	69.50
October	53.34	63.47	60.79	50.65	49.38	67.85	87.33	101.12	119.14	83.48	70.97	68.01
November	55.72	62.79	58.99	49.08	51.71	71.60	85.89	101.12	127.91	77.64	68.23	65.18
December	54.90	63.37	57.76	49.37	34.97	75.76	85.96	101.12	131.98	64.78	65.76	64.62
Average	53.30	60.83	59.79	54.81	49.68	65.66	81.42	96.77	111.11	100.86	62.66	67.58

[1] Since June 17, 1920, the averages are based on the price of foreign silver, the price of domestic silver being retained at $1 by Government purchases under the Pittman Act.

[2] Quotations suspended Aug. 1 to 21.

No reliable table exists of the amount of silver consumed in the arts, such as photography, silver plating and other uses which, in effect, destroy the silver. The best estimates available place this consumption at from 10,000,000 to 20,000,000 oz. per annum. From 20,000,000 to 30,000,000 oz. per annum are probably consumed in the manufacture of articles which do not destroy the silver (except from abrasion loss), such as tableware, toilet articles, ornaments, and the like. By far the greatest use of silver is as money, both coined and uncoined.

The Year Book of the American Bureau of Metal Statistics for 1922 (p. 83) estimates the total silver consumed in coinage in the United States and the world from 1914 to 1921 as given in Table 3, the figures being in fine ounces.

Table 3. Silver Consumed for Coinage, 1914 to 1921, in Fine Ounces

Year	United States	World
1914	4,400,885	179,593,224
1915	2,976,024	225,116,911
1916	6,424,149	292,148,559
1917	21,276,122	286,596,805
1918	18,425,915	238,692,502
1919	8,560,716	298,300,518
1920	18,125,805	220,318,663
1921	68,814,302	148,036,313

The same authority (p. 83) for the years 1920 and 1921 gives the ounces consumed in coinage by the countries as in Table 4.

Tables 3 and 4 suggest the conclusion, highly important, if true, that, deducting from the world's production the amount of silver consumed in the arts each year, coinage requirements are such as to demand all the silver produced from the mines, and in some years to call for a minting of silver which had been used previously for commercial or artistic purposes in some form or other.

The great demonetization of silver for subsidiary coinage in the bankrupt countries of Europe (together with the debasement of such silver as remained in use in many countries) which has occurred since the World War, together with the completion of the Pittman Act, may result in a greater production of silver than the needs of coinage. Even if this be true, it is highly probable that as, one by one, the paper currencies of European nations are restored and rehabilitated, silver will be found necessary, to an extent sufficient to restore again the former situation of coinage demands approximating new annual production, after allowing for silver used in the arts. Many economists believe that the gold supply is not sufficient alone to stabilize European currencies, especially in consideration of the large amount of gold in the United States and the present tendency of the United States to retain its own hoard.

Table 4. Consumption of Silver for Coinage, 1920-1921, in Fine Ounces

Country	1920	1921
United States	18,125,805	68,814,302
Philippine Islands	276,205	915,643
British Empire:		
Australasia	387,992	1,318,882
British Guiana	.....	5,045
Canada	1,156,014	361,849
Ceylon	228,094	146,086
Cyprus Island	.....	168,178
Great Britain	9,981,945	15,357,260
India	37,343,858	.....
Kenya Colony (formerly East Africa and Uganda)	1,421,467	1,328,652
Saragwak	8,730	.....
Straits Settlements	3,371,875	1,974,292
West Africa	2,122,277	.....
Chile	202,321	330,848
China	115,373,035	35,095,064
Colombia	335,137	524,012
Cuba	976,556	290,175
Denmark	53,315	.....
Egypt	277,187	441,858
France	3,973,555	.....
French Colonies:		
Indo-China	624,938	6,668,178
Tunisia	243	243
Italy:		
Somaliland	446,875	.....
Mexico	17,866,189	7,792,774
Netherlands	.....	903,574
Netherlands East Indies	2,946,063	2,686,626
Norway	868	.....
Persia	284,807	273,898
Siberia	.....	3,883
Siam	887,099	467,059
Sweden	.....	102,215
Switzerland	1,429,200	1,342,262
Uruguay	217,013	321,500
Venezuela	.....	401,955
Totals	220,318,663	148,036,313

Relation Between Price and Production

Another interesting fact about silver is that there seems to be a less-than-normal relation between production and price. For convenience, we reproduce in Table 5 the essential figures of Tables 1 and 2.

There are three principal reasons why production and price have so little relation:

(1) Much the larger part of the silver now produced comes from ores bearing also lead, copper, zinc and other metals. The silver is only one factor to be considered and will, therefore, be produced whenever the

combined contents—copper, lead, zinc, gold, silver, antimony—yield a profit on the ore mined.

(2) The demand from India and China materially affects the prices that rule in the silver market. If crops and other commercial conditions are unfavorable in these countries, the price of silver is apt to fall; and to rise when the reverse is the case. Particularly in late years the governmental conditions in both countries have had an unusually important bearing upon the demand of those countries for silver, and hence upon the price.

Table 5. Relation of Production and Prices

Year	Total Production (Millions of Ounces)	Average Price (Cents per Fine Ounce)
1911	226.2	53.30
1912	226.4	60.83
1913	210.5	59.79
1914	176.8	54.81
1915	173 0	49.68
1916	180.1	65.66
1917	187.4	81.42
1918	204.2	96.77
1919	181.8	111.11
1920	173.2	100.86
1921	171 9	62.66
1922	150.6[1]	67.58[1]

[1]55.5 million ounces of United States silver produced in 1922 in addition to above were sold at $1 per oz. under Pittman Act.

(3) The ultimate demand for silver is subject to considerable fluctuation, while production is relatively steady and producers insist on the sale of the silver as soon as it is available for market.

The demand is inconstant because governments often change their silver requirements from time to time, and also because the requirements of the chief consuming countries—India and China—vary widely on account of conditions of crops, the highly speculative tendencies of Chinese and Hindu financiers and governmental conditions.

Smelters Sell Silver as Fast as Produced

Production, on the other hand, is relatively constant and there is a remarkable insistance on the part of the producer to sell his metal as soon as it is produced. A large proportion of the world's entire production of silver is purchased by smelting companies from mines in the form of ore. Smelters pay for the silver contents of the ore on the date of arrival at the smelter at the then prevailing price. About four months on the average elapses in the process of smelting, transporting and refining before the silver contents of the ore are ready for delivery upon the market. To protect themselves from the loss that might occur, smelting companies have practically universally adopted the policy of selling, each day, an amount equal to the intake of that day, so far as they can. Assuming a relatively steady quantity of silver in process, the refinery output should equal the smelter intake, and this refinery output they, as a rule, sell as rapidly as it is available.

Functions of an Association

The desire for an immediate sale of the silver not sold in the form of ore to smelting companies, but produced as silver by mining companies, is equally insistent. Mines of this class, as a rule, must sell their product to meet operating expenses or to pay dividends. Silver has fluctuated so violently and the production of any one mine is so small an amount that there has been practically no tendency whatever for mining companies to hold their silver, waiting for a better price. This has been true almost without exception; the fact furnishes a singular contrast to the practice prevailing in almost any other class of commodity. Obviously any silver association would have to be prepared to purchase the silver output of its members and pay therefor at the time of delivery of the silver.

We now reach the answer to the question, "What steps can a silver export association take to enhance the price of silver?" Such an association's function will be to act to some extent (much less than is often supposed) as a reservoir to equalize the variation between intake and outgo; to obtain first-hand knowledge of conditions in India and China; to stop such unnecessary reduction in the price as often happens when, in a dull market, many sellers compete for few buyers; and generally, by its preponderant position, to help in stabilizing and enhancing the price of silver. This result will be especially likely to happen if co-operation can be arranged between the silver export association and the principal financial interests of London, New York and the Far East who are particularly interested in silver, especially such institutions as The Chartered Bank of India, Australia & China. The Yokohama Specie Bank, Ltd., and Hong Kong & Shanghai Banking Corporation, and the silver brokerage firms of Samuel Montagu & Co., Sharps & Wilkins, Mocatta & Goldsmid and Pixley & Abell.

Co-operation Would Be Essential

Certainly it will be difficult to persuade some of the larger producers of silver to join an export association unless they are assured in advance of cordial support from their own government, from a majority of the large financial institutions interested in silver, and possibly from the governments of Great Britain and the Far East.

What Financing Will Be Necessary? The "trade" could not easily be induced to go into any silver export association which had in view any program of buying up the world's output and holding until it got its price. This for two reasons:

(1) The principal use of silver is as money. One of the most important purposes of the association should be to help restore the former use of silver as money and to encourage its continuance by those still using it. Any revival of political feuds, any "strong-arm" method arousing animosity, any effort to compel governments against their wills, would invite inevitable disaster. The friendly co-operation of the chief financial interests of England and of the United States and the friendly attitude of each of those governments must be obtained. English financiers for generations have had what is practically a commission on the sale of the world's silver. This would probably have to be continued in some degree, the extent to be arranged by negotiation. The large English banks engaged in the Oriental business should be interested also. The whole plan and purpose of the association should be to work along lines of co-operation and without arousing antagonism, trade rivalries and political animosity.

(2) There is a large store of silver hoarded, especially in India and China. This might come upon the market at any time. It would be the height of unwisdom to attempt to obtain or fix a price based upon control of the supply without taking this hoarded stock into full consideration.

Assuming the proper purpose and plan, a silver export association should be organized with a capital of at least $5,000,000—more desirably $10,000,000. The money should be provided by the mines. The smelting

companies would not subscribe that amount of capital corresponding to the silver which they buy in the ore. It is believed, however, that practically all the larger mines could be induced—the organization being formed along the above lines—to take their pro rata share.

The association might very well charge a commission of 1 or 2c. per ounce, which, with an average production of silver of, say, 175,000,000 oz., would yield a revenue of from $1,750,000 to $3,500,000 per annum, a sum sufficient to take care of the various sales commissions, cover actual expense, and build up additional working capital.

In addition to its capital, the association should be in a position to borrow large sums of money, say, up to $50,000,000, from time to time, as might be required. This borrowing should be in the form of short-time loans, which would be retired as the silver is sold. I do not believe that the association would want to accumulate at any one time more than, say, two to four months' output, or, say, 30,000,000 to 60,000,000 oz.

The association should obviously have the ablest financial advice and management. While it should be free from political control and activities, none the less it might be highly desirable to have upon its board, if possible, representatives of the United States Government and of the British Government to give moral, as well as political, support and to assure the world of the stability and ability of the association.

Many Problems, But Not Insuperable

Assuming the requisite support of the present Senate committee in favor of such an organization, and the accomplishment of such change in the law as presumed in this article, it seems quite possible that a silver export association can be worked out, having the friendly co-operation and moral support of the governments of the United States and of Great Britain, and of the important financial interests of each of those countries, particularly those associated in any way with the handling of silver. All this necessarily would involve an enormous task, but it is not beyond the range of feasibility.

I venture to present these views in the hope that the statistics given and the opinions expressed (many of which are obviously personal only) may be of some slight value in the general discussion of the subject. Doubtless many valuable suggestions and much needed information will be brought forth by the Senate Silver Committee and the subject greatly clarified by its investigations and hearings. I, for one, believe that some great, concrete good can come from the activities of that committee.

Corduroy Replaces Amalgamation at South African Plant

As a result of experiments which were carried out during last year at the Meyer and Charlton Gold Mining Company's mill, in South Africa, amalgamation was discontinued in the early part of 1923, the plates being replaced by corduroy. The change has been effected without any fall in extraction; in fact the figures in this direction show, so far, a slight improvement, according to the management. The chief benefits which follow the new method are, first, better health for the workmen, owing to the absence of mercury; second, the reduction of the chances of gold thefts in the mill to a minimum; and, last, a certain saving in cost.

Tests Prove "Ribboned" Slate To Be as Strong as Any

The term "ribboned" is applied to slate traversed by bands, usually about ½ to 2 in. wide, and darker in color than the main mass. Ribboned slate is used widely for structural purposes, but there is a hesitancy on the part of some prospective users to employ such material because the clearly defined borders of the ribbons suggest planes of weakness. A study of the origin and history of slate has led to the conclusion that no such weakness in the structure of the slate is to be expected.

The ribbons represent variations in the nature of the constituent materials during the successive stages of original deposition of the clay or silt from which the slate was formed. Thus the clay was consolidated into a shale having occasional thin beds darker in color than the main mass. The intense pressure resulting from mountain-building forces acting upon the flat-lying beds, folded them into complex forms, and heat and pressure acting in conjunction brought about certain profound changes in structure and composition. The constituent minerals were completely rearranged and recrystallized with development of the characteristic splitting property known as slaty cleavage. The new orientation of the minerals, with the resulting properties which they impress upon the rock, bear a definite relation to the direction of earth pressure, and are quite independent of the original bedding. Thus the bedding planes as marked out by the ribbons may be parallel with the slaty cleavance, or may cross it at any angle. Any original tendency to split along the bedding planes has been entirely obliterated through this complete realignment of particles, and thus no plane of weakness parallel with the ribbons should develop in industrial or utilitarian application of slate which shows that formation.

Though such reasoning is sound, and though its principles are well established, it is sometimes difficult to convince a user on a theoretical basis only. No matter how convincing a theory may be, the practical man prefers a practical demonstration. To meet this need, certain Pennsylvania slate producers submitted samples of ribboned slate to the Bureau of Standards for transverse strength tests. In the slate tested the ribbon was approximately at right angles to the slaty cleavage, and the slabs were so cut that the ribbons crossed them about at their centers. Strips ½ in. thick were placed on supports 9 in. apart, and pressure was exerted midway between the supports until fractures occurred. Upon examination it was found that the fractures crossed the strips in an irregular way, tending to follow the slaty cleavage which was parallel with their long axes, and breaking across in irregular steps. In no case was there any tendency for the fractures to follow the boundaries of the ribbons, nor was there any evidence of a tendency for them to run parallel with the ribbons in the slate.

Thus, conclusions regarding the strength of ribboned slate as deduced from the theory of its origin and history are entirely substantiated by practical experiment. The results of the tests should banish from the minds of slate users all doubt regarding the strength of such material, and should encourage an increasing use of ribboned slate in structural work and for such other industrial and general applications as it is particularly suitable.

An Improvement in Electrolytic Silver Refining

Newly Developed Cell for the Rapid Deposition of 999 Silver From Anodes Containing High Percentages of Base

By A. H. W. Cleave
Deputy Master, Royal Mint, Ottawa

DURING THE WORLD WAR the Ottawa Mint was suddenly called upon to refine large amounts of gold. Up to that time the amount refined yearly had averaged about 200,000 oz., which had been treated by the chlorination method. It was required to increase the production to 1,000,000 oz. per month—or 12,000,000 oz. per annum—probably the greatest amount ever produced by a single refinery. Moreover, the increased output was required to become effective in the shortest possible time. It would have been impossible to make the necessary changes and additions, quickly, if the electrolytic process had been in use, as war demands for munitions and supplies kept all the factories fully employed. Fortunately, the equipment of a refinery using the chlorine method is comparatively simple. The result was that, within eight weeks from the receipt of the urgent demand, all the necessary additions and changes had been made, and the refinery was actually producing 250,000 oz. of fine gold per week.

The chlorine method of refining gold has been described in an article published in the *Engineering and Mining Journal-Press* of Feb. 3, 1923, entitled "Refining Gold Bullion With Chlorine at the Ottawa Mint."

The production of fine gold at the increased rate continued steadily, month after month, and year after year, until the necessity for such increased production no longer existed. During that period, however, it was not found possible to deal with the large amounts of silver chloride which had been produced by the process. This was, therefore, stacked in large piles, to await a more favorable opportunity for treatment. The receipts of gold from the Porcupine district had increased so greatly (over 300 per cent in four years) that the silver plant was fully employed for this service, alone.

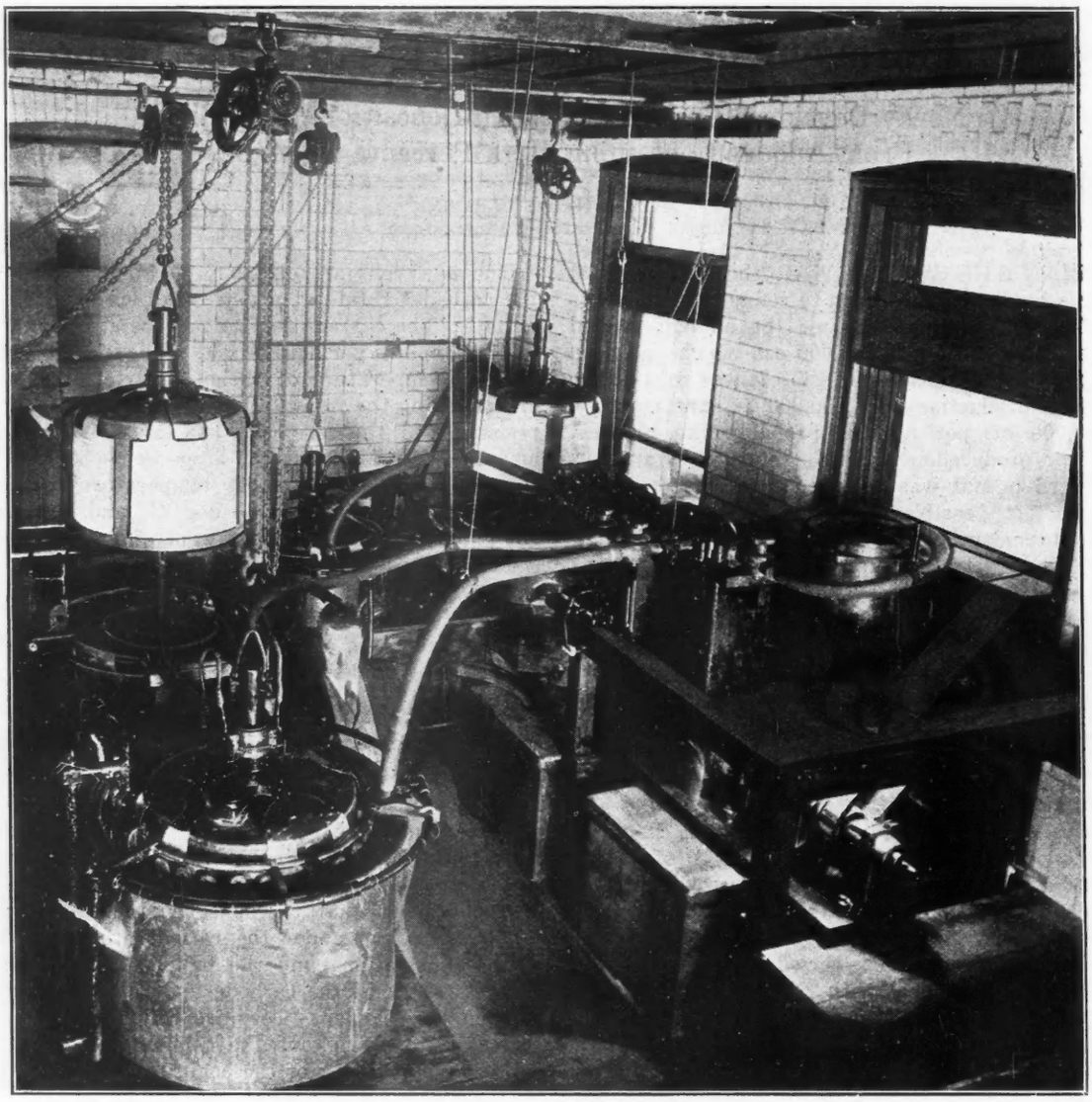
The silver in the chlorides, after being reduced to the metallic state, is cast into anodes, and refined in electrolytic cells. It was therefore necessary to increase the output from these cells, either by increasing their number, or by the introduction of a new type of cell which would deposit the silver from the anodes more quickly. There was not room in the refinery to accommodate more cells, with the necessary additional washing and filtering apparatus; nor was it possible to increase the current density in the cells. The anodes which had to be treated contained from 10 to 16 per cent of base, and it was found that, with such large percentages of base, any increase in the current density at once resulted in raising the temperature of the electrolyte to a dangerous height, and fouling it; in addition to which the resistance of the cell was greatly increased. To deal with the situation thus created, I designed some special cells, in which the silver is deposited on the cathode more rapidly, without producing the unsatisfactory conditions mentioned. When these cells were put into operation their behavior exceeded my expectations, and the results obtained were so satisfactory that a description of them may prove valuable and interesting.

The new cells are circular, 36 in. in diameter, and the cathodes rotate at a peripheral speed of 40 ft. per minute. The current density may be anything from 75 to 150 amperes per square foot without unduly increasing the temperature of the electrolyte, or fouling it; or increasing the resistance of the cell abnormally. The resistance of the cells does not exceed 1.2 volts at 75 amperes, or 2.5 volts at 150 amperes per square foot of cathode area. The highest temperature of the electrolyte at 75 amperes is 30 deg. C., and 40 deg. C. at 150 amperes, when running twenty-four hours per day.

The electrolyte is contained in the annular space between the outer and inner walls of the cells. This space is 8 in. wide and 18 in. deep. The rotation of the cathode keeps the electrolyte well mixed, and prevents, entirely, any tendency to stratification.

