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Dredge of Gold Canyon Dredging Co., Near Silver City, Nevada

Concentrating by Roughing—II

By E. S. Wiard

The Transportation of Dredge Material

By George J. Young

The Black Lake Asbestos Area

By Wynant D. Hubbard

A description of the details covering the sinking of the Water Lily Shaft at Eureka, Utah, is given on page 376. Information required by rules governing the Gold Medal award for breaking the World's Shaft Sinking Record has been submitted to the Committee.

The subject of licensing mining engineers has been under discussion by the Mining and Metallurgical Society. A report of the Committee appointed to analyze the replies received to a questionnaire appears this week under "Echoes from the Fraternity."

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Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
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The Progress of Rock Drill Bits

DURING THE LAST several years a number of important articles have been contributed to the technical and Institute publications on the subject of rock drill bits and drill steel. Probably the most important principle described is exemplified by the double-tapered rock drill bits. The Carr bit was, according to an expert with whom we had the pleasure of discussing the subject, the first bit in which the double-taper principle was utilized. Although incorporated in the design of the bit and made use of, its importance was probably not recognized for some time.

Briefly, the double-taper bit is a cross-bit with all of the cutting edges lying in one plane and the wings brought back from the cutting edges within a conical surface, making an angle with the axis of the drill varying from a minimum of 5 deg. to a maximum of 7 deg. This conical surface is brought back from the cutting edges for a distance of ¾ in., and from this point the wings fall within a 14-deg. cone to the drill steel. The result is that a bit is produced which has excellent reaming qualities and which permits, in many instances, a change from the customary ¼-in. to a ⅛-in. reduction in diameter for follower bits. It is thus possible to diminish the size of starting bits, with the result that there is a perceptible gain in drilling speed and a smaller total of energy required in overcoming the cohesion of the rock particles, as a smaller volume of rock is removed in drilling a hole of given depth. Manufacturers of drill-sharpening appliances have been chiefly responsible for the double-taper cross-bit, and the necessary appliances for its convenient manufacture at mines have been pretty thoroughly developed.

One company has pioneered a step further and developed what is termed a "double-arc" bit. This is similar in principle to the double-taper cross-bit, with the difference that the cutting edges are curved in the form of two arcs connected by a short bridge at the center. This bit has been tried out and has been found to give excellent results. According to our information, it has not been patented and has been given freely to the mining industry. There are thus available, in addition to the Carr bit, two well-developed rock drill bits, the cross-bit and the double-arc bit, both of the double-taper design. The Carr bit is, both in speed of drilling and stamina, as satisfactory for hard rock drilling as the cross-bit and double-arc bit. It is, however, harder to make and to maintain. Of the three bits, probably no one has special advantage in drilling as compared with the others. The double-taper cross-bit is the most used, principally because it is easy to form and maintain. It is important, however, to bear in mind in any discussion on rock drill bits that there is no *best* type of bit for *all kinds of rock.*

The significant features in modern rock drill bits have been described in the *Journal* and elsewhere, but the mining industries have been slow to take full advantage of the splendid work done for their benefit. There has been prompt acceptance of drilling machines of different types, but apparently only a small proportion of the total number of mining companies have taken advantage of the double-taper cross-bit and double-arc bit.

We can understand how efficient salesmanship can keep the mechanical drilling equipment up to the minute. The same force has contributed to the mechanicalizing of the drill-sharpening shop. Drill sharpeners and oil furnaces are now conspicuously employed. By their help a conscientious blacksmith can turn out bits conforming to accurate sizes and shapes. The technique has been well worked out, but how thoroughly does mining practice take advantage of the facilities thus afforded?

From our limited inquiry it would appear that the more progressive companies are keenly alive to the economies resulting from utilizing to the fullest measure proper mechanical upkeep of drilling machines, thorough lubrication by means of carefully selected lubricants, and the use of the best grades of drill steel accurately sharpened and hardened. We do not believe that the rank and file have, on the other hand, realized fully the economic advantage of doing this. Standards can be worked out for small as well as for larger organizations.

The economy resulting from consistent study of details of mining is in the aggregate large. Isolation and excessive conservatism are probably in a measure responsible for the slowness to take advantage of the progress that is being made. These can, however, be overcome by consistent study of technical publications and by visiting mining districts where variations in mining practice can be observed.

Offending Latin Americans

THERE IS A PROVINCIALISM which exhibits itself in a racial or sectional bitterness and depreciation of one people by another. We find it rampant in Europe, whether in Germany, France or England—a narrow snobbery that reminds one of the horizons of our childhood. Some Americans who are familiar with Latin-American countries complain that a certain type of superficial Americans, writers and otherwise, make patronizing statements concerning South America which have not even the merit of being true, to say nothing of being courteous. We have before us a letter from such a man who speaks concerning an article in the *Century Magazine,* criticising the City of Santiago, Chile. Concerning this he says:

"It is time that our Government took steps to discourage this line of advertising for the U. S A. There are a lot of people in the United States with nothing above their shoulders who are continually making derogatory statements about the Latin-American countries, while a few of us who

are living here are trying to show these people we are right, and endeavoring to promote better relations between the two countries.

"A great many of the statements in the article mentioned are greatly exaggerated, and the entire article is productive of no good whatever. It says the streets of Santiago resemble White Chapel, London; this is plain libel, the streets of Santiago compare in cleanliness very favorably with the streets of many of our large cities in the United States. It says the streets are badly paved; this is true in a few cases, but generally speaking the streets of Santiago compare very favorably with cities of like size in the United States. It says the Cerro Santa Lucia is the only place worthy of notice; this is indeed far from the truth, the interior of many of the churches are beautiful and some of the homes, with their enclosed patios, are well worth visiting. The Alameda, with its Sunday parade of well-dressed and comely señoritas, should be seen by every foreigner, and so one might go on describing features without number that are of much interest in the city of Santiago; and last but not least is the climate, excelling without fear of successful contradiction our own California. Tell the United States to call off their dogs. That kind of twaddle nauseates those of us who know."

Certainly we should be courteous in our designations of people and places. Nothing hurts personal and local pride so much as patronizing and slighting characterization; nothing makes for such ill-feeling in the end. It is sometimes difficult to subdue the irritation caused by foreign mannerisms, and if there is to be criticism, it will make toward better mutual understanding to seek the good and worthy which may be found everywhere, and to point that out equally with a kindly and generous appraisal of shortcomings.

Interest in the Comstock Revives

THE EXPENDITURE of a relatively large sum by the United Comstock Mines Co. at Gold Hill, Nev., in operations preliminary to the mining of a developed orebody (unmined ore and stope fills) approximating 2,250,000 tons of low-grade ore and stated to average between $5 and $6 per ton, is responsible for a new interest in the Comstock district. This well-known and historic mining district has contributed a comparatively small annual production during the last twenty years, amounting to less than $15,000,000.

Beginning in 1898, efforts were made to recover the levels below the Sutro tunnel. A number of companies co-operated, and the work of unwatering was concentrated at the C. & C. shaft and the Ward shaft. The latter was finally abandoned, and at the North End mines the 2,900 level was eventually recovered. Orebodies were discovered and worked in the Union, Mexican, Ophir, and Con. Virginia. These contributed a substantial quota to the production.

At present, the lower levels, up to the 2,250, on the North End group have been abandoned, and work at these mines has been restricted to following the minor fissures to their intersection with the main fissure. The old bonanza stopes on the Sutro tunnel level are also being reopened. A promising lead is being prospected in the Savage mine at the same level. A modest tonnage is being mined in the Chollar and Potosi, but the operations are not deeper than the 350 level. On the Gold Hill group the workings of the United Comstock Mines Co. extend to a depth of about 600 ft.

The present activity at Gold Hill succeeds a period during which efforts were made to work the levels below the Sutro tunnel in Yellow Jacket, Crown Point, and Belcher ground. These efforts were partly successful, but were discontinued after a fire. The working of waste dump and old stope fills continued, but was probably unprofitable. Stories about large tonnages of low-grade ores in the area north of and adjoining the three mines mentioned were current, but no mining was done to check them up. Alex Wise saw an opportunity here and proceeded to get financial assistance. The result of his and Herbert Humphries' preliminary work was the development of a low-grade orebody close to surface in the midst of the old workings. This proved sufficiently attractive to secure the capital necessary for large-scale operation. Thus vision, nerve, capital overcame inertia and vitalized this almost dormant area.

It is of great interest that the portion of the Comstock lode near the surface still contains such a large tonnage of ore that will probably yield a profit when worked under modern conditions. The deeper levels have been studied long ago. There is still a large portion of the lode contiguous to the Sutro tunnel level that challenges the engineer to more thorough work in prospecting. At depth, on the North End, the possibility of discovering new ore, except near old worked-out bonanzas, is seemingly remote.

An area characterized by strong persistent fissures and widespread mineralization is worth repeated investigation by experienced mining men, even though it may appear to have been completely exhausted. Not only should the usual conditions be studied, but the facilities, training, and results obtained by previous operators should also be subjected to close scrutiny. Only by so doing can the possibilities of apparently worked-out mines be visualized. That there are occasionally excellent mining potentialities in old mining districts is proved by the example of Gold Hill and by other instances in the experience of many engineers.

Catching the Wicked Smelter Trust Red-Handed: Foiled Again

TO BE VICTIMIZED, mulcted, deceived, duped, cheated, fleeced, tricked, gulled, cozened, defrauded, hoodwinked, and in other ways man-handled by "The Smelter Trust," whatever that may be, is the cherished prerogative of every independent miner. It is human nature to blame someone else when something happens that we do not like, and ore buyers and smelters are the logical target when a man who owns or operates a small property finds that he is not making a good living. Doubtless he in turn makes things warm for the laborers working for him, and also the Government fastens high taxes and unwelcome laws on the "trusts." As De Morgan rhymed it:

"Great fleas have little fleas upon their backs to bite 'em,
And little fleas have lesser fleas, and so *ad infinitum*."

Of course, being near Wall Street (about three miles away), we suffer from propinquity; at least they say we do, and so cannot give the wails of the small operators the sympathetic consideration which is their due. Nevertheless, when one of them recently complained to us that he was being unduly penalized for a certain constituent in his ore, that he was being unjustly discriminated against by a certain smelter and could not ship to another which did not discriminate and penalize because the freight rate was just a little too high, our dander was up. The crooks shall be exposed, we vowed, if it brings down upon us the wrath of the mighty.

We had all the data—settlement sheets and all—and

had the letter of protest all edited ready to go to the composing room, when it occurred to us to see from the settlement sheet just where the penalty came in, and just how it was that this down-trodden lessee had been mulcted of one hundred dollars, as he affirmed. We considered ourselves fairly familiar with settlement sheets, but we were unable to find out just where the cause of complaint came in, so we wrote for further particulars. This brought the following letter:

"My agent wrote me in regard to the shipment of chloride ore and told me that it was a nice batch of ore, but that the chloride played hob with it and that I should send such ore as that to ———, where they pay no attention to the chloride. That if I had sent that shipment to ——— that I would have received one hundred dollars more for it than what the ——— smelters allowed me. When the superintendent here gave me my settlement and check I paid no attention to it but took it for granted that I had been penalized for a hundred wheels. Recently I sent to you the final settlement sheet for that shipment of ore, and no doubt but what you are right in that I was paid for the full amount instead of for 34 oz. of silver as I supposed. Personally I pay but little attention to accounts; I get the ore and leave all else to another. Perhaps our genial Supt. stretched a string and paid me in full for what the ore assayed and I did not notice it, a thing that perhaps the smelters would not have done. At any rate, I will be more careful in future before I try to break into print and I thank you for saving me from deeper shame than what you did save me. I hope this explanation will be satisfactory to you."

So there was nothing we could do after all, and in future if any one has a kick to register we hope that he will make sure of his facts first.

A View Concerning the Licensing of A Business Man

GOVERNMENTAL REGULATION is the panacea of the day. Soon we shall be Prussianized and shall have it determined where we shall live, what we shall have for breakfast, and whom we shall marry. Every one will be tagged, and either pup or master will be fined if caught without his license, which (in the case of master) enables him to work as a lawyer, an engineer, a shoe-shiner, or a parlor ornament. The *Iron Age* in July published an article by a successful business man, Mr. Alvan T. Simonds, a manufacturer of saws and knives, proposing that no man should be allowed to engage in important business without examination and securing a license, just as lawyers and doctors must do.

A subsequent writer in the same publication, Mr. Sterling H. Bunnell, the head of a firm of consulting engineers, however, points out regarding lawyers, doctors, and the like, that "the examinations, or investigations required prior to the granting of such licenses are not intended to determine whether the applicant will be successful in his own affairs, but only whether he possesses sufficient knowledge to avoid conspicuous errors likely to lead to accidents or danger to himself or others."

It is impossible to judge a man from an examination, Mr. Bunnell points out. "No mere examination can determine whether a man who has studied navigation and sailed the seas for years has in him the necessary qualities for a successful captain."

"All life activity is the result of individual initiative. The successful man is he who is able to create an idea, give it shape and form, and carry it out to a useful result. The qualities of success are often found in men totally ignorant of economic laws; yesterday keeping a small news-stand, today operating a large organization; yesterday carrying a hod, today building and owning a block of houses."

As a result of his analysis, the writer concludes with trenchant wisdom:

"At the present time, however, the civilized world appears thoroughly convinced that governmental interference with a man's right to practice his business in the best way he knows how is the most unfortunate experiment a nation can make."

Sulphur on the Spanish Main

MR. WALDEMAR LINDGREN sends us from the South an article in the *Panama Star and Herald* of Aug. 1, under the head of "West India News." News it is: it is along the lines of discussing popularly geological phenomena, which we have frequently advocated. The language of the article is mellifluous and erudite, and if there is any scientific term hovering anywhere near the subject, the author promptly reduces it to captivity and includes it in his glittering pageant. We should like to quote for the information of our readers, but it is hard to find the beginning and the ending, and the following bearing on the origin of the sulphur will be enjoyed by all:

"The geologic mind readily understands that where these mineral agencies have combined for the creation of physiographic configuration and other physical features, there is every likelihood for the existence, in tropical regions, of such mineral and chemical concomitants. In this particular phase, we have sulphur and chalybeate deposits with their accompanying hot springs, known as *eaux bouillants*, all over the island. In the Parish of St. Andrew's, where this incident occurred, there is a large number of them, and perhaps more than may be found anywhere else in the country. Generally, where the locality is dry, and until rain or other moisture disturbs the elasticity of the latent sulphuroids, there may be no spectacular demonstration of the vitriolic atoms or the more elaborate display and distension of gaseous ignition. As soon as rain falls in these regions, there is the presence of the pungent odor which betrays the existence of sulphurous mineral matter, and cloudy fumes envelop the surroundings, while in some places evidence of some mineral remains may be seen in the shade of the volatile matter which the ebullitionary temperature of the spring may throw out upon the edges of the miniature geyser."

The author pauses for a moment to discuss a point in technical English concerning which he is meticulous —phenomenon vs. phenomena—and then returns to put some finishing touches on the theory of the origin of sulphur:

"The designation *phenomenon*, in connection with this incident, is scientifically and dynamically incorrect. In these electrical discharges which combine with other mineral and chemical agencies, the activity and cause are practically the *phenomena* of electrical forces. The question may arise as to whether electricity exclusively and absolutely, or originally and conductively, caused the disturbance, or originated the kinetic movement of the galvanic atoms. The sulphuric acid has a very aggressive tendency toward other gases and chemical ingredients; the atmosphere with its oxygen and other oxides may harmoniously congregate until the dynamic magnetico traveling in space in a progressive and accelerated plane, impregnate the sulphuric atoms at a radius which must create an impact, or ignite the volatile fluid loosened in the ether."

At any rate, we imagine, as Dr. Lindgren did, that this is a theory of the origin of sulphur. We may as well give the boy a name. But as we peruse this we wonder if the Panamans would be worse off if they were not enlightened thus scientifically as to natural mysteries.

WHAT OTHERS THINK

Fair Play for the Graphite Industry

I have noted during the last year various articles and items in *Engineering and Mining Journal* dealing with graphite production and tariff requested by American producers. Some of the information given is inaccurate, although the generalized data are substantially correct, but in my opinion the net result of the publications does not give a fair idea of the industry.

As a premise I may state that our company (The Ceylon Company) started operations in January, 1917, and, under the able management of Floyd Weed, remained in continuous twenty-four hours a day operation until Christmas, 1920. During the years 1917 to 1919 inclusive we produced 23 per cent of the Alabama graphite in tonnage and 21½ per cent in value, and of the total United States crystalline graphite 13 per cent in tonnage and 13 per cent in value. The United States figures for 1920 are not available, but our percentages for that year are decidedly higher than the above figures. We were the first to use oil flotation on graphite in the United States, although I discovered after negotiating process rights that oil flotation had been previously used in Austria. We were the first to use ball mills for wet grinding of graphite ore, and in fact were the pioneers in present-day graphite ore milling. I mention these facts to indicate that our knowledge of the business, both from an economic and scientific standpoint, is not academic.

There is no question that we have had lower costs and greater profits than any graphite plant in the United States with the possible exception of one New York plant, and yet it is questionable, in view of Federal and state taxes and the present situation, whether our stockholders will ever get their original investment back. If personal income tax is taken into account, it is certain that some will not get back 60c. on the dollar on their investment unless some protection is afforded against foreign competition.

I am thoroughly familiar with the conditions and possibilities of other graphite districts in the United States, and there is not one graphite plant in this country which by improved mining or milling methods or better production or selling means can in normal times meet the open competition of Madagascar graphite with its high-grade ore and cheap labor, not to mention the present exchange situation. If a protective tariff is a sound policy, there is not a mineral industry in this country which is more clearly entitled to protection, in view of this country's exceedingly large reserves of graphite ore, the character of the foreign competition, and the necessity of the product as a war mineral.

Protective tariff as an economic issue is good doctrine to some and bad to others, but the industry is certainly entitled to a fair presentation of the facts. We are not begging for a helping hand, and in our particular case we are preparing to utilize our trained organization in other lines not so bitterly competitive, but we are certainly entitled to fair play and an equal chance with other industries in a similar or less unfavorable position if a protective tariff policy is adopted.

Birmingham, Ala. E. E. ELLIS.

The "Freedom" of "The Press"

Please allow me to congratulate you on your ready ability to put your finger on a sore spot. Your editorial on "The Triumphs of Journalism" in the issue of Aug. 20, touches a peculiarly sore spot.

I might change "sore" to calloused, so far as journalism is concerned, for in spite of frequent and inexcusable errors, even leading dailies, weeklies, and monthlies still insist that "The Press" is the greatest public educator—"the poor man's university." Yet it goes calmly on making inexcusable errors in its news items and even in its more formal papers.

Every position of leadership should carry an equal degree of responsibility. "Print," even today, exerts a tremendous influence over the well and even the liberally educated. "If you see it in the *Sun*, it's so" is fairly indicative of the attitude of the general reader as well as self-complacency of "The Press." This means, or should mean, a sobering influence on the part of "The Press." It is conspicuous by its absence.

Mistakes are bound to occur, errors are unavoidable, but either mistakes or errors that are obviously avoidable should not be allowed. A new and well-tested hoisting rope may break even under a "safe" load. Personal injury or death may follow. But the mine manager who ignores a "frayed" rope is criminally negligent.

Your remedy is obvious and practical. I have often wondered why editors have not employed engineers on their staffs or at least submitted items which are out of their lines to technical men. Even an encyclopedia would help in many cases.