At the center of the cell is a hollow space in which is situated the support for the cathode carrier. This carrier is supported by, and revolves on, a large ball bearing. The driving shaft is driven from below by belt and worm gearing. The cathode carrier is not attached rigidly to the driving shaft. The carrier is fitted with a hollow spindle, near the top of which is a cotter pin which engages with a slot in the upper part of the driving shaft. The slot in the driving shaft can be seen just under the raised cathode at the left of the illustration; and the ball bearing which takes all the weight of the cathode and cathode carrier can be seen lower down. To raise the cathode it is only necessary to swing out the commutator brush arms, and engage the hook of the chain block and tackle with the shackle at the end of the hollow spindle of the cathode carrier. In this way the cathode can be raised completely from the cell in thirty seconds.

By means of the specially designed cathode, and multiple grouping of the anodes, the current becomes a pulsating one, which causes the deposited silver to adhere loosely to the cathode, so that it is easily removed. The cathodes are automatically stripped by means of a scraper, which can be adjusted so as to keep the distance between the anode and cathode faces constant. This also keeps constant the resistance of the cell. The silver stripped from the cathodes falls into removable trays which are emptied at intervals of about four hours. When once started, the cells require no attention other than the occasional removal of the fine silver from the collecting trays, and the renewal of the exhausted anodes. Any individual cell can be stopped without interfering with the others. The cathodes are permanent, and, with ordinary care, will last indefinitely. Those in use here have been in continuous operation for over eight months, and are as good now as when first made. The deposited silver is dense and crystalline, and is so loosely adherent to the cathode that it is removed by an india-rubber scraper. Though the anodes contain from 10 to 16 per cent of base, as previously stated, the deposited silver is invariably as high as 999 fine and at times reaches 999.9.



Four of the new cells installed at the Ottawa Mint

One great advantage derived from the use of the new cells is the great reduction in the amount of precious metals locked up in the process, and the reduction in the time they are locked up. This is an important matter and in a large plant would mean a considerable saving in interest charges alone. The amount so locked up has been reduced to less than one-half that retained previously; yet the amount of fine silver produced per cell per hour has been more than doubled.

Below are given some comparisons between the old Moebius cell and the new type of cell:

	Old Cell	New Cell
Amount of electrolyte in cell	71 Imperial gallons	52 Imperial gallons
Weight of cathodes in use	285 oz. (Renewable every three weeks)	311 oz. (Permanent; no renewals required)
Anodes in use	5,104 oz.	2,310 oz.
Current consumption	1.2 volts, 350 amperes	1.2 volts, 400 amperes
Current density per square foot of cathode	13 amperes	75 amperes
Efficiency	38 per cent	78 per cent
Labor required	Stripping cathodes, twice daily	No stripping required
Condition of electrolyte	Continually gaining in strength	Constant
Agitation of electrolyte	By mechanically driven stirrers (not thorough)	By rotation of cathode (thorough)
Output of silver per cell per hour	17.30 oz.	40.30 oz.

During the rush period the refinery was operated continuously for twenty-four hours per day; but, lately, the cells have been in operation for eight hours only, out of the twenty-four. When the day's work is completed, the electrolyte is run off into settling tanks, so that no chemical action takes place after the current is turned off. When starting up in the morning, the electrolyte is pumped back into the cells by a "Duriron" centrifugal pump, the cells being filled and ready for operation five minutes after the pump has been started.

The accompanying illustration shows the general layout of a group of four of the new cells. Two of the cathodes and cathode-carriers are shown raised from their cells. The settling tanks, pump, and other apparatus can be seen on the right.

Reading Under Difficulties

"I want to compliment you on your typography: it makes easy reading for a tired man," writes a friend in Mexico. "I read my *Journal* usually in bed, under a mosquito bar, legs of the bed setting in kerosene to keep off the scorpions, bedding sprayed with Fly-o-San to minimize the fleas, and a towel to wipe off the sweat."

THE PETROLEUM INDUSTRY

Petroleum Found in Appalachian Valley

Discovery Considered Remarkable if in Commercial Quantity—Possibility of Occurrence Hitherto Doubled

OIL has recently been found in a well 2 miles east southeast of Rose Hill, Lee County, Va., in the southwest corner of the state. Its occurrence there is of uncommon interest, because the place is in the Appalachian Valley, where the presence of oil in commercial quantities has been doubted by geologists, and because the oil oozes from the rocks of a formation that lies in an abnormal position—the Clinton formation, which is here entirely surrounded and apparently overlain by the Knox dolomite, a formation that normally lies 5,000 to 6,000 ft. below the Clinton. It remains to be seen whether the occurrence is of commercial or merely of scientific and local interest.

The attention of the U. S. Geological Survey was first directed to the matter by Representative John M. Robsion, of Kentucky, and the detailed information which had been sent to him by J. H. Walker, of Middlesboro, and which he forwarded to the Survey, made it evident that oil had been found under conditions so unusual as to justify at least a brief examination of the area. Accordingly late in May it was examined by Charles Butts, acting as a representative of the Federal and the Virginia State geological surveys. Mr. Butts states that the general geology of the region is similar to that of the Estillville area, on the east, and the Morristown area, on the south, which have been described in folios of the Geologic Atlas of the United States.

An oil seep is reported to have been known at this locality for the last fifteen years, and a well was recently drilled to a depth of 303 ft. The seep and well are on land belonging to Mr. Bayless, of Rose Hill. Here, according to Mr. Bayless, oil amounting to several gallons has sometimes been pumped out of an old dug well. The driller's log of the new well is as follows:

"Started through gray shale and went through this to a depth of 71 ft., when from 18 to 24 in. of green sand was found with a good showing of oil; then to depth of 185 ft. greenish-gray shale was found. A green sand of about 4 ft. followed, with good showing of oil. The well was left open for two days and one night, during which time oil rose and overflowed casing. After going through this sand I found red shale to depth of 220 ft., then found 9 ft. of dark oil-bearing sand. This sand was apparently full of oil but very hard, and oil did not flow from this sand; then found red shale for a distance of about 30 ft., then a very green shale to a depth of 285 ft., then went into a gray sand 18 ft., which was brittle, not hard like 9-ft. sand, and was full of oil. Every bailer dropped into hole to clean the well would come out one-half to two-thirds full of oil. After going through this sand salt water was found at depth of 303 ft. which rose in casing to a height of 200 ft."

Drillings reported to come from the 18-ft. sand at the bottom showed a coarse quartzose sandstone. Other drillings representing the stratum yielding the salt water either from the lower 2 ft. of the 18-ft. sand or immediately below it showed a very fine-grained quartzose sandstone. At the time of Mr. Butt's visit oil was seen as a scum on the salt water filling the well, and the platform surrounding the casing was smeared with oil for a distance of several feet from the hole.

A small sample of the oil sent by Mr. Walker to Representative Robsion was examined by E. T. Erickson, a chemist of the Geological Survey, who reported that the oil sample, about 115 c.c. in volume, appeared low in viscosity, opaque to transmitted light, dark green by reflected light, and emitted a kerosene-like odor. Specific gravity 0.815 at 23 deg. C. (equivalent to 41.8 deg. Bé.). A slight quantity of water was noted in the bottom of the sample container. The oil is very similar to some oils from Western Pennsylvania.

After the salt water was struck drilling was discontinued, the well soon filled to the top with water, and the flow of oil into the well practically stopped, so that at the time of the visit by Mr. Butts only a thin scum of oil could be seen on the water and no sample could be obtained.

It is reported that an experienced operator has been put in charge of the work and that the salt water will be cemented off, after which the well will be regularly tested to determine the real importance of the discovery. Meanwhile it is planned to drill a new well to a depth of 2,000 ft. a short distance from the other.

Mr. Butts states that if this well proves to be commercially valuable it will be remarkable as the first productive oil well ever drilled in the ancient and greatly disturbed rocks of the Appalachian Valley and it will be not less remarkable because of the structural relations of the oil-bearing formation.

The oil at Rose Hill comes from the Clinton formation, a small area of which crops out two miles southeast of Rose Hill. The rocks, so far as exposed, consist of soft green shale with thin layers of sandstone, red or chocolate-colored shale, and thin, fine-grained green sandstone. The formation may be easily identified by the abundant small blocky pieces of sandstone 2 in. or so thick scattered over the surface. They are derived from the thin sandstone layers. The thin sandstones carry fossils that are distinctly characteristic of the Clinton. The color of the soil also serves to distinguish the Clinton outcrop from that of other rocks. The Clinton soil is yellowish or gray, but the soil from the surrounding dolomite is bright red, and the boundary between the two kinds of soil is sharply marked in the cleared fields. The extent of the Clinton outcrop was not precisely determined in the short time given to the examination, but it appears to be about a square mile in area and of triangular outline. This outcrop of Clinton rocks in which the oil occurs lies in the bottom of a little valley surrounded on three sides by ridges that rise 300 ft. or more above the bottom of the valley.

USEFUL OPERATING IDEAS

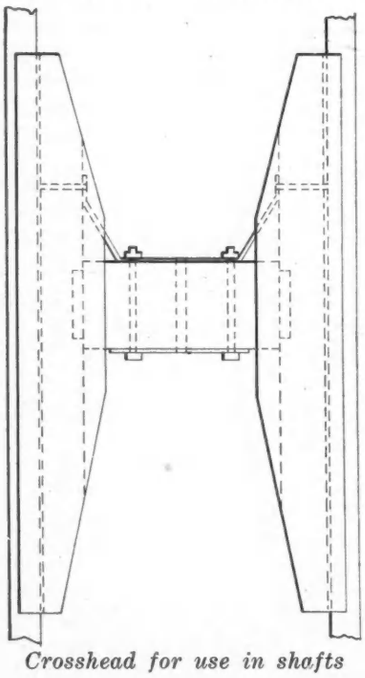
Crosshead for Shaft Sinking

BY ATHA A. RICHIE

The little book of "thou shalt and thou shalt nots," which is passed out to the operators of California by the Industrial Accident Commission, says that all vertical shafts more than 300 ft. deep from which hoisting is done must be provided with a crosshead and that such crosshead must have a height of at least two-thirds its width. But it is such short crossheads that hang up in the shafts and have caused so many serious and fatal accidents in shaft sinking.

A crosshead should be at least one and a half times as high as it is wide to be safe from hanging up in the shaft unless it is made fast to the cable. But a great many of the low headframes which are being used in conjunction with self-dumping apparatus will not permit of one of such height.

The crosshead in the accompanying cut is for a shaft 4 ft. in width and has a height of 6½ ft. and still allows the same amount of room for dumping as the ordinary one of 4 ft. 3 in. It is shaped like the capital letter H and allows the two sides or shoes to pass up beyond the sheave wheel and thus gives the additional room from the center piece to the top of the shoes when dumping.



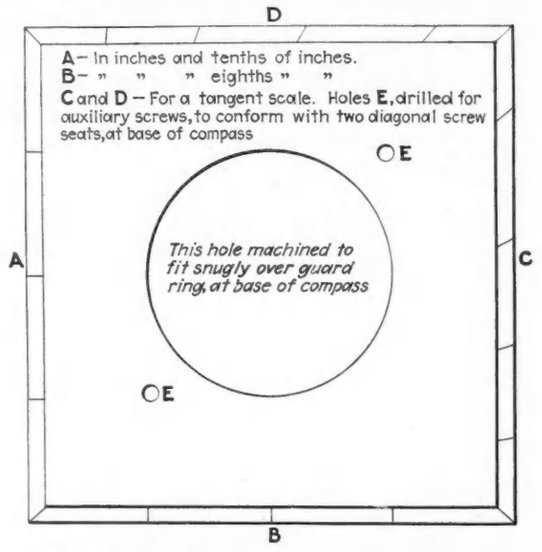
Crosshead for use in shafts

It is constructed by mortising a 4x12-in. timber, or two 4 x 6-in. timbers, into two 4 x 6-in. timbers in the shape of the letter H and then bolting a 2 x 12 on each side of the 4 x 6-in. pieces and cutting the corners of the 2 x 12-in. pieces in such a manner as to improve its appearance. A brace of ½-in. x 2-in. iron is placed on the top side of the center piece to give it stiffness and rigidity. The cable passing through the hole in it has no chance to cut the wood of the center piece. There should also be a piece of iron on the bottom of the center piece to save the wood from being cut by the cable and the clamp which carries the crosshead. The lower part of the shoes should be about 6 in. longer than the upper to make it hang properly in the shaft. There is little danger of this crosshead being left hanging in the shaft as the men ride between the lower halves of the shoes.

Accessory for Brunton Transit

BY G. T. EYMAN

A criticism commonly expressed by users of the Brunton type of pocket transit in taking observations for dip, of a strata or vein, is the uncertainty regarding the accuracy of results obtained when using the instrument at close range, due to sighting over the broken straight-edge produced by the open transit.



Sketch of alidade protractor base for use with Brunton type of pocket transit

The auxiliary base shown in sketch, which is identical in form to that used on the Gurley type of geologist's compass, and is adapted for attachment to the Brunton pocket transit, is suggested as a means of overcoming this difficulty. It consists of an aluminum plate 4 in. square and $\frac{1}{16}$ in. thick, with edges beveled and graduated. The combination may also be used as a short-sighted alidade or for platting observations in the field, particularly in underground work where a minimum number of instruments is desired.

Chart for Balata Belts

BY W. F. SCHAPHORST

The chart on page 24 will be found useful by buyers and users of balata belts in determining the horsepower that will be transmitted by any ply of belt 1 in. wide.

For example, how many horsepower will a balata belt of seven plies transmit when running 2,000 ft. per minute?

Connect the 7 (column *A*) with the 2,000 (column *C*) as shown by the dotted line, and the intersection with column *B* gives the answer immediately as a trifle over

7.2 horsepower. This is for each inch of width. Thus, a belt 10 in. wide would transmit 72 hp. when running 2,000 ft. per minute.

To show how the chart can be used "backwards" in solving problems that seem more complex, let us assume that you have an engine on which is a 4-ft. pulley, the face being 9 in. wide. The engine runs at a speed of 250 r.p.m. and develops 50 hp. How many plies should the balata belt contain?

First, to find the speed of the belt in feet per minute,

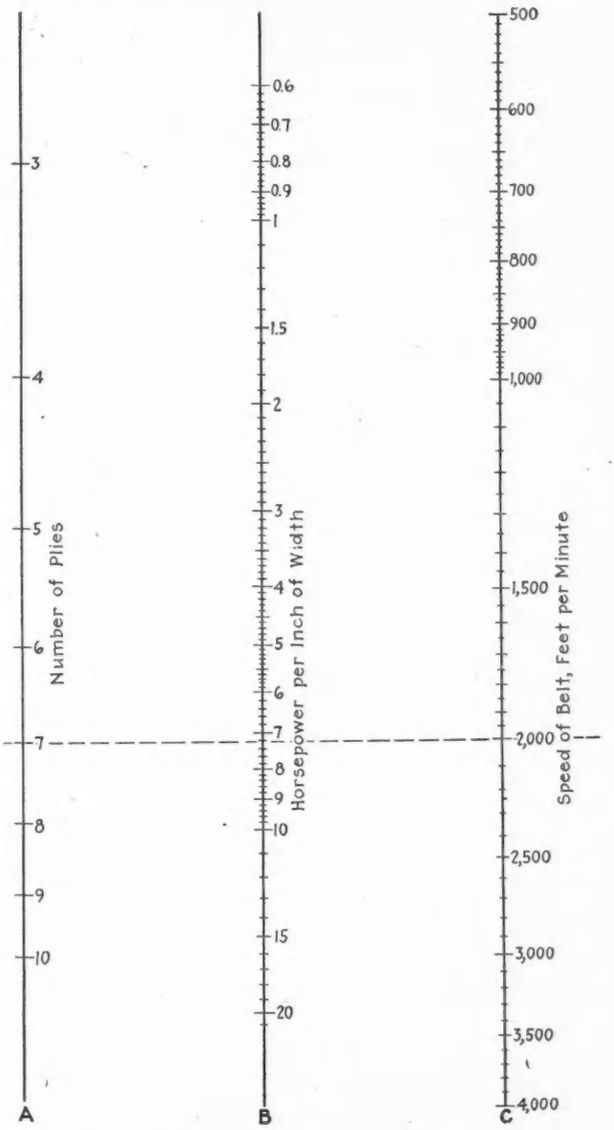


Chart for determining horsepower transmitted by balata belts

multiply the diameter in feet by 3.1416 and then by the r.p.m. We therefore get $4 \times 3.1416 \times 250 = 3{,}140$ ft. per minute.

Next, it is customary to use belts on pulleys that are narrower than the pulley faces. This pulley being 9 in. wide, we would use an 8-in. belt. Each inch of width will therefore have to transmit $(50 \div 8)$ or 6.25 hp.

Lastly, connect the 3,140 (column *C*) with the 6.25 (column *B*) and the straight-edge will intersect column *A* between the 4 and 5. Inasmuch as there is no such thing as a 4½-ply belt, a 5-ply belt must necessarily be used.

Friction Factors in the Metric System

BY WALTER S. WEEKS

An engineer working on ventilation problems in certain foreign countries will find it desirable to use the metric system, so it will be necessary for him to have at hand the friction factors for the metric form of the mine resistance formula.

The English system formula for mine resistance is

$$R = KSV^2$$

S is the rubbing surface in square feet.
V is the velocity in feet per minute.
R is the total resistance of the duct measured in pounds.
K is the friction factor, which varies with the density of the air and the condition of the duct.

If the metric system is used the formula becomes

$$R_1 = K_1 S_1 V_1^2$$

S_1 is measured in square meters.
V_1 is measured in meters per minute.
R_1 is measured in kilograms.
K_1 is a new factor to be determined.

If each formula is solved for the factor

$$K = \frac{R}{SV^2} \quad K_1 = \frac{R_1}{S_1 V_1^2}$$

The ratio of K_1 to K will be

$$\frac{K_1}{K} = \frac{R_1}{R} \times \frac{S}{S_1} \times \frac{V^2}{V_1^2} \quad \ldots \ldots \quad 1.$$

1 kg. = 2.205 lb.
1 m. = 3.28 ft.

Consider a rubbing surface whose area is S square feet. If this area were measured in metric units, its area would be S_1 square meters and the following relation would hold:

$$(3.28)^2 S_1 = S \text{ or } \frac{SS}{S_1} = 10.76$$

According to the same reasoning

$$2.205 R_1 = R \text{ or } \frac{R_1}{R} = \frac{1}{2.205}$$

$$(3.28)^2 V_1^2 = V^2 \text{ or } \frac{V^2}{V_1^2} = 10.76$$

Substituting in formula No. 1

$$\frac{K_1}{K} = \frac{10.76 \times 10.76}{2.205} = 52.51$$

Hence, to change an English factor into the corresponding metric factor, multiply the English factor by 52.21.

Consider the following example:

A drift has a cross-section 10x10 ft. and is 1,000 ft. long. The air has a velocity of 3,000 ft. per minute. The English system factor K is 0.00000000150. Let us determine R in lb. and R_1 in kg. and show that the resistances computed by the two systems are equivalent.

In the English system:

$R = KSV^2$
$R = 0.00000000150 \times 40{,}000 \times 9{,}000{,}000$
$R = 540$ lb.

In the metric system:

$R_1 = K_1 S_1 V_1^2$

$$S_1 = \frac{40{,}000}{10.76} = 3{,}717 \text{ sq.m.}$$

$$V_1 = \frac{3{,}000}{3.28} = 915 \text{ m. per min.}$$

$K_1 = 52.51 \times 0.00000000150 = 0.0000000788$
$R_1 = 0.0000000788 \times 3{,}717 \times 837{,}255$
$R_1 = 245$ kg.
245 kg. = 540 lb.

New Books

The Ore Magmas

A Series of Essays on Ore Deposition by Josiah Edward Spurr

The Ore Magmas. By Josiah Edward Spurr. Two volumes, 915 pages. McGraw-Hill Book Co., Inc. Price $8.

Within the limited space it is impossible to give more than a suggestion of the riches of these volumes, which contain "the gist of thirty years' study of ore deposits, mainly in the field . . . the most fundamental principles underlying the science." "I have written them," says the author, "from one motive alone: the setting forth of my experiences and opinions for such help as they may be to others."

In the first chapter the author introduces the new term "ore magma" for those differentiation products of igneous magmas that have given rise to many ore deposits. He concludes that many of these have been thick viscous or gelatinous solutions which have been intruded into fissures, like dikes of rock magma, forming a class of mineral veins for which the name "veindikes" is coined. Unsupported inclusions of rock point to solutions of high density, and the great thickness of many such veins indicates intrusion under great pressure. The ore-forming period is found to be a sharply defined stage in the cycle of differentiation.

"The secret of igneous intrusion" is thought to be largely the expansive force of included gases, which reach their maximum in the siliceous magmas. Not only domical uplifts, but much folding and faulting—even overthrown folds and overthrust faults—are ascribed to magma migrations on a local, regional, or continental scale. Each recurrent upsurging of magma from a deeper source brings a new supply into the zone of differentiation and begins a new cycle.

Scarcely more than chapter headings can be given for many of the most interesting discussions. "The Sequence of Ore Magmas" (V) describes the author's well-known temperature-pressure sequence of the metals, in vertical zones above a focus below or in concentric shells about a central focus. "The Near-Surface Telescoped Ore Deposits" (VI) refers mainly to the Tertiary volcanics, in which the metals of all the zones may be "telescoped" within a single set of shallow veins, due to rapid fall in temperature. "The Aplitic, Pegmatitic, and Superpegmatitic Rock and Ore Magmas" (VII) ascribes these types to the relatively dry, wet, and highly watery differentiation products, respectively. These have an increasing capacity, in the order named, for reacting with and replacing earlier rocks and veins.

"The Time Relation Between Rock Intrusion and Ore Intrusion" (VIII) shows that typically ores are deposited in fissures of slight displacement that form immediately after intrusion. "Epochs of Ore Deposition" (IX) shows that metallogenetic epochs are brief and widely separated. The older are generally shown in regions of deep erosion; a post-Cretaceous-Tertiary belt rims the Pacific Ocean. Arizona is cited as a wonderful example of metallographic province (X), in which ores carrying much copper have been formed in at least four epochs, ranging from pre-Cambrian to late Tertiary. These point to local enrichment of each magma wave. Surface waters (XI) are unimportant below the depth of atmospheric effects. Hot springs and fumaroles do not represent ore-depositing solutions.

Differential vapor tension is suggested as the cause of the differentiation of magmas and the association of certain ores with basic or siliceous rocks (XII). The ore magmas from siliceous, intermediate, and basic sources have the sequence copper (silver), zinc, lead (silver), in common (XIII). Gold, silver, and nickel occur at a definite principal zone and also recur, generally with arsenic, antimony, tellurium, or selenium. These mobile metals are carriers of the others and are probably more important than fluorine, boron, or water. Ore magmas of basic origin are calcic and poor in water and gases; those from siliceous sources are siliceous and rich in water and gases. Residual solutions from the former give lime silicates in the intrusive, but not in the limestone (XIV); the latter type forms lime silicates at the expense of the limestone.

Variations from the normal conditions for ore deposition may be due to reactions with the rocks, or with carbonaceous matter, or to mingling of unlike types of solutions (XV); sometimes there seems to be differentiation within the ore magma. "The Origin of Fissure Veins" (XVI) points out the dependence of all veins—both intrusive veindikes and those due to replacement and impregnation of thinner and more watery solutions—upon pre-existing fissures, many of which arise from adjustments of the igneous rock after intrusion. A vertically exerted force is thought to be generally the primary cause of fissuring, as indicated by the common dips of 60 deg. to 70 deg.

"The Influence on Veins of Rock Texture and Rock Structure" (XVII) points out how the form, trend, strength, and openness of fissures are modified by the character of the country rocks. "The Succession of the Earthy-Mineral Veins" (XVIII) is an instructive discussion of the barren-gangue minerals that follow the deposition of the sulphides. "The Sand or Breccia Dike" (XIX) and "The Origin of Certain Ore Chimneys" (XX) are illuminating discussions of puzzling phenomena, the latter of which has the added interest of great commercial importance.

To the conservative-minded this book, which plays ducks and drakes with many cherished traditions, will prove a severe shock. Many others—and the reviewer would like to believe that these constitute the great majority of mining engineers and geologists—will find it a wholesome stimulant, even though they may not follow the author in all of his conclusions. The field is full of fascinating problems—most of them confessedly more or less obscure. Here is a record rich in facts culled from the broad experience of an active man with a keen mind; and his interpretation of conditions as he has found them must command the respectful consideration of every mining geologist—and of every geologist, for that matter.

The book is neither dogmatic nor controversial in tone, but maintains throughout the open-minded scientific attitude with remarkable success. For example, in discussing the origin of fissure veins (p. 90), we are told that "it will be better not to assume that all veins are formed alike, and to proceed with our examination of the evidence decorously . . . I shall go over many instances before inviting you to final general deductions."

Deduction is the curse of much geological writing, and it is refreshing to find here the inductive method followed consistently. If at any point we do not agree with the author's interpretations it must be largely because of difference of opinion as to the sufficiency of the evidence. This contingency the author himself clearly recognizes, and without exception his conclusions are presented modestly and tentatively, with no suggestion of finality. A clear straightforward style is wonderfully enriched with 175 maps, cross-sections, drawings, and halftones; and the book has great permanent value simply as a record of facts.

The author is to be congratulated upon the highly successful summaries of the twenty chapters, which occupy the first 57 pages. Most authors of scientific books lack the time (or the energy?) to put their thoughts into such convenient form for the reader. The volumes are attractively printed and bound, and of the few typographical errors observed none is seriously misleading. J. VOLNEY LEWIS.

Technical Papers

Mineral Resources—Recently issued chapters of the Mineral Resources series issued by the U. S. Geological Survey, Washington, D. C., obtainable on request, are "Natural Gas in 1919-1921," 34 pages; and "Petroleum in 1919-1921," 80 pages.

Waste Rock at Lime Plants—U. S. Bureau of Mines Reports of Investigations, Serial No. 2,463, pp. 5, discusses waste-rock utilization at lime-plant quarries. It is obtainable on request from the Bureau, Washington, D. C.

SOCIETIES, ADDRESSES, AND REPORTS

Report of Coal Commission Delayed

Release for Publication Expected Next Week—Postponement of Action Held Serious in Some Quarters

SO AS to make possible a stronger and a more comprehensive report, the President's Coal Commission, of which John Hays Hammond is chairman, has sacrificed compliance with the literal date set for its special anthracite findings and probably will release it for publication on July 9 instead of July 2, as had been planned. The report is expected to be in final form on July 4, but to insure a maximum amount of publicity, it must be delivered in advance to the press so that copies may be mailed to publications for use on July 9.

Though one of the causes of delay is the late receipt from certain companies of essential data, Chairman Hammond and Commissioner Smith made it very clear in their statement to the press, that the delay is in no way chargeable to dilatoriness on the part of those making returns. The task in some instances was greater than could be accomplished within the time limit. Some delay is chargeable to compilation, and the commissioners themselves must have some time to digest and interpret the recapitulation which has been made.

In some quarters the delay in the issuance of the report is regarded as serious. This is based on the fact that it cuts down the time during which it could be considered by those engaged in the anthracite wage negotiations. Had the report been available promptly on July 1, it would have strengthened the position of the conservative leaders at Scranton, some contend. There is a general feeling of regret that it did not come through on schedule time. The plain terms of the law are that the report should be made on or before July 1. The fact that this was not done is certain to result in criticism. This is particularly the case since those engaged in the anthracite negotiations were keyed up to expect the report on July 1.

The commission undoubtedly owes its existence to the anthracite situation. Had that not become acute at the time the legislation was under consideration, the bill probably would not have passed. This is given as an additional reason why nothing should have been allowed to prevent the report coming out so as to give the maximum amount of time for its consideration at this particular stage of the wage negotiations.

The position of the commission apparently is that it is better to sacrifice a few days and have a much better report —one which will be of more service during the wage negotiations than would have been the case had it been issued with the material at hand on July 1. To issue the report on July 1 would have meant its completion on June 28 or 29 so as to provide the time necessary for publication release. As it is, the commission is keeping in particularly close touch with the situation in the anthracite region, where Judge Daniel M. Link, of Indiana, is acting as observer for the commission.

The extent to which the Attorney General may have been guided in dismissing the Indianapolis indictments by the recommendations of the Coal Commission is not known, but it is certain that the commission is much of the opinion that nothing constructive could have been secured from pressing that action and that its discontinuance would be in the public interest.

Ever since those indictments were brought, it has been a generally held opinion that they were ill-conceived. Had they been pushed it would have thrown the industry into complete chaos. Judge Anderson is perhaps the only federal judge who would have taken them seriously. It has become increasingly clear, many contend, that large blocks of tonnage must be represented in any agreement, when the coal from six states competes in a single city. It called for an interstate agreement, but along came the Attorney General of the United States professing to see restraint of trade in the well-established and long-practiced processes of collective bargaining.

The dismissal of the suit not only indicates that there is to be more sanity on the part of the Federal Government in the handling of coal problems, but it emphasizes the conspicuous failures which have followed the efforts to deal legalistically with coal problems in the past.

The President's speech at Cheyenne and the assigned car decision are other signs that federal authorities are becoming educated in coal. The experience here during the last strike and the results in the Ruhr demonstrate beyond peradventure that coal cannot be mined with troops. The problems which confront the industry are myriad, but the Coal Commission is fully expected to urge a code of conduct which will take these disputes out of the realm of hostility into one of sane and practical negotiation.

Lake Superior Mining Institute Planning for Annual Meeting

Arrangements are well under way for the twenty-third annual meeting of the Lake Superior Mining Institute to be held in Duluth and on the Minnesota iron ranges, Aug. 29, 30 and 31. Headquarters will be at the Spaulding Hotel, Duluth. Transportation may also be obtained there for the excursion trips to the steel plant, Duluth, and the towns on the Mesabi and Cuyuna ranges which are to be visited. A. J. Perrin, secretary of the Lake Superior Industrial Bureau, will act as the local secretary, with headquarters in Duluth.

Idaho Students Win Prizes Offered by A.I.M.E.

The annual contest between the graduating students of the University of Idaho and Washington State College has been awarded to Idaho. The Columbia Section of the American Institute of Mining & Metallurgical Engineers offers prizes each year to the students of the two institutions writing the best thesis on any subject related to mining, metallurgy or economic geology. The first three prizes of $25, $15 and $10, respectively, were won by Idaho students this year, the subjects being "Air Compression at the Hecla Mine," by Lynn Hersey; "Geology of the Boise Basin District," by Stanley S. Siegfus; and "Geology of the Silver Hill Tin Mine," by Arthur A. McLeod.

The next five contestants on the list received each a book on a technical subject. These additional prizes were awarded because, as this was the first contest and there was more or less confusion at the time, the committee felt that the spirit of the awards would thus be more fully carried out. Of these extra prizes three went to the University of Idaho.

Golden Alumni Organize in Los Angeles

Colorado School of Mines graduates, numbering about forty-five, met some time ago in Los Angeles, Calif., and organized the Alumni Association of the Southwest. At this meeting the following officers were elected for the ensuing year: Colonel Louis R. Ball, consulting engineer, Pasadena, president; Ward Blackburn, Ingersoll-Rand branch manager, Los Angeles, vice-president; Harry M. Fiske, Ingersoll-Rand, Los Angeles, secretary-treasurer. The office of the secretary of the association is 834 Higgins Building, Los Angeles.

MEN YOU SHOULD KNOW ABOUT

James S. Douglas was recently in San Francisco.

Huntington Adams has returned to New York from Bolivia.

S. J. Speak is on his way back to England from South Africa.

E. A. Hersam has returned to Boston after a visit to milling plants in Ontario and Michigan.

E. R. Bennett, of the Rochester Silver Corporation, was recently in San Francisco.

E. G. Germer, of Erie, Pa., one of the owners of the Colonial mine at Cobalt, Ont., has been visiting the property.

Jay A. Carpenter, engineer for the Randsburg Silver Mining Co. of Johannesburg, Calif., is in San Francisco.

Jose Jackowski has been placed in charge of the mines of the Cia. de Minas de Colquiri, at Oruro, Bolivia.

Bruno V. Nordberg has received the honorary degree of Doctor of Engineering from the University of Michigan.

John Knudson has resigned as superintendent of Brea Refinery, Union Oil Co. of California. **C. F. Jennings** succeeds him.

J. B. Hafner has been made general superintendent of the Anyox plant of the Granby Consolidated company, in British Columbia.

Allan M. Bateman, of New Haven, Conn., has examined the Duthie Mines, near Smithers, B. C., in the interest of the owner, J. F. Duthie.

Newton W. Emmens has been retained by British Petroleums Limited, of Canada, as petroleum engineer with headquarters in Vancouver.

D. J. Williams, representing New York interests, has made an examination of the Reco-Aspen group of claims on Hudson Bay Mountain, B. C.

Oliver E. Jager has resigned as smelter superintendent of the British America Nickel Corporation, Nickelton, Ont., and is now in New York.

Prof. W. J. Miller, of the New York Geological Survey, is conducting an aerial survey of the crystalline rocks of the Adirondacks, in the Thirteenth Lake region.

William Sloan, Minister of Mines for British Columbia, is making a personal inspection of the underground workings of the principal coal mines in the province.

Horace F. Lunt, having completed his term as Commissioner of Mines, Colorado, has opened an office as consulting mining engineer in Room 617, Majestic Building, Denver.

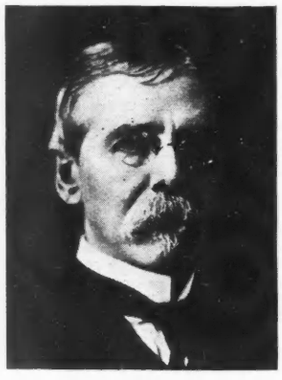
Dr. Alexander H. Phillips, professor of mineralogy at the mining engineering school of Princeton University, is visiting mining districts of Arizona, having made a special study of Bisbee mines and the Inspiration mine.

H. C. George, petroleum engineer, and **Ludwig Schmidt,** assistant petroleum engineer, of the Bureau of Mines, spent the last week of June at the Tonkawa oil field of Oklahoma.

John C. Greenway, general manager of the Calumet & Arizona Mining Co., has returned to Arizona after spending more than a month in the East and South.

J. T. Crabbs, president of the Granby Consolidated Mining, Smelting & Power Co., has been inspecting the company's newly acquired properties at Copper Mountain and Allenby, B. C.

Eugene A. Smith, State Geologist of Alabama, has now in preparation revised editions of several important maps, entirely out of print or very scarce, including a geological map of Alabama, a map of the Warrior coal basin and also a revision of Squire's map of the Cahaba coal field. The Alabama Survey has arranged for the co-operation of the U. S. Geological Survey in this work.



Eugene A. Smith
State Geologist of Alabama

W. A. Caldecott, well-known metallurgist, has been appointed technical and administrative head of the Industries Division of the Department of Mines and Industries in South Africa.

Dorsey Lyon, acting director of the U. S. Bureau of Mines, was a recent visitor at New Brunswick, N. J., where he made final arrangements with the officials of Rutgers College for the opening of the Bureau's experiment station at Rutgers on July 2.

A. E. Bendelari, vice-president of the Eagle-Picher Lead Co. and manager of its mines in the Tri-State field and its smelter at Henryetta, Okla., has returned to Joplin from a 36,000 mile trip around the world. He left Joplin, on Jan. 22, last, and returned on June 25.

F. J. Bailey, the assistant to the director of the Bureau of Mines, with which he has been connected for more than ten years, has resigned to accept the chairmanship of the personnel classification board and to be an assistant to the Director of the Budget.

Julian B. Beatty has been elected vice-president and secretary of the Nichols Copper Co., having resigned as secretary and treasurer of the American Metal Co. **Julius Loeb,** one of the vice-presidents of the American Metal Co.. has assumed the duties of treasurer and vice-president. **H. K. Hochschild** will succeed Mr. Beatty as secretary.

Dr. Victor Dolmage, head of the British Columbia branch of the Geological Survey of Canada, has left Vancouver to make a geological survey of Copper Mountain. **George F. Barnwell,** professor of mineralogy in the Missouri School of Mines; **William Smitheringale,** of the University of British Columbia; and **J. Buckle,** of McGill University, will accompany him.

Dr. Morris M. Leighton resigned from his position as a member of the faculty of the University of Illinois on June 4, to succeed Dr. F. W. DeWolf as chief of the Illinois Geological Survey. During his four years of residence at the University of Illinois he devoted his summers to investigations for the Illinois Geological Survey, having been in charge of Pleistocene studies.

Dr. George Hanson, of the Canadian Geological Survey, will spend the summer season in the field at Kitsumkalum Valley and the northern British Columbia region from the town of Terrace to Alice Arm. He will map the Coast Range batholiths in the area, investigate the coal and mineral resources generally, and will give special attention to the reported arsenic deposits of the Hazelton district.

OBITUARY

W. A. Prichard died of heart failure in Colombia on June 5.

Major-General R. G. Edwards Leckie died at St. Paul's Hospital, Vancouver, B. C., on June 22, after a serious operation. He was born in Nova Scotia in 1869, and was the eldest son of the late Major R. G. Leckie, who was once president of the American Institute of Mining Engineers. Bert Leckie followed his father's profession, and was connected with mining enterprises in Nova Scotia, Ontario, British Columbia, and the State of Washington.

During the war he served his country with marked distinction, received several decorations, and rose to the rank of major-general. He was mining engineer on the commission appointed by the Provincial Government to investigate the cost of coal production in British Columbia, and for the last year has been manager for the Windpass Mining Co., which is developing a gold mine at Chu Chua, near Kamloops, B. C.

THE MINING NEWS

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

Leading Events

A SUSPENSION of production for two weeks has been agreed upon by 90 per cent of the operators in the Joplin-Miami zinc-lead district centering at Picher, Okla. After July 15 the rate of production will be determined by a committee of producers.

The new McCracken mill, in the Oatman district, in Arizona, is making a 48 per cent lead concentrate.

Senator Oddie, chairman of the gold-silver commission, declares that there is no thought of advocating bimetalism in the inquiry regarding silver.

Diesel engines are proposed as a desirable alternative for uncertain hydro-electric power in northern Ontario mining camps.

The directors of the North Butte Mining Co. have decided to suspend production at Butte. The end of the Pittman silver purchases is one cause.

Many likely prospects are being worked in the Hyder mining district, in Alaska.

"Last" round finds new ore in the Success mine, in the Coeur d'Alene.

The state mine inspector in Arizona plans to enforce to the letter the law providing for the use of wet drills only in mines of the state.

Operations have been discontinued at a number of silver prospects in the Randsburg district, in southern California.

"Wet" Stopers Must Be Used in Arizona, Says Inspector

Many Mexican Miners Fear Water and Rheumatism More than Dust and Tuberculosis

Tom C. Foster, state mine inspector of Arizona, says that the law against dry drilling is to be rigidly enforced by his department and that he is determined to enforce the use of wet machines in every mine in the state. This law, which was enacted by the state Legislature several years ago, has never been enforced in a definite way, and although previous mine inspectors have recommended its observance, none have attempted to enforce it completely.

Mining officials are appreciative of the value of the wet machines, and most mines use that type altogether, yet it has been a problem to make the men use water when drilling, as many prefer to take chance with the dust rather than to withstand the discomfort of wet clothes and a "sloppy" working place. This condition is especially true of Mexican miners, and their increasing numbers among the mines of the Southwest make it even harder to enforce such a ruling. One large operator provides canvas aprons or slickers at cost to its men and encourages their use, so that drillers may keep dry and avoid the danger of colds and rheumatism which many miners feel is the main objection to the use of the water stopers. After a recent inspection of the mines of several districts, Mr. Foster stated that he found many miners drilling dry and that he had recommended to the officials that steps be taken to compel the men to use the safeguard against the dangers of rock dust with the same stringency that any of their orders are enforced. This co-operation has been promised, and it is expected that a complete discontinuance of the use of dry machines, or wet machines without water, is to be effected.

Operations in Joplin-Miami District Suspended for Two Weeks

Declining Price for Concentrate Forces Move—Miners Are Able to Get Work in Harvest Fields

On July 1 an agreement involving 90 per cent of the mining operators in the Joplin-Miami zinc-lead district became effective, whereby operations were entirely suspended for two weeks. At the end of this period a committee of ten producers headed by J. F. Robinson, president of the Commerce Mining & Royalty Co. will decide whether or not to resume, and if so, on what scale resumption shall take place. It is probable that night shifts and Saturday work will be eliminated. This action results from the continued decrease in the price of concentrate, which is regulated by the current quotations for zinc. During the last month about twenty of the smaller mines have been shut down as a consequence of the same conditions. It is believed that by concerted action of this kind the market can be improved and all operators can profitably resume work. Many of the miners have already gone to work in the harvest fields, and it is felt that no serious hardship will be imposed upon the employees, by a shutdown at this time.

"The Last Round" Wins for Success Mine, in Idaho

Another Discovery Opens 3 Ft. of Fine Ore on the 860 Level—Seventy-Five Men Employed

About a year and a half ago a new orebody was discovered in the Success mine, near Wallace, Idaho, and its subsequent development on two levels gives evidence that the old mine, after a suspension of four years, has entered upon a new lease of productive life. This new orebody is wholly independent of the old and in ground which had been tabooed by former managements as being outside of the mineral-bearing zone.

Another surprise has now been sprung at the Success. While developing the new oreshoot on the 860 level, a small stringer of quartz with a little lead was discovered in an old drift leading to the former workings. This was followed about 75 ft. without material change, and the one-more-round-before-abandoning-it stage was reached. This "final" round broke into 3 ft. of practically solid lead-silver, which is steadily increasing in width as the drift advances. Its position corresponds to a similar shoot on the 1,400 level, and apparently adds another important resource to this eccentric old mine.

The company is employing 75 men and shipping about 500 tons of lead-silver concentrate a month. The ore also carries much zinc and the company has a large accumulation of zinc concentrate, which is at present being held for a more favorable metal market.

Hyder District, in Alaska, Scene of Much Digging

Many Prospects Have Excellent Gold Showings—Summer Will Be Devoted to Development

BY H. P. CROWTHER

THE accompanying map shows the location of the principal groups of claims in the Hyder Mining District in Alaska and a number in the Portland Canal Mining District in British Columbia. The principal mine is, of course, that of the Premier Gold Mining Co. just over the line in British Columbia. However, prospecting and development have opened excellent showings in a number of the properties between Hyder and the Premier. The present summer will see active work on a great many claims. The following notes (with references by number to the map) will serve to give an idea of the present status of the various groups of claims. The last six it will be noted are situated in British Columbia.

1. Hemlock group. Nine claims. Little development, but several interesting showings. Owned by Scovill et al.

2. Virginia group. Six claims. Prospect tunnel in 200 ft. Good values across face of 8 ft. Owned by Virginia Syndicate of Spokane under option from locators. Andrew Larson of Spokane, is one of the syndicate and is consulting engineer.