"The Press" claims to be a public educator. But what is the advantage of being educated in things that "aint so"?

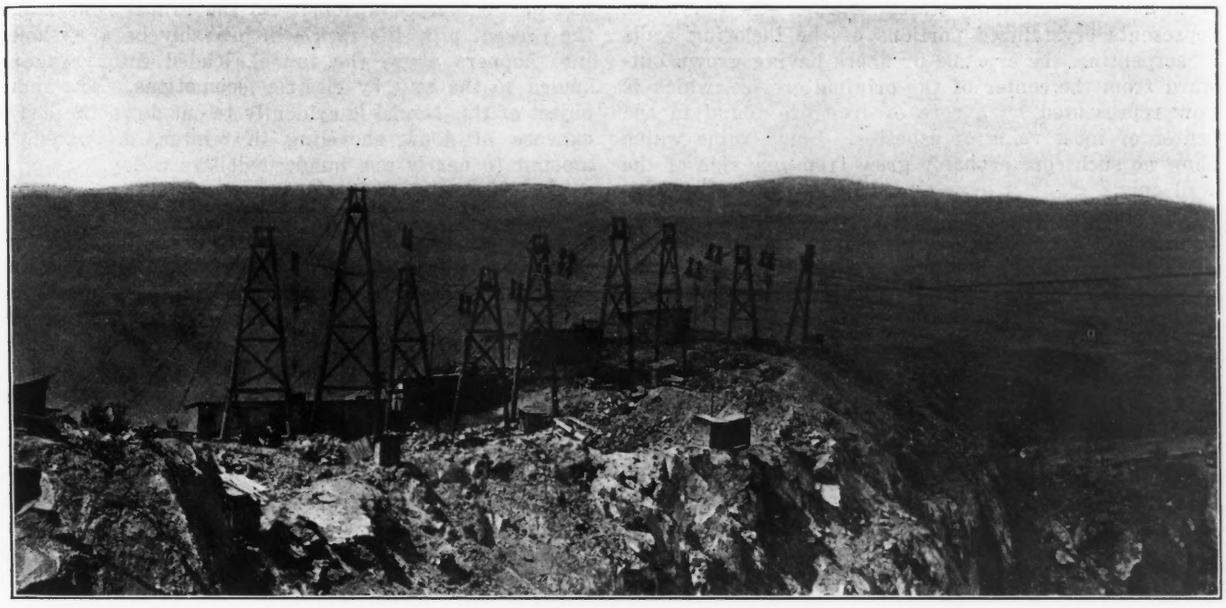
A daily paper may be excused from many casual errors owing to the haste of getting out daily editions on time. Monthlies and weeklies, however, have no such excuse. They have time to prepare and to exercise due precautions. Yet in the staid *Outlook* of May 25, an inexcusable error occurs. In an editorial on "The Discoverer of Radium" is this statement: "Intricate and innumerable experiments with radio-active substances led to the logical conclusion that *hornblende* must contain one radio-active element totally unknown."

This story is related of a celebrated French lexicographer. He defined a crab as a "fish that walks backwards." Descartes, on being asked if the definition was correct, replied that with two exceptions it was. "In the first place, a crab isn't a fish; in the second place, it doesn't walk backwards."

In one of New York's most aged and dignified magazines, several years ago appeared an article on some unpublished notes of our Mexican war. In one of General Scott's battles on his way from Vera Cruz to Pueblo, he sent a division of cavalry to silence the enemy's annoying battery. The description of the charge was exciting to the last degree. The gallant troopers charged up a slope of 45 deg., evidently unconscious that they had achieved the impossible. No mention was made of the effect of depressing the guns to an angle of 45 deg. With no effort at all I can recall very many instances of a similar nature.

If a manufacturer vaunts the superiority of his wares and then habitually sends out defective mechanisms he is called a fraud and is treated accordingly. Why should not "The Press" be treated in the same way?

West Haven, Conn. FRANK L. NASON.



NO. 6 PIT OF BLACK LAKE ASBESTOS & CHROME CO. END TOWERS OF CABLE DERRICKS. SHELTERS ON EDGE OF PIT ARE FOR SIGNAL BOYS

The Black Lake Asbestos Area

District Rich in Chrysotile Asbestos Deposited in Serpentine—Open-Pit Mining Using Derricks and Cables Is the Usual Practice—Much Labor Required—Welfare Work Not General

BY WYANT D. HUBBARD
Written for *Engineering and Mining Journal*

ASBESTOS of the chrysotile variety is mined in Canada in three main districts, the Danville, the Thetford-Black Lake, and the Broughton areas. As I have studied the occurrences in the Black Lake area, this article will be confined to a description of the geology and mining there.

Attention was first called to the serpentine of eastern Quebec by Sir William Logan in 1863.[1] His careful report was published in the "Geology of Canada," together with a series of mineralogical and lithological examinations by T. Sterry Hunt. The conclusion reached was that the serpentines were altered sediments derived from magnesian limestone, but Dr. F. D. Adams in 1882 showed unmistakably that these serpentines were altered igneous and not sedimentary rocks, as had been supposed. Since that time scattered reports and articles have been published concerning the asbestos- and chrome-bearing rocks of Quebec.

The asbestos-bearing serpentine belt of the eastern township of Quebec forms part of a series of basic igneous rocks which extends from Vermont through Quebec to the Gaspe Peninsula. These rocks are intrusive through sediments of Palæozoic age, mainly strata of Devonian and lower Ordovician time. In areas to the south, strata of Devonian and Silurian age are thought to be intruded by igneous rocks of this serpentine belt. The intrusive are therefore chiefly of Post-Ordovician time, and the evidence seems to indicate that they were intruded during the great igneous activity in the Devonian uplift in the northern Appalachian region.

[1]G. S. C. Memoir 22: Dresser.

The country underlain by the serpentine belt forms a range of subdued hills which have a distinctive relief. Abrupt profiles and steep faces are characteristics, due to the different rates of erosion of the various rocks composing this series. The range lies on the southeast side of the Sulton hills northeast of Sherbrooke, the main city of importance in southern Quebec.

ASBESTOS OCCURS IN SERPENTINE

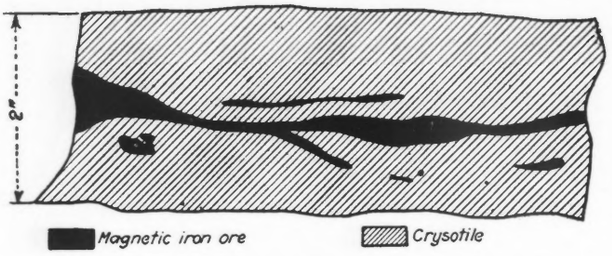
The economically important rock is, of course, that which carries the asbestos form of serpentine. Two phases of this are recognized, the Thetford and Broughton. The country rock of the Thetford phase is a peridotite in places so rich in olivone as to become a dunite. The serpentine is found as narrow bands along fissures and cracks in peridotite. The asbestos occurs in the center of the serpentine bands and constitutes, roughly, one-sixth of the whole.

The cracks and fissures developed because of dynamic or other deformation, and are often found in a nearly rectangular arrangement. Smaller veins of minor importance have developed along lines normal to pressure exerted upon the peridotite and some fill cracks due to the disintegration of the rock.

The asbestos of chrysotile variety of serpentine has developed *in situ*. Generally the mode of formation has probably been as follows: The original intrusive peridotite has been fractured, the fractures serving as channels for water, the principal agent in changing the peridotite to serpentine. A chrysotile is practically identical in chemical composition with serpentine, it is not probable that its composing minerals were brought either

from above or below by water. Rather, the chrysotile represents crystallized portions of the inclosing walls of serpentine, the crystals or fibers having grown outward from the center of the original crevice, which is now represented by a core of iron ore found in the center of most veins of asbestos. Small veins which show no such core probably grew from one side of the wall only.

The changes necessary to convert peridotite to serpentine are essentially a loss of iron and an addition of water, and it is evident that two sources of water are possible, magmatic and meteoric. As by far the greater part of asbestos occurs along joints and strain



SKETCH OF ASBESTOS VEIN, SHOWING CENTRAL CORE OF IRON ORE

fractures, magmatic water is thought to be mainly responsible for this alteration.

The Thetford type of asbestos deposit is found in segregations of the peridotite country rock which is rich in olivene. These segregations are found near the base of intrusive sills and in the central parts of stocks. Granite in masses and dikes has been intruded into the peridotite and serpentine, accounting possibly for the necessary pressure and heated water to alter peridotite to serpentine and chrysotile. The granitic intrusions are valuable aids in locating asbestos deposits.

Deposits May Extend to Great Depths

The origin and structure of the asbestos deposits of the Thetford phase as outlined above may be summed up as follows: (1) The asbestos-bearing serpentine occurs in peridotite rock rich in olivene; (2) the most favorable occurrence of such rock is near the base of sills and in the center of stocks; (3) the waters which produced the alterations of peridotite to serpentine and to chrysotile probably were magmatic. This indicates that the deposits probably extend to great depths, and therefore mining can continue until the limits of profitable extraction have been reached.

The Black Lake area is roughly four miles long by two wide and adjoins the Thetford area on the northeast end. Active mining is confined largely to a hill high above the town, and it is on this hill that the four main companies are at present operating.

With the exception of one company, all mining is of the open-pit type, and operations are in general rather crude and inefficient. The pits are not large, 500 x 300 ft. probably being the size of the largest. Rock is raised by cable derricks and transported to the mill in small wooden cars, drawn, in one mine, by steam locomotives, and in the others by electricity.

The most important mine in Black Lake is the Amalgamated Asbestos Corporation. It is also the most progressive. Besides mining by the open-pit method, a tunnel is being driven toward two of the company's most distant pits, presumably to connect the pits with the mill, so that ore can be handled continuously regardless of weather conditions. As the tunnel runs under the present pits, the rock will probably be glory-holed into hoppers above the tunnel, loaded into cars and hauled to the mill by electric locomotives. The main object of this tunnel is evidently to cut down the heavy expense of snow shoveling in winter, estimated to amount to nearly one hundred dollars a day.

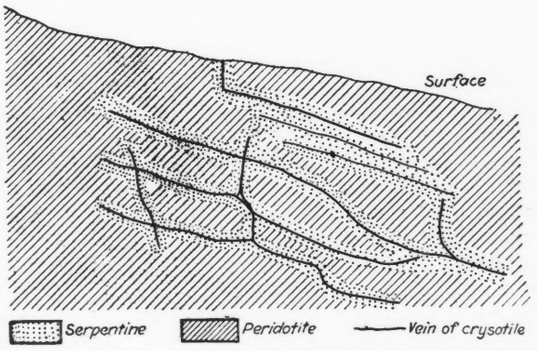
Black Lake a Typical Producer

The Black Lake Asbestos & Chrome Co. is the second largest mine. As it is one of the oldest operators and is typical in many respects of the mining as practised in the district, a detailed description will be of interest.

Mine and mill are situated near the top of a serpentine ridge nearly 400 ft. vertically above a railroad. A dirt road about a mile long, with one extremely steep grade, serves for transportation of asbestos and supplies. In wet weather this road is a veritable sea of mud, due to the churning action of the wheels of heavily loaded teams. Pits are sunk in the side of the hill above and not far distant from the mill. The largest of these, No. 9, is about 150 ft. deep by 500 ft. long by 200 ft. wide. The entrance is 300 yd. from the mill hoppers.

The mill itself stands on a level about sixty feet below the bottoms of the deepest pits. It is rated at 850 tons' daily capacity and is supplied from bins built below the tracks leading from the various pits. The primary bin will hold about 350 tons. A machine shop stands above and to the west of the mill, the tracks from the pits leading directly into it. Practically all the local repair work of the mine is performed in it.

Operations in the pit are about as follows: The rock is drilled by tripod drills, holes averaging about twelve feet deep. These holes are spaced about eight feet apart and twelve feet from the wall, breaking the rock in benches. Large chunks too small to be hoisted separately are blockholed with plugger drills. None of the drills require water, as the rock is comparatively soft. Broken rock is hoisted by nine cable derricks, the reason for this large number of hoists being that, although a cable derrick is almost unlimited in longi-



SKETCH OF PIT FACE, SHOWING ARRANGEMENT OF ASBESTOS VEIN

tudinal reach, it is decidedly limited laterally. Hence to cover the whole pit efficiently many derricks are used. Each derrick has a separate electrical hoist, which means that there are nine hoistmen. These hoists are situated back from the edge of the pit, and consequently the hoistman cannot see when to raise and lower his boxes. This necessitates having men stationed at the pit edge to signal the hoistmen. One signaler is sufficient for two derricks and one man dumps the boxes

from two derricks. Three to four men are employed shoveling rock into the boxes. Three boxes are used with each derrick, enabling each hoistman to complete between ninety and one hundred loaded trips per ten-hour day. The boxes hold a ton and a half, and three of them fill a car.

As the cable derricks cannot cover the whole pit without an almost impossible network of cables, a steam crane is used to pick up boxes in places outside of the cables' reach. This crane runs on a track about twelve inches wider gage than the ore trains, which necessitates an extra rail coming into the pit. It also limits the usefulness of the crane, because new track has constantly to be laid.

MANY WORKMEN NEEDED

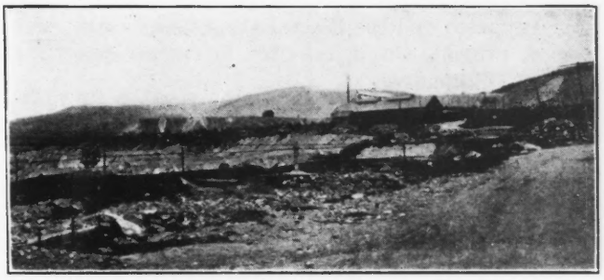
It can be seen from the above that the minimum number of men working in the pit under normal conditions would be distributed as follows: Number of hoistmen, 9; number of signalers, 4; number of dumpers, 4; number of loaders (3 to each derrick) 27, a total of 44, not including trip-riders, cranemen, bosses, or engineers.

The hoist motors for each derrick are electric and are rated at fifty horsepower. The horsepower of the crane is not known, but it must be at least seventy-five. This gives a total of 525 hp.

It would seem that two electric shovels could reduce costs and speed up operations to a marked degree. H. W. Rogers has shown conclusively that electric shovels operating on direct current will always be cheaper than steam shovels of the same capacity when labor, available capital, interest and amortization are taken into consideration. Two small shovels would probably be more satisfactory than one large one, because while one is moved away from a face for safety in blasting the other may still continue work. Marsh's admirable book on steam-shovel mining[2] gives comparative costs of steam, oil, and electric shovels. Much less labor is required in the operation of mechanical shovels than in the operation of the lines and boxes.

[2]"Steam-Shovel Mining," by Robert Marsh, Jr. McGraw-Hill Book Co., 1920.

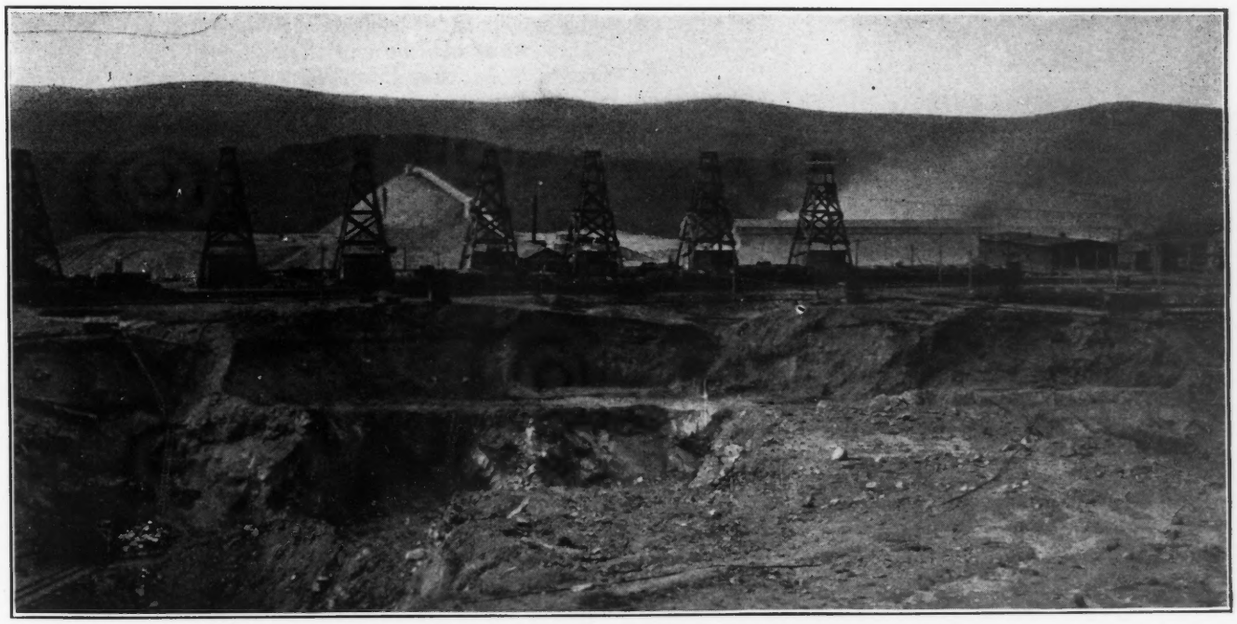
An item of importance which could be improved without great expense is the haulage equipment. Steam locomotives are generally known to be one of the most inefficient of steam engines, and yet steam locomotives are used in this operation, for which coal must be hauled at a cost of approximately $4 a ton. Electric engines using a trolley would seem far more efficient in the long hauls from the pit and out on the dump. A storage battery locomotive could be used for shunting in the pit, although extreme cold might affect its usefulness.



LOOKING UP TOWARD BLACK LAKE ASBESTOS CO. EDGE OF PIT IN FOREGROUND.

As the working pits are all considerably above the mill, a system of gravity haulage could be arranged without undue expenditure. Inclined tunnels driven from mill bins to the bottom of the pit floors would not only save haulage distance but would do away with trouble about snow shoveling in winter. It is to curtail just this expense that the Amalgamated Asbestos Corporation is driving its tunnel.

The question of how to supply a property cheaply in the elevated location of the Black Lake mine is difficult of solution. To haul coal and heavy machinery up a road rising 400 ft. in a mile is certainly not economical. The average load of coal which a two-horse team can pull up the hill is 1,700 lb. The teams are required to make only four trips a day, and are paid $9, which means that it costs approximately $4 to haul a ton of coal up the hill. The transportation of heavy machinery would cost even more.



PIT AND CABLE DERRICKS OF AMALGAMATED ASBESTOS CORPORATION

A few teams are kept by the mine, but as the mine owns no storage shed near the railroad tracks, additional teams are necessary when a large shipment of machinery or coal arrives, or when a shipment of asbestos must be hauled down hill.

An aerial tramway running gfrom the mill straight down to a special siding with storage sheds would help to cut down expense. Asbestos and repairs leaving the mill could be run down without the use of any power.

The Johnston mine, situated halfway between the Amalgamated and the Black Lake mines, is not operating at present, but is reported to contain the richest deposit of this area.