3. Stoner group. Twenty-two claims. Under option to Wilson & Trites directors of the Premier Gold Mining Co. Several very good showings. Development work to be pushed during the summer. This prospect has the earmarks of being a producer in the future.

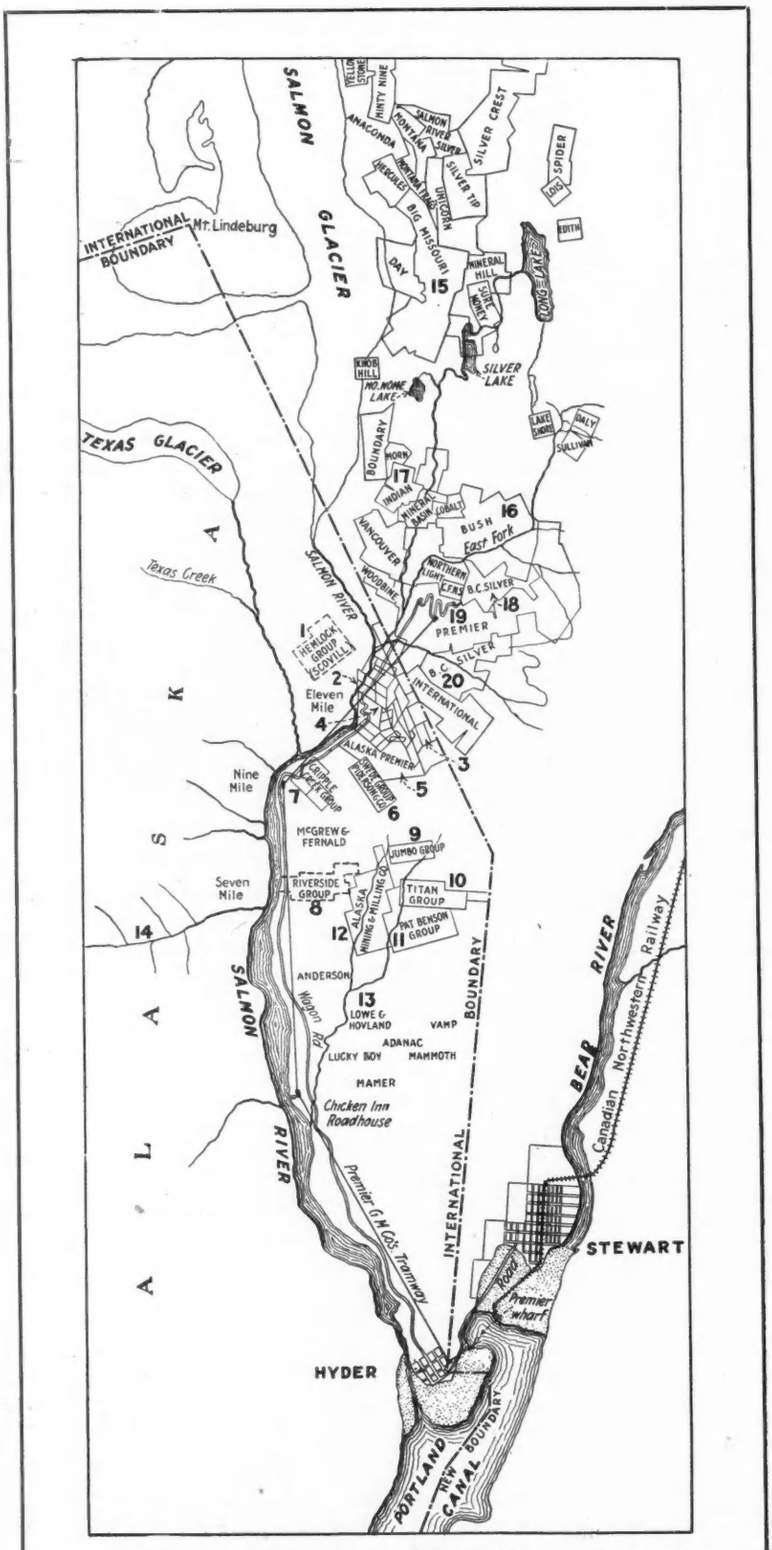
4. Eleven Mile Group. Twelve claims. Formerly known as "Daly Alaska" group, also as "New Alaska" group. Several veins have been crosscut in this group, and the showings are encouraging both in tonnage and value. The property has recently been bonded to English people, but is involved in litigation between former optionees and optionors. Development is, however, being continued.

5. Alaska-Premier group. About 15 claims. Some good showings, but little development work done. Owned by Alaska-Premier Gold Mining Co., consisting chiefly of local capitalists.

6. Swede group. Six claims. No real development work done, the group being merely a prospect with possibilities. Owned by Pederson and partner. Stated to be under option to the Virginia Syndicate.

7. Cripple Creek group. Six claims. High-grade samples have been obtained at several places. No real development work done. Owned by local capitalists including Judge Wickersham.

8. Riverside group. Ten claims. Owned by Lindeborg Bros. & Hall of Hyder; under option to Strong, Barber & Black of Ketchikan. Compressor installed, 600 ft. of tunnel work done to crosscut the vein. It is stated that the values encountered in depth (300 ft.) are better than those on the surface, and that the optionees are contemplating a development this summer under the management of Littlepage, former chief engineer at Alaska Juneau Gold Mining Co. Twelve men are now employed.



Map of the Hyder Mining District in Alaska and part of the Portland Canal District in British Columbia (after H. P. Crowther)

9. Jumbo group. Four claims. Prospect only. Owned by Blanton and other local men. Stated to be under option to Virginia Syndicate.

10. Titan group. Owned by Titan Syndicate by purchase from Fitzgerald Bros. and other local capitalists. Considerable development work done, with very good results; it is stated that optionees are to install compressor as soon as season permits. Small shipments of ore have been made, showing excellent values.

11. Pat Benson group. Twenty-one claims. Some work done. No definite information available as to footage or values. Locally regarded as a prospect with possibilities.

12. Tonkin group. Seventeen claims. Owned by American Mining & Milling Co. Considerable work has been done on this group under Manager Tonkin, formerly of Butte, Mont. It is stated to be under option to Jackling interests, but no definite information is available. Good values are found in numerous places, but it is understood that the tonnage blocked out is small. Also stated that considerable work is to be done this summer.

13. Lowe & Hovland group. Two claims. Prospect only.

14. Thumb Creek hydro-electric project: owned by Wickersham and partners.

15. Big Missouri group.

16. Bush Mines group.

17. Indian group.

18. B. C. Silver groups.

19. Premier Gold Mining Co.

20. B. C. Silver groups.

Distribution of Mexican Ore Deposits Reviewed in Bulletin

According to a statement recently published by the *Mining Bulletin* of Mexico regarding metals produced in the republic, gold is found principally in the states of Sonora, Sinaloa, Chihuahua, Michoacan, Mexico, Oaxaca, and Chispas. The richest silver mines are those of Guanajuato, Pachuca, Zacatecas, and Durango, and in the districts of Catorce, El Oro and Tlalpujahua.

Mercury has been mined extensively in various parts of the states of Morelos, Mexico, Jalisco, Guanajuato, Hidalgo, Queretaro, Chihuahua, Guerrero, Zacatecas and Oaxaca.

Lead occurs in a large majority of the mines throughout the republic but the richest deposits are found in the Lomo de Toro in the state of Hidalgo.

The largest iron deposit is the Cerro del Mercado, adjoining the City of Durango. This mountain, almost a solid mass of iron ore, is over 5,000 ft. long by about 2,500 ft. wide and 800 ft. high.

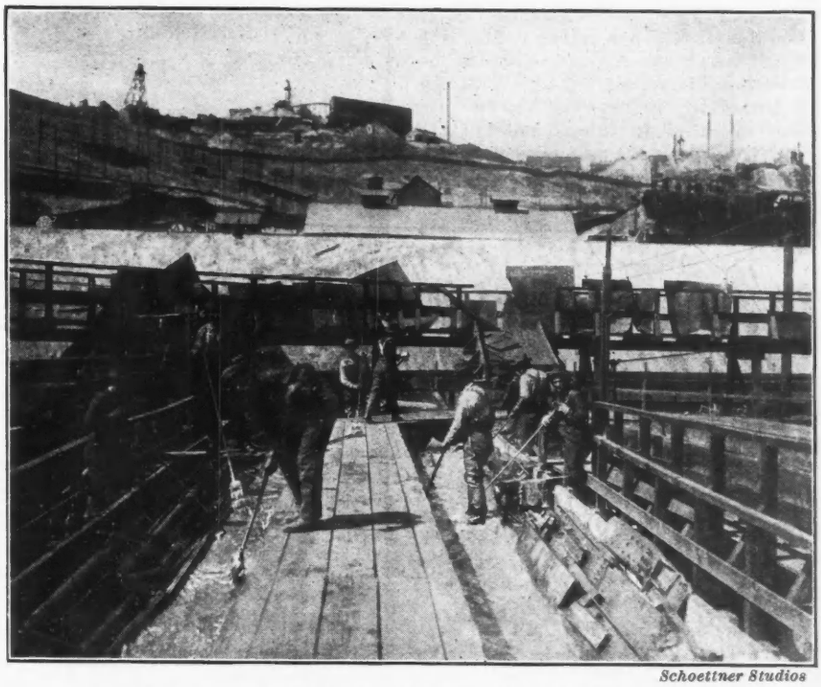
Copper occurs in some districts of nearly all the mining states but the richest copper mines are the Boleo properties in Lower California.

Tin mines are operated in Guanajuato, Jalisco, Sonora, San Luis Potosi and Aguascalientes.

North Butte Mining Co. Suspends Operations in Montana

Drop in Copper Market, Completion of Pittman Act Purchases, High Cost of Mining, and Narrower Veins Are Causes

AT A MEETING of the directors of the North Butte Mining Co. held in New York on June 30 it was decided to suspend operations at Butte for the time being. Due to the expiration of the Pittman Act, income from silver has been reduced to an amount corresponding to 1½c. per lb. of copper produced. Further, the 2c. drop in the price of copper means a total reduction in value since the last of April, of over 3½c. per lb. of copper produced. The company has been producing about 1,000,000 lb. of copper monthly since January, 1923. It operates the Speculator and Granite Mountain mines, which adjoin properties of the Anaconda Copper Mining Co.



Schoettner Studios

Anaconda company's copper-precipitation plant, Leonard mine, Butte

The directors statement to the stockholders says: "In practically all copper mining districts there is a scarcity of efficient labor, even though the wage scales almost equal the high war-time peaks, and prices of supplies are also correspondingly high. Under these adverse circumstances, only the most favorably situated mines are able to earn a satisfactory profit, and the profits of even such producers cannot be considered adequate when it is considered that in operating their mines they are depleting their capital resources.

"North Butte does not now, of course, possess the very wide and rich orebodies which earned the large profits made in former years. The extension of operations to deeper levels has shown in some of the veins at least, a continuation of ore of good grade—in fact of better average grade than the ground immediately overlying. The orebodies have, however, become smaller, and this, together with increased heat and other conditions incident to deep mining, has brought about an increase in costs.

"The mine is not exhausted, but the available tonnage or ore is limited on the one hand to the price of copper and on the other hand to the wage and price factors which determine costs. With an 18c. copper market, we could continue to operate on the present ore reserves for some time, but on a 15c. market, operations show a loss. The directors therefore consider that it is to the best interests of the company to conserve its resources and to restrict operations at Butte in the future to periods when the price of copper will be high enough to assure a profit.

"The encouraging results of development work on the 3,200 level where the Edith May orebodies were larger and richer than they had been on either of the two levels above, had encouraged us at that time to believe that the mine was entering into another rich horizon. The orebodies extended down with considerable strength to the 3,400 and 3,600 levels, but the showing was not as good as on the 3,200 level."

The last estimate of ore reserves as of March 31, 1923, showed 232,763 tons of copper ore, averaging 4.1 per cent copper and 3.2 oz. silver. Of this 72,762 tons on the three lower levels averaged 4.6 per cent copper and 3 oz. silver.

Diesel Engines Compete with Hydro-Electric Power in Ontario

Latter Preferable If Adequate Supply Is Assured—Installations Pending at Several Plants

Unless definite guarantees of an adequate supply of electric energy can be secured from the power companies, Diesel engines are likely to be installed at many mines in northern Ontario for providing a permanent power supply. Agents for several Diesel engine companies are in the field submitting figures to show that they can successfully compete as to cost with the power companies.

Electric power now costs $50 per hp. and cost figures on Diesel operation submitted by four companies range from $39 to $49 per annum. The Hollinger has under consideration the installation of approximately 1,000 hp. by Diesel oil engines; the Vipond may place an order for about 500 hp. and other companies are considering smaller installations. The Hollinger company is now generating 850 hp. at its steam plant in order to treat 4,500 tons per day.

Ore on 400 Level of Galena Mine in Coeur d'Alene

The Callahan Zinc-Lead Co. is carrying out plans for the development and equipment of the Galena mine which it is expected will place it on a productive basis. The shaft, now down 400 ft., is being extended 400 ft. deeper. On the 400 level a good body of lead-silver ore has been developed, and this is also true of the 200. In No. 6 tunnel, the portal of which is only a few feet above the collar of the shaft, two important oreshoots have been developed, and altogether the mine has quite a large proved tonnage available. An electric hoist has been ordered to meet the requirements of deep development. A new boarding house is being constructed that will accommodate between 50 and 60 men. The company is understood to have under consideration the construction of a mill, but it is probable that for immediate use a mill will be leased. The development of the Galena by the Callahan company is a matter of unusual interest, as the property is situated in a section of the Coeur d' Alene district that has long been under the ban of expert geologic opinion as to its prospective possibilities for profitable development.

Katanga Carnotite Cuts Price in This Country in Two

Apparently the exploitation of the large deposit of high-grade pitchblend by the Union Minière du Haut-Katanga, in Africa is putting a stop to the production of carnotite ores in the United States. The Congo ore is far richer than American carnotite and is being laid down in the United States at one-half the price which prevailed here a few months ago.

News from Washington

By PAUL WOOTON
Special Correspondent

No Thought of Bimetallism in Silver Inquiry

Objection to Reno as Meeting Place—Wheat and Cotton Producers in U. S. May Have Interest in Silver Price Stabilization

Mint May Buy 10,587,514 Oz. More of Pittman Silver

Audit Reveals Discrepancies—Comptroller Deceived by Treasury Officials—May Recall Ruling

By Wire From Our Washington Correspondent

Purchases of at least 10,587,514.51 additional fine ounces of silver at the Pittman Act price seem assured. Certified accountants employed by the Senate Commission of Gold and Silver Inquiry apparently have just established, after two months of work, that the amount mentioned was actually used in subsidiary coinage and was not "held in the vaults all along," as claimed by the Under Secretary of the Treasury. Under Secretary Gilbert's contention throughout the recent controversy has been that the amount of Pittman Act silver allocated for subsidiary coinage and afterward revoked never had been used for the purpose for which it was allocated. In fact the decision of the Comptroller General authorizing the revocation was predicted on a statement to that effect. There now is reason to believe that the Comptroller General will reconsider his decision in the light of Senator Pittman's disclosure that these 10,587,514 oz. were not held in the vaults, but were actually converted into subsidiary coins.

In the course of his investigations Senator Pittman has brought to light copies of letters from the Bureau of the Mint which support his contentions that the silver allocated for subsidiary coinage actually was used for that purpose. Either ignoring or being unaware of that correspondence the Treasury officials proceeded to advise the Comptroller General that the silver never had left the vaults. Though there is no thought that they deliberately misstated facts to the Comptroller, it now seems clear that the Comptroller's decision was based on a faulty premise and that it is likely to be recalled.

EVIDENCE is not wanting that Treasury officials are weakening in their stand in the matter of diminishing the amount of silver purchases at the Pittman price by arbitrary rulings in regard to sundry allocations. It is thought that high officials in the administration realize that the Treasury Department has been placed in an embarrassing position by the handling of the silver purchases. The thought is expressed in some quarters that this may have had a bearing on the resignation of S. Parker Gilbert, Jr., as Under Secretary of the Treasury.

The plans for the Pan-American Silver Conference in Reno are being perfected. It is probable that this gathering, which has as its object the discussion of the proposed Silver Export Association and the discussion of means for popularizing the use of silver for coinage and other purposes, will be held during the first week of September. Some opposition has developed to the choice of Reno as the place for the gathering, the contention being that it should be held in the national capital. Senator Oddie, chairman of the Commission, takes vigorous exception to that objection. He contends that this meeting should be held in the silver-producing section of the country and points out that Reno is centrally situated in that respect. His main objection, however, is to the lateness with which this proposal has been brought forward. Senator Oddie points out that the intention to call the meeting at Reno was announced early in March. Those who would have the meeting in Washington waited until the end of June to voice their opposition, after plans and preparations were well advanced. He declares that the West is entitled to this gathering and he intends to insist that the meeting be held there.

That the bankers have no fear of a movement for unsound money growing out of the activities of the Commission of Gold and Silver Inquiry is indicated, Senator Oddie points out, by the attitude of the "Journal of the American Bankers' Association." In that connection, Senator Oddie calls attention to his public pronouncement which should set at rest any such apprehension. Senator Oddie's position was pointed out as follows in a public address: "I am for sound money. There is no thought of bimetallism in this inquiry and no thought of departing from the gold standard. We desire to help the great mining industry, but not by the creation of an unsound currency."

After having received assurances from the Department of Commerce that the information is available, the commission has called upon it formally for the following:

1. The monthly exports of silver in ounces from the United States, to India and to China separately and the monthly imports of silver in ounces into India and to China from all sources for the last decade, inclusive of the calendar year 1922.

2. Whether a low price of silver results in the dumping of India's wheat on the world's market in competition with the wheat of the United States, thereby reducing the price and export volume of our wheat, and whether a high price for silver results in the ability of India and China to purchase a larger volume of cotton goods at a higher price, thereby enabling the American cotton grower to sell more cotton at a higher price. In so far as the facts are available, the commission would appreciate an answer to this question, supported by the monthly American exports of raw cotton to Great Britain, Indian exports of wheat and Indian trade balances, expressed both in value and in volume for the last decade inclusive of the year 1922, and the monthly average world prices for wheat, silver and cotton over the same period, to be presented in tabulated form and graphically charted with appropriate conclusions.

3. The mechanics of oriental exchange and the factors which most greatly influence fluctuations in the price of silver.

4. The disadvantages to our oriental trade arising from unstable silver exchange and the advantages which would arise if silver exchange were to be stabilized.

5. The probable effect of a silver-bullion loan to China upon the financial conditions of that country and upon our own trade with China.

French Company Organized to Exploit Mexican Mining Property

A company has been organized in Paris known as the Corporation Miniere du Mexique for the purpose of acquiring and operating mines in this republic, and constructing mills and smelters. The capitalization is 25,000,000 francs, divided into 250,000 shares of 100 francs each, fully paid.

At the same time a subsidiary company was organized, as the Corporacion Minera de Mexico, S. A., with a paid in capitalization of $10,000, for the management in Mexico of the business of the principal company in Paris.

Prominent French financiers, bankers and officials are connected directly with these organizations. The president is Carols Berrogain and the vice-president, Jose J. Reynoso.

A number of the officers are connected with the famous Pedrazzini mines, of the state of Sonora, which paid a dividend of 18 per cent on the capitalization last year.

Optimism and Honesty Do Not Make a Tungsten Mine

So Rules Solicitor in War Minerals Relief Claim—Many Disallowances; One Award

"Good faith, honest effort, and endeavor to develop tungsten at this mine," says the solicitor of the Interior Department reporting on the War Minerals claim of C. C. Bracken, "are not alone sufficient to justify an award. In my judgment, this effort and work, although made in good faith, were not made 'for or upon property which contained tungsten in sufficient quantities to be of commercial importance.'"

The Bracken claim has been the subject of considerable discussion, since it involved the matter of just where the commercial importance line is to be drawn. In this instance, a shaft 60 ft. deep was sunk, from which some drifting was done. From these workings ore having a net value of $124 was shipped. The property, however, is situated in a good tungsten district, and the claimant believes further prosecution of the work would result in a profit, but the fact that he abandoned it after nine months of work, with other disclosures of the record, led Solicitor Edwards to recommend the disallowance of the claim.

The only award approved by the Secretary of the Interior during the week ended June 30 was one for $576.46, in favor of the Horse Mountain Copper Co., covering one of its chrome properties. John Briar, the War Minerals Relief Commissioner, has recommended and the Interior Secretary has approved disallowances as follows: Ralph M. Curl, chrome, net loss not established; Thomas H. Green, manganese, right to additional award not established; Barry and Cramer, chrome, commercial importance not established; William R. McArthur, chrome, commercial importance not established; Edward A. Silberstein, manganese, right to additional award not established; Cramer and Co., manganese, net loss not established; Tyner and Pittard, manganese, stimulation not established.

News by Mining Districts

By Special Correspondents in the Field

London

Pyrites Combine Probable — Russo-Asiatic Behind Akim—Rhodesia Broken Hill?

By W. A. Doman

London, June 21—Some weeks ago I mentioned a rumor that the Rio Tinto, the Tharsis Sulphur & Copper, and one or two other Spanish mines were negotiating with the object of forming a selling organization to market their pyrites and so maintaining the price, rather than continue the old plan of competing with one another. This rumor is being strongly revived, and it is said that the agreement is on the point of being signed.