A new mine, that of the Asbestos Crude & Fibre Corporation, is being opened on top of the hill near the

NO. 6 PIT OF BLACK LAKE ASBESTOS & CHROME CO. VEINS OF SERPENTINE SHOWING IN BENCH FACE. CABLES OF DERRICKS IN UPPER PART

Black Lake Asbestos Co. A 100-ton mill has been erected and a pit started, but the recent drop in the asbestos market has caused work to be stopped. From all indications the methods to be used will be similar to those employed elsewhere. A steam boom-derrick is to be used to operate the pit, and other power machinery is to be electric.

Canada now enjoys a monopoly of the asbestos market, and this probably accounts for some of the inefficiency which would otherwise condemn the business. Hauling coal up a grade with a rise of 400 ft. to the mile, employing a larger number of men than necessary, and unnecessarily shoveling heavy snow in winter could not keep mines operating on a paying basis if no monopoly existed. This seems the more inexcusable when one considers that motor trucks, aerial or gravity haulage, and electric power are all available.

Such inefficiency indicates lack of foresight on the part of the management, particularly in the face of growing competition from other parts of the world. A South African engineer of note who made a report on one of the properties here made the uncomplimentary remark that farming was more suited to the men than mining. He was probably thinking that the large asbestos deposits of Africa, Russia, New Zealand, Australia, and the United States would soon furnish keen competition for Canada. One wonders how long it will be before most managers will recognize that changes making for a higher efficiency are needed.

Labor conditions are unsatisfactory. The average French-Canadian laborer is slow and not capable of rising much above the mucker stage. These men supply the bulk of the labor. The rest are Czechs, Russians, Austrians, and Italians, the last named being by far the most efficient workmen. Because of the autocratic labor policy of the management, the men have a low morale. By this I mean that the men are not encouraged to keep themselves and their living quarters clean, even when they occupy company houses; no incentive, such as a bonus, is provided to encourage a more efficient and higher standard of work. No amusements other than a high-priced moving-picture show and an occasional ball game are at hand, with the result that the younger element in the town is not on as high a standard as it might be. Because Quebec does not have compulsory education, many boys who should be at school are employed as hoisting signalers and general errand boys, when not running the streets.

For some time I worked with this type of workman, and many of their remarks showed that they were anything but favorable to this state of affairs. "We do everything two times, three times over; waste money; no good practice. Why not right first time?" is a remark often heard. Another: "If only I had learning and could speak English good I could be a manager." Would not a little help to such men result in a large gain to the mines?

It is generally recognized now that ten hours is too long a shift. In Black Lake the ten-hour shift is still in force, and for this the men receive 32½c. an hour. Before the recent cut it was only 40c. When one considers that many of the men have to climb a steep hill for over a mile to get to work, it is not surprising that at the most only about eight hours of work is done.

I recently talked with one of the leading managers, and he heartily condemned all laborers as ungrateful. When I suggested better houses, educated mine doctors, a well-conducted hospital and better hours and pay he laughed, and said the men would not appreciate such things—that they would abuse them. It is a recognized fact, however, that a clean, self-respecting man makes a reliant, efficient, and alert workman; the type of man conspicuous for his absence in this district.

On the whole, the Black Lake mining district can be summed up as potentially rich because of its inexhaustible ore reserves and its firmly established place in the asbestos market, but practically poor because of inefficient labor.

Preliminary Roughing Concentration by Sorting, Jigging, and Tabling—Part II*

A Diagrammatical Representation of the Principles Underlying The Separation of Grains of Various Sizes and Specific Gravities in Jigs—Automatic Discharge Devices and Why They Are Not Perfect

BY EDWARD S. WIARD
Written for *Engineering and Mining Journal*

THE ORDINARY FORMULA which governs separations by jigging in water is the free-fall formula of the form $V = F[D(s' - 1)]^{\frac{1}{2}}$. F is a constant whose value depends upon whether the answer for the velocity, V, of a body falling freely in water is desired in feet, meters, inches, or other units; and whether the diameter of the falling particle, D, is to be in feet, meters, inches, or other units, the velocity desired either being in the same unit as the diameter, or in some other unit. The velocity fall depends upon diameter and specific gravity, the greater the diameter the greater the velocity; and the greater the specific gravity, the greater the rate of fall. When jigging under the free-settling formula, the sizes at which a smaller grain of superior specific gravity will have equal settling velocity with lighter gangue grains determine the extreme ranges of size at which pairs of any two minerals can be jigged and the grain of superior specific gravity separated.

Eliminating the square root and the constant, F, there remains, as the equation of equal settling, $D(s - 1) = D'(s' - 1)$, D and s being the diameter and specific gravity respectively for the large grain of low specific gravity, and D' and s' the diameter and specific gravity respectively of the small heavy grain. By substituting the proper specific gravities, the ratio of D' to D, or the free settling or screen ratio, is obtained. Rittinger's free-settling ratio of 4.01 for galena to quartz is obtained by substituting 2.67 for the specific gravity of quartz and 7.7 for the specific gravity of galena, and means that a grain of galena of any given size will, in jigging, separate with a quartz grain the diameter of which is less than 4.01 times that of the galena grain. The smaller such quartz grains are, within the limit imposed by the ratio, the more quickly will separation take place. The *difference* in the velocities of fall for any two fragments of different size and specific gravity is a measure of the rate at which they can be fed to a Harz jig of given size.

Richards, by his experimental jigging work, increased the free-settling ratios for various pairs of minerals to higher figures, which he denominated hindered-settling ratios, the quartz galena pair being 5.842. The greater the difference between the ratios of any two minerals, each with quartz, the more rapid will be the separation and the greater the capacity with which jigs may be fed.

In free settling, the grains must be considered to be so far apart and so few in number that they do not affect the specific gravity of the fluid in which they fall. In jigging with a closely locked mass of grains the specific gravity of the fluid is not 1, as given in the formula, but is the average of the water and the grains which displace the water. This increase in specific gravity of the fluid by the presence of suspended solids favors the separation of smaller grains of heavy mineral than the free-settling formula indicates.

In obtaining the formulas for velocity of fall, the downward impelling force is equated with one for fluid resistance and the velocity of fall is obtained by transposition.

Under the principle of Archimedes, the downward impelling force must be equal to $vw(s' - s)$ where v is the volume of a grain, w the weight of a unit of water, and s' and s are the specific gravities respectively of the falling solid and the fluid through which it falls. If the solid falls through water the formula becomes $vw(s' - 1)$. The velocity under this force is $\frac{(s' - s)}{s} gt$. If there be no fluid resistance, there is accelerated motion and the velocity at the end of any time, t, in any particular fluid, depends only upon the specific gravity of the falling body.

COMPUTATION OF SEPARATION RATES

To obtain some inkling as to why it is possible to separate smaller heavy grains from large light grains than would be indicated by the free-settling ratio, some substitutions will be made in the fall formula, omitting, for convenience, the gt portion of the expression. In water, the fall for quartz specific gravity, 2.67, and galena specific gravity, 7.7, would be proportional to 0.625 and 0.870 respectively. The rate at which separation will take place would be proportional to the difference of these two figures, or 0.245. In the bed of the jig, due to the presence of the ore, the specific gravity of the mixture would, of course, be higher than that of water. If for argument it is assumed to be 2, the figure for quartz will be proportional to 0.250, and for galena to 0.740, and the rate at which separation will take place will be proportional to 0.490, just twice as great as in the first instance. In one of Richards' experiments there was a partial separation on prolonged jigging of 0.0683-in. quartz and 0.0095-in. pure galena, a ratio of over 7.

Whatever the actual ratio of settlement, it makes no particular difference in an explanatory discussion of middling separations. Because of simplicity, the free-settling formulas will be used in what follows. In the mills the screen sizes are, or used to be, very much nearer to one another in point of size of opening than is necessary under the free-settling ratio. A common screen system is, or used to be, through 20 mm. on 12 mm., through 12 mm. on 8 mm., through 8 mm. on 5 mm., and so on. Under the free-settling ratio, the drop from 20-mm. to the next size, for galena ores, will be obtained by dividing by 4.01 and the next size screen

*Continued from Aug. 27 issue.

would have holes of approximately 5 mm. The sizes are closer together so as to aid in middling separation. The advantage obtained by close sizing was often defeated by poor screen work.

FREE-SETTLING FORMULA DETERMINATIONS

Taking the 20-mm. on 12-mm. size, with the assumption of perfect screen work, let us see at what point, in using the free-settling formula, clean gangue will issue with middlings. Substituting in the formula:

$$20(2.67 - 1) = 12\ (s' - 1),$$

$$\text{or } s' = 3.78$$

In the case of galena grains, the percentage of lead in the 12-mm. size can be obtained by the following relations: In 100 lb. of mixed gangue grains, specific gravity 2.67, and pure galena grains, specific gravity 7.7, with an average specific gravity of 3.78, where X and Y equal the weight, respectively, of quartz and galena,

$$X\,2.67 + Y\,7.7 = 378$$

$$\text{and} \quad X + Y = 100$$

By substitution, Y is found to equal 14.8 lb. or per cent. Since galena contains 86.6 per cent of metallic lead, the 12-mm. particle will contain 12.82 per cent of metallic lead. Since, at a later point in this paper, a sizing device is described, containing the sizes given below, some figures on equal-settling grains for the openings of this device will be computed here for reference:

Percent of weight	15.9	15.1	14.0	12.7	11.3	9.9	8.4	7.0	5.7
Assay of column, % Pb	5.51	4.30	3.12	2.23	1.55	1.01	0.50	0.20	0
Cumulative % of Weight	15.9	31.0	45.0	57.7	69.0	78.9	87.3	94.3	100.0
Cumulative % Lead Recovery	32.6	58.3	75.5	86.8	93.8	97.4	99.3	100.0	

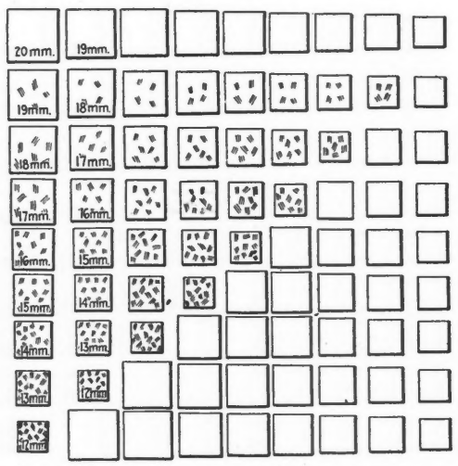


DIAGRAM COVERING GRAIN SIZES FROM MINUS-20 TO PLUS-12 MM.

Through 1 in. on 0.85 in.
Through 0.85 in. on 0.70 in.
Through 0.70 in. on 0.55 in.
Through 0.55 in. on 0.40 in.
Through 0.40 in. on 0.25 in.

This close range of sizes cannot be obtained by ordinary screens. Picking out such a size as through 0.55 in. on 0.40 in., and going through the same procedure as with the 12-mm. grain, the heavy small grain will be found to contain 10.83 per cent of metallic lead.

Close sizing in middling separation is desirable but not necessary. What is required is a compact screen device which can be adjusted to give any desired degree of close sizing and which will do good work with large capacities. Such a device is sorely needed to take the place of the long trommel or screen lines, with their large first cost, mechanical troubles, and high upkeep.

In order to understand the true nature of the roughing problem, attention will be concentrated on the size through 20 on 12 mm., and it will be further assumed that a galena middling is under discussion. That portion of the middling field with a grain assaying under 12.82 per cent metallic lead will be discussed.

EXPLANATION OF DIAGRAM

In the pictorial diagram the grains are arranged by 1 mm. drop in size from and including a 20-mm. grain down to and including a 12-mm. grain. At the top of the diagram there is this range of size by 1 mm. differences from left to right of pure quartz. Under each size at the top is indicated pictorially in vertical columns the grains which have free-settling falls equal to that at the top of each column, and differing in size from one another progressively by 1 mm. That these grains may have equal settling in each vertical column it is necessary to increase their specific gravity, going from top to bottom, by the requisite amount.

The first vertical column shows nine grains of varying size and each of different specific gravity. The second column shows eight grains of different specific gravity, which is all that could be had for equal settling under the fixed conditions, and to make the count equal to nine, an extra quartz grain 19 mm. in size is added for reasons to be explained. Similarly in the third column two extra 18-mm. gangue grains are added and in the same way the deficiency in the count of all the other vertical columns is made up by adding quartz grains of the same size of those at the top of each of the columns.

As to whether the diagram gives pictorially a correct representation of true middlings, an answer can be made in a number of ways: First, it does represent a middling of more than average difficulty in tailing elimination; second, the answer to the objection that the diagram should show an equal number of grains of each size would be that the diagram does not represent the grading as it comes originally from the screen, but after much elimination of concentrates and rich middlings before the remnant represented by the diagram becomes what might be denominated "final middlings." The requisite number of grains to balance the count as to size is without the boundaries of the diagram. The "assay of the diagram" is 2.58 per cent lead, and represents only a part of an original feed to a hypothetical multi-compartment jig, and with an assay, of course, higher than the portion represented by the diagram, passing to the portion of the jig represented by the lower compartments, or to jigs working purely on the roughing principle for the completion of the roughing treatment.

Further, to make it clearer that the diagram does not violate grading principles, attention is called to the first vertical column. There may have been in the feed eighteen 20-mm. grains, but to satisfy conditions both as to size and specific gravity, seventeen of them must have been of greater specific gravity than the top or pure quartz grain shown in the diagram, and, as is evident, these seventeen would have been removed before coming to the treatment phase that the diagram represents. The same conclusion would be true with respect to the other sizes shown on the top line, but

in these cases, as it is possible to put in other gangue grains of the size of the several grains on the top line, it is done for a reason to be explained. In the second column, for example, there are two 19-mm. gangue grains, and the fifteen others, since there is one of this size in the first column, may be considered to have been eliminated before coming down to the phase represented by the diagram, or to have had a greater rate of fall than those of the second vertical column.

When the smallest size is reached, that of 12-mm. grains, the diagram shows nine grains of pure quartz and nine others containing varying amounts of lead, the richest grain in the diagram in point of lead being the 12-mm. grain at the bottom of the first column. When the 12-mm. size is reached, we have the full number of grains, viz., eighteen, which has been considered in the foregoing discussion. This does not preclude, hypothetically, other 12-mm. grains being in the original feed from the screen, but, as must be evident, such grains would be richer than the one at the bottom of the first column and, to satisfy the equal-settling factor, be coupled up with larger grains of less specific gravity. Ultimately carrying this train of thought out completely, and into the field outside the diagram, the smallest, or 12-mm. grain, would attain to the pure galena grade.

When, following the result just noted, the next vertical column of an enlarged diagram is laid down, the count of grains would be reduced to eight, for the 12-mm, having reached the grade of pure galena, would have to be dropped. The 13-mm. grain in this column would then become pure galena, and in constructing the next following column, one would have to be dropped, reducing the count to seven. The final column would contain one 20-mm. grain of pure galena. It must be evident that in thus extending the diagram to the left the top grains of each column in such extension must each be of 20-mm. edge, the successive grains going in that direction getting richer until the grain of pure galena at the extreme left is reached.

It will be evident on reflection that by thus extending the diagram an equal count of all the different sized grains as they come from the screen will be obtained, and the unequal count in the field of the actual diagram will be explained.

Practical Application of Proportion Ratios

The argument that the diagram does not show proper proportioning of waste grains, there being only one of the 20-mm. size to, at the other extreme, nine of the 12-mm. size, is met by the known result of unlocking, for, in practice, there would be more mineral-free grains of the smaller sizes than of the larger. The diagram does indicate a "final middling" of great complexity and difficulty of treatment, as has already been stated. So long as the diagram is kept symmetrical, that is, with nine grains to the column, any desired complexity and difficulty of treatment can be illustrated by substituting for the waste grains any desired number and grade of mineralized grains. But this can quickly be carried to the point where no separation of middling from tailing would be possible. In other words, there would have to be finer grinding before any practical separation of middling from tailing could be effected by a roughing operation.

It is not believed that the grouping of the grains into arbitrary sizes and the use of a regular figure will offer any difficulty when translated into conceptions of actual grains of irregular shape. The squares of the diagram will be understood to represent all the grains the cube root of whose volume falls within the range of the length of side of the square nearest to it in this respect, and the differences in specific gravity (of the irregular grains) are taken care of in a similar way.

Tailings Content Reflects Degree of Success in Roughing

It now remains to conceive of the diagram as the remnant of a portion of an ore suitable for roughing, the remainder of the portion having been removed by previous jigging operations, leaving the more difficult part, in point of separation, covered by the diagram for immediate consideration. The aim in further jigging of this remnant would, of course, be the withdrawal in the form of further middling of as much of the metallic content as possible. The richer such middling, and the smaller the tonnage rate of withdrawal, the greater will be the success, viewed from one angle, as a roughing operation. From the other angle, success in treatment will be measured by the amount of tailings made and the low metallic content of such tailings. The greater the amount of tailings made, and the lower it is in percentage of lead, the greater also is the success in roughing. The two aims war with one another, and the best that can be done will be a compromise.

In the diagram, the waste grains represent 33.6 per cent of the weight. If all the grains which are mineralized could be withdrawn, the result would represent a 100 per cent recovery with a sloughing off of waste of 33.6 per cent. An inspection of the diagram will show what can be effected theoretically by taking off in middlings compartments the material represented by the various vertical columns, starting from the left of the diagram.

In theory it would seem possible to draw off from a single compartment as great a range of middling as would be desired. Referring to the diagram, it should be possible to draw off from one compartment the grains represented by columns one, two, three, and so forth, in one operation, carrying the separation of middlings to any desired point to the right in the diagram and wasting the balance of the diagram as tailings. The cumulative per cent of weights and metallic contents at the top of the diagram will show what should be possible theoretically.

If the diagram be turned around so that the left-hand vertical row of grains becomes a bottom tier, a picture will be presented of the arrangement of the grains in the compartment of a jig after a sufficient amount of the material represented by the diagram had been introduced to fill a compartment and no more, and the material had been jigged for a limited number of strokes and the jigging then being stopped. Of course, the grains in each row of the bed in the compartment would be arranged higgledy-piggledy and would not be in the graded arrangement shown in the turned diagram, but there would be, in each row, representatives equivalent in size or grade to those of the diagram.

"Static" Arrangement of Grains

For convenience it is preferred to call this arrangement of the grains obtained under the fixed conditions which have been recited the "static" arrangement, the one which will be obtained after sufficient pulsions to

allow the separation and settling influence to come fully into play. While a jig is running, being steadily pulsed by the eccentrics and constantly receiving fresh accessions of feed, the static arrangement of the grains will not prevail, or at best it will prevail only imperfectly. If top discharges be used on the jig, and they be set so as not to take out too many of the lower layers forming in the bed, it would seem possible to remove such layers continuously by means of the discharge, provided the discharge is so set that the rate of removal is not greater than the rate of settlement and separation. In practice, neither the static arrangement can be maintained nor can the lower layers be removed perfectly by the automatic discharges, even when the rate at which the lower layers tend to receive accessions remains constant.

Principle of Automatic Discharge Devices

To refresh the memory of those familiar with automatic discharge devices, and for the benefit of those unfamiliar with them, it may be stated that they consist essentially of a pipe or closed passageway which ends near the screen of the jig and has an outlet to the outside of the jig at a point lower than the surface of ore and water in the compartments. The ore and water surround the discharge, but only the rich lower layers of the bed can enter it. Under static conditions, using the word static in its ordinary sense, the column of grains outside the discharge, ranging from the poorest at the top to the richest at the bottom, will just balance the column of rich grains within it. To provide for friction and velocity head to remove the lower layers, the outside gate of the discharge must be set at a lower point than would be necessary to ballance the columns of grains within and without the discharge. Automatic discharges are adjustable both for the discharge point and the depth in the bed. They can be pushed down to the screen or be pushed down or raised to any desired point above it.

When the jig is in operation there is no longer the arrangement of grains indicated by the turned diagram, because of the confusion produced by grains of high settling rate settling through those of lesser settling rate. This confusion is, of course, greatest at the entry point of the compartment. It must be evident that the grains of greater settling rate interfere with the proper settlement of those of less rate and that the latter are carried farther along in the compartment than they would be if it were not for such interference. There must then be, in order to cope with the problem of "final middlings" removal, either a very long compartment, which is precluded on mechanical grounds, or a plurality of compartments. The total area spread can be determined by experiment.

Range of Removable Grade

The following example will furnish a criterion as to what can be done in the way of range of grade removable from a single compartment. The assay of the whole diagram is 2.58 per cent lead; this corresponds to a specific gravity of 2.82 and this in turn to a grain of about 15 mm. edge. This grain would have a place about midway in the fourth vertical column of the diagram. This column will mark the limit of a single separation.

It is not believed that removal in the first compartment used to treat the diagram ore should be attempted beyond this point and with further removals based on this principle for the other compartments and the rest of the diagram. It will be seen that the greater the rate of middlings withdrawal the greater will be the general confusion of the upper layers. At the extreme of withdrawing through the discharge all the material entering the compartment, there would be no gradation from the top to the bottom and the bed and discharging material would be the same as that which enters.

Origin of Jig Work Inefficiency

Some of the reasons for inferior jig work in practice have been touched upon. They may be summarized by saying that either the jigs are driven beyond their capacity, based on area, or that, owing to defects in detail or in operation, the maximum separative capacity is not obtained.

At the Bunker Hill & Sullivan mills, years ago, Caetani showed that a dump of jig tailings containing 2 to 3 per cent lead could be graded up to 5 to 6 per cent lead with a recovery of about 60 per cent. This was effected partly by an improved Harz jig but mostly by what, in effect, amounted to increasing the number of jigging compartments or the jig surface spread of the jigs over which the tailings originally passed. It was in effect giving the ore more of the separative area required to effect a close separation. I have been through a number of similar experiences.

The removal of the lightest middlings is, however, impossible with top discharges, and, unfortunately, on jigs fed from screens, these are the only practical devices for continuously removing the screen accumulations. Successful mechanical devices for moving the lower layer of the jig bed to a common discharge point have almost insuperable difficulties to overcome. Anyone who does not agree on this point has my well wishes in trying his inventive bent, and he might begin, in lieu of ideas of his own, on endless moving jig screens, rake conveyors, or other devices of such ilk. The rub does not come so much in moving the lower layers as in getting them out of the jig without disturbing the balance of the bed. Jigs with shaking screens and operating on the principle of discharging the lower layers through, are not adapted to the separation of the lightest middling grain, advocates of this type of jig to the contrary notwithstanding. With fixed screens, the jigging of coarse sizes through the screen is entirely impracticable.

Theoretical Recoveries Not Realized in Practical Work

In the average mill employing jigs to make tailings and middlings, that is, using jigs in the ordinary way, making concentrates at one end and middlings and tailings at the other, the uninitiated observer will note with surprise mineralized grains going over the tailboard of the jig, and he will be quite correct in imagining that such grains should have been recovered in the jig or by jigging, or the bulk of them at any rate. As a reference to the diagram will show, all of the mineralized grains cannot be recovered, and in practice, owing to the inferior action of the automatic discharges on middlings, far more middlings grains are lost than would be indicated in theory and also very much richer grains are recovered than in theory would be recoverable.

In the average jig mill there is not sufficient jig

area to effect a close separation, but the poor work of the discharges would defeat a close separation even if there were. In the next part of this paper, dealing with experimental work, it will be shown that the Harz jig is very sensitive to slight differences in specific gravity. Material containing less than one-half of 1 per cent of lead was effectively jigged and an enriched product was recovered, but not by the aid of the automatic discharges. They were tried, but were a complete failure, and were quickly discarded.

As long as material can accumulate in any compartment of a jig so that there is as marked a difference in specific gravity between the bottom and top layers as there is in the concentrate and rich middlings compartments of a jig, it will be impossible for any of the light material in the upper layers to be drawn down into the discharges contaminating the concentrates or middlings. In practical parlance, the closing off of the discharges until such rich lower layers accumulate is termed "making a bed." The jig is not allowed to discharge products until a bed is formed, and it is maintained by suitably adjusting the position of the discharge opening after the discharges are opened to let out the concentrates and middlings.

In discharging material with automatic discharges it is necessary to drag the grains in the lower layers from the farthest point in the compartment, as well as from points nearest to the discharges, against the frictional resistance of the screen and against the friction of the upper layers. The force for producing discharge is at best feeble, and it cannot exceed the average specific gravity of the column outside the discharge. The maximum discharging force would be obtained if the discharge opening were lowered to the depth of the screen and would then be equal to $2\,w\,a\,s\,h$ where w is the weight of a unit of water, a is the area of the discharge opening, s is the average specific gravity of the column outside the discharge, and h the head or depth of column of grains outside. Since w, a, and h are practically the same throughout the jig, they may be eliminated in making comparisons, and there remains s, to which the pull of the discharges will be proportional at a maximum. Actually, of course, the force is very much less than $2\,w\,a\,s\,h$, for if there is to be even a semblance of separation there must be a column of grains within the discharge to counterbalance those in the column outside the discharge. The conditions under which this balance is maintained have already been discussed. The effective head is of course the difference in weight of the two columns and is much less than the maximum $2\,w\,a\,s\,h$ and grows increasingly less as successively lighter material is removed.

It will be convenient and simple to think of the force of the discharges as being proportional to the specific gravity, s, of the material entering the compartment, and it will be seen at once how the force for moving the grains diminishes from compartment to compartment while the work to do increases, for the rate of removal by the discharges becomes successively greater as the tailing end of the jig is approached.

In attempting to remove the lightest middling the millman finds that the automatic discharge draws in grains along the lines of least resistance. It will pull from all the layers from bottom to top in its immediate vicinity, and the middlings grains at some distance from the discharge will be unaffected by it. Because of this defective action, an undue amount of waste will come out of the lower discharges of a jig, and as this displaces true middling grains which are too far away from the discharge to be drawn toward it, they will pass either to the next compartment or to waste.

To Be Continued

Properties Domestic Talc Should Possess

HIGH-GRADE prepared talc may be divided into two classes, dependent upon use: (1) massive talc, used for lava gas-burner tips and electrical insulation, pencils, and tailors' chalk; and (2) ground talc used for toilet powder. The mining and preparation of massive talc does not present special difficulties, and foreign competition is not a large factor.

The production of high-grade white talc suitable for the manufacture of toilet powder is a problem which requires considerable attention, according to R. B. Ladoo in U. S. Bureau of Mines *Reports of Investigations*. Until the last few years most of the toilet-grade talc consumed in this country was imported mainly from Canada, Italy, and France. A small, irregular production of white talc was obtained from North Carolina, Georgia, and Virginia, but this material fluctuated so greatly in quality and quantity that it was not largely used by manufacturers of high-grade toilet powders. Gradually a wall of prejudice against all domestic talcs grew up in the toilet trade, and has been fostered by people interested in the sale of imported talc in preference to domestic.

Aside from import duties, the principal point to be considered in meeting foreign competition is the comparative quality. A difference of a few dollars in the price of a ton of talc is of little importance to the manufacturer of toilet powder, for the cost of the talc is an unimportant part of the cost of a package of finished toilet powder. Since definite, standard physical tests for quality of talc are lacking, comparisons of quality are largely governed by personal opinion and prejudice. Some of the qualities demanded of talc for toilet powder are: pure white color, good slip, freedom from grit, fine grain size, and freedom from lime. Opinions of consumers differ as to the necessity for insisting on all of these qualities.

It is probable that lime is not as objectionable an impurity as has been sometimes claimed, for some Canadian talcs that are comparatively high in lime are imported and used in large quantities in this country. Another objection sometimes raised to some domestic talcs is that they tend to "ball up" or collect in small clots when poured out or shaken from a can. This is a property common to most very finely ground materials, and is, in a way, an index to fineness. If this property is objectionable it can be easily remedied, with a decrease in cost of production, by coarser grinding; but to most consumers extreme fineness is a virtue and not an objection. In the essential qualities of pure white color, freedom from grit, and fine grain size it is a well-established fact that the best California talcs equal or surpass the best imported talcs. In the debatable qualities of slip and freedom from lime some of the best California talcs equal some of the best imported talcs and in other ways excel imported talcs. Some of the largest consumers of toilet-grade talc have expressed complete satisfaction with high-grade California talcs and have used them regularly in preference to Italian talc.

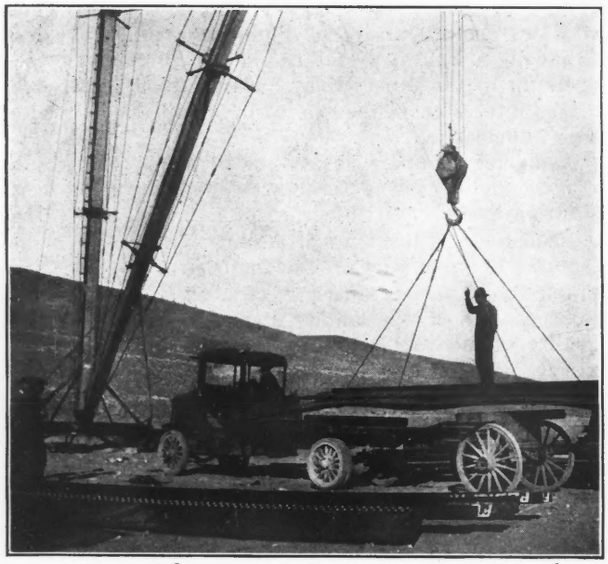
Transportation of Dredge Material at Dayton, Nev.*

Unloading Device—Use of Two and One-Half Ton Motor Truck—Short Haul—Cost Analysis of Truck Operation—Team Haulage of Heaviest Pieces

BY GEORGE J. YOUNG
Western Editor, *Engineering and Mining Journal*

THE HAULAGE of equipment and construction material for its new gold dredge from the rail head near Dayton, Nev., to the dredge site was begun by the Gold Canyon Dredging Co. several months before actual construction started. Owing to unforeseen delays, the interval preceding construction was unduly prolonged, but, as a result, a large part of the hauling was done before there was critical need of any material.

The road between the railroad spur and the dredge site is one mile long, and free from excessive grades. It was improved and put in good condition before heavy hauling began. A 2½-ton motor truck was purchased, and it was planned to use it for hauling all except the larger parts. Two-wheeled trailers and heavy wagons were used with the truck. The truck was also intended for bringing the construction crew to and from their work.

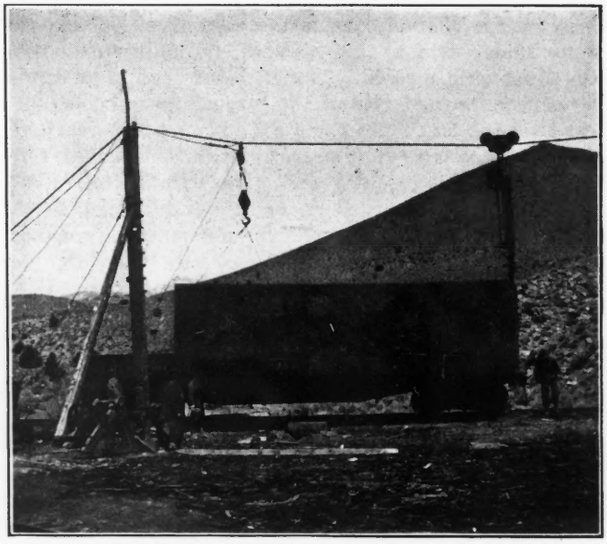


UNLOADING AT DREDGE SITE FROM TRUCK AND TWO-WHEELED TRAILER

A spur track for the receipt of freight was constructed on the Southern Pacific line from Mound House to Churchill, at a convenient point 2½ miles from Dayton. The expense for this purpose was $1,746, the Gold Canyon company paying $659 of this. At the spur an unloading rig was installed. This consisted of a 1⅝-in. cable supported by a single mast and crossed posts, one end of the cable being anchored and the other end arranged for tightening by tackle placed between it and the anchorage. A crab to which was attached a 10-ton chain block enabled weights up to 10 tons to be lifted from the railroad cars and transferred over the truck or wagon and lowered into position. The heaviest weights were removed from the cars by rollers and supported on cribbing. At the pit unloading was done by the derrick, which had a lifting capacity of 15 tons, a maximum radius of 100 ft. and a maximum lift of 70 ft. at a 45-deg. angle of the boom.

HAULING ERECTION CREW BETWEEN DAYTON AND DREDGE SITE

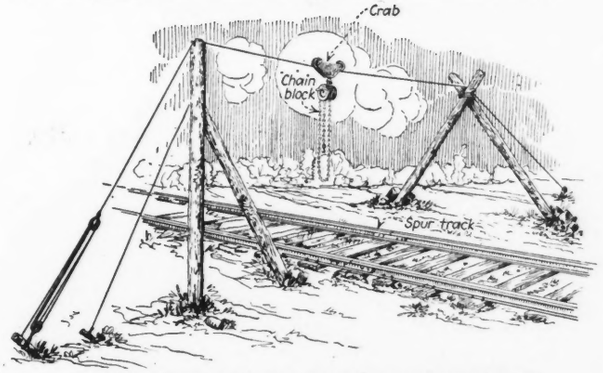
In hauling the heaviest parts it was planned to put "deadmen" at 100-ft. intervals along the road and to move the wagons carrying the parts by rigging used in conjunction with the motor truck. This plan was abandoned, as it was feared that damage would result to the truck if it were so used. Arrangements were then made with a teamster to haul the heaviest pieces at a reasonable price for ten horses and three men. One intermediate section of the ladder, weighing 20,000 lb., and one upper tumbler, weighing 16,500 lb., were hauled by team. Up to Jan. 19, 1920, the truck had success-



UNLOADING FROM RAILROAD CAR AT SPUR TRACK, USING STATIONARY CABLE AND CHAIN BLOCK

*The second article on the dredge of the Gold Canyon Dredging Co. The monthly construction reports by Gerald H. Hutton, who was in direct charge of this work, were made available for the preparation of this article through the courtesy of the Metals Exploration Co. and the Gold Canyon Dredging Co.

fully hauled the upper section of the ladder, weighing 35,000 lb., and loaded on two wagons; one ladder hoist drum weighing 17,360 lb., on one wagon; one gantry cap weighing 9,170 lb., partly supported on body of truck and partly on trailer; and two upper suspension blocks, each weighing 7,500 lb. and supported on truck body.



CABLE USED IN UNLOADING DREDGE PARTS

The approximate amount of material hauled is given in the following table, the cumulative totals being listed under each date:

TABLE I. DREDGE MATERIAL HAULED BY MOTOR TRUCK

Material	To Feb. 3, Pounds	To March23, Pounds	To May 15, Pounds	To June 15, Pounds	To July, Pounds
Sundry	15,954	19,051	26,257	29,110	33,858
Miscellaneous equipment.	146,960	178,083	193,832	273,308	294,682
Structural	.....	168,720	447,629	582,862	606,989
Marigold machinery	493,940	744,660	971,700	1,052,180	1,144,785
Totals	656,854	1,110,514	1,639,418	1,937,460	2,080,314

Truck operation began Dec. 17, 1919, and continued more or less intermittently throughout the construction period, although most of the hauling of dredge parts

TABLE II. MOTOR TRUCK COSTS AT DAYTON, NEV.

	Dec. 17, 1919, to Jan. 1, 1920	Jan. 1 to Feb. 16	Feb. 16 to March 21
Gasoline used, gal	82	230	140
Cost per gal	$0.28	.....	.....
Total cost gasoline	$22.96	$64.40	$38.08
Transmission oil	$0.50	$2.28	$1.88
Crank case oil	$1.25	.....	.....
Total cost, not including labor	$24.71	$66.68	$39.96
Mileage	148	601.9	425.5
Miles per gal	1.67	2.61	3
Cost per mile for oil and gasoline.	.....	11.8c.	9.39c.

was finished by the end of June. Until March 1, the cost analyses of operating the motor trucks were not reported in detail, but after that date a detailed analysis of each month's operation is available, and this has been condensed in Table III. The costs given are direct operating costs and include repairs. No attempt was made to include depreciation.

The adaptability of the motor truck to mining conditions is excellently illustrated by this example. The length of haul was comparatively short, and the truck would have made a better cost record over a longer haul. Much of the incidental service about a mine, however, is restricted to short hauls, and ore haulage represents a service of a different order. The example here given, therefore, will be useful to mine managers and superintendents in making comparisons with haulage by teams over short distances.

Suggested Changes in Low's Methods Of Analysis

A few improvements over the methods given in Low's "Technical Methods of Ore Analysis" are suggested by A. Whitby and J. P. Beardwood in the *Journal of the Chemical, Metallurgical and Mining Society of South Africa.* As a first example the authors of the paper state that they believe Low deals with the assay of nickel and cobalt on wrong lines, as he overlooks the common association of those metals with arsenic and iron. His procedure is to take down with nitric acid and chlorate and add ammonia to dissolve out the nickel and cobalt. It has been found, however, that an arsenate of iron tends to dissolve in the ammonia. Arsenic must therefore be removed, and the best results are obtained with aqua regia treatment followed by citric or tartaric acid, sodium hydroxide, and sodium sulphide. After digestion, the insoluble sulphides can be filtered off and treated by ordinary methods, the arsenic being in the filtrate.

Another point arises in the determination of chromium in chromite. According to Low, the filtrate, after fusion in nickel crucible with sodium peroxide and the usual treatment, is apparently free from chromium. This has been found to be incorrect, on account of certain reducing actions which tend to retain chromium in the precipitated hydrates. This difficulty may be overcome by adding successive washes of hot sodium peroxide solution to the filter. The effervescence of oxygen tends to break up the insoluble matter and oxidize any chromyl salts present. These washes are best boiled by themselves and are then added to the main filtrate.

In his latest edition, Low states that 4.74 gm. of ammonium molybdate should be used for making up the standard solution in the Alexander method of determining lead. His earlier editions say 8.5 gm. per litre. The commercial salt has the composition $(NH_4)_6 Mo_7O_{24}4H_2O$ and, with 8.5 gm. to the litre, gives the factor 0.00996 gm. per c.c. The quantity used by him in making his present solution, which is half the strength formerly used, should be a trifle above 4.25, but nowhere near 4.74 gm.