The statements recently in circulation that Akim, Ltd., the West Coast of Africa company with a large gold and diamond concession, was about to deal with its diamond area, have now taken definite form. It appears that Leslie Urquhart and the Russo-Asiatic group are behind the business. The capital of the West African Diamond Syndicate is £500,000, of which £250,000 will be paid to the Akim company, and other diamond areas in the Gold Coast Colony are likely to be included. The manner in which the gold-quartz proposition will be dealt with is still under consideration. Apparently Leslie Urquhart sees not immediate possibility of the Russo-Asiatic Corporation's properties being restored by the Soviet Government. These alone would require all his energies and the capital at his command. He has, however, gone into Turkey, and in conjunction with French capital has formed the Corporation for the Economic Development of Turkey, which will have the exclusive monopoly of all Turkish exports and imports. To show how the new company is regarded it may be pointed out that among the founder members are 175 deputies of the Angora Assembly. The nominal capital is £250,000.

The policy of the directors of the Zinc Corporation in writing off, out of past profits, the cost of the tailing dumps has borne good fruit, for the treatment of the dumps last year yielded abnormally profitable results. The zinc concentrator has now been shut down. A settlement has been arrived at with Messrs. Aron Hirsch und Sohn by the payment of £24,375 by that firm. At Dec. 31 last the ore reserves were estimated at 2,115,700 tons, averaging 14.6 per cent lead, 2.6 oz. silver and 9.4 per cent zinc.

Although the Kaduna Syndicate (Nigeria) has the small capital of £40,000, only £27,800 is in issue. The directors follow the policy of reinvesting the proceeds of ore sold in the purchase of metallic tin to be held for higher prices and last year this proved profitable, for an operating profit of £6,632 was made. For the twelve months to Oct. 31, 1922, the output was slightly under 140 tons, against 170 tons for the preceding period, but for the first six months of the current year the production has reached 157 tons.

Although the Central Mining & Investment Corporation has sold out its firm stock in Rhodesia Broken Hill, this does not mean that the property has lost in value. A cable dispatch has just come to hand from the mine stating that recent developments eastward are of great importance, but that sulphides are near the surface. The sulphide mill is being rapidly constructed.

Johannesburg Letter

April Gold Output Dwindles Slightly—2,000 Claims "Pegged" After Strenuous Foot-Race

BY JOHN WATSON

Johannesburg, May 29.—The gold output of the Transvaal mines, for the month of April, was declared on May 9 as 743,651 oz., having a realized value of £3,253,473. This is a decrease of 20,945 oz. as compared with March; but April was a thirty-day month with five Sundays. As a matter of fact and calculation, April showed a daily average increase of 455 oz. over the March working. The native labor returns show a decrease of over 3,000 natives working on the gold mines and an increase of about 600 on the diamond mines.

The farms Batavia and Kameelboom, about 105 miles Northwest of Rustenburg, were thrown open for public pegging, under the Gold Act, on May 8. For two days before, streams of motor-cars, motor-cycles, ox-wagons and donkey-carts made their way along the normally lonely road, leading through this remote part of the Bush-veld. Mining Commissioner Jack was present with his staff and eight police. A meeting was held beforehand and an executive appointed. The reef was divided up, according to the number of syndicates, and areas were alloted by ballot. About 6½ miles of reef was divided up into eleven equal lengths. Two areas adjoining the discoverers' rights were left open for a general rush. At about 9 p.m., on May 7, all had arrived at their particular spots and camp-fires were lit to the south of, and covering the length of, the outcrop. At daybreak next morning all were astir. At 9 o'clock a shot was fired on the central peak of the range, this was the signal to start pegging. The running, under the Act, was done on the open spaces. One syndicate had engaged Nico van Heerden, a well-known "Spring bok" (footballer), whose long strides gained much for his employers. The number of licences issued was 850, allowing over 2,000 claims to be pegged. The nearest railway station to Batavia, at present, is Gaberoner, thirty-six miles to the West. Gaberoner is ninety-two miles north of Mafeking, on the main line to Bulawayo.

The 28th annual meeting of the Rand Mines, Ltd., was held on May 25 in the Corner House, F. R. Phillips presiding. This company, with a capital of over £500,000 has the controlling interest of about twenty leading Transvaal mines. The chairman gave a very full account of the company's position. The profit for the year ending Dec. 31, 1922, had been £800,620. The re-organization of underground work, after the strike of Jan.-March, has effected a marked increase in efficiency. The fall in the average price of gold during 1922, as compared with 1921, was 15s. 1d. per fine ounce. The whole gold output of the Rand is now treated by the Rand Refinery, Ltd. at New Germiston. Operations will shortly commence at the Pretoria Mint, which, at first, will coin only silver and bronze.

W. A. Caldecott, late consulting metallurgist to the Consolidated Goldfields, Ltd., has been appointed as the technical and administrative head of the Industries Division of the Department of Mines and Industries. Some year ago, he visited Canada, the United States and Mexico, in connection with metallurgical research.

San Francisco Letter

Copper Operations Being Resumed—Several Randsburg Prospectors Discontinue Work

By Our Special Correspondent.

San Francisco, July 2.—The Supreme Court of California has declared the statute providing for the payment of $350 for each fatal compensable injury suffered by an employee not leaving dependents, unconstitutional. The funds collected under this statute had been used for the rehabilitation of injured workmen.

Unsettled claims in California and Nevada against the Government under the War Mineral Act have been turned over to the field division of the General Land Office for investigation. Sixty claims remain unsettled in California and ten in Nevada.

Ten men are employed at the Balaklala mine and 40 men at Mammoth by the Mammoth Copper Co. The resumption of postoffice facilities at Mammoth has been asked of the Postal Department.

The American Zinc & Lead Co. has resumed work through the Uncle Sam tunnel for the purpose of prospecting an area contiguous to the Uncle Sam.

Six claims between Whiskytown and French Gulch have been consolidated by Charles Rotero of San Francisco. A ten-stamp mill will be erected.

A coal property six miles southeast of Round Mountain is being developed by Byron Frost of Willows. Eastern capital has been interested, and as soon as the Alturas lateral road has been completed it is planned to supply local users of fuel.

A Diesel engine and additional equipment has been installed at the Central Consolidated mine under development by the Banner Consolidated Mines. Eventually electrical power will be installed.

An adit on the Norambayne is also being cleaned out and will be extended and used for mine drainage.

The Brunswick Gold Mining Co. is planning to resume milling in the near future.

Work has been started at the Martinez group of claims south of El Dorado and also at the Hines-Gilbert, Slager and Good Luck mines near Diamond Springs. A new ledge has been discovered at the Ingraham mine near El Dorado.

Unwatering is in progress at the Kennedy mine.

The winze in the Plymouth mine has been sunk to a depth of 4,016 ft., the vein in the bottom showing a workable width and good assays.

The Elephant Gravel mine near Volcano has made a cleanup after a run of four months.

In the Randsburg silver district between 15 and 20 shafts are active. The drop in the price of silver finds the California Rand Silver, Inc. in a good financial position. After paying a total of $409,600 in dividends for the first five months of the year, a cash balance of $450,000 remains. In addition to milling 10,000, tons of ore per month, shipments of over 1,000 tons of 100-oz. ore, have been made. Although Randsburg has the highest scale of wages of any camp in the West, there are comparatively few men available and wages are expected to remain at their present level. Exploration has in general been disappointing and several companies have stopped work. The Big Four shaft which has reached a depth of 800 ft. is expected to cut the ore-bearing schist formation at 900 ft. Much of the future exploration will depend upon the results obtained in the Big Four shaft, the Fox, Santa Fe and Flat Tire shafts.

QUEENSLAND

Mt. Chalmers Copper Concentrate Will Flux Laloki Ore in New Guinea

From our Brisbane Correspondence

A big low-grade copper mine at Mount Chalmers, a short distance outside Rockhampton in the central district, that was worked several years ago but afterwards abandoned, is about to be reopened, and the ore therefrom transported to the large Laloki copper mining enterprise in New Guinea. The Laloki ore is very basic and contains but little silica, while that at Mount Chalmers is highly siliceous and cannot be smelted without a basic ore or flux. It is therefore considered that the two kinds of ore will make a very suitable smelting blend. The Mount Chalmers mine is only a few miles by railroad to a shipping wharf on the Fitzroy River, but the ore will have to be transported by water a distance of from 1,200 to 1,400 miles.

Owing to the distance the ore has to be carried, it will no doubt be concentrated before being shipped, and also "fritted" for the New Guinea furnaces. It is expected that smelting will be commenced at the Laloki works of the New Guinea Copper Mines, Papua, shortly after August next. The smelters being erected there are estimated to cost £78,000. The company now has ore reserves of 290,000 tons, containing 13,300 tons of copper and 36,250 oz. of gold. The most important development work carried out during last year was in the Debuna mine, which the company has bought and where two winzes from the tunnel level went down to 80 ft. in 6 to 8 per cent copper ore which was still showing underfoot. The native labor position, which had been unsatisfactory, has improved, and 500 men are now employed.

BRITISH COLUMBIA

Alice Arm Promising, Thinks Hanson

George Hanson, of the Geological Survey of Canada, has expressed the view that the Alice Arm district, may look forward to a bright future from a mining standpoint. The Dolly Varden, he is quoted as saying, is far from a "done" mine and he advocates the consolidation and operation of the larger low-grade silver properties adjacent to and including that mine. This would involve the installation of a transportation system of short tram lines from some five or six properties surrounding the Dolly Varden to a centrally located concentrator. He also suggested that profits may be obtained by the exploitation of high-grade silver veins on a small scale as now is being done at the Esperanza mine.

Gold Ore in Silver Bar Property

The Silver Bar Mining & Development Co., Ltd., with holding near Ewings Landing on Okanagan Lake, B. C., is reported to have uncovered promising showings. There is said to be an orebody, 36 feet wide, which has given returns up to $200 in gold to the ton. As to mining conditions, a two mile aerial tramway would connect the prospect with a dock on the lakeside; timber is plentiful, but water scarce.

Leadville Property Will Have Road

A group of Spokane capitalists is reopening the Leadville group, near Kitchener, B. C. The property was located several years ago, and some promising silver-lead ore was opened up, but, owing to lack of means of transportation, the mine never succeeded. The new owners have commenced development and will build a road from Kitchener to the mine, a distance of six miles.

ONTARIO

Dome Finds Ore in Greenstone

A diamond-drill hole recently completed on the 12th level of the Dome mine has cut 50 ft. of ore running $12 a ton, beneath the hanging-wall orebody, and separated from it by a mass of porphyry 500 ft. thick. This discovery, which is made in the greenstone underlying the sediments, is of particular importance in view of the statements in the annual report which pointed to the possibility of the hanging-wall orebodies being cut off below the 12th level by a large intrusion of porphyry.

There has been a good deal of speculation as to what might happen to the Dome orebodies when the bottom of the sediments was reached, but this latest discovery appears to set these doubts at rest. Below the 12th level the Dome is getting into the same formations as those in which the Hollinger and McIntyre orebodies are found, and there seems to be good reason for believing that the Dome may have equally as good results below the 12th level as were found above in the sediments.

ALASKA

Hyder Railroad Project Revived

The construction of a railroad from tidewater at Hyder, Alaska, through the Salmon River Valley to the boundary of British Columbia, a distance of thirteen miles, again is being discussed. Chas. F. Caldwell, mining operator, first proposed this work four years ago and organized the Portland Canal Shortline Ry. Nothing was done because the project was considered premature. Now, however, conditions are different. A considerable tonnage of ore, independent of that of the Premier Gold Mining Co., which is handled over its aerial tramway, is promised, in fact seems assured. The railway, which is said to offer no unusual or insuperable engineering difficulties, is believed to be a practical enterprise and, from the viewpoint of the mining industry of the district, a necessity. Mr. Caldwell is in London endeavoring to raise funds for the carrying out of the work. A charter was obtained for the railroad some time ago.

Mill for Henderson Mine

The Henderson mine, on Ester Dome, of the Fairbanks district, recently purchased a Lane mill, which will be erected this summer. This gold property has been under development all winter, and with pleasing results. Mr. Henderson, the principal owner, recently bought the interest of one of his partners and now plans to get the mill built and to make a test run this summer.

NEVADA

Virginia Louise Ships 200 Tons Daily

The Virginia Louise mine, under the management of Squires & Gemmell, is now producing 200 tons of ore per day, the product being shipped to the United States smelter at Midvale. Analysis of the product is approximately as follows: gold, 20c., silver 3.0 oz., lead 3.0 per cent. The total iron-lime-manganese content exceeds the insoluble by 35 per cent, making the material a desirable flux ore. A large number of improvements have been made at the plant to facilitate the movement of ore. The Prince mine adjoining the Virginia Louise is now closed down pending the arrival of new pumping equipment. James Quirk is superintendent of both mines.

Ore Cut in Chalk Mountain Mine

E. M. Dawes, manager, reports that a second vein has been cut at the Chalk Mountain mine, 45 miles east of Fallon, Nev. Seven feet of lead ore containing some silver and gold has been exposed. A narrow streak on the hanging wall assays $100 per ton. Since starting work on the property, early this year, 250 ft. of crosscuts have been driven in addition to sinking the shaft from the 60 to the 110 level. Two cars of ore have been shipped from development work.

ARIZONA

Senator Clark Likes Crushing Plant

In a recent interview with local press representatives, Senator W. A. Clark, owner of the United Verde Copper Co., who is visiting the company's property, at Jerome, expressed himself as being much pleased with the progress made on the new crushing plant and stated that he expected it to be the very last word in that branch of operations when completed.

McCracken Mill Makes 48 per Cent Lead Concentrate

The McCracken mill, near Kingman, in Mohave County, Ariz., is reported to be operating satisfactorily, making recoveries that average 80 per cent of the lead and 70 per cent of the silver values in the ore. The product of the mine is mixed sulphide and carbonate ore and is one that is difficult to treat. The company is shipping about six car loads of 48 per cent lead concentrate each month and it is said that the silver content pays the cost of milling, mining and hauling. Most of the ore now being mined is taken from the upper levels of the mine and the company reports a reserve that is considered suitable for milling.

Telluride Mill Design Finished

Design of the new Telluride gold mill that is to be constructed by the Telluride Mining Co., at Oatman, has been completed, and William Linfesty, formerly superintendent of the Tom Reed mill, which is in the same district, has been engaged to superintend its construction The new mill is to be erected for treating the Telluride ores by the cyanide process. The Telluride company recently authorized the erection of the mill after it had been decided that ore could be treated at a profit by having a plant of its own thereby eliminating hauling and treatment costs at a custom mill where shipments had been formerly made. The mine is reputed to have $1,000,000 worth of gold ore in reserve that is suitable for milling.

Bonanza Lease Will Continue

A clean-up recently made by Wooten & Jacobson, operators of the Bonanza lease, at Tombstone, netted over 1,700 oz. of silver, the product of the new mill which was only recently completed. The metal was shipped by express to the Denver mint, where the owners had filed affidavit regarding its production previous to the expiration of the Pittman Act purchases. A large tonnage of ore had been stocked at the Bonanza mine during the last year, but the lessees only completed the erection of the 50-ton cyanide mill in April. This shipment of bullion will be the last for which they will receive the dollar price. However, the mine and mill are to be kept in operation, as considerable ore is already mined and in stock, and ore blocked out and available for mining will warrant its operation when the metal market improves.

IDAHO

Diamond Drilling at Copper King

A contract for 1,200 ft. of diamond-drill work in the property of the Copper King Mining & Smelting Co. at Mullan, has been let by H. W. Ingalls, manager, to the Diamond Drill Contracting Co. Operations will start at once. The drilling will be done on a well-arranged plan which has been prepared after an exhaustive study of the property by geologists and engineers, according to Mr. Ingalls. The drill holes will prospect the orebodies midway between the upper and lower tunnels which are 1,000 ft. apart vertically.

Independent Drives Tunnel

The crosscut being run by the Independent Mining & Milling Co. has been extended 30 ft. since work was started a few weeks ago, according to John H. Nordquist, manager. The property is in the Mullan district of the Coeur d'Alenes. The crosscut is an extension of an exploration tunnel run by the National Mining Co. several years ago. A five-year lease has been secured on the tunnel and surface buildings of the National mine, and the Independent company plans to work the property through the National tunnel. A compressor has been installed.

First National Starts Crosscut

Crosscutting in the First National mine, east of the Bunker Hill & Sullivan group, has been started on the lower level, according to R. L. Brainard of Kellogg. The crosscut begins at a point in the tunnel 1,600 ft. from the face and at a depth of 1,000 ft. It will have a length of about 500 ft. Considerable equipment has been added to the property and the buildings and machinery have been overhauled thoroughly. A new road to the property is being built by the county.

Ore has been followed for 2,000 ft. on the 2,000 level of the Hecla mine at Burke. The body is 10 ft. wide and contains lead-silver ore. The point of this development is 400 ft. below the next level above, on which ore was followed for a long distance. A continuance of the shaft to the 2,400 ft. depth was resumed recently. A crosscut for the Star vein is proceeding at the rate of 15 ft. a day.

Rescue Car at Wallace

The mines rescue car recently purchased by the mine operators of the Coeur d'Alene district from the U. S. Bureau of Mines has arrived at Wallace. Provision has been made by the operators to equip it with every modern device of rescuing and maintaining human life and for training employees in first-aid and rescue work. The car will be permanently stationed at Wallace, from where it can be quickly taken to the mines when needed. The car will be in charge of K. T. Sparks, engineer formerly with the Bureau, who will give his entire time to supervising equipment and to training employees at the various mines.

MONTANA

Porphyry Dike Is Remodeling Mill

Under the supervision of James Brien, the old mill on the Porphyry Dike property near Basin is being rapidly remodeled. The installation of a large ball-mill has just been completed. It is understood that the plant will start with a 500-ton daily capacity, and that this will be increased.

Butte-Jardine Metals Curtails

Due to the expiration of the Pittman act and the present low price of silver the Butte-Jardine company has reduced its working force from 125 to 60 men. This reduction will cut production to approximately 60 tons per day.

The majority of the miners retained by the company will be kept on development work. It is not improbable that the main shaft will be sunk from the 800 to the 1,000 level in the near future.

Development from Two Shafts Progresses

The Midwest-Butte Development Co. is completing the station on the 600 level of the Garibaldi shaft, and as soon as it is finished a cross-cut will be driven to cut the veins found on the 300 level. Cross-cuts are also planned for the 400 and 500 levels. Development work is progressing favorably in the Prospector shaft. Sinking is now well under way. A cross-cut will be driven from the 500 level to reach the ore-bodies found on the 300 level. When this is well started sinking will be continued to the 700 level.

Big Dick Mine to Start Shipping

The Big Dick mine owned by the Butte-Elliston company and located at Elliston, has just shipped two cars of ore, one of which went to the Washoe smelter at Anaconda, and the other to smelter at Tacoma, Wash.

The ores from this mine have a high arsenic content as well as a fair gold value. The present demand for arsenic is the principal reason for the reopening of this old property.

It is said that more than 50,000 tons of ore have been stored on the dump for a period of thirty years. It has not been profitable to ship these ores on account of the penalty that was placed against the arsenic.

If the test shipments just made give satisfactory returns a large force of men will be given employment.

JOPLIN-MIAMI DISTRICT

Little Pat Will Have Mill

A. M. Gaines, in charge of operations for the Kanok Metal Co., is building a new mill on what is known as the Little Pat lease, lying to the south and west of the New Chicago, which has been a steady producer for many months. However, it has been proved that the orebodies in this particular portion of the field are not as wide as in some other sections, and because this is a fact smaller concentrators are being erected. The new plant on the Little Pat will have a capacity of 200 tons.

Federal Leases 700 Acres

The Federal Mining & Smelting Co. has taken a lease on 700 acres of land known as the O'Neil tract, about halfway between Galena and Peacock, on Spring River, northwest of Joplin, and plans a thorough test of it with drills in the next few months.

The Federal company only recently closed an option it had on the Kansouri lease, near Treece, Kan., after a six-months' drill investigation campaign. The company has closed down its Lucky O. K. mine, at Hockerville, and it is understood it will not be reopened until ore prices are much better than at present.

MICHIGAN

Addition to Mohawk Mill

The Mohawk Mining Co., in the Michigan copper district has let a contract for the erection of a steel addition, two stories high, the full length of the stamp mill for use in finer grinding operations. Each regrinding unit as it is completed will be placed in operation. At present, Mohawk is regrinding about 30 per cent of its mineral, and when all four heads are equipped, the additional saving per ton will be 1 lb. of refined copper. The building of the addition and installation of new equipment will not interfere in any way with regular stamping operations.

New Franklin Shaft Creates Interest

Much interest attaches to exploration the Franklin Mining Co. has started. Ground has been broken for a shaft on the Kearsarge lode, master vein of the copper district, it being the first time operations on the Kearsarge have been attempted so far to the south. The point at which the shaft will go down lies between two fissure veins, which Thomas S. Woods, president of Franlin, believes have influenced the deposition of copper, a theory he has worked out to his own satisfaction elsewhere in the district. The zone is the one in which the New Baltic and New Arcadian shafts of Arcadian Consolidated are located and although the Arcadian shafts are not in the Kearsarge lode, the enrichment was caused by the fissure veins, according to the opinion of Mr. Woods.

Labor Still Scarce

While the labor situation in the Michigan copper country has not improved materially, a few men continue to come into the district each week and high hopes are held that the approach of fall will witness an appreciable increase in underground force. Every effort is being made to bridge the shortage by concentrating work in fewer shafts, employing labor-saving devices and doing as little "dead work" as possible. Some immigrants are coming in, but the amount of labor from this source is negligible, a condition which will continue to prevail under the 3 per cent restriction act, in the belief of local officials.