TABLE III. TRUCK REPORT DURING CONSTRUCTION

	March	April	May	June	July	August	Total
Gallons gasoline	134	105	105	101	85	120	650
Cost of gasoline	$34.84	$29.40	$31.50	$30.30	$23.80	$33.60	$183.44
Oil (qt.) grease (lb.)	7	5	16	8	16–2	9–3	61–5
Cost oils and grease	$1.40	$1.00	$3.20	$1.60	$3.65	$3.08	$13.93
Repair cost	$23.65	.....	.....	.....	$5.00	$334.70	$363.45
Labor cost	$150	$150	$100	$75	$53.45	$75	$603.45
Total cost	$209.90	$180.40	$134.70	$106.90	$85.90	$446.47	$1,164.27
Distributed Cost:							
Cost of hauling men	$83.10	$90.65	$45.34	$44.38	$35.12	$167.07	$465.64
Cost of general work	$53.81	$51.65	$42.93	$41.36	$47.27	$257.83	$494.85
Cost of hauling freight	$72.99	$38.12	$46.43	$21.16	$3.51	$21.56	$203.77
Performance:							
Number of miles operated	407.2	310.5	460.6	375.8	366.9	414.2	2,335.2
Number of hours used	125.5	90.5	105	92.5	70	8.5	573
Number of man trips	1,224	1,724	1,740	1,682	1,634	1,316	9,320
Tons freight hauled	247.25	80.2	220	87	4.5	8.0	646.95
Unit costs:							
Cost per man trip (cents)	6.8	5.3	2.6	2.6	2.4	12.7	5
Cost per ton-mile (cents)	45	58	29	28	23	1.08	31
Cost per mile (cents)	51	58	29	28	23	1.08	50
Cost per hour	$1.67	$2.41	$1.28	$1.15	$1.23	$4.99	$2.03
Miles per gal. gasoline	3.04	2.95	4.38	3.72	4.3	3.45	3.6

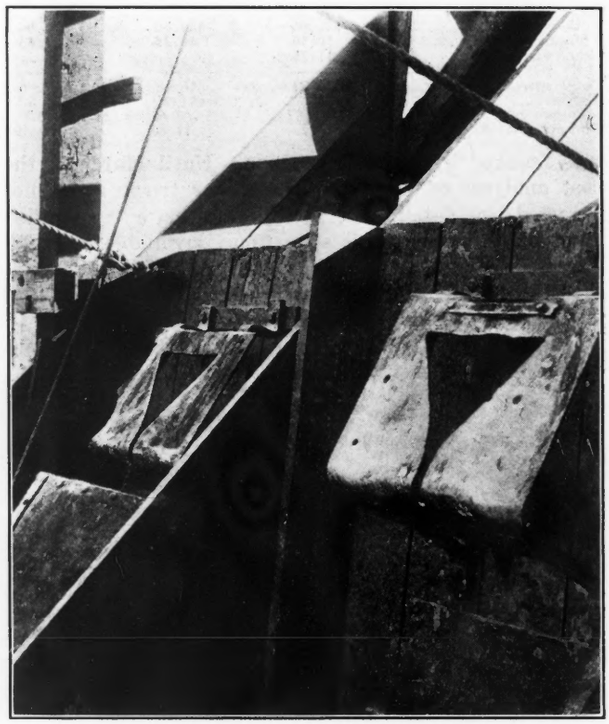
SHAFT SINKING CREW, WATER LILY SHAFT, EUREKA, UTAH

World's Shaft Sinking Record Made in Tintic District, Utah

THE world's shaft sinking record has been made in the Water Lily shaft of the Chief Consolidated Mining Co. in the Tintic district, Utah, by the Walter Fitch, Jr., Co., shaft and tunnel contractors, under the supervision of J. D. Matheson and H. W. Jarvis, foreman. The shaft is vertical and divided into three compartments 4 ft. 4 in. x 4 ft. 6 in. each. The surface equipment consists of two small hoists and two compressors which are operated electrically. Hoisting was done through two compartments with 17-cu.ft. rim-hung buckets. These buckets discharged their load on top by means of an automatic dump (shown in an accompanying cut) into 18-cu.ft. tram cars. No crossheads are used, but the hoisting compartments are lined with lagging on the inside and the entire shaft is lined on the outside. Eight by eight shaft timbers were used.

The first 367 ft. of sinking passed through a porphyry formation which proved to be favorable mucking material but offered difficulties in drilling on account of its sticky character. The last 60 ft. consisted of what is known locally as white lime shale—a moderately hard, close-grained limestone.

The sinking was done on a 3-shift basis with an average of 5.7 shaftmen per shift. Most of the timbering was done on day shift and on the four o'clock shift. Shaft sets were placed at the rate of 2.8 sets per day by an average of 4.8 timbermen. The timber was installed from a suspended steel bulkhead, which hung from the last set and made it possible to carry on the timbering and mucking or drilling operations simultaneously. An average of 72.5 buckets of muck were hoisted each shift. It was necessary to drill 23.9 holes for each round. The average powder consumption was 15¼ lb. of gelatine powder per foot. The average footage per day was 13.8 ft., making a total footage for the 31-day period, from July 15 to Aug. 15, of 427.5 ft. All men were paid the standard scale and a bonus that increased proportionately with the footage. During the 31-day period shaft operations were delayed 13 hours on account of failure of power and headframe repairs.



AUTOMATIC DUMPING DEVICE USED DURING THE SINKING OF THE WATER LILY SHAFT

By The Way

Attention

The Arizona Board of Equalization is valuing copper bullion for taxation purposes at 15.7c. per lb. The members of the board are cordially invited to look at the monthly average prices of copper published regularly in the *Engineering and Mining Journal.*

Unlucky Thirteen

Thirteen crates of ore and rock weighing 3,400 lb. have been sent to Phœnix, Ariz., by the Tom Reed Gold Mines Co. as an exhibit in its appeal from the decision of the Mohave County Superior Court in the United Eastern case. This can hardly influence the learned judge, weighty evidence though it be. With winter coming on, 3,400 lb. of coal would be more appreciated, to say nothing of thirteen cases of contraband.

Lack of Secondary Enrichment

"Short bit h'ago," said Cap'n Dick, "w'en tha mines in Bisbee closed daown, Jan an' 'Arry Thomas started for tha farmin' country to look for a job. H'after day or two they foun' a farmer 'oo needed some 'ands an' tha firs' moornin' h'out 'ee puts Jan an' 'Arry diggin' spuds. 'Baout tha middle o' tha shif' 'ee gaws to call they for dinner and 'ee fin's 'Arry daown to one h'end o' tha field w'ere 'ee 'ad sunk a bloody 'ole 'baout five feet deep. 'W'ot's doin' daown there,' sez tha farmer. 'W'y, dam-me,' sez 'Arry, 'I did 'ave a bit o' pay dirt h'on surface, but tha bloody begger's pinched h'out daown 'ere.'"

A Streak of Oil

J. H. Walker, of Colorado Springs, promises to give all a run for their money who invest with him at 10c. per share. In fact, he promises to pay $5,000 to anyone who loses money on investments through his advice. What more can one want? He has worked nearly four years on the geology of Colorado, he claims, and has disapproved of the location of hundreds of wells in the United States, located by the best geologists in the world, but, to date, has not failed himself. All of this is greatly reassuring. At present he is drilling several wells on the same structure on state land in El Paso County, Col., and invites all to come and see him. He picked up a nice oil sand, non-productive at 145, 260, and 335 ft., he claims, but is after a gasser and a gusher; "the kind you read about but seldom see," he says. To quote further from his advertisement:

"We believe we have 'treed' the finest structure in the West. We believe structures are found on 'streaks of oil' extending across the state and accordingly we have ten men at work securing leases on this 'streak of oil.' I have followed and made a map of this 'streak of oil' and I find oil and gas have been found at depths ranging from 500 to 1,300 ft. in wells on either side of this 'streak of oil.' Many wells would be producers had they been drilled properly. Gas is being utilized from many of these wells. Did you know that Colorado oil is the highest grade known to science? It should bring over $10 per barrel.

"A gusher or gasser where we are drilling would help every taxpayer in this state, since one-eighth of the oil and gas must go to the State of Colorado, therefore we cannot see how you could lose your money if you invest with us to assist in the drilling of these wells. We do not claim to be a 'sure shot' in geology, but we do agree to leave the holes in the ground. Every cent will go into these holes."

The stockholder, indeed, will be in a bad way if Mr. Walker does not leave the holes in the ground. But the only alternatives are to fill them up with sand or pull them out, "both of which he'll do neither," as the Irish attorney said.

From the Newspapers

Rich deposits of petrifix of copper, native sulphur, and gypsum will be opened by the railroad proposed between Bernalillo and Cuba, N. M.

S. J. Marsh, prospector, miner and president of the Cariboo Gold & Platinum Reduction Co., combines the practical mind of the miner with the aspirations and dreams of the scientist. Among other things, Mr. Marsh declares that several years ago he conceived the theory of "relativity," so widely heralded recently by Professor Einstein, which is said to be really understood by less than a score of men. He has for a long time been of the opinion that the ancients were right in their alchemic ideas about gold, and proposes to write a book which will attempt to prove that gold actually grows like fungi, though naturally at an incredibly slow rate. Mr. Marsh's theories regarding the glacial epoch are extremely revolutionary, and differ radically from any found in accepted textbooks. He has also written four papers on his investigations in connection with the fourth dimension. He is also an authority on astronomy, geology, physical science, chemistry, and navigation.

There is some discussion as to which is the right word—"pyrite" or "pyrites." A third form, "pryites," is peculiar to San Francisco.

The blue color of the potatoes raised in Marengo County, Ill., is caused by the petroleum content of the soil.

Search for a lost river—a river of gold—will be undertaken this year by several prospectors, including old-timers from the Yukon and Alaska, who are now here outfitting for the long journey into the north country. This lost river bed, where the Peace River once flowed, is somewhere in the big bend of the Peace, bisected by a line drawn from Fort St. John to the mouth of the Battle River.

Miner-Men

By Edwin Heimbach

A thousand songs for the sailor-man who sails the world around.
A thousand songs for the soldier-boy wherever he be found.
But never a song for us miner-men who toil in the underground.

God never gave breath to a breed of men that can claim what we can claim!
God never sent danger to walk with man as it walks with us in our game!
As it walks in the depths of the precious heart of the mother from whence we came.

So give us songs for the work we do, songs just to make us strong.
Show us your faith in printed words to help us carry along,
A song now and then to us miner-men. Has our sweat been worthy a song?

Handling Chilean Nitrate

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CHILE'S GREATEST EXPORT TRADE IS IN NITRATE. THE INDUSTRY IS DEPRESSED AT PRESENT, DUE TO HIGH PRICED STOCKS AVAILABLE ABROAD, AND THE DROP IN SALES. MORE THAN HALF THE OFICINAS HAVE SUSPENDED OPERATIONS, RESULTING IN UNEMPLOYMENT AND DISTRESS. THESE MEN ARE SHOVELING NITRATE, BENEATH A SCORCHING SUN, FROM A TANK ONTO A DRAINAGE BOARD

Copyright by Underwood & Underwood

NITRATE PILES READY FOR SACKING AND SHIPMENT AT THE OFICINA MARIA. CHILE'S NITRATE INDUSTRY CONTRIBUTES ABOUT NINETY PER CENT OF THE COUNTRY'S REVENUE THROUGH AN EXPORT TAX

HANDY KNOWLEDGE

A Review of Drilling—Part II*

BY GEORGE J. YOUNG
Western Editor, *Engineering and Mining Journal*

CONSUMPTION OF DRILL STEEL

R. H. Bedford and William Hague gave the drill-steel consumption at the North Star mine in the A. I. M. E. *Transactions*, Vol. 49, p. 346, as equivalent to 1 lb. of steel per 2.44 tons broken for drifters and 2.95 tons for stopers. H. T. Mercer and A. C. Paulson, *Transactions*, August, 1920, give the results at the Champion mine (Lake Superior copper district) as follows:

	Tons Broken per Lb. Steel		Tons Broken per Lb. Steel
1913	7.8	1917	18.5
1914	7.0	1918	20.0
1915	14.9	1919	16.4
1916	18.5	....	....

B. F. Tillson gives complete data for several years' operation of the New Jersey Zinc Co.'s mines which indicates a consumption of 1 lb. drill steel for 49.7 cu.ft. rock broken (4.1 tons estimated) in the Franklin mine and 34.25 cu.ft. (3 tons estimated) in the Sterling mine. At a Mother Lode mine in California, in medium ground, an approximate figure given ranged from 6 to 8 tons per pound of drill steel. At the North Star mine, the rock broken is diabase, tough granodiorite, and quartz. At the Champion mine, the rock is much less hard and tough. At the New Jersey zinc mines the ore is composed of the "combined oxides of iron, manganese and zinc, zinc oxide and silicate of zinc," associated with a highly crystalline limestone. Masses of feldspar and numerous trap dikes are encountered in the orebody.

Other things being equal, the hardness and toughness of the rock will determine the amount of steel consumption. The use of dull steel increases breakage. B. F. Tillson gives an example of a stoping drill steel, used without a bit, failing in thirty-seven minutes or after receiving an approximate total of 55,500 impacts. To avoid this condition, so strikingly illustrated by the example, it is essential to standardize the drill changes for each important rock condition in the mine. Thus, for the hardest and toughest rocks, a drill change of 12 in. may result in material decrease in breakage. For hard rocks, 18 in. and for medium rocks 24 in. steel changes may be readily attainable. A consistent study of drill steel changes and the degree of dullness resulting under different rock conditions should result in the selection of standard drill changes. It should not be overlooked that reducing the length of drill change has an important effect upon the footage drilled per shift. Excessive length of drill change may mean lower drilling rates, the result of using drill bits. Too short a drill change may mean excessive time consumed in changing drills. Given proper hardening, a drill bit will cut a hole of given diameter to a certain depth before becoming dull. Beyond this point the bit becomes progressively duller and the conditions for steel breakage more acute. According to C. R. Forbes and J. C. Barton ("Comparative Tests of Hammer Drill Bits," A. I. M. E., October, 1917), the drill bit will cut a certain distance and no more, no matter what the air pressure is. Thus it is essential to determine experimentally the limit of hole depth for bits of different gages.

Aggregate length of cutting edges is another factor. The Carr bit has a minimum, the four-point intermediate and the six-point the maximum, length of cutting edges. Five-point and six-point bits are seldom used, as they possess no advantage except for starting holes, and hence may be disregarded. The Carr bit represents the maximum concentration of blow; the four-point less. It would thus appear that the Carr bit would become more quickly dulled than the four-point bit. Thus the drill change for this bit is probably less, although no definite experimental data on this point are available. Reasoning from theoretical conditions it would appear that the critical dullness resulting in danger of steel breakage would be sooner reached with the Carr than with the four-point double-taper bit.

The carbon content is, in the opinion of some mining engineers, a controlling factor in steel breakage, other conditions being equal. Medium carbon steel, 0.8 per cent, is less subject to breakage, which increases rapidly as carbon content goes up. It would thus appear that in cases of excessive steel breakage, a lower carbon steel should be experimented with, if other factors have been controlled.

It is evident that there is a minimum consumption of drill steel at any one mine for a given output. To attain this minimum, good steel, suitable cross-sections and weight, proper blacksmithing, and intelligent drill running are essential. Failure of any one of these conditions means a larger, and failure to meet all of these conditions properly may mean a prohibitive, consumption of steel.

DRILL BITS

The cutting end of the drill, its shape and size and the hardness given the steel are critical features, and in the case of hard and tough rocks the efficiency of drilling may depend more upon this than upon any other single factor. A great amount of experimentation has taken place in which many kinds of bits have been tried out, but the cross-bit continues to be the most used, and next to this is the Carr bit, although it seems probable that the Carr bit has little or no advantage over the double-taper, four-point bit except under special conditions. The double-arc bit has also been more or less established in mining practice and deserves a greater acceptance. The Carr bit is more difficult to form and maintain, and for this reason has been, under many general conditions, discarded. The double-taper cross-bit is the easiest to make and maintain. George H. Gilman has discussed the subject of drill bits and drill steel in an illuminating and instructive way. From his several papers on the subject I have condensed and abstracted some of the more important points.

The drill bit performs two functions. The cutting edges cut the rock and the side or corners ream the hole

*Continued from Aug. 27 issue.

sufficiently to provide enough clearance to allow of the rotation of the drill. Without this side clearance the drill could not be operated for longer than a comparatively short interval. The reaming action wears the sides of the drill and gradually reduces its diameter, so that the following drill must be of smaller diameter, in order to continue the hole to greater depth. The cross-bit, as once formed, was tapered back from the cutting edges to the bar at an angle of approximately 14 deg. This resulted in the reaming action falling upon a comparatively small area at the outer edge of the wings. The diameter of the bit was rapidly diminished in drilling a short distance, and follower drills were reduced in diameter from $\frac{1}{8}$ to $\frac{3}{16}$ in. for each successive size. As a consequence, drill holes had to be started of a diameter of from 3 to 2½ in. in order to bottom at the required diameter of 1⅝ to 1¼ in. Starting diameters of the size given necessitated drill steel of proportionate diameter.

The next step was the introduction of the double-tapered cross-bit. The outer extremities of the wings for a short distance back of the cutting edges were forged to be contained with a conical surface making an angle of from 5 to 7 deg. with the axis of the drill. The remaining portion of the outer surfaces of the wings was brought back to the bar in a 14-deg. cone. The result of this was to give a reaming line instead of a point, as was the case with the single-taper cross-bit. As the outer line of the wings wore off, more surface came into play, and the reduction of the bit diameter for a given length of drilling was diminished.

The next step consisted in making the forward extremities of the wings cylindrical instead of tapered for a distance of about $\frac{3}{4}$ in. back from the cutting edge. This gave a reaming surface and still further diminished the reduction in bit diameter. Cylindrical reaming surfaces are not suitable for dense tough rocks, as they do not provide sufficient clearance to permit the drill to be rotated easily. Gilman says:

"A reaming surface may be employed to advantage only when the rock conditions are such that natural transverse whipping action of the drill bit when struck by the hammer will cause it to cut a clearance for itself. The effect of this action is emphasized in ground of a granular nature in which the rock particles are readily disintegrated from the side walls by the natural crushing action of the bit, under which conditions it will cut a round hole of greater diameter than the maximum diameter of the bit. Inasmuch as such reaming qualities, dependent upon the area of the surface in contact, provide for wear-resistng qualities, it is advisable to employ as great a reaming surface as the conditions of the ground will permit without imposing undue duty upon the rotating mechanism of the drill. [Note—hammer drills provided with independent and adjustable rotating mechanism permit greater advantage to be taken of this principle]. For all conditions of ground where a reaming surface is not permissible, it is recommended that the reaming qualites of the bit be determined by a reaming edge, the clearance angle of which should be as slight as the conditions of the rock will stand. A clearance angle for the reaming edge of 5 deg. should be employed in preference to an angle of 7 deg. unless the greater clearance is essential to secure the required freedom of rotation, for the smaller the amount of reaming clearance the less will be the reduction in gage diameter by wear of the bit in service."

Under average mining conditions the cutting-edge angle used is 90 deg. For softer and more friable rocks a more acute angle can be used. Gilman recommends a greater angle than 90 deg. for hard brittle ground, and in ground of a flinty nature, which shatters readily, a cutting angle of 120 deg. is advantageous. H. T. Mercer and A. C. Paulson, in describing drill practice at the Copper Range mines, in the Lake Superior copper district, state that a 100-deg. cutting angle is used upon a double-taper four-point bit, the reaming taper being 7 deg. Both the Carr bit and the double-arc bit follow the same principles with reference to the reaming surfaces and cutting angles. Gilman says with reference to high-center or low-center bits:

"The practice of making bits with concave or convex cutting edges is largely a matter of opinion, based upon the conditions encountered. A convex or raised center bit is often desirable in starting drill holes, especially with stoping drills equipped with a pneumative feed, while concave bits will assist materially in maintaining the alignment of the drill holes. However, tests that have been conducted show no advantage as regards stamina or drilling speed when compared with flat-ended bits identical in all other respects."

Although the double-taper four-point bit admits of the use of a $\frac{1}{16}$-in. change of bit size, this change can be used only where skilled blacksmiths are available and close gaging is practiced. Generally, owing to lack of skilled blacksmiths, the $\frac{1}{8}$-in. bit change rules in the majority of cases. Upon the Copper Range mines in Michigan, according to H. T. Mercer and A. C. Paulson, changes in bit diameter of $\frac{1}{16}$ in. are in use. The dimensions of a set of steels are as follows:

	Length as Made	¾ in. Steel Bit Diameter	1 in. Steel Bit Diameter
Starter	3 ft. 0 in.	1 $\frac{7}{16}$	1 $\frac{1}{2}$
4-ft. drill	4 ft. 10 in.	1 $\frac{3}{8}$	1 $\frac{9}{16}$
6-ft. drill	6 ft. 6 in.	1 $\frac{5}{16}$	1 $\frac{3}{8}$
8-ft. drill	8 ft. 4 in.	1 $\frac{1}{4}$	1 $\frac{5}{16}$
10-ft. drill	10 ft. 2 in.	1 $\frac{3}{16}$	1 $\frac{1}{4}$

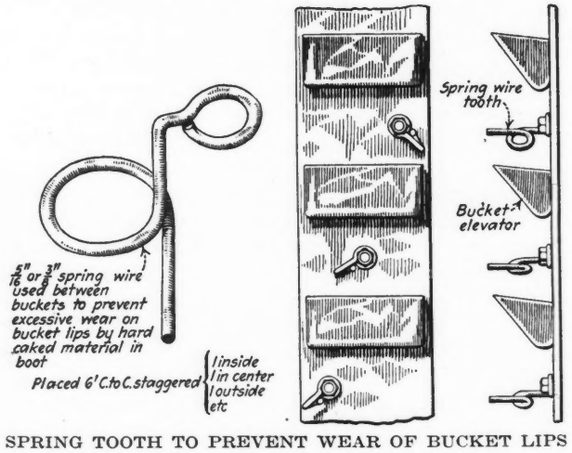
To Be Continued

Bucket Elevator Improvement

By Charles Labbe

Written for *Engineering and Mining Journal*

In elevator boots where the wet or coarse material cakes as hard as rock, the lips of the buckets become so badly worn that they have to be replaced, the remaining part being perfectly good. To prevent some of the wear, a spring tooth such as that shown in the accompanying illustration is made out of $\frac{5}{16}$- or $\frac{3}{8}$-in. steel wire,



SPRING TOOTH TO PREVENT WEAR OF BUCKET LIPS

and is fashioned with an eye and hole for an elevator bolt of the size used. The tooth is bent $\frac{3}{8}$ to ½ in. out of the bucket line and is made not over ½ in. longer than the bucket lip. These teeth are fastened to the belt between buckets, one being placed about every 6 ft. and staggered, one in the center and one on each side. This device placed on a bucket elevator taking coarse material, minus 2 in., helped greatly in keeping the material loose.

THE PETROLEUM INDUSTRY

Conditions in the Tampico Oil District

The existence of petroleum in the Tampico district of Mexico has been known for many years, its presence being manifested by surface pools containing *chapopote*, or crude oil, but, according to the Mexican *Boletin de Petroleo*, the first oil for commercial purposes was not produced until 1901. During that year the yield amounted to 10,345 bbl. The production gradually increased until in 1911 it was 12,552,798 bbl.; in 1919, 87,072,954 bbl., and in 1920, 163,540,000 bbl.

On March 31, 1921, there were 387 producing wells in the district, yielding a total of 3,689,969 bbl. every twenty-four hours. Nearly all of these wells are gushers, few pumps being necessary for extraction.

There are 215 oil-tank steamers employed in conveying the oil from Tampico and other smaller ports in the oil region to all parts of the world. About 78 per cent of the product goes to the United States. A large majority of the steamers belong to American companies.

The depth of the wells varies according to the location. There are a few wells in the State of San Luis Potosi, near Valles, where the average depth is 3,700 ft. At Panuco and Topila, the principal oil zones of Tampico, the oil deposits are found at approximately 2,200 ft.; at Tepetate, Chinamapa, and Amatlan, 1,900 ft.; Cerro Azul, 1,700 ft.; at Potrero del Llano, 2,000 ft., and Furbero, 2,200 ft. Most of these districts are in the State of Vera Cruz. On the Isthmus of Tehuantepec flowing wells are brought in at from 600 to 1,000 ft.

The cost of drilling a well in the Panuco and Topila region is estimated at about 100,000 pesos, or $50,000 United States currency. In the districts of Chinamapa, Amatlan, and Zacamixtle the cost ranges from 150,000 to 200,000 Mexican pesos.

The Mexican oil is composed of about 9 per cent naphtha, 10 per cent illuminative, from 50 to 70 per cent fuel oil, the remainder containing various substances such as lubricants, paraffine, and asphalt.

Up to March 31 there were 1,557 miles of pipe lines, which have been and are constantly being extended throughout the extensive oil regions. There are fourteen refineries now in operation and others in course of construction.

Various municipal, state, and federal taxes are imposed on the wells, structures and production, but the biggest item of expense of this nature is the export duty. Crude petroleum, fuel oil and gas oil pay an export tax of 10 per cent of their value; gasoline and kerosene, 6 per cent of their value; lubricating oils about 20 mills per liter; paraffine, 2 pesos per ton; asphalt 25 centavos per ton, and natural gas 5 per cent of its value.

Many of the big oil companies are paying as high as 40 to 50 per cent dividend on their millions of dollars of capital stock.

According to a recent issue of *Commerce Reports*, petroleum shipments from the Tampico fields totaled 17,185,331 bbl., of 42 gal. each, for the month of June, 1921, the greatest volume of shipments for any month of this year, except the record total of January. June figures show an increase of 3,418,794 bbl. over May shipments, and a decrease of 1,417,167 bbl. from those of January, 1921.

San Joaquin Valley Oil Operators Protest Wage Scale

SAN FRANCISCO CORRESPONDENCE

The leading operating companies in the San Joaquin Valley have declined to meet the representatives of the oil workers for the purpose of renewing the agreement expiring Aug. 31. The operators state that the agreement will not be renewed, and the present schedule of wages will remain unchanged except that the $1 per day added on July 1, 1920, to compensate the increased cost of living will no longer be paid, because of the general decline in prices.

The oil workers have addressed a telegraphic appeal to President Harding and members of his Cabinet, asking their intervention and giving warning of a general strike, though the common opinion is that there will be no strike.

Government Bureaus To Assist in Arkansas Field

WASHINGTON CORRESPONDENCE

Owing to the promise of the new oil field near Eldorado, Ark., plans have been made by the U. S. Bureau of Mines and the U. S. Geological Survey to send specialists to the region to render such assistance as they can toward its development. The Bureau of Mines already has aided in helping to exclude salt water in some of the wells.

Oil-Well Machinery Exports Active

Oil-well machinery valued at $708,923 was exported during July, 1921, according to the Bureau of Foreign and Domestic Commerce. This compares with $458,704 in July, of 1920. Exports of all other types of mining machinery during July, 1921, were valued at $482,677, as compared with $676,336 in July, 1920. Exports of pumps and pumping machinery in July, 1921, were valued at $513,749. This compares with $936,560 in July, 1920.

New Recording Office at Whitehorse

A new recording office has been established at Whitehorse, Yukon Territory, for the purpose of recording claims in the Fort Norman oil district. Previously it has been necessary to record the claims at Edmonton, and claim owners were compelled to travel to the recording office via Skagway and Vancouver, B. C. The new office will save the prospectors a trip of over 2,000 miles, which consumes practically a month's time.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Licensing of Mining Engineers Inadequate For Purposes Intended

Majority Opinion, as Voiced by Members of Mining and Metallurgical Society, Indicates Opposition to Licensing Plan, but Co-operation With Other Interested Bodies Is Offered

ON ACCOUNT of the great interest shown by the members of the Mining and Metallurgical Society of America in the question of licensing of mining engineers, as evidenced by their replies to a questionnaire on this subject, the executive committee has decided to place the report of the committee appointed for the purpose of analyzing the replies received, before the members in advance of its publication in a bulletin. The report follows:

To the Members of the Council,
Mining and Metallurgical Society of America.

Dear Sirs:

In accordance with the instructions which your Committee on Licensing of Mining Engineers received from President Spurr, we beg to submit to you the following report:

One hundred and twenty-eight letters have been received in response to the letter of the president asking for an expression of opinion. The responses have been classified as follows:

A—Unconditionally opposed	81
B—Opposed on general principles, but would favor uniform state laws with reciprocity or general Federal law	12
C—Opposed, but would accept licensing as a matter of expediency and would join in attempting to steer legislation	4
Total opposed	97
D—In favor, conditionally	16
E—In favor, unconditionally	5
Total in favor	21
F—Doubtful	8
G—No opinion	2
	10

The difference between B and C and D is that B and C are opposed on principle while D favor the principle, but wish to avoid the annoyance and expense entailed in individual state licenses.

Those unconditionally in favor of licensing base their attitude on the desire for higher professional standing and better protection of the public. Obviously, however, these are matters as to which those of the opposition are equally concerned, even though their solicitude may not be voiced or may be but inferentially or negatively expressed. It is also to be observed that those conditionally favorable must be considered as virtually of the opposition, in view of the weight of negative opinion bearing on the conditions stipulated.

Briefly, the point of view of this opposition is to the following effect: Licensing would neither improve nor safeguard professional standing, partly because professional qualifications could not be adequately formulated in such a law, and partly because of probable miscarriage in its administration.

In determining professional qualifications it is necessary to take into account not only the technical ability called for by the work in contemplation but also character and the lay attributes acquired of the engineer in that connection. Often, technical ability is secondary to the other factors, and the matter of qualifications is a question of something inherent—or earnest, rather, than of something required—something that no conceivable licensing system could measure.

Administration would not only be confronted with difficulties, due to the considerations just mentioned, but, in all probability, would suffer from the play of politics as well as from undue regard for local interest.

Consequently, it is widely held that licensing would be of no real advantage to the profession; that, even with state reciprocity, it would involve useless expense and hardship, and that it could not possibly result in the exclusion of the unfit. Some, indeed, are of the opinion that licensing would afford cover to the unfit and thereby tend to lower the standing of the profession.

The maintenance of professional standards is regarded as essentially a professional matter, although it is recognized that a strong incentive to excellence is provided by the discernment of employers and clients.

The position of the public in relation to the question of licensing is discussed from the standpoint of employers, as well as investors, in the replies.

Employees are considered to be al ready protected, or in the way of being protected by legislation applying to those directly responsible. Whether mine managers should be regarded as sharing responsibility, and be required to qualify by examination for a license, as in South Africa, is not, as a rule, touched on. It may be observed in this connection, however, that, even in South Africa, licensing does not extend to consulting engineers.

Investors are believed to be as well protected as possible and more liable to suffer than to benefit through licensing. Their position is different from that of the general public in relation to the other professions, for their transactions are not of such urgency as to preclude inquiry and verification, the means for which are ample. Licensing would not relieve them of the need for precaution, since, as already stated, it would not eliminate the unfit from the profession, although, it might, in some instances, give rise to a false sense of security and thus obscure that need.

In conclusion, your committee begs to recommend that an analysis of the correspondence on the subject of licensing mining engineers be placed before the members for their information. As to the proper course of the society on this matter, your committee further recommends that the society should not take independent action in opposition to licensing mining engineers, but should stand ready to co-operate with other interested bodies to that end if joint action appears to be called for.

(Signed) W. L. HONNOLD,
Chairman,
A. M. SMOOT,
F. F. SHARPLESS,
J. VOLNEY LEWIS,
H. G. MOULTON.

Mexico Protests Against Reduction of Export Taxes

According to reports that have just appeared in the Mexico City dailies, the President of Mexico, General Alvaro Obregon, has made declarations of great interest to oil and mining men. He is reported to have said, by way of a general reply to the numerous petitions which have been received by the government asking for the reduction of the export taxes on oil and silver, that sooner than grant what was asked the government would prefer that the oil should remain in the subsoil and the silver in the veins until such time as these commodities could be exported with profit both to the producer and the country; that he regarded both the oil and mining industries as merely transient ones, and that as such they should at all times contribute their share to the revenues of the nation; that most of the oil and silver industries in Mexico are in the hands of foreigners, and that in consequence practically none of the profits derived from these industries remain in the country; and that if the taxes were reduced or remitted Mexico would see her mineral resources exhausted without any profit to herself. Sooner or later, the president is reported to have said, the prices of both oil and silver are bound to rise, and then both wells and mines could be operated profitably for all concerned, including the nation, which is the real owner of all subsurface wealth; that it is far better for the interests of Mexico that her oil especially should not be produced in such quantities as to adversely affect the markets of the world, as has been the case of late; and that, finally, the government is in a position to stand the loss involved in the paralyzation of both industries.

The Oil Controversy Between the United States and Great Britain

In a report embodying the results of a recent trip abroad, Van. H. Manning, director of research of the American Petroleum Institute, writes as follows concerning the oil controversy between the United States and Great Britain:

"The establishment of an oil mandate principle assumed by mandatory powers has been the subject of numerous discussions between the representatives of the governments of the United States and Great Britain, with particular reference to Mesopotamia during the last fourteen months. The recent mutual exchange of assurances between these governments is that they find themselves in general agreement that the world's petroleum resources should be thrown open to all nations and that opportunity to explore and develop these resources wherever found should without discrimination be freely extended. While these governments appear to be in accord as to the principles involved, the adjustment of a division of the mandate territories is yet to be worked out in a way that will establish reciprocal relations as should exist between the United States and England.

"There are influential interests in England who feel that a closer relationship could be established by an amalgamation of American and English capital in development of the oil fields in the Near East. It is a fact that British and French capital is working jointly in the acquirement of oil properties in Rumania and elsewhere. Can we lay down a definite policy? Do we know what we want and what to do with it when we get it?"

MEN YOU SHOULD KNOW ABOUT

C. O. Lindberg, of Los Angeles, was recently in San Francisco on business.

Alexander Richardson, principal of the Camborne School of Mines, Cornwall, is in New York this week.

Louis D. Huntoon has just returned from the Alma district of Colorado, where he was engaged in examination work.

G. C. Martin, of the Alaskan division of the U. S. Geological Survey, is now engaged in work in the Tanana district.

K. Tawara, of the metallurgy department of the Imperial University of Tokio, Japan, visited Mesabi Range iron mines last week.

Colonel B. F. Millard, of Seattle, is in New York with a view to financing a group of platinum claims four miles from Grant's Pass, Ore.

C. E. Abbott, general superintendent of iron mines for the Tennessee Coal, Iron & R.R. Co., at Bessemer, Ala., was a recent visitor on the Mesabi Range.

D. G. MacLachlan, general superintendent of the Armstead mines, Talache, Idaho, has returned to his Spokane home after several weeks in a hospital.

J. S. Diller, of the geologic staff of the U. S. Geological Survey, has completed his field work in the Lassen Peak area and is returning to Washington.

J. A. Stewart has resigned as assistant superintendent of the Ramapo Ore Co., Sterlington, N. Y. His present address is 3,910 12th Ave. South, Minneapolis, Minn.

R. T. Walker, of the U. S. Smelting & Refining Co., Salt Lake City, Utah, made a complete inspection of the Franklin camp, southern British Columbia, during August.

Edwin Ludlow, president, and **F. F. Sharpless**, secretary, of the A. I. M. E., will leave on Sept. 5 to attend the organization of the Charleston, W. Va., Section of the Institute.

A. M. Swartley, of the Oregon Bureau of Mines, conducted a survey of the mineral resources of the territory in the vicinity of Canyon City, Grant County, Ore., during August.

James B. Kennedy, J. R. Gross, Fred Tod, and **R. C. Steese**, of the Brier Hill Steel Co., accompanied by **J. S. Lutes**, manager of mines for the Tod-Stanbaugh Co., visited the properties of the latter company on the Mesabi Range last week.

Olaf P. Jenkins, of the Washington Geological Survey, is now in western Washington, making an examination of iron-ore resources. This work is in accordance with an act passed by the last state Legislature, authorizing such an investigation.

A. H. Brooks, in charge of the division of Alaskan mineral resources of the U. S. Geological Survey, is at present making an inspection tour in the Kantishna district. He expects to be in Anchorage on Sept. 15, and will sail for Juneau on Sept. 21.

Dr. S. C. Lind, superintendent of the U. S. Bureau of Mines experiment station at Reno, Nev., was in Denver recently in connection with research work to be undertaken by the Government with a view to the further development of the radium industry of Colorado.

H. Foster Bain, of the U. S. Bureau of Mines, will be in Salt Lake City on Sept. 28 and 29, when a dinner will be given in his honor at the Commercial Club of the city. Mr. Bain will be asked to speak at a meeting of the Utah Section of the American Institute of Mining and Metallurgical Engineers.

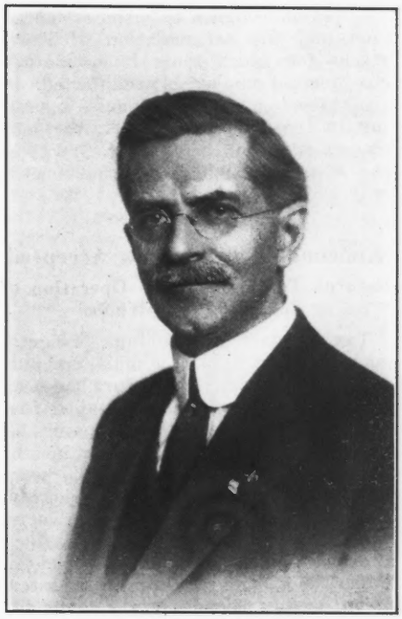
Cleveland A. Dodge, of New York, vice-president of the Phelps Dodge Corporation, accompanied by **G. H. Dowell**, general manager, and **Arthur Notman**, superintendent of the Copper Queen properties at Bisbee, Ariz., recently visited the Mesabi Range, studying mining and transportation methods and equipment.

John McNair, comptroller, **W. K. Knox**, assistant secretary; **H. M. Kalagner**, and **W. A. Meyers**, general store manager for the Phelps Dodge Corporation, and **O. M. Palmquist**, purchasing agent of the Old Dominion Copper Co., of Globe, Ariz., are at Clifton, Ariz., working on detail inventory.

Mining engineers and metallurgists recently in New York City included: A. H. Wethey, Paris, France; **R. T. Wilder**, Matehuala, Mexico; **J. R. Thoenen**, Evansville, Ind.; **A. C. Langden**, Palouse, Wash.; **L. R. Lane**, Havana, Cuba; **J. S. Cunningham**, Charleston, W. Va.; **Verne Frazee**, Moweaqua, Ill., and **M. G. Cheney**, Graham, Tex.

Sir Archibald Mitchelson, a leading British financier, formerly associated with the late Lord Rhondda, is visiting Canada in connection with the reorganization of the Davidson Consolidated Co. of Porcupine.

James F. Callbreath, secretary of the American Mining Congress, was tendered a banquet at the Davenport Hotel, Spokane, Wash., on Aug. 18, by local and Coeur d'Alene mining men. During the course of the evening Mr. Callbreath outlined many details of the forthcoming meeting and exposition of the American Mining Congress, to be held in Chicago.