The Situation at the Mines

By Arthur B. Parsons
Assistant Editor

IF THE MARKET value of the recoverable silver, copper, and lead, or other salable constituent of a block of ore, is not appreciably more than the cost of mining, smelting, and marketing, it is better, by and large, to leave the ore in the mine. Accordingly the drop (as a consequence of the completion of the Pittman Act purchases) in the price of silver from $1 to 63c. and the further declines of copper to 14¼c., of lead to 6⅝c., and of zinc to 5⅜c. are having their effect on mine operations. The fall in the base-metal prices during June was not great; but it followed steady declines from 17½, 8¼ and 7⅜c. respectively since March, and the cumulative influence is evident.

In spite of these recessions the rate of copper production in the aggregate is increasing. Most of the metal comes from large operations, where it is inadvisable to retard the momentum of output once it is gained, and producers generally are sufficiently optimistic regarding both the near and distant future to overlook sags in the selling price of their metal. North Butte has suspended operations, because of a combination of factors, including low prices for copper and silver. Some small producers who sell to custom smelters on the basis of current quotations have curtailed, but up to date the more important mines for the most part are unaffected. Utah Copper has started enough sections in the Magna plant to bring its production to 19,000,000 lb. per month and Nevada Consolidated has increased output to 6,500,000 lb. The new Copper Queen concentrator at Bisbee is handling 2,000 tons of ore per day, thereby augmenting the Phelps Dodge output. The only reason for failure to increase production in Michigan is the serious shortage of mine labor. The total for the district during June was 10,975,000 lb.

Anaconda, with 18,000,000 lb., is mining more copper at Butte than at any time since the shutdown. Incidentally, the position of Anaconda emphasizes the importance of silver to mines in which that metal is considered to be a byproduct. If Anaconda ore contained no silver the company could not, it is safe to say, afford to operate long with the copper market around 15c. Compared with most of the copper mines, Anaconda's ore is unusually rich in silver, and, while the others benefited materially from one-dollar silver, the drop of 37c. per ounce is by no means vital. Of copper mining it may be said that the decline of the metal markets has had no important effect up to this time. It would even have been impossible to increase production more rapidly, because of the inability to get miners.

With the other metals it is different. Silver is a more important factor in lead mining. In Utah and Idaho most of the lead ores are rich in silver. Moreover, the lead-silver mines are generally smaller and they can adjust their production to meet the exigencies of the market more easily. Smelter receipts in Utah fell off precipitately during the last half of the month of June. Although no significant curtailment has been reported from the Cœur d'Alene, in Idaho, a decrease is certain if lead does not pick up.

The outcome of the steady decline in zinc is the shutting down for at least two weeks of about 85 per cent of the mines in the Joplin-Miami district. During June twenty small companies suspended operation. On July 1 by concerted arrangement production was stopped temporarily, with the understanding that the rate of output on resumption will be fixed by a committee of operators.

The so-called straight silver mines have of course been hard hit. Curtailment and shutting down are reported from many localities. In Nevada the Tonopah Mining and Tonopah Belmont companies have reduced output by 50 per cent; Tonopah Divide has suspended shipments temporarily; Rochester is expected to shut down soon; Candelaria is said to be losing money on current operations. The Commonwealth mine, at Pearce, Ariz., has shut down, as have numerous lessees in Tombstone. In Utah the Vipont has curtailed drastically, and other properties shipping siliceous silver ore have come to earth after the fervid days that preceded the completing of the Pittman Act purchases.

A modicum of consolation lies in the fact that the shortage of good miners will become less stringent.

In California, Grass Valley operators have increased wages approximately 50c., making the scale for miners $5.25. Prospectors for silver in the Randsburg district are not having much luck, and some are quitting. In Nevada the United States S. R. & M. Co. has resumed work at Eureka. Copper mining in the Ely district is flourishing.

Smelters in Utah are working at capacity, and this will continue until the accumulated stock of ores has been disposed of. The labor situation at Butte is somewhat improved. Approximate figures of zinc production are: Butte & Superior, 7,500,000 lb.; Elm Orlu, 6,500,000 lb.; Anaconda, 5,750,000 lb.

Estimated Current Rate of Copper Production in Pounds per Month

Ahmeek	1,600,000	Kennecott	6,000,000
Anaconda	18,000,000	Miami	6,000,000
Arizona Commercial	800,000	Moctezuma (P. D.)	3,000,000
Braden	11,000,000	Mohawk	1,000,000
Butte & Superior	300,000	Mother Lode Coalition	2,700,000
Calumet & Arizona	3,500,000	Nevada Consolidated	6,500,000
Calumet & Hecla	4,200,000	New Cornelia	3,700,000
Cerro de Pasco	6,000,000	Old Dominion	2,100,000
Chile	20,000,000	Phelps Dodge (U. S.)	9,000,000
Chino	5,000,000	Quincy	1,000,000
Copper Range	2,100,000	Ray	5,000,000
Davis Daly	800,000	United Verde	8,000,000
East Butte	450,000	United Verde Ex	3,500,000
Engels	1,250,000	Utah Consolidated	900,000
Granby Consolidated	3,250,000	Utah Copper	19,000,000
Greene Cananea	3,500,000	Walker	720,000
Inspiration	9,000,000	Wolverine	325,000
Isle Royal	750,000		

Two new producers in Colorado, the Rawley and Black Bear, will in a measure offset the loss of output resulting from the end of the Pittman Act purchases. Smelters and railroads have lowered rates on ore from Clear Creek and Gilpin counties, so that it is hoped to equal the record for the first half of 1923—the best in the state for many years. High-grade ore has been opened in the Cresson mine, at Cripple Creek. Increased activity is reported in the gold district centering around Oatman, in Arizona. A new mill is to be erected by the Telluride Mining Co.

In spite of the shutdown in the Joplin-Miami district, several new mills are being built and prospecting is active. The Schwab interests represented by the Quapaw Mining Co. have purchased the Tom L and Chub properties; both are considered valuable. Output during June averaged about 11,000 tons of concentrate per week.

Iron-ore shipments from Lake Superior country are heavy. Two new docks, one at Escanaba, Mich., and one at Superior, Wis., are being built. Labor agitators said to be I. W. Ws. from Butte are attempting to foment a strike.

The following figures indicate the current rate of output in Ontario: Nipissing, 275,000 oz.; Keeley, 150,000 oz.; Mining Corporation, 180,000 oz.—all silver; Tech Hughes, $105,000; Lake Shore, $53,000; Wright-Hargreaves, $60,000; Hollinger, $900,000; Dome, $360,000; McIntyre, $300,000—all gold. Development is active; miners are neither scarce nor overabundant. The Florence mine, near Ainsworth, in British Columbia, has arranged for an adequate supply of electric power from Nelson, and will increase its mill capacity from 300 to 500 tons per day. As usual during the summer months, prospectors are busy.

Significant news from Mexico includes the announcement that the A. S. & R. Co. will take over the smelter of the Cia. Metalurgica Mexicana, at San Luis Potosi; and the United States S. R. & M. Co. is making a thorough examination of the Asuncion property near Guanajuato.

THE MARKET REPORT

Daily Prices of Metals

June	Copper, N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
28	14.25	38.375	38.875	6.85	6.50@6.55	5.75@5.80
29	14.25	38.50	39.00	6.85	6.50	5.75@5.80
30	14.25	38.25	38.75	6.85	6.50	5.75@5.80
July 2	14.25	37.125	37.625	6.65	6.40@6.50	5.75
3	14.15	37.25	37.75	6.50	6.25@6.35	5.75
4	.....	.....	.....	....	.....	.....
Av.	14.230	37.900	38.400	6.740	6.455	5.765

*These prices correspond to the following quotations for copper delivered: June 28th, 29th, 30th, and July 2d, 14.50c.; 3d, 14.40c.

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

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

June	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
28	64 3/8	64 7/8	71 1/2	180 3/4	181 7/8	24 1/2	23 7/8	28 1/2	29
29	64 7/8	65 3/8	71 1/2	182 5/8	183 5/8	24 3/8	23 3/4	28 3/8	28 7/8
July 2	64 5/8	65 1/8	71 1/2	176 3/4	177 7/8	23 7/8	23 3/8	28 1/4	28 3/4
3	64 7/8	65 3/8	71 1/2	177 3/4	179 1/4	23 3/4	23 3/8	27 7/8	28 1/2
4	64 3/4	65 1/4	71 1/2	176 1/8	177 1/4	23 7/8	23 1/4	27 3/4	28 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, Go'd, and Sterling Exchange

June	Sterling Exchange "Checks"	Silver		Gold	July	Sterling Exchange "Checks"	Silver		Gold
		New York	London	London			New York	London	London
28	4.59 1/8	63 7/8	31 1/4	89s. 6d.	2	4.57	62 3/4	30 13/16	90s.
29	4.58	63 5/8	31 1/4	89s. 11d.	3	4.55 3/4	62 7/8	31 1/16	90s. 2d.
30	4.57 1/2	63	31 1/16	....	4	.....	...	30 13/16	90s. 4d.

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

Average Metal Prices for June

Copper:	
New York Electrolytic.....	14.663
London Standard	66.607
London Electrolytic	73.238
Lead:	
New York	7.146
St. Louis	6.852
London	25.429
Silver:	
New York, foreign.....	64.861
London	31.611
Sterling Exchange	461.132
Zinc:	
St. Louis	6.031
London	29.548
Tin:	
99 per cent	40.375
Straits	40.957
London	191.798
Antimony	6.839
Quicksilver	67.769
Platinum	115.615

Metal Markets

New York, July 3, 1923

Copper

Our report of a week ago caused considerable stir in the copper market, for it was not generally known that copper had sold at the low levels named. Brokers were unable to get the metal at those prices, and also it was not available for export at those quotations, but several million pounds were sold to large domestic consumers. This week the same condition has existed. The majority of producers continue to adhere rigidly to the 15c. delivered price, but they are selling only an occasional carload where special conditions apply. Copper has been obtainable from three or four sources at 14⅞c. delivered, but so far as we have been able to learn, all offers at that price were turned down by the indifferent consumers. The 14.50c. delivered quotation has not been general, but sales have been made every day at that level until today, when buyers were no longer tempted even at that price and a seller of 1,000 tons had to come to 14⅜c. to make a sale. Most of this copper went to Connecticut Valley points. Another sale was also made today on the New York Metal Exchange, 100 tons netting the seller 14.27c., refinery. There seems to be no distinction as to time of delivery, copper being available for any month in the year at the quoted prices.

Coupled with the unsatisfactory domestic situation has been an extremely listless market abroad, and no export orders worth the noticing have been received.

Lead

The official price of the American Smelting & Refining Co. was reduced from 7 to 6.85c. on Thursday, June 28; again reduced to 6.65c. yesterday, July 2; and today July 3, the 6.50c. level was established. These reductions were caused by the declines abroad, which would have otherwise resulted in Mexican and Spanish lead competing in the domestic market. Latterly, prices have been reduced to the point where virtually all Mexican lead, with the exception of that contained in ore, has been exported. The foreign market has shown a remarkable ability to absorb these large supplies.

Lead sales have been few and far between in the domestic markets during the last week. In the Middle West hardly enough business has been reported to establish prices, and consumers have been disconcerted by the rapid decline in New York. Faced by falling prices, consumers throughout the country are showing no disposition to take more lead than is necessary, and the specifications of battery, paint, and cable manufacturers have been much under what they were two or three months ago.

Zinc

Zinc has held its own during the week, although not because of buying.

Prices have been somewhat more stable in London, and also, owing to the high price of ore, smelters here are not anxious sellers. Prompt deliveries continue to be somewhat easier than forward metal. New York prices are equal to the St. Louis figure plus the freight differential of 35c. per 100 lb. High-grade zinc has declined one-half cent for the first time in several weeks, owing to a quieter demand. Present prices are 8 to 8.50c., delivered in the East.

Tin

The violent price decline of yesterday stimulated some buying on the part of both traders and consumers, but until then the market was a quiet affair. The 99 per cent grade continues very scarce, only a little English or Chinese tin being available for early delivery. Some prompt Banka has been offered at one-eighth to one-quarter cent above 99 per cent. Forward Straits has commanded one-eighth cent premium over the price of spot.

Arrivals of tin, in long tons: Total for June, 4,415. Of this, 3,320 was Straits; 40, Australian; 405 Banka and Billiton; 410, English; and 240, Chinese. Deliveries amounted to 5,410 long tons.

Foreign Exchange

Foreign exchanges have shared in the general weakness. On Tuesday, July 3, cable quotations on francs were 5.925c.; lire, 4.345c.; marks, 0.0006c.; and Canadian dollars 2$\frac{3}{4}$ per cent discount.

Silver

The decline in silver in New York set two successive new lows for the year on June 30 and July 2. On July 3, however, the resumption of buying by the Indian bazaars caused a slight improvement, although the reaction was not as marked in New York as it was in London.

Mexican Dollars—June 28th, 48$\frac{3}{4}$; 29th, 48$\frac{1}{2}$; 30th, 48; July 2d, 47$\frac{7}{8}$; 3d, 48.

Other Metals

Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified.

Aluminum—99 per cent, 26@27c. per lb.; 98 per cent, 25@26c. London, 98 per cent, £115 per long ton.

Antimony — Chinese and Japanese brands, 6.90c. W. C. C., 7.75c. Cookson's "C" grade, spot, 10@10$\frac{1}{2}$c. Chinese needle antimony, lump, nominal, 5.50c. per lb. Standard powdered needle antimony (200 mesh), 6@6.50c. per lb. White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, 7.75@8.25c.

Bismuth—$2.55 per lb. London, 10s.

Cadmium—$1 per lb. London, 5s.

Cobalt—$3 per lb. for spot. Discounts on contracts. Oxide, $2.10@$2.25. London, 12s. for metal; 9s. for black oxide.

Iridium—$275@$300 per oz.

Magnesium—Sticks, 1$\frac{1}{2}$ in., 99.9 per cent, $1.25 per lb. London quotes 4s.@4s. 9d. for 99 per cent.

[1]**Molybdenum**—99 per cent, $12 per lb.

Monel Metal—32c. per lb.

Nickel—27@32c. per lb. for 99 per cent virgin metal. London, £130@£135.

Osmium—Pure, $75@$80 per oz. troy, in Los Angeles.

Palladium—$80@$81 per oz. London, £17, nominal.

Platinum—$116 per oz. London, £25 for manufactured; sponge, £23.

Quicksilver — $68 per 75-lb flask. San Francisco wires $66.50. London, £10 15s.

Radium—$70 per mg. radium content.

[1]**Rhodium**—$4.50@$5 per gram.

Selenium — Black powdered, amorphous, 99.5 per cent pure, $2.10 per lb.

Tellurium—$2 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $8 per lb.

Tungsten Metal—Powder, 97 to 98 per cent, $1 per lb. contained tungsten.

Metallic Ores

Chrome Ore—Indian chrome ore, $21 per ton, c.i.f. Atlantic ports. Rhodesian, $23 and New Caledonian, $25.

Iron Ore—Lake Superior ores, per long ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51$\frac{1}{2}$ per cent iron, $5.70; Mesabi non-bessemer, 51$\frac{1}{2}$ per cent iron, $5.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $5 per long ton; old bed concentrates, 63 per cent, $5.25; Harmony, cobbed, 63 per cent, $5.25; new bed low phosphorus, 65 per cent, $7.50.

Manganese Ore—40@45c. per long ton unit, seaport, plus duty; chemical ore, plus 82 per cent MnO_2, $75@$80 per gross ton, powdered.

Molybdenum Ore—75@85c. per lb. of MoS_2 for 85 per cent MoS_2 concentrates.

Tantalum Ore—Hand-sorted ore, 70 per cent combined columbite-tantalite, 40c. per lb., South Dakota. Active.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, $\frac{3}{4}$@1c. per lb. for ore. Rutile, 94 per cent TiO_2, 10c. per lb. for car lots.

Tungsten Ore — Wolframite and scheelite, $8.75@$9 per unit of WO_3 for high-grade ore. Chinese ore, $8.50.

Uranium Ore (Carnotite)—Ore containing from 2 to 2$\frac{1}{2}$ per cent U_3O_8, $3.50 per lb. of contained U_3O_8.

[1]**Vanadium Ore**—75c.@$1 per lb. of V_2O_5.

Zircon—$50 per ton.

Zinc and Lead Ore Markets

Joplin, Mo., June 30—Zinc blende, per ton, high, $36.90; basis 60 per cent zinc, premium, $34.50; Prime Western, $32@$34; fines and slimes, $33@$31; average settling price, all blende, $34.46. Calamine, basis 40 per cent zinc, $22@$24 per ton.

Lead, high, $90.35; basis 80 per cent lead, $85@$75; average settling price, all lead ore, $89.63 per ton.

Shipments for the week: Blende, 9,835; calamine, 397; lead, 2,289 tons. Value, all ores the week, $552,910.

Shipments for six months: Blende, 356,272; calamine, 2,676; lead, 49,578 tons. Value, all ores six months, $20,617,140.

Producers held to a late hour today and received an advance over last week for blende. The price of lead was lowered another $5 at the week end.

About 70 to 80 per cent of the production will be suspended next week on account of producers agreeing to a week's vacation over the Fourth. Some will continue idle two weeks, and perhaps 20 to 30 per cent of the output, the second week.

Platteville, Wis., June 30—Blende, basis 60 per cent zinc, $37 per ton. Lead, basis 80 per cent lead, $80 per ton. Shipments for the week: Blende, 723 tons; lead, 40 tons. Shipments for the year: Blende, 17,705; lead, 380 tons. Shipments for the week to separating plants, 877 tons blende.

Non-Metallic Minerals

Asbestos—Crude No. 1, $500; No. 2, $250@$300; spinning fibers, $100@$250; magnesia and compressed sheet fiber, $100@$150; shingle stock, $60@$90; paper stock, $35@$40; cement stock, $8@$12; paper fillers, $20@$25—all per short ton, f.o.b. mines, Quebec, Canada. Demand fair for crudes. High-grade fibers very slow; low-grade fibers, good. Brake linings and brake-lining yarns in large demand but at low prices. Demand in paper and coverings has slacked off somewhat.

Barytes — Crude, $8@$10 per ton; market firm. Foam A barytes $28@$30 per ton, f.o.b. St. Louis; natural barytes, $26@$28. Steady tonnage required for lithopone. Manufacturers tending to buy up properties.

Bauxite—American, crushed and dried, $5.50@$8.75 per gross ton; pulverized and dried, $12@$14 per gross ton; calcined, crushed, $20@$24 per gross ton, all f.o.b. shipping points. Foreign bauxite offered at $6@$9 per metric ton, c.i.f. Atlantic ports, duty paid.

Borax—Granulated and refined, crystals or powdered, in bags, carloads, 5$\frac{1}{4}$c. per lb.; in bbls., 5$\frac{1}{2}$c. Boric acid, 10$\frac{1}{2}$c.

Chalk—English, extra light, 5c. Domestic light, 4$\frac{1}{2}$@4$\frac{1}{2}$c.; heavy, 3$\frac{1}{2}$@3$\frac{3}{4}$c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $7@$9; washed, $8@$9; powdered, $13@$20, f.o.b. Virginia points. Powdered clay, $14@$20, f.o.b. Virginia points. Imported lump, $15@$20, f.o.b. American ports; powdered, $45@$50, f.o.b., New York. 1A grade, refined, $15 per ton, Delaware.

Diatomaceous Earth—Natural aggregate, $25 per ton; insulating powder, $30; filtration powder, $35; calcined

[1]Price furnished by Foote Mineral Co., Philadelphia, Pa.

aggregate, $50; f.o.b. plant, California. Steady, heavy demand.

Emery—Turkish and Greek, 6@8c. per lb. American, 5c. Market good. Supplies plentiful and demand increasing.

Feldspar—In Maine, No. 1 pottery grade, $19 per ton; market good.

In Connecticut, No. 1 spar, $6.50 per ton; No. 2, $6. Pulverized, from $18@$20 for 60 to 80 mesh to $25 for 200 mesh. Good demand, but manufacturers not contracting so far ahead as formerly.

In New York, No. 1 crude, $8 per ton. Market strong.

In North Carolina, No. 1 ground, 140 mesh, $15@$16 per ton. No. 2 ground, 90 to 100 mesh, $10 per ton. Market only fair.

Canadian high-potash spar, $17@$25 per ton, delivered at U. S. mill.

Fluorspar—95 per cent CaF_2, 3 per cent SiO_2, $17 per net ton, c.i.f. N. Y. in bond.

Fuller's Earth—16 to 60 mesh, $18 per ton; 16 to 30 mesh, $17; 30 to 60 mesh, $18; 60 to 100 mesh, $14.50; 100 mesh and finer, $7.50; f.o.b. Florida mines. Demand fair.

Graphite—Ceylon lump, first quality, 6@6½c. per lb.; chip, 4½@5c.; dust 3½@4c.

Gypsum—Crushed rock, $3@$4.50 per ton. Ground, $3.50@$8.50, f.o.b. shipping points.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ½ in. and larger, $1.10 @$1.75 per net ton. Agricultural limestone, pulverized, $2.50@$4.50 per net ton, f.o.b. eastern shipping points.

Magnesite — Dead-burned magnesite $32@$37.50 per ton in bulk, unground, at Pacific Coast mines. Market very good.

Manjak—Barbados, in 1 to 5 ton lots, grade "C" lump, $330 per short ton; "C" fine, $250; grade "A," $185—all c.i.f. New York.