JAMES F. CALLBREATH

George Otis Smith, director of the U. S. Geological Survey, returned to Washington from London last week. The primary object of his visit to England was to serve as a member of the organization committee of the International Geological Congress, the next meeting of which is being arranged for August, 1922, at Brussels.

Dr. Smith visited various government scientific institutions in England whose work corresponds to that of the Survey. It is interesting to note, he remarked, that such official bureaus and commissions number not fewer than half a dozen, operating under nearly as many different government departments or bureaus.

THE MINING NEWS

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

LEADING EVENTS

International Nickel Suspends Operations

It is officially announced that the mines and smelter of the International Nickel Co. at Copper Cliff and Creighton will close down on Sept. 1 for an indefinite period. The refinery at Port Colborne will also suspend operations. The reason assigned is business depression and the accumulation of heavy stocks for which there is no market. Six hundred employees are affected. Of the three big nickel companies operating in the Sudbury district, the only one in operation after Sept. 1 will be the Mond Co., which is producing on only a limited scale.

Anaconda's Tax Views Accepted

Returns To Be Based on Operation of Company as a Whole

Tax officials in Montana recently made an effort to tax the individual output of mines, and, if the effort had been successful, it would have entailed further tax outlays for the companies of Butte. Heretofore, as all the mines of the Anaconda company virtually were connected, and were operated jointly, and with one central air-compressing plant, it was the output as a whole which afforded a basis for tax calculations. Under the statute for the state, as interpreted by tax officials, it was contended that each property should be taxed upon its individual output. In other words, the matching of a loss by one mine against a profit by the other would be prohibited. In this case, several departments of the Anaconda company would show a profit for the year.

The Montana board of equalization has decided to accept the view of the Anaconda Copper Mining Co. and take its return on ore produced from its properties as one mine. There was a disposition on the part of the state board to require each mine owned by the company to make a separate report, but after listening to officials of the company and others, the board became convinced that under the circumstances it would be right to accept one report for all the mines on the Anaconda hill. John Gillie, general manager, informed the state board that the company had more than 2,500 miles of levels and tunnels and that there are twenty-six operating shafts and eight air shafts working to extract ore. He said that it cost $6,000,000 a year to keep the mines of Butte open while not hoisting a pound of ore.

WEEKLY RÉSUMÉ

International Nickel Co. suspends operations. Anaconda's tax views are accepted. Superior Copper Co. abandons operations. White Pine Extension moves its surface plant to another property. Silver mining in Mexico is being heavily taxed. Erupcion Mining and Ahumada Lead companies to work on a larger scale. Mexico trying out a system of labor arbitration.

Senator Smoot would exempt gold mines from excess profits tax. Two more experiment stations provided for by Foster Act. Conduct hearings on compulsory metric system.

Porcupine Davidson Gold Mines takes over Davidson Cons. Mines closing in Colorado through lack of funds. Opp mine, in Oregon, to be reopened. Railway conditions unsatisfactory in Guanajuato. Penoles mine active in Chihuahua. Silver Hoard mine, in British Columbia, makes a strike. Western Chemical to manufacture sulphate.

White Pine Extension Surface Plant Being Moved

The surface plant of the White Pine Extension Co., owned by the Resource Development Co., of Detroit, is being dismantled preparatory to shipping it to Michigamme, Marquette County, to be set up as a temporary plant at the Imperial iron mine, owned by Henry Ford and recently reopened after a long period of idleness. The Imperial mine is part of the property of the Michigan Iron, Land & Lumber Co., the upper peninsula (Michigan) Ford subsidiary. The removal of the surface plant probably seals the destiny of White Pine Extension. The mine was under development by the Stanton interests, in association with a number of Detroit men. The results have been only of mediocre character. The problem at White Pine Extension is one involving an extensive development and the use of the flotation system.

Superior Copper Co.'s Property Abandoned

The property of the Superior Copper Co., a subsidiary of Calumet & Hecla, which has been closed since December, 1920, has been permanently abandoned. The ground has been thoroughly explored by means of diamond drilling, crosscuts, and drifts, but has been found to be badly faulted and the lodes of such character as to offer no inducement for further expenditure.

Silver Mining in Mexico Heavily Taxed

Revenue Laws Still Being Threshed Out by Officials

Guanajuato—The outlook for the immediate future in the mining camp of Guanajuato is extremely gloomy. Beginning with April 1 of this year, the federal government conceded for a period of four months a considerable reduction in the export tax on silver. It had been hoped that when the four months' period referred to had expired, no great difficulty would be experienced in obtaining an extension. In the meantime, however, the curtailment of operations in the oil-producing regions of the country caused a loss to federal revenues of between four and five million pesos monthly, and probably on account of this the government decreed that beginning with Aug. 1 the old schedule of the export tax on silver would be used, despite the most determined efforts on the part of the representatives of practically every mining company in the republic.

The government is probably now at its wits' end to find the money required for its current needs, as every industry in the country is in a deplorable condition, and figures that even if some of the mines or smelters close down, many will continue operations, and that the receipts from the silver tax will be greater than they have been during the last four months, in which it is probably right. It is a case of charging all the traffic will bear, regardless of consequences. At the present price of silver the tax amounts to 5½ per cent, to which has to be added the "infalsificable" tax, amounting to about 1 per cent, and the state tax of 2 per cent, making in all direct payments to the government of about 8½ per cent. In addition to these direct payments there are a number of indirect ones, which in addition to freight, express, insurance, and refinery charges, bring the realization cost on silver to most companies up to about 15 per cent, a heavy burden for even a rich mine, and an almost impossible one for a low-grade one, such as are all the mines in the Guanajuato camp.

Following hard on the heels of the increase in the silver tax comes another blow in the form of an extraordinary income tax, to be, for the present at any rate, levied for one month only and payable in September

next. Every mining company that has produced either this year or last will, in all probability, have to pay 4 per cent. The tax should produce a large sum, which, after deducting collection expenses, will be applied to the purchase of merchant vessels as a means of decreasing the high cost of living, says the decree.

Mexico Trying Out System of Labor Arbitration

Councils Organize To Conciliate Differences Between Employer and Employee

In the mining news published in the July 2 issue, reference was made to a labor law enacted by the Congress of the State of Guanajuato in which the formation of councils of conciliation and arbitration to settle differences between capital and labor was provided for. These councils have now been formed in the various industrial centers of the state, and in the city of Guanajuato, the center of most of the mining in the state, already a number of claims brought by workmen against the different mining companies are being heard by the local council. No decisions have as yet been rendered, but they are awaited with considerable interest. Any decision given by a local council can be appealed and carried before the Central Council for the State. A decision by this Central Council is, according to the state law under discussion, final, but many feel that this point is not constitutional, and that the ordinary civil courts of the country can, if necessary, be appealed to. Most of the claims are for three months' pay, or for wrongful dismissal, one company alone, which has just been obliged to shut down on account of exhaustion of its ore supplies and cash resources, having been the recipient of over thirty claims, with fresh ones coming in daily. There are a few claims for compensation for injuries received. One of these latter claims refers to an accident which happened as far back as 1915, and which was the victim's own fault. Though it is expected that most of the cases will be successfully fought, there is considerable loss of time in attending to them, as well as some expense, and the whole business forms one of the many irritating factors that go to make the life of a mine manager in Mexico today anything but a pleasant one.

Western Chemical Co. To Manufacture Sodium Sulphate From Its Mineral Deposits

The Western Chemical Co. has given publicity to plans for the erection at San Pedro, near Los Angeles, of a factory, to cost $150,000, to be the first unit of what is to be a great plant to handle the threnardite secured from a lease of 600 acres of Arizona state lands in the neighborhood of Camp Verde, Ariz. The material is to be purified into commercial sodium sulphate for paper and glass manufactures, sodium sulphide, used in the canning and dye industries; glaubers salts, and hyposulphites. An active market for the sulphate already has been developed in Sweden, Norway and Denmark, where the paper mills have offered to take the new mill's entire output of 200 tons a day.

In view of the unsettled trade conditions, the proffered contracts have not been closed, the same disposition having been made of pending South American contracts. The new plant will be on the west basin of Los Angeles Harbor, where the raw material will be received from railroad cars and the product handled by gravity into deep-sea vessels. The company already has a $200,000 plant, thirty miles west of Tonopah, Nev., turning out twenty tons a day each of potash-alum and flowers of sulphur.

Copper Discovered in Shetland Islands

Special Cable by Reuter's to "Engineering and Mining Journal"

London, Aug. 23—Important deposits of copper have been discovered in the Shetland Islands. The lodes, upon analysis, yielded a high percentage of the metal. It is estimated that 500,000 tons of copper ore are readily available. Engineers are laying down a plant, and mining will start in September. The ore extends to a depth of 500 ft., and it is declared that the supply is inexhaustible and superior to the Spanish product. A London syndicate has acquired the rights over an area of ten square miles.

Old Hematite Mines Reopened in Austria

Special Cable by Reuters to "Engineering and Mining Journal"

Vienna, Aug. 16—The brown hematite mines at Spitz, a village on the left bank of the Danube, about forty-five miles from this city, which have been idle for sixty years, were recently reopened, and it is announced that the ores contain 45 to 50 per cent of iron and more than 2 per cent of manganese.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Bureau of Mines Supervising Oil Production on Public Domain

As a result of having been selected to handle the operating features of the Oil Land Leasing Act and to supervise operations on the naval oil reserves, the Bureau of Mines is finding that a task of real proportions has been assigned to it. The oil wells on the public domain now produce over 12,000,000 bbl. of oil per year, yielding the Government a royalty of at least 2,000,000 bbl. The work of supervising this production is increasing constantly as new fields are brought in. There is also necessity for supervision and occasional technical investigation in connection with mining on Indian lands.

The Bureau has organized, to care for this oil work, a staff of approximately twenty-five petroleum engineers, well drillers, oil gagers and oil clerks. The engineers and drillers supervise the actual methods employed by operators in drilling and handling their wells, and assist operators in adopting approved methods. The oil gagers and clerks measure the oil produced and compute royalties accruing to the Government.

The headquarters of the field work is in Denver, Col., through which the various field offices report and from which data are forwarded to Washington. To supervise work in their respective adjacent fields, field offices are maintained at Winnett, Mont.; at Caspar, Wyo.; at Shreveport, La., and at Bakersfield, Cal. For all this work, $93,020 has been allotted.

Pittman Act Silver Purchases

Purchases of silver under the Pittman Act during the week ended Aug. 29 totaled 151,000 fine ounces. This brings the total purchases to 70,204,430 fine ounces.

Appropriation Made for Bureau of Mines Mineral Investigations

"Mineral Mining" has been allotted $125,000 of the appropriation allowed the Bureau of Mines for the current fiscal year. It is from a general provision in the appropriation act that the Bureau draws its main support for studies of the ores and metals for which no specific provision is elsewhere made. Studies are also made of health and sanitation in Western metal mines. To this work, $9,920 has been allotted. This study is directed specifically to the investigation of dust and humidity as affecting health and efficiency. An allotment of $2,750 is made for statistics covering metal-mine accidents. In an effort to improve quarry technology and to find uses for quarry wastes, $3,740 has been set aside. Laboratory research on non-ferrous alloys is to receive $14,870.

The internal budget of the Bureau of Mines in addition shows the following allotment of funds for specific purposes: General expenses, $76,900; investigating mine accidents, $409,065; testing fuel, $142,510; non-metallic investigations, $35,000; investigations of petroleum and natural gas, $135,000; expenses mining experiment stations, $200,000; inspecting mines in Alaska, $7,325; care of buildings and grounds of the Pittsburgh Station, $50,000; operating mine rescue cars, $160,000; enforcement of the oil leasing act, $132,000.

Two More Experiment Stations To Be Established Under Foster Act

As the time approaches for the consideration of next year's appropriations, there is a renewal of the interest on the part of certain mining regions in the two mining experiment stations which are yet to be established under the Foster Act. Ten mining experiment stations were authorized by the Foster Act, but only eight of these stations have been established. Considering the present state of the Treasury, it is hardly probable that Congress will appropriate for more than one of these stations this year.

Of the remaining two stations, it is believed that one should be devoted to underground mining problems and one to the fundamental problems of chemistry and physics as applied to mining and metallurgical industries. Obviously, the former station would be established in the Rocky Mountain region and the latter in the East. Probabilities favor the establishment of the Western station first.

Will Conduct Hearings on Compulsory Metric System

A subcommittee of the Senate Committee on Manufactures has been designated to conduct hearings on a bill by Senator Ladd, of North Dakota, providing for the compulsory adoption, after ten years, of the metric system of weights and measures. Senator McNary, of Oregon, will act as chairman of the subcommittee. The other members are Senator Weller, of Maryland, and Senator Jones, of New Mexico.

It is the intention to have limited hearings soon after the Congressional recess, so that the proponents and opponents of the legislation may state their views as to the desirability of such a law. It then is the intention to circulate as widely as possible a stenographic record of the hearing, with the idea of acquainting the public with the problems involved. Later, during the regular session of Congress which begins in December, it is planned to have further hearings, after which an attempt will be made to secure favorable action by the committee, thereby securing a place for the bill on the Senate calendar, where its consideration would be taken up in due course.

NEWS BY MINING DISTRICTS

London Letter

Far East Rand Costs the Lowest — Broken Hill Mines To Use Chemical & Metallurgical Corporation's Process

BY W. A. DOMAN

London, Aug. 15. — Mining returns from the Rand for the last month afford an interesting study in the matter of working costs. Admittedly it is not easy to make any very effective comparison, because there is no standard method of presenting the returns. Each group seems to follow its own policy, for although the influence may be but small, it is something, and it is frequently the practice to include miscellaneous revenue with profit, without stating working costs, and so disguise the actual expense figure. Contrary to the view generally entertained, a big tonnage milled does not necessarily mean the lowest expense ratio per ton, as may be seen from a comparison of production and costs in the following statement:

	Tons	Working Costs Per Ton s. d.
Crown Mines	201,000	24-8
Government Areas	140,000	21-2
Randfontein Central	127,000	26-8
East Rand Proprietary	127,000	27-7
New Modderfontein	90,000	22-9
Van Ryn Deep	49,300	27-6
Geduld	45,300	23-6
Modder Deep	42,500	22-1
Consolidated Langlaagte	42,300	24-4
Langlaagte Estate	40,300	26-0

Generally speaking, the most economical working is with the newer companies on the Far East Rand, which doubtless is the result of improved layout methods and arrangements. Some of the older companies, such as Crown Mines and Randfontein Central, were not started on the best basis as big units for economical working, they being amalgamations of already existing mines. The East Rand Proprietary Mines suffers perhaps the most in this respect, though the rapid exhaustion of its profitable ore reserves, and the great distances separating the working faces naturally increase the cost of stoping. The Modder Deep, which mills only a moderate tonnage, as mines go on the Rand, is fortunately placed, its twin shaft layout being particularly suitable.

Perhaps the arrangement at a bigger mine would not prove so effective. The Van Ryn Deep, although a relatively new mine, is an expensive property to work, the cost per ton being only a penny below the East Rand Proprietary, which is the highest cost in the list.

At the meeting of shareholders of the Chemical & Metallurgical Corporation some hopeful statements were made. It is decidedly interesting to learn that, even at the high level of working expenses now ruling, the corporation can operate at a materially lower cost per ton treated than was contemplated when the undertaking was formed. Claims made as regards recovery were unquestionably high. In regard to complex ores, formerly thought to be commercially worthless, the processes used by the Corporation can recover from 90 to 100 per cent of the lead contents; the silver recovery has been improved from about 30 per cent to over 90 per cent, and the zinc recovery from about 85 per cent to over 95 per cent, depending to some extent upon the nature and grade of the ore handled. Mr. Cocking, an independent chemical engineer, has studied the Elmore process, and gives it a remarkable blessing. Seeing that the process is designed to treat material which has already borne the full cost of milling, there would seem to be a vast field for its application. So impressed are they with the results obtained that certain parties connected with the Broken Hill mines, in Australia, have decided to complete an agreement for using the process, and will erect a plant locally as soon as practicable. This should prove the beginning of another era for the Broken Hill field, for it is apparently only by a great reduction of working costs, or by a higher recovery of metals, that the mines can again be rendered profitable, with wages and materials at their present levels and under existing unsettled conditions.

On previous occasions I have referred to the difficulties experienced by the Cam & Motor mine, in Rhodesia. The ore is of a somewhat complex nature, so that hitherto the ore reserves, of something like 400,000 tons averaging about 37s. per ton, have not yielded a profit. The treatment plant has been reconstructed, and although the first few runs were of an unsatisfactory character, news has now come to hand that the corner is turned, and it is estimated that the profits for the current month will be between £7,000 and £8,000.

CANADA

British Columbia

Silver Hoard Mine Makes Strike

Ainsworth—One of the most important strikes made here this season is reported from the Silver Hoard mine, where Messrs. Grant Bros. and Rogers, lessees, in following up a showing opened up by the Silver Hoard Co. some time ago, when making an excavation for a boiler house, uncovered a wide body of ore, carrying silver values of from $75 to $125 per ton. The find is believed to be capable of producing upward of a carload per day, and is close to the surface. The lessees started operations only recently, under provisions of a lease extending two years.

Greenwood—Messrs. Nelson, Jackson and Lofstad, local miners and prospectors, are starting active development of the Riverside mine, at Rock Creek, a few miles west of here.

Nelson—Spokane interests have obtained an option on the Bayonne group, in what is known as the Bayonne country. Ground is believed to be owned by Butte and New York interests. An engineer's exmination is being made to ascertain the possibilities of the group, upon which considerable was expended in development some years ago.

Salmo—Trail investors have been conducting active development on a group of claims near this point, and with encouraging results. A 600-ft. crosscut has been run, which cut the vein at a depth of 380 ft. Drifting at that level disclosed oxidized lead ore with good silver values.

Trout Lake—Craig and McLean, owners of the Noble Five group for a number of years, and who have been developing the property by following a small stringer, have opened up an encouraging showing of copper-gold-silver-lead. Development of a number of other prospects in the vicinity of Trout Lake and Ferguson is being continued and good assays are being obtained during the course of this season's development on the Mansfield claims on Silver Cup mountain. A start has been made by M. R. Leahy, owner of the Horn Lead group and manager of Mansfield Mining Co., on gathering a collection of Lardeau district ores for exhibition at various mining conventions.

Cranbrook—A meeting of Columbia Section A. I. M. E., to be held here the latter part of August, has had to be dropped because of inability of a large number of the members of the section to be present.

Stewart and Alice Arm—A first shipment of twenty tons of high-grade ore has been made by the Fish Creek Mining Co., whose property is situated on Fish Creek, Portland Canal district. As soon as the road which the Alaskan administration is building up the creek is completed, it is the intention to instal a compressor. Extensive alterations to the dock at Stewart are being made preparatory to the construction of ore bunkers by the Premier Mining Co.

Encouraging reports come from Marmot River, where the Patricia group is being developed, together with the Washington, Prince George, and other properties. Work on the former is to be continued through the winter.

A new strike is reported on the Dolly Varden, Alice Arm. The lead was uncovered on the surface about 20 ft. above the old workings, and picked samples are said to have assayed 267 oz. in silver.