Mica—Domestic, No. 1 quality, 1½x2 in., 10c. per lb.; 2x2 in., 35c.; 2x3 in., 70c.; 3x3 in., $1.20; 3x4 in., $1.75; 3x5 in., $2.25; 4x6 in., $3.25; scrap, $25 per ton, North Carolina.

Scrap, $22 per ton; washer and disk, $8@$15 per ton, f.o.b. N. H. mill. Market good.

[1]Monazite—Minimum 6 per cent ThO_2, 6@8c. per lb.

Phosphate — 77 to 76 per cent tricalcium phosphate, hard rock, $7.50 per ton, f.o.b. Jacksonville; 77 to 76 per cent pebble grades, $6.75; 75 to 74 per cent pebble, $5.75; 70 per cent pebble, $4.35; 66 to 68 per cent pebble, $3.90, f.o.b. Tampa.

In Tennessee, 65 per cent ground rock, $5.50@$6.50 per ton; 72 per cent washed, unground, $5.50@$6 per long ton; 75 per cent lump, free of fines, $6.25@$7; 78 per cent, lump, $8@$8.50 per long ton. Market slow.

Pumice Stone—Imported lump, 3@ 40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Imported lump, 1 in. diameter and up, 11½c. per long ton unit; furnace size, 2½ in. diameter, 12c. per long ton unit; fines, through ½-in. mesh, 11½c. per long ton unit; cinder property of buyer, ex ship, Atlantic ports. Ore contains 50@51 per cent sulphur; cinder about 63 per cent iron. Market very limited owing to many works having changed over to brimstone.

Silica—Glass sand, $1.50@$3 per ton. Market quiet. Ground, 250 to 450 mesh, $20@$31 per ton, Illinois.

Sulphur—$16@$18 per ton for domestic, f.o.b. Texas and Louisiana mines; $18@$20 for export, f.a.s. New York.

Talc—Ground talc, 150 to 200 mesh, $6@$8 per ton, bags extra, Vermont. Market weak; quotations freely offered that ignore production costs. Demand irregular and not equal to supply.

Roofing grades, $5@$7.50 per ton; paper grades, $10@$18; Vermont. Market seasonably quiet.

Coarse, $5; fine, $8@$14 per ton; crayons, $1.20@$2 per gross; Vermont.

White talc, $25 per ton; gray-white, $8; yellow, $8.50; red, $12; North Carolina. Worst market for powder ever experienced.

Tripoli—Once ground, rose and cream colored, $16@$25; white, $18@$27; double ground, r. and c., $17@$25; w., $19@$30; air-float, r. and c., $25@$30; w., $35; super air-float, r. and c., $35@ $40; w., $40@$45. All per short ton in 200-lb. burlap bags with paper liners, minimum car, 30 tons, f.o.b. Missouri. Demand decreasing and buyers cautious.

Mineral Products

Arsenious Oxide (white arsenic)—Prompt, 13½c. per lb. Second half 1923, 10@11c. per lb.

Copper Sulphate — Large crystals, 5.60c. per lb.; small, 5.50c. Imported material offered much cheaper.

Sodium Nitrate—$2.45@$2.52½ per 100 lb., ex vessel Atlantic ports.

Potassium Sulphate—Basis 90 per cent, $43.67 per ton.

Sodium Sulphate—$26@$28 per ton, New York.

Ferro-Alloys

[1]Ferrocerium—$7 per lb.

Ferrochrome—1 to 2 per cent carbon, 28@30c. per lb.; 4 to 6 per cent carbon, 12c. per lb.

Ferromanganese — Domestic, 78@82 per cent, $125 per gross ton, f.o.b. furnace. Spiegeleisen, 19@21 per cent, $45@$47.50, f.o.b. furnace; 16@19 per cent, $44@$46.50.

Ferromolybdenum—$2 per lb. of contained molybdenum for 50 to 55 per cent grades. Dull.

[1]Price furnished by Foote Mineral Co., Philadelphia, Pa.

Ferrosilicon—10 to 12 per cent, $48 @$55 per gross ton, f.o.b. works; 50 per cent, $90@$92.50 delivered.

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

Ferrotungsten—92@95c. per lb. of contained W, f.o.f. works. Quiet.

[1]Ferro-uranium—35 to 40 per cent U, $4.50 per lb. of U contained, f.o.b. works.

Ferrovanadium—$3.50@$4 per lb. of V contained, f.o.b. works. Active.

Metal Products

Rolled Copper—Sheets, 23.75c., base; wire, 18c.

Lead Sheets—Full lead sheets, 10.25c. per lb.; cut lead sheets, 10.50c. in quantity, mill lots.

Nickel Silver—29.50c. per lb. for 18 per cent nickel Grade "A" sheets.

Yellow Metal — Dimension sheets, 20.75c. per lb.; rods, 17.75c. per lb.

Zinc Sheets—$8.90 per 100 lb., f.o.b. works.

Refractories

Bauxite Brick—$140@$145 per M., Pittsburgh, Pa.

Chrome Brick—$50 per net ton, f.o.b. shipping point.

Firebrick—First quality, $45@$47 per M., Ohio and Kentucky works; second quality, $41@$43.

Magnesite Brick — 9-in. straights, $65 per net ton, f.o.b. works.

Magnesite Cement—$47@$50 per net ton, f.o.b. Chester, Pa.

Silica Brick—$45 per M., Ohio; $53 @$55 Alabama.

Zirkite—Powdered, 80 per cent ZrO_2, 5c. per lb.; 70 per cent, 2½c. per lb. Brick, straights, 75@95c. each.

The Iron Trade

Pittsburgh, July 3, 1923

Steel buyers are conservative, though steel consumption has had practically no decrease. The current rate is higher than the average of the last six months. In some quarters it is held that the conservatism is overdone and that there will be another buying movement in the latter part of August or in September.

Pig Iron—Late last week a sale of basic iron was made at a slight concession from $26, f.o.b. Valley furnace, but the market is commonly quoted at that figure. Bessemer is down $1 to $27.50, and foundry 50c. to $26.50. Inquiry remains light, and a few furnaces are likely to go out.

Connellsville Coke—Following third-quarter furnace coke contracts made at intervals over a long period from $7.50 down to $5.25, a contract was closed Saturday at a shade under $5. Uncovered furnaces will buy from hand to mouth, and their buying, with the influence of the holidays, has made the spot market firmer, at $5@$5.25. Spot foundry remains at $5.50@$6.

METAL STATISTICS

Monthly Average Prices of Metals

Silver

	New York		London		Sterling Exchange	
	1922	1923	1922	1923	1922	1923
January	65.450	65.668	35.035	31.928	421.750	465.053
February	65.290	64.313	33.891	30.875	435.511	468.631
March	64.440	67.556	33.269	32.310	436.912	469.269
April	66.575	66.855	34.080	32.346	440.715	465.220
May	71.154	67.043	36.023	32.611	444.106	462.252
June	71.149	64.861	35.900	31.611	444.615	461.132
July	70.245		35 644		444.165	
August	69.417		34 957		446.069	
September	69.515		35 305		442.800	
October	68.015		34.498		443.583	
November	65.177		32.882		447.484	
December	63.905		31.383		460.440	
Year	67.528		34.406		442.346	

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

Copper

	New York		London			
	Electrolytic		Standard		Electrolytic	
	1922	1923	1922	1923	1922	1923
January	13.465	14.510	65.226	64.494	72.321	71.409
February	12.864	15.355	60.250	67.700	66.125	74.500
March	12.567	16.832	59.245	73.851	65.739	81.464
April	12.573	16.663	58.799	73.169	64.028	81.331
May	13.111	15.440	61.092	67.460	66.554	76.568
June	13.575	14.663	61.988	66.607	69.333	73.238
July	13.654		63.137		70.321	
August	13.723		63.784		69.932	
September	13.748		63 113		70.917	
October	13.632		62.773		70.693	
November	13.598		62.795		70.216	
December	14.074		63.267		70.132	
Year	13.382		62 123		68.859	

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

Lead

	New York		St. Louis		London	
	1922	1923	1922	1923	1922	1923
January	4.700	7.633	4.388	7.571	23.667	27.119
February	4.700	8.050	4.396	8.093	20.681	28.519
March	4.720	8.252	4.421	8.254	21.266	28.815
April	5.115	8.101	4.946	7.996	22.993	26.956
May	5.420	7.306	5.281	7.085	24.462	25.614
June	5.745	7.146	5.563	6.852	24.685	25.429
July	5.729		5.447		24.869	
August	5.824		5.537		24.580	
September	6.110		5.868		24.131	
October	6.530		6.338		25.551	
November	7.047		6.868		26.199	
December	7.163		6.978		26.079	
Year	5.734		5.503		24.097	

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

Tin

	New York 99%		New York Straits		London	
	1922	1923	1922	1923	1922	1923
January	31.480	37.986	32.100	39.173	163.065	181.852
February	29.835	40.693	30.767	42.011	149.850	190.513
March	28.426	46.569	29.171	48.569	143.152	219.607
April	29.810	44.280	30.605	45.810	149.840	213.081
May	30.149	42.346	30.971	43.135	150.163	203.097
June	30.707	40.375	31.497	40.957	152.512	191.798
July	31.025		31.733		156.149	
August	32.134		32.380		160.006	
September	32.075		32.395		160.065	
October	33.935		34.600		170.563	
November	35.911		36.734		179.341	
December	36.480		37.695		178.697	
Year	31.831		32.554		159.450	

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

Zinc

	St. Louis		London	
	1922	1923	1922	1923
January	4.691	6.815	26.321	35.733
February	4.485	7.152	24.213	35.613
March	4.658	7.706	25.467	36.720
April	4.906	7.197	26.576	34.275
May	5.110	6.625	27.304	31.057
June	5.346	6.031	27.893	29.548
July	5.694		29.042	
August	6.212		31.170	
September	6.548		31.750	
October	6.840		34.528	
November	7.104		38.011	
December	6.999		37.757	
Year	5.716		30.003	

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

Antimony, Quicksilver and Platinum

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) New York	
	1922	1923	1922	1923	1922	1923
January	4.463	6.884	49.960	72.731	97.260	112.462
February	4.416	7.290	48.295	70.636	89.545	113 273
March	4.319	8.885	50.204	70 808	87.500	110 846
April	4.980	8.380	52.280	69 200	87.500	116.840
May	5.467	7.477	54.885	68.000	85.529	115 077
June	5.145	6.839	55.115	67.769	87.212	115.615
July	5.091		55.000		90.180	
August	5.315		57.593		98.370	
September	6.580		67 640		117 280	
October	6.905		72.560		109.440	
November	6.584		71.521		108.000	
December	6.382		72.300		113.600	
Year	5.471		58.946		97.618	

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

Pig Iron, Pittsburgh

	Bessemer		Basic		No. 2 Foundry	
	1922	1923	1922	1923	1922	1923
January	21.55	29.27	20.15	27.35	21.34	28.77
February	21.46	29.79	19.71	28.15	20.88	27.21
March	21.35	32 03	19.96	31.79	20 83	31.77
April	22.50	32.77	21.26	32 77	22.70	32.77
May	26.36	31.87	26.87	29.83	25.96	32.46
June	26.96	30.27	26.96	28.34	25.96	29.81
July	26.77		26.33		25.97	
August	30.44		27.18		30.81	
September	35 27		34.70		36 79	
October	35.27		31.77		33.40	
November	33.52		29.37		30.55	
December	29.87		26.34		27.69	
Year	27.61		25.88		26.91	

In dollars per long ton.

Monthly Crude Copper Production

	1923			
	February	March	April	May
Alaska shipments	7,975,434	4,684,081	6,886,159	8,693,161
Washoe Smelter	15,600,000	20,250,000	19,400,000	18,100,000
Calumet & Arizona	2,998,000	3,506,000	3,520,000	2,868,000
Calumet & Hecla	(c)	(c)	(c)	(c)
Other Lake Superior	(c)	(c)	(c)	(c)
Chino	(c)	(c)	(c)	(c)
East Butte	(c)	(c)	(c)	(c)
Inspiration	(c)	(c)	(c)	(c)
Miami	5,059,000	5,310,000	5,017,000	5,557,000
Nevada Cons.	(c)	(c)	(c)	(c)
New Cornelia	2,666,557	3,181,928	3,155,615	3,631,906
Old Dominion	2,098,000	2,530,000	3,271,600	.....
Phelps Dodge	7,329,000	8,767,000	7,668,000	8,947,000
Ray	(c)	(c)	(c)	(c)
Shattuck Arizona	(c)	(c)	(c)	(c)
Southwest Metals Co.	.....	.....	.....	.....
United Verde	(c)	(c)	(c)	(c)
United Verde Extension	3,220,306	3,621,074	3,759,160	3,759,012
Utah Copper	(c)	(c)	(c)	(c)
Others, estimated	11,500,000	12,500,000	10,500,000	.....
Total United States	.....	.....	.....	.....
Imports: Ore and concentrates, matte	.....	.....	.....	.....
Imports of black and blister, unrefined	.....	.....	.....	.....
Imports of refined and old	.....	.....	.....	.....
Grand total	.....	.....	.....	.....
Backus & Johnston	(c)	(c)	(c)	(c)
Boleo	.....	1,302,053	1,519,245	1,389,150
Cananea	(c)	(c)	(c)	(c)
Cerro de Pasco	(c)	(c)	(c)	(c)
Chile	(c)	(c)	(c)	(c)
Cons. M. & S. of Canada	(a)	(a)	(a)	(a)
Falcon Mines	567,200	.....	.....	.....
Furukawa	2,645,337	3,233,515	.....	.....
Granby Cons.	3,589,377	3,251,360	3,217,577	2,771,179
Hampden Cloncurry	.....	.....	.....	.....
Katanga	7,829,955	8,824,410	8,531,145	9,012,405
Mount Morgan	832,000	.....	.....	.....
Mount Lyell	1,012,000	.....	.....	.....
Phelps Dodge Mexican	3,118,000	3,960,000	3,940,000	3,688,000
Sumitomo	1,377,643	2,563,681	2,663,750	2,643,944
Wallaroo & Moonta	357,626	354,397	208,026	.....

Comparative Monthly Copper Production

	1920	1921	1922	1923
January	121,903,744	90,596,597	32,010,292 (b)	112,341,000
February	117,540,000	86,682,941	45,957,530 (b)	102,641,000
March	120,309,316	91 046,345	55,705,760 (b)	122,202,000
April	116,078,871	46,946,523 (b)	76,601,000 (b)	117,914,000
May	114,964,207	25,310,511 (b)	88,714,000 (b)	124,785,000
June	116,107,856	24,623,693 (b)	93,740,000	.....
July	109,729,610	22,033,739 (b)	91,000,000	.....
August	112,460,254	23,248,398 (b)	101,188,000	.....
September	104,919,562	23,855,316 (b)	96,408,000	.....
October	105,231,571	23,231,572 (b)	103,273,000	.....
November	106,700,178	28,341,442 (b)	102,845,000	.....
December	95,709,009	29,629,137 (b)	03,003,000	.....

(a) No copper produced during this month. (b) Department of Commerce. (c) Not available.

Facts for the Stockholder

XXII—Seneca Copper Corporation

THE SENECA COPPER CORPORATION was incorporated in New York, in December, 1916, and in October, 1918, acquired all the property and assets and assumed the liabilities of the Seneca Mining Co. The Seneca Mining Co. had been incorporated in Michigan, in March, 1860. It was a subsidiary by stock ownership of the Calumet & Hecla Mining Co.

In October, 1919, the company purchased from the Calumet & Hecla 79,500 of the 100,000 outstanding shares of the capital stock of the Gratiot Mining Co. Payments due Calumet & Hecla for this stock are $50,000, due Dec. 1, 1923, and $360,000, due Dec. 1, 1924. These payments may be anticipated and discounted at the rate of 5 per cent. When all payments shall have been made, Calumet & Hecla agrees to assign to the Seneca Copper Corporation the indebtedness of the Gratiot Mining Co. to Calumet & Hecla, amounting to $495,519. In November, 1920, Seneca purchased from the Mohawk Mining Co. the balance of the capital stock of the Gratiot, 20,500 shares.

In 1921, the Seneca Copper Corporation purchased 10,000 shares of the 100,000 shares of capital stock of the Lake Milling, Smelting & Refining Co. Through this purchase the company acquired a stamping capacity for treating 1,200 tons of ore a day.

The holdings of the company are situated in Keweenaw County, Mich. The property forms a continuous tract of mineral land comprising about 2,465 acres, the Ahmeek property lying to the south and the Mohawk property to the east and south. The company also owns over 350 acres of surface, comprising a mill site on the shore of Lake Superior, building sites, and railroad rights of way.

The Kearsarge Amygdaloid lode outcrops for about 2,000 ft. on the Seneca property and about 6,000 ft. on the Gratiot. This is a blanket vein about 15 ft. thick underlying both properties below the outcrop. The property also includes areas of Osceola Amygdaloid, Calumet Conglomerate, Pewabic Amygdaloid, and other copper lodes, all of which are being worked by companies operating at other points south of Seneca. Development by the present company to the end of 1922 was as follows: Seneca, No. 1 shaft, 2,540 ft.; crosscuts, 484 ft.; raises, 236 ft.; drifts, 11,752 ft.; total, 15,012 ft. Gratiot, No. 2 shaft, 33 ft.; raises, 404 ft.; drifts, 1,881 ft.; total, 2,318 ft. Including previous work done by the Gratiot, workings at No. 2 shaft are as follows: Shaft, 1,521 ft.; raises, 404 ft.; drifts, 6,260 ft.; total, 7,966 ft. The two shafts are approximately 3,800 ft. apart along the strike of the vein, and will be connected by drifts. Development work at Seneca No. 1 produced copper ore, of which 43,785 tons was stamped, yielding 1,236,185 lb. of copper, or more than 28 lb. copper per ton stamped. Some copper ore has also been produced at Gratiot and stockpiled. The company expects to begin active production on a commercial scale before the end of the summer, and get the mines up to present milling capacity as soon as possible. With regard to future possibilities, it has been estimated that the Kearsarge lode on the company's property can be mined to a depth of at least 7,500 ft., which should yield about 600,000,000 lb. of copper, with ultimately a possible annual output of about 30,000,000 lb., after development shall have progressed sufficiently.

An increase in the capital stock was authorized June 30, 1923, making the present authorized issue 450,000 shares of no par value, of which 325,000 shares are outstanding. The present outstanding funded debt consists of $500,000 in convertible debenture 8 per cent bonds, due April 15, 1925, redeemable at thirty days' notice, at 110, with interest, and convertible into capital stock at the rate of five shares of stock for each $100 par value bonds. There has been further authorized an issue of $1,500,000 par value ten-year 7 per cent first mortgage bonds, due July 1, 1933. Of this issue, $500,000 is to be used to retire the 8 per cent outstanding debenture bonds and an additional $500,000 par value is offered for sale at 98, this installment having been underwritten. The first mortgage bonds are convertible at par into stock at $15 per share and carry a sinking fund provision of 1c. per lb. of copper produced by the company after Jan. 1, 1926, up to 21,000,000 lb. of copper per annum. They are redeemable on any interest date at 110 and interest.

The company's operations to date have consisted of development work, and therefore no income has been earned, and no dividends have been paid.

Price range of stock on the New York Stock Exchange has been as follows: High, 26½ in 1919 (curb); low, 6 in 1922 and 1923; closing price, 6½, July 2, 1923.

INVESTIGATOR.

North Butte Mining Co.

Copper; Butte, Mont.

At the meeting of the directors of the North Butte Mining Co. on June 30 it was stated that the last estimate of ore reserves was made on March 31, 1923. At that time there was developed 232,763 tons of copper ore averaging 4.1 per cent copper and 3.2 oz. silver, and 14,509 tons of zinc ore averaging 20 per cent zinc and 2.7 oz. silver. Of this, 76,762 tons was on the three lower levels of the Edith May vein, this ore averaging 4.6 per cent copper and 3 oz. silver. The report continues:

"Due to the generally disappointing results of development on the deepest levels, the directors felt that it was wise to consider taking on other properties from which the earnings of the company might be augmented. A number of properties have been examined, with the result that the company recently took an option on a promising group of claims at Superior, Ariz., where active development is now in progress. Options have also been taken on two groups of silver-lead properties in the Mayo district, Yukon Territory. It is hoped that the development of these and possibly other properties may result in opening up profitable orebodies which, with adequate mining and milling facilities provided, should bring the earnings of the company back to the satisfactory basis of former years."

Following is the balance sheet, May 31, 1923.

Assets

Property	$9,188,901.19	
Granite Mountain shaft construction	144,260.15	
East Side property development	485,900.51	
Deferred development	534,332.98	
Properties under option	2,500.00	
War savings certificates	252.60	
Investments	2,448.64	
Cash	58,078.63	
Notes receivable	16,320.01	
Accounts receivable	4,894.91	
Supplies at mine	36,405.62	
Copper and silver to company's credit with Metals Sales Corporation	693,078.44	$11,167,373.68

Liabilities

Capital stock	$6,450,000.00	
Dividends unclaimed	1,033.15	
Accounts payable	41,748.91	
Copper Export Association, Incorporated	75,167.52	
Advances on metals	281,651.69	
Treatment charges (not due)	123,495.54	
Reserve for ore depletion	3,360,319.69	
Surplus	833,957.18	$11,167,373.68

The Santa Gertrudis Co., Ltd.

Gold, Silver; Mexico

A report of the operations of the Santa Gertrudis Co., Ltd., for the first quarter of 1923, Jan. 1 to March 31, shows that the mill crushed 34,885 dry tons of ore from the Santa Gertrudis mine, and 93,643 tons delivered by the Inversiones company from its El Bordo, Malinche, and El Cristo mines. The value of the bullion produced was $261,198, U. S. currency, of which, working expenses (including development, shipping, and selling) took $189,836, leaving a profit of $71,362. The average milling rate was 89 per cent of capacity. Installation of new hoisting equipment, compressor plant, blacksmith and timber-framing shops, and terminal ore bin has been completed at the Malinche mine, so that it is now well equipped for economical operation.

MINING STOCKS

Week Ended June 30, 1923

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	62	55½	56	June 23, Q	$1.50
Alaska-Br. Col.	N. Y. Curb	1¼	1⅛	1⅛		
Alloues	Boston	20	18	18	Mar. '19	1.00
Anaconda	New York	41½	38½	38½	Je. 16, Jy. 23	0.75
Arcadian Consol.	Boston	1½	*85	*85		
Ariz. Com'l	Boston	10	8½	9	Oct. '18, Q	0.50
Calaveras	N. Y. Curb			2		
Calumet & Arizona	Boston	50	44½	46	Mar. '23,	1.00
Cal. & Hecla (New)	Boston	47½	40	42	June '23, Q	10.00
Centennial	Boston	9½	8	8	Dec. '18, SA	1.00
Cerro de Pasco	New York	41	37⅞	38⅛	May '23,	1.00
Chile Copper	New York	26½	24⅛	25⅛	Je. 2, Je.30 Q	0.62½
Chino	New York	21½	18	18	Sept. '20, Q	0.37½
Con. Coppermines	N. Y. Curb	3	2½	2⅝		
Copper Range	Boston	32½	29	29¼	May '23, Q	1.00
Crystal Copper	Boston Curb	1½	*93	*94		
Davis-Daly	Boston	2⅜	2¼	2⅜	Mar. '20, Q	0.25
East Butte	Boston	6½	5⅞	5⅞	Dec. '19, A	0.50
First National	Boston Curb	37	35	37	Feb. '19, SA	0.15
Franklin	Boston	1⅜	1¼	1¼		
Gadsden Copper	Boston Curb			*80		
Granby Consol.	New York	20½	15⅞	15⅞	May '19, Q	1.25
Greene-Cananea	New York	19	16⅜	16⅜	Nov. '20, Q	0.50
Hancock	Boston	1⅜	1⅛	1⅛		
Howe Sound	N. Y. Curb	3½	3⅛	3⅜	Jy. 2, Jy.16	0.05
Inspiration Consol.	New York	31½	28	28	Je.14, Jy. 2 Q	0.50
Iron Cap	Boston Curb	5	3⅜	4⅜	May 23, K	0.15
Isle Royale	Boston	22	19⅜	20	Mar. '23, Q	0.50
Kennecott	New York	35½	32	32	Je. 8, Jy. 2 Q	0.75
Keweenaw	Boston	1	1	1		
Lake Copper	Boston	2½	1⅞	2		
Magma Copper	New York	31½	29	29	Jan. '19, Q	0.50
Mason Valley	N. Y. Curb	1⅝	1⅜	1⅜		
Mass Consolidated	Boston	1⅝	1½	1½	Nov. '17, Q	1.00
Miami Copper	New York	25⅜	22½	22½	Au. 1, Au. 15, Q	0.50
Michigan	Boston	1⅜	1	1		
Mohawk	Boston	48	40	41	June '23, Q	1.00
Mother Lode Coa.	New York	8⅞	8½	8⅜	Je. 8, Je. 30, Q	0.50
Nevada Consol.	New York	12⅜	11⅛	11⅜	Sept. '20, Q	0.25
New Cornelia	Boston	18	16	16⅛	May '23, Q	0.25
North Butte	Boston	5¼	4¼	4¼	Oct. '18, Q	0.25
Ohio Copper	N. Y. Curb	*58	*48	*52		
Old Dominion	Boston	21	19	20	Dec. '18, Q	1.00
Osceola	Boston	30	29	29⅛	Mar. '23, K	1.00
Phelps Dodge	Open Mar.	†160	†170		Je. 20, Jy. 2 Q	1.00
Quincy	Boston	30	25	26	Mar. '20, Q	1.00
Ray Consolidated	New York	12	10	10¼	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb	1¼	1	1		
St. Mary's Min. Ld.	Boston	37	32	32	Mar. '23, K	3.00
Seneca Copper	New York	7¼	6⅜	6⅜		
Shannon	Boston	*65	*55	*65	Nov. '17, Q	0.25
Shattuck Arizona	New York	7⅛	6	6⅛	Jan. '20, Q	0.25
South Lake	Boston			*12		
Superior & Boston	Boston	1⅛	1	1		
Tenn. C. & C. cfs.	New York	9¼	8½	8⅜	Je.30, Jy. 16, Q	0.25
Tuolumne	Boston	*22	*20	*20	May '13,	0.10
United Verde Ex.	N. Y. Curb	33	30	31½	Jy. 5, Au. 1, Q	1.00
Utah Consol.	Boston	2	1⅝	1⅝	Sept '18,	0.25
Utah Copper	New York	62	56½	56½	Je. 8, Je. 30, Q	1.00
Utah Metal & T.	Boston	*80	*75	*76	Dec. '17,	0.30
Victoria	Boston			1		
Winona	Boston	*80	*30	*75		
Wolverine	Boston	7	6	6		
NICKEL-COPPER						
Internat. Nickel	New York	13½	12⅛	12⅛	Mar. '19,	0.50
Internat. Nickel pfd.	New York	82	77	77	May '23, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh			3½		
National Lead	New York	116	110½	110½	Je.15, Je.30 Q	2.00
National Lead pfd.	New York	107½	107½	107½	June '23, Q,	1.75
St. Joseph Lead	New York	18½	17	17	Se.9,Se.20 Q,X	0.50
ZINC						
Am. Z. L. & S.	New York	10	8⅛	8⅛	May '20,	1.00
Am. Z. L. & S. pfd.	New York	37	30⅜	31	Nov. '20, Q	1.50
Butte C. & Z.	New York	6⅜	5⅛	5⅛	Mar. '23,	0.50
Butte & Superior	New York	21½	18	18½	Je. 15, Je. 30, Q	0.50
Callahan Zn-Ld	New York	5⅜	5⅛	5⅛	Dec. '20, Q	0.50
New Jersey Zn.	N. Y. Curb	151	147⅞	151	Jy.31,Au.10 Q	2.00
United Zinc	N. Y. Curb			1		
Yellow Pine	Los Angeles	*65	*65	*65	Sept. '20, Q	0.03
SILVER						
Alvarado	N. Y. Curb	4	3½	3½		
Batopilas Mining	New York			¼	Dec. '07, I	0.12½
Beaver Consol.	Toronto	*34½	*33	*33	May '20, K	0.03
Candelaria	N. Y. Curb	*8	*6	*6		
Castle-Trethewey	Toronto	*25	*24½	*24½		
Coniagas	Toronto	2.70	2.70	2.70	May '21, Q	0.12½
Crown Reserve	Toronto	*60	*58½	*58½	Jan. '17,	0.05
Hilltop-Nev.	N. Y. Curb.			*95		
Kerr Lake	N. Y. Curb	2⅜	2⅜	2⅜	Jy. 2, Jy. 16, Q	0.12½
La Rose	Toronto	*33	*32	*32	Apr. '22,	0.10
McKinley-Dar.-Sav.	Toronto	*17¾	*17	*17¾	Oct. '20, Q	0.03
Mining Corp. Can.	Toronto	2.65	2.60	2.60	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	5⅜	5⅛	5⅜	Jy. 1, Jy. 20 Q	0.15
Ontario Silver	New York	4⅜	4⅛	4⅛	Jan. '19, Q	0.50
Temiskaming	Toronto	*43	*38½	*40	Jan. '20, K	0.04

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	¼	¼	¼		
Alaska Juneau	New York	1⅛	1	1⅛		
Boundary Red M.	N. Y. Curb	*20	*15	*20		
Carson Hill	Boston	6	5⅜	5⅜		
Cresson Consol. G.	N. Y. Curb	3 7/16	3⅜	3⅜	Apr. '23 Q	0.10
Dome Mines	New York	37½	34½	34¾	Je.30, Jy.20 Q	1.00
Golden Cycle	Colo. Springs	1.08	1.05½	1.05½	Dec. '22, Q	0.02
Hollinger Consol.	Toronto	12.50	12.15	12.15	Je.28, Jy.16 M	0.05
Homestake Mining	New York	64	64	64	Je.20, Je.25 M	0.50
Kirkland Lake	Toronto	*39	*38	*38		
Lake Shore	Toronto	3.50	3.25	3.35	May '23, Q	0.02
McIntyre-Porcupine	New York	17⅞	16½	16½	May '23, Q	0.25
Portland	Colo. Springs	*35	*34½	*35	Oct. '20, Q	0.01
Teck-Hughes	N. Y. Curb	1⅜	1⅜	1⅜		
Tom Reed	Los Angeles	*58	*55	*55	Dec. '19,	0.02
United Eastern	N. Y. Curb	1⅞	1⅜	1 11/16	Apr. '23, Q	0.15
Vipond Cons.	Toronto	*53	*45	*53		
Wright-Hargreaves	Toronto	3.15	3.10	3.10	Apr. '23,	0.02½
Yukon Gold	N. Y. Curb	1⅜	1⅜	1⅜	June '18,	0.02½
GOLD AND SILVER						
Boston-Mont. Corp.	N. Y. Curb	*16	*12	*12		
Con. Cortez	N. Y. Curb	*67	*65	*67		
Cons. Virginia	San Francisco	11½	10	10		
Continental Mines	N. Y. Curb	5½	5⅜	5¼		
Dolores Esperanza	N. Y. Curb	1⅜	1 7/16	1 13/16	Jy. 1, Jy.10 Q	0.05
Jib Consol.	N. Y. Curb	*85	*75	*75		
Tonopah Belmont	N. Y. Curb	*75	*75	*75	Apr. '23, Q	0.05
Tonopah Divide	N. Y. Curb	*53	*50	*50	May 23	0.10
Tonopah Extension	N. Y. Curb	2⅛	1⅞	1 15/16	Je. 9, Jy. 2	0.05
Tonopah Mining	N. Y. Curb	1⅜	1 7/16	1 7/16	Apr. '23, Q	0.07½
Unity Gold	N. Y. Curb	4	3¼	3¼		
West End Consol.	N. Y. Curb	*95	*85	*85	Mar. '23, Q	0.05
SILVER-LEAD						
Bingham Mines	Boston			*16½	Sept. 19, Q	0.25
Cardiff M. & M.	Salt Lake	*60	*53	*60	Dec. '20,	0.15
Chief Consol.	Boston Curb	4⅛	3⅜	4	May '23, Q	0.10
Columbus Rexall	Salt Lake	*59	*52	*53	Aug. '22,	0.03
Consol. M. & S.	Montreal	26½	25⅛	25½	Oct. '20, Q	0.62½
Erupcion	Boston Curb			2½	Apr. '23, Q	0.125
Federal M. & S.	New York	7⅛	7⅛	7¼	Jan. '09,	1.50
Federal M. & S. pfd.	New York	38	35	35½	Mar '23, Q	1.75
Florence Silver	Spokane	*38	*38	*38	Apr. '19, Q,X	0.01½
Hecla Mining	N. Y. Curb	8	7⅞	7⅞	Je. 15 Q	0.50
Iron Blossom Con.	N. Y. Curb	*25	*25	*25	Apr. '22, Q	0.02½
Marsh Mines	N. Y. Curb	*11	*11	*11	June '21, I	0.02
Park City	Salt Lake	3.15	3.15	3.15	Je.15, Jy. 2 Q	0.12½
Park Utah	N. Y. Curb			3½	Je.15, Jy. 2 Q	0.15
Prince Consol.	Salt Lake	*3½	*2	*2	Nov. '17,	0.02½
Silversmith	Spokane	*38½	*36	*38	Apr. 23,	0.01
Simon Silver Lead	N. Y. Curb	*23	*23	*23		
Snowstorm Silver-L.	N. Y. Curb			*43		
Tamarack-Custer	Spokane	1.25	1.25	1.25	Je.30, K	0.02
Tintic Standard	Salt Lake	3.15	3.00	3.00	July '23	0.15
Utah-Apex	Boston	3⅜	3⅛	3⅛	June '23, Q,X	0.50
IRON						
Bethlehem Steel	New York	51½	41⅜	42	Je. 1, Jy. 2 Q	1.25
Char. Iron	Detroit			1		
Char. Iron, pfd	Detroit			2⅜		
Colorado Fuel & Iron	New York	29⅛	25	26	May '23, Q	2.00
Col. Fuel & Iron pfd.	New York			102	Feb. '23, Q	2.00
Gt. North'n Iron Ore	New York	28⅛	25⅛	25⅛	Apr. '23	1.00
Inland Steel	N. Y. Curb			46½	June '23 Q	0.62½
Mesabi Iron	N. Y. Curb			9		
Replogle Steel	New York	15⅛	13	13		
Republic I. & S.	New York	47⅛	40⅛	40⅛	May '21	1.50
Republic I. S. pfd.	New York	87⅛	86½	86½	Je.15, Jy.2 Q	1.75
Sloss-Sheffield S. & I.	New York	45⅛	40	40	Feb. '21	1.50
Sloss-Shef. S.&I. pfd.	New York	76⅛	74	74	Je. 22, Jy. 2 Q	1.75
U. S. Steel	New York	93⅛	89⅛	90⅛	Je.29, Q	1.25
U. S. Steel pfd.	New York	118½	117⅛	117⅛	May '23	1.75
Virginia I. C. & C.	New York	55	53	53	Je.16, Jy. 2	2.00
Virginia I.C.&C.pfd.	New York	80	77½	77½	Je.16, Jy. 2	2.50
VANADIUM						
Vanadium Corp.	New York	30⅜	25⅛	25⅛	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	54	53⅜	53⅜	Je.30,Jy.15 Q	1.50
Asbestos Corp. pfd.	Montreal	78	77	77	Je.30,Jy.15 Q	1.75
SULPHUR						
Freeport Texas	New York	12⅛	10	10	Nov. '19, Q	1.00
Texas Gulf	New York	59⅜	55⅛	55⅛	May '23, Q	1.50
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	3	3	3		
MINING, SMELTING AND REFINING						
Amer. Metal	New York	44⅛	40¼	40⅛	Je. 1, Q	0.75
Amer. Metal pfd.	New York	108	106	107¼	Je. 1, Q	1.75
Amer. Sm. & Ref.	New York	58⅛	53	53⅜	Jy. 9, Au. 1	1.25
Amer. Sm.& Ref. pfd	New York	96½	93	93⅜	Au.10, Se.1 Q	1.75
U. S. Sm. R. & M.	New York	24⅛	20	22	Jan. '21. Q	0.50
U.S. Sm.R.& M. pfd.	New York	43	40⅛	40⅛	Jy.6,Jy.14 Q	0.87½

*Cents per share. †Bid or asked. Q. Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Arthur E. Moysey; Spokane, Pohlman Investment Co; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Mines and Oil; Colorado Springs, Colorado Springs Stock Exchange.

INDUSTRIAL NOTES

The Need of Research

"Why Research Is Necessary" is the title of a recent bulletin put out by the British Cast Iron Research Association. It says:

"Unless a test reveals a condition which can be modified it is useless as a routine control method in manufacturing. Furthermore, the ease with which the test can be made is also a regulating factor. Thus an analysis of pig iron for the elements commonly found in it in appreciable quantities enables the metallurgist to mix the iron in such proportions that the metal from the cupola will have the composition desired, and an analysis of the casting will indicate whether the iron has been charged as ordered. But a test for titanium and other extremely small amounts is too complicated for routine work and would not give any indications which would permit the chemist to modify the mixture. On the other hand, such a test will be essential to a research worker carrying out a large research.

"This indicates the vast difference between works tests for routine control and those for investigational work. In the former the test must be simple, in the latter it may be of the most complicated and lengthy nature. In fact, the one cause for limited results in foundry research work is the lack of thorough investigation. Superficial methods in this line of endeavor bring little reward, and in some cases lead to conclusions which discredit research with many practical foundrymen.

"It is here where the work of the British Cast Iron Research Association differs so much from the general routine work of a foundry. An argument has been put forward that if a foundry cannot do without the assistance of such an association as this it ought not to be in business at all. If such an argument had any force at all it means that no industry should make any attempt to progress. No doubt foreign countries would approve of such a course being adopted, as they recognize themselves that the more industry joins up with scientific research work the better it is equipped to meet all competition. The foundry that decrys the value and help of research is doomed to failure in the long run.

"Many factors are responsible for the growth and commercial success of any manufacturing organization, but even a superficial survey of the industrial field will indicate to any interested observer that adaptation to changing conditions and the adoption of new and improved methods and processes characterize all firms which have been in business over a long period of time and who have progressed. This phase of business life means that large manufacturing enterprises recognize the great value of co-operative scientific research such as carried out by this association and readily support any such organization that has for its objects the furthering of industry.

"Possibly no industry requires assistance such as can only be given by research more than the ironfounding industry. In the cast-iron field metallography has not made as much impress as it has in the steel industry. A few metallurgists have developed the microscopic study of malleable iron until the annealing operation is becoming better understood, but little of practical value for the gray-iron foundryman has been obtained through microscopic investigation. From time to time articles on the microstructure of gray iron have been published, particularly by Prof. Bauer. These articles have given an idea of what might be done from the further investigation of this product under the microscope. The condition of carbon also offers an important field for investigation. In steel, the state in which the carbon exists effects a marked influence and has been studied under the microscope. Microscopic investigation of carbon in gray iron has been confined largely to examining the shape and size of the graphite particles, but little has been indicated regarding the effects producing the different states of the graphite which was not already known. It would appear that research must go deeper and study the graphite formation at higher magnifications. Already investigations by the association have shown the complexity of the graphite grain of which graphite is only a part. Possibly when the nature of the graphite particle is understood, a method of controlling it to give higher physical properties to the gray iron may be evolved.

"Once these problems are solved the results will be turned over for practical application. The beneficial results arising from work of this character can only be measured as the various problems awaiting solution are tackled by the association."

Bruno V. Nordberg, president and chief engineer of the Nordberg Manufacturing Co., of Milwaukee, Wis., was recently honored by the University of Michigan by having the degree of Doctor of Engineering conferred upon him. This was in recognition of Mr. Nordberg's ability in the design of machinery used in mining fields. Such installations as the Quincy hoist installed in the No. 2 shaft of the Quincy Mining Co., Hancock, Mich., and the automatic electric hoist installation for the Inspiration Consolidated Copper Co., Miami, Ariz., are examples of Mr. Nordberg's skill and ability in the design of special machinery used for mining operation. Nordberg steam and electric hoists, air compressors, blowing engines, and Corliss engines are found in all mining fields and are noted for their efficiency and performanace records. The quality of this equipment is largely due to Mr. Nordberg's exceptional engineering ability.

He received his engineering education at the University of Finland, Helsingfors, being graduated from that institution in 1878. After coming to this country he engaged in the manufacture of a poppet valve governor which at that time was far superior to anything else in use. This led to the founding of the concern bearing his name, which later went into the manufacturing of large and special machinery. He still takes an active part in the business, especially where important engineering problems are involved.

On July 1 the business previously carried on by H. A. Watson & Co., Inc., 56 Pine St., New York, dealers in ores and metals, was taken over by Watson, Geach & Co., Inc., a New York corporation, with increased capital, at the same address. The personnel remains unchanged and the new corporation will represent H. A. Watson & Co. Ltd., Liverpool, Engand, as H. A. Watson & Co. did in the past. All of the assets of the latter company have been acquired by the new corporation, which has assumed all of the old company's obligations. The business will be continued in the same manner as heretofore.

Arthur T. Beach, president of both the Beach Russ Co. and the Abbe Engineering Co., of New York, died at his home in Brooklyn, N. Y., on June 16 in his sixty-first year. He was born in Hazardville, Conn., in 1862 and came to New York thirty-two years ago, when he founded the Beach Russ Co., manufacturers of pumps. In 1912 he also became president of the Abbe Engineering Co., one of the largest manufacturers of grinding and pulverizing machinery.

The Carnegie Steel Co. has bought two new model Westinghouse underfeed stokers for its Mingo Junction, Ohio, plant. These stokers will heat two 1,000-hp. boilers by burning Pittsburgh bituminous coal.

NEW MACHINERY AND INVENTIONS

A Small Portable Compressor

A combined compressor and gasoline engine, 1½x2x2½ ft. in dimensions and weighing 200 lb., has been developed by Edward J. Wilcox, of the Non-Exhaust Compressed Air Machinery Co., of Cambridge, Mass. According to the makers, the machine will develop power enough to "drill the deepest hole in the hardest granite; dress the hardest rock surfaces, cut the toughest bolt, drive the largest rivet, chip metal, and so on down to the finest lettering or ornamentation on stone or marble. The machine is valveless and is made in three sizes, operated by gasoline. It is also made in three sizes operated by electricity.

TRADE CATALOGS

Stokers—The Combustion Engineering Corporation, Combustion Engineering Building, Broad St., New York, has just issued catalog K-1, consisting of four pages describing the company's Type K Stoker for operating boilers ranging up to 200 hp. at high capacity and efficiency. The design of this stoker utilizes the principle of underfeeding the coal. Data of a test conducted on an installation at a plant operating three 150-hp. B. & W. boilers are given.