A. H. Lawry, of San Francisco, Cal., recently visited and inspected the Dolly Varden.

New Hazelton—The John Gariel silver property, Copper River, is being opened up, with satisfactory results. A trail is being constructed, finances being furnished jointly by the provincial government and the owner. With transportation facilities, and the ready obtaining of plant and supplies assured, development will be expedited.

Rossland—The new concentrator of the Le Roi No. 2 is in operation. The ore on the dumps is to be treated first, after which attention will be given to the mining of the property.

All of the efforts made to induce the Great Northern Ry. to restore service on the Red Mountain branch between Northport, Wash., and Rossland have so far been unsuccessful. It is still hoped, however, that the Dominion Board of Railway Commissioners will be prevailed upon to give the case a hearing.

Trail—The Trail Mining Co.'s property, near Salmo, the ore of which is an oxidized lead containing silver, has been developed recently by the driving of a 600-ft. tunnel. The main lead is 16 ft. wide. On the construction of a road it will be possible to begin shipping.

One quarter of a million tons of ore and concentrates were received at the Trail smelter this year up to and including Aug. 7. Of the actual total, 250,980 tons, 246,140 tons was from the properties of the Consolidated Mining & Smelting Co., and 4,840 tons was custom ore. Ten properties shipped ore to the smelter from Aug. 1 to 7. There were included the Freddy Lee and the Majestic, of Sandon; the Kokomo, of Beaverdell, the Skyline, of Ainsworth, and the Bingo.

The Associated Boards of Trade of Eastern British Columbia, made up of the boards of trade for Trail, Nelson, Rossland, Kaslo, Penticton, Princeton, Creston, Slocan district, Nakusp, Cawston, Revelstoke, Grand Forks, and Greenwood, have indorsed a memorial of Trail Board of Trade requesting imposition by the dominion government of a tariff on copper rods and various scrap metals imported into Canada from the United States. It is expected the memorial will be indorsed by various coast boards of trade also.

The California Mining Co., owners of gold-bearing properties in British Columbia, will resume operations as soon as alterations in the mill are completed, according to reports.

Ontario

Porcupine Davidson Gold Mines Takes Over Davidson Consolidated

Porcupine—The shareholders of the Davidson Consolidated, at a special meeting held in Toronto on Aug. 24, ratified the sale of the assets of the company to a new company to be known as the Porcupine Davidson Gold Mines, capitalized at £1,000,000. The old company was capitalized at $5,000,000, of which $4,000,000 was issued. Shareholders of the old company retain their securities, the old company obtaining in payment for its assets £175,000 preferred stock and £450,000 common stock in the new company, together with £50,000 cash. A sum of £200,000 is to be set apart for working capital. The stock of the new company will be divided into 1,500,000 preferred shares and 2,500,000 common shares, each of 5s. par value. Dewatering of the mine has already been begun.

An early resumption of work at the Porcupine V.-N. T. is anticipated. It is planned to bring the mill up to a daily capacity of 150 tons. There is a large tonnage of medium grade ore already developed at the 400-ft. level, and at the 600-ft. level the main vein is about 20 ft. wide, of which about 12 ft. carries average gold content of $11.50 to the ton. It is proposed to make the 600-ft. one of the main levels and to open up other main levels at 750 and 900 ft. deep.

Work has been started on the Ankerite Extension in the southern part of the Dome area of the Porcupine field, where it is believed that a contact zone extends through the property, with prospects of valuable ore deposits.

Officials of the Keora deny the report that the property will close. On the 250 level the vein has been crosscut for a width of 35 ft. and the last round showed considerable free gold in the face.

Plans are under way for the financing of the Barry Webster property in Skead township, where good assays over a large width are reported.

A new gold strike is also reported from the property of the Lightning River company south of Lake Abitibi. The vein is exposed for a length of 200 ft. and a width of 5 ft. and shows a considerable amount of free gold.

Cobalt—July was Nipissing's best month for the current year, during which there was produced ore of an estimated net value of $166,383. Total production for the year to date was $1,050,000. There was no underground development of importance during the month.

The O'Brien was the only shipper from Cobalt for the week ended Aug. 6, when one car of 31 tons was sent out.

It is officially stated that the Hudson Bay will resume milling operations for the treatment of about 6,000 tons of broken ore. After this is completed the management will determine whether to undertake further development or close down.

The La Rose has dewatered its Violet

property and is resuming active development.

The shaft on the Waldman property of the Oxford-Cobalt is down 50 ft. and has encountered some high grade and a substantial amount of milling ore.

The Bailey Silver Mines during July shipped 1,262 tons of ore. The Bailey custom mill was operated at capacity, realizing gross earnings of $12,129.

Ore shipments over the T. & N. O. Ry. in July totaled 168 tons, O'Brien shipping 32, La Rose 43, Kerr Lake 23, and Coniagas 70. Of this 55 tons went to the Deloro plant, 70 tons to the A. S. & R. Co., at Perth Amboy, and 43 to the Pennsylvania Smelting Co., at Carnegie, Pa.

Kirkland Lake—The Lake Shore during July produced bullion to the amount of $49,155, from the treatment of 1,967 tons of ore, being an average recovery of $24.99 per ton. The mill ran 92.60 per cent of possible running time.

Structural work on the 100-ton mill of the Ontario-Kirkland will be completed within a month. The machinery is arriving and production is expected to commence about the new year. A quantity of ore averaging about $15 per ton is ready for milling.

Goudreau—Claims are being staked in this area on an extensive scale. Following the Murphy strike, the original discovery, an area two miles wide and six miles east and west has all been staked, in addition to claims which have been located to the north and east.

Boston Creek—The results of diamond drilling at a depth of 500 ft. on the Miller Independence have so far been encouraging. A porphyry intrusion has been cut showing a width of 14 ft. in one hole and 12 ft. in a second, adjacent to about 2 ft. of schisted rock.

MEXICO

Erupcion and Ahumada Plan Operations on Large Scale—Plans Perfected for Railroad To Join National Ry.

Chihuahua—The Erupcion Mining Co. and the Ahumada Lead Co., which have large holdings in the northern part of the state, in the Sierra de los Lamentos, will soon resume operations on a large scale. The development of the properties will consist of a tunnel 1,200 ft. long, and several winzes, which have exposed a body of lead-silver ore 1,200 ft. in length, 200 ft. in width and 25 ft. in thickness. It is stated that this is supposed to be the largest single body of high-grade lead ore in the world. The development of the property is only partly begun. The formation is one of the characteristic cave or fissure deposits so common in the northern plateau of Mexico, and is similar in its general characteristics to the camps of Sa. Eulalia, Naica, and Sierra Mojada.

The construction of a fifty-mile railroad from the mine to some point of the National Ry. north of Villa Ahumada was authorized on Aug. 8, at a meeting of the stockholders of the Erupcion Mining Co. at Anthony, N. M. Authorization took the form of a vote to increase its capital stock from $1,000,000 to $1,500,000 and to accept the proposal of the Ahumada Lead Co. to guarantee sale of the half million excess. The $500,000 will be used to build the road. The Ahumada Lead Co. is composed of such mining operators as Colonel John C. Greenway, Dr. L. D. Rickets, and others connected with the Calumet & Arizona and New Cornelia companies.

A survey of the routes now in progress will be completed by the end of August. The Mexican government has granted concessions for the road. The concessions reach through to the Compañia Minera Erupcion y Anexas S. A. and appended interests represented by the Compañia Minera Polomo S. A. They are controlled by the Erupcion Mining Co. The Ahumada Lead Co., a Delaware corporation, in turn owns a majority of the Erupcion stock.

Peñoles and Other Lead Mines Shipping Ore

Federico Moye is to resume operations on his mine La Carambola, of the Cusi camp.

The Peñoles Mines Co., owners of the San Toy, Inglaterra and many other mines in the Sa. Eulalia district, is shipping high-grade silver-lead ore to the smelter of the A. S. & R. Co. at Avalos. The company is employing at the present about sixty men, which number will be greatly increased, as the company intends to resume work on a large scale in the near future. W. F. Eaton is manager.

The owners of the Dolores mine, at Sa. Eulalia, Escobar & Stiles, have purchased the adjoining property, El Continente, and have started operations on both properties. A fifty-ton concentrating plant will be put on the property to treat lead-silver ore, the product of which will be shipped to the smelter.

The A. S. & R. Co. at Avalos, near Chihuahua, has five furnaces going. The sixth one will be blown in soon. Gold-silver and lead bullion is being produced in large quantities.

The Dolores mines, one of the units of the Dolores Esperanza Corporation, which has its properties situated at Dolores, at a distance of thirty miles from the Madera station of the Mexican North Western Ry., has finished its reconstruction work. The mine, which was closed down for many years on account of unsettled conditions, was put again in condition for operation and a new cyanide plant, Dorr equipment, with a daily capacity of 200 tons, has been erected. The plant at Madera is furnishing all power needed, and shipping of silver and gold bullion was started after many years of interruption. James S. Colbath is general manager, with residence at El Paso, Tex., and Roy A. Sulliger is superintendent of the mines.

La Reina de Plata Mining Co., of the Sa. Eulalia camp, has shipped to the A. S. & R. Co. smelter at Avalos twelve tons of high-grade silver-lead ore, running 406 ounces of silver and 30 per cent of lead, in the last week.

Guanajuato

Railway Conditions Unsatisfactory—Mine Development and Improvement Progressing

The congestion of traffic on some of the railroad lines is still great; on others, there seems to be an improvement. For instance, shipments from any of the seaports and from Laredo and Piedras Negras take sometimes months to reach any point in central Mexico, though on the line from Ciudad Juarez little or no delay is experienced. No reductions have been made in any freight rates, as was promised some months ago; on the contrary, in some instances, rates have been raised.

General conditions in the state are good, as there are no political troubles or bandits, and no particular labor dificulties.

The Peregrina Mining & Milling Co. suspended operations a few days ago, mainly on account of the depletion of its orebodies. The company has for some time been working at a loss, and the recent increase in taxation finally caused the management to close down. The Peregrina mine is an old one and has probably been worked for hundreds of years. The present company acquired the mine and began operations about fifteen years ago, and has milled almost continuously ever since, over a million and a quarter tons having been treated in its plant.

The Guanajuato Consolidated Mining & Milling Co. continues the alterations to its mill, which remains shut down. At its Sirena mine the company is doing development work which is greatly increasing its ore reserves. Production will not be renewed in all probability for some time.

The Guanajuato Reduction & Mines Co. continues to operate its mines and mills at full capacity. Its new mill and plant in the La Luz district is running smoothly, and the metallurgical results are well up to expectations.

The Cubo Mining & Milling Co. is treating about five thousand tons monthly in its mill and cyanide plant. Development work is being pushed ahead, with reported satisfactory results.

The United Mines Co. continues to develop its holdings at La Luz. Satisfactory progress is being made in the new shaft.

All development work on the Esperanza properties at Santa Ana, under bond and lease to the Pinguico Mines Co., has been stopped for the present. The shaft of the Pasadena mine is being deepened. It is proposed to sink this shaft until it cuts the El Monte vein in depth. The evidence on hand so far indicates that Guanajuato is what might be termed a comparatively shallow camp. So little deep work, however, has been done that this evidence can only be considered as presumptive.

ARIZONA

Louis d'Or M. & M. To Expand Operations

Miami—At a directors' meeting held in Chicago of the Louis d'Or Mining & Milling Co., in consultation with C. E. Hart, general manager, much new exploration work was planned, including another shaft and the sinking of additional diamond-drill holes. A pilot mill is to be erected, a larger hoist is to be placed in the first shaft as soon as it reaches 500 ft. depth, an electric plant will furnish light and minor power, a large administration building will be erected, including quarters for the engineering force, and the assay building will be equipped with a chemical department that can make tests upon structural building materials.

Active development work is reported on the Celtic group of mines, north of the Greater Miami group. The main tunnel, No. 4, now is in 300 ft. and is expected to strike the main ledge within 60 ft. more. Ore taken out gives assays of 17 oz. in silver and 9 per cent copper. The owners are H. H. MacDonald, of Ray, and Owen Morris, of Globe.

Tombstone—J. L. Melgren & Son have purchased all the interests of the Tombstone Co-operative Milling Co. The mill was originally started with eight shareholders, each of whom was to take a certain period of the mill time, but there was disagreement that ended in the Melgrens buying out the six other members. A new steam plant will be installed, and water secured from a well. Custom ores will be received.

Duncan—It is reported that the old Carlisle and Jim Crow mines have been purchased from George H. Utter by George F. Wilson, H. V. Snell, and W. D. Fisk, of Globe. The same people purchased several years ago the New Year Gift mine from Utter, and have since developed an ore reserve of about 24,000 tons. An effort was made a short time ago to get the mine owners of this district to co-operate and treat their ores in the cyanide mill of the Duncan M. & M. Co., which is within three miles of the Carlisle and adjoins the Jim Crow ground. No results have as yet been apparent, though it is stated that the plan is not dead by any means.

Patagonia — An encouraging strike has been made in the new development tunnel on the Bender property, where a southwest dipping vein has been opened which contains streaks assaying from 20 to 100 oz. silver a ton. The diamond-drill hole on the Hardshell property is down 825 ft., and is in a lime-quartz formation.

NEW MEXICO

Application for Receiver for Octo Company Denied

Lordsburg—Returns from the last car of silver ore shipped by the Co-operative mine, it is claimed, show 4,300 oz. silver in the 35 tons shipped.

The application for a receivership for the Octo Mining Co., brought by Lawrence R. Boyd, was thrown out of court as insufficient.

Messrs. Crites, Williams, and Nicholas, who are interested, it is reported, with John A. White in the Last Chance mine, have been visiting the property with their engineer, Matt Chestnut. The property is developing satisfactorily. The upraise from the 275 level has been connected, and a rich showing of native silver ore has been encountered on the 275 level; 15,000 tons of ore that will run from 15 to 30 oz. have been blocked out. It has been decided to install a compressor plant, develop a water supply, and build a fifty-ton mill to handle the ore. A mill would probably not be built at the present but for the excessive treatment charges made by the El Paso smelter, which is the only smelter receiving ores in this territory at this time.

The Great Eagle Fluorspar property has been shut down temporarily pending a change in superintendents.

COLORADO

Mines Closing Because of Lack of Funds

Ouray—The Ouray Union was closed down recently by the refusal of the men to work longer without payment of past-due wages; the men filed a labor lien, but agreed to give the company a reasonable time before bringing suit. The company had been for some time engaged in remodeling the mill, equipping the mine, and in general preparing for active work, but was not able to complete financing the work. The mine, which produced heavily a good grade of gold ore a few years ago, is said to still contain a good deal of ore besides having good undeveloped territory. The plant is practically complete now, and the company is actively negotiating for more funds.

The Chipeta M., M. & S. Co. is still closed down on account of lack of funds. Most of the stock sold recently was placed among coal miners on the eastern slope in Colorado, and these subscribers declare themselves unable to resume payment of their subscriptions until coal mining is resumed in the fall. The company has just completed the delivery of an air compressor and most of the work of installing pipe lines, erecting buildings, and constructing electric line has been completed.

After a short period of inaction, the Hidden Treasure Mines Co. has resumed operations on its mine just northwest of the Camp Bird. A change in management, and evidently in plans, is shown by the work now being carried on by E. R. Baur, the new manager. A small mill, to be used as a test mill, is being erected at the mine, machinery for this plant being bought in the vicinity. Jigs, followed by Huntington mill regrinding, and tables and flotation, will be the essential features. The plant will probably be ready for operation before snow falls.

The Silverton Ry. has applied to the I. C. C. for permission to abandon its line from Silverton to Joker Tunnel via Red Mountain, and is now advertising locally to that effect. This is the railway built by Otto Mears, the San Juan pioneer, in the days when the famous Red Mountain copper-silver mines were active. A large tonnage of high-grade copper-silver ore was hauled by this road for some years. The passing of this almost historic railroad is not being actively opposed, since there is little going on in the Red Mountain district. The Barstow is the only shipper, and the railroad company declines to repair its road for hauling the fifteen carloads offered by the Barstow.

Owing to the refusal of the Silverton Ry. to run trains for Barstow concentrate alone, the operators of that mine, under the C. R. Wilfley lease, are hauling their year's accumulation of concentrate to Silverton by wagon, and there loading on the D. & R. G. R.R. for shipment to the smelter at Durango. The operators have made a preliminary estimate of $100,000 for the year's production.

The Mountain Top Mining Co., of which G. H. Beebe is manager, is in high-grade ore again, and making a splendid production. A new Hardinge mill has just been purchased, and when it is received the underground mill will be doubled in capacity, with the addition of other machinery.

Telluride—Operations have been resumed at the Alta mine by the Belmont-Wagner Mining Co., a subsidiary of the Tonopah-Belmont Mining Co., under the management of John M. Warner. The Black Hawk tunnel will be advanced to connect with the mine workings, so that ore can be delivered directly to the mill. At present the mill is operating on tailing. About sixty men are employed. The force will probably be increased to 200 in the near future.

Cripple Creek—The Queen mine will be reopened in the near future under the direction of John T. Milliken. The shaft will be sunk 250 ft. and laterals will be advanced to develop the vein.

UTAH

Revision in Tax Laws Considered

Revision of the taxation laws of Utah to be voted on in the form of amendments in 1922 by the electorate of the state is being undertaken by a commission appointed last year for this work by the state Legislature. William Bailey, chairman of the commission and of the state Board of Equalization, in a paper read before the commission, has furnished a general outline of the state taxation laws and of the work before the commission. It has been decided, following Mr. Bailey's suggestion, to take up one at a time the questions to be examined, and to start out with the classification of property for taxation purposes.

It will be remembered that in Utah mining porperty is assessed according

to the surface valuation placed on the ground and according to the value of improvements, and the production of mines at three times the net proceeds. This system of taxation was felt at the time of its enactment to bear heavily upon the mining industry, and efforts were made to bring about changes which would not place what was regarded by mining men as a disproportionate share of taxation upon mining. Any changes which may be proposed as the work of the committee progresses will therefore be watched with interest.

Eureka—The Little May is starting to sink its two compartment shaft from the 200 to the 300 level. Drifting with encouraging results has been done on the 200 level. The mining committee of the Salt Lake Commercial Club adopted a resolution Aug. 19 congratulating the Walter Fitch, Jr., Contracting Co., which is sinking the Water Lily shaft in the eastern holdings of the Chief Consolidated, with having broken the world's shaft sinking record. The shaft was sunk 427½ ft. in one month.

Lead furnaces at the Valley plants operating Aug. 20 were as follows: The United States Co. at Midvale had four lead furnaces in blast, including one on matte concentration. The large new stack at this plant is being built, the foundations having been completed and the brickwork being up about 100 ft. This stack will be 465 ft. high or over when completed. The A. S. & R., at Murray, had four lead furnaces in operation. No lead furnaces were in blast at Tooele.

Salt Lake City—The Utah-Apex, of Bingham, is presenting in the U. S. district court at Salt Lake City its objections to the accounting of the Utah Consolidated for ore taken from ground formerly in dispute and lately adjudged to belong to the Utah-Apex Co.

Alta—The Little Cottonwood Transportation Co., operating a narrow-gage railroad between Alta and Wasatch down Little Cottonwood Cañon, is applying to the Public Utilities Commission to be allowed to make a 25 per cent increase in freight rates. The shipping season for this road begins late and ends early, and operation is over steep grades. The petition states that shippers agree to the increase, and the management gives the closing down of the road as the only alternative to making the proposed increase. The present daily loss is placed at $50.

MONTANA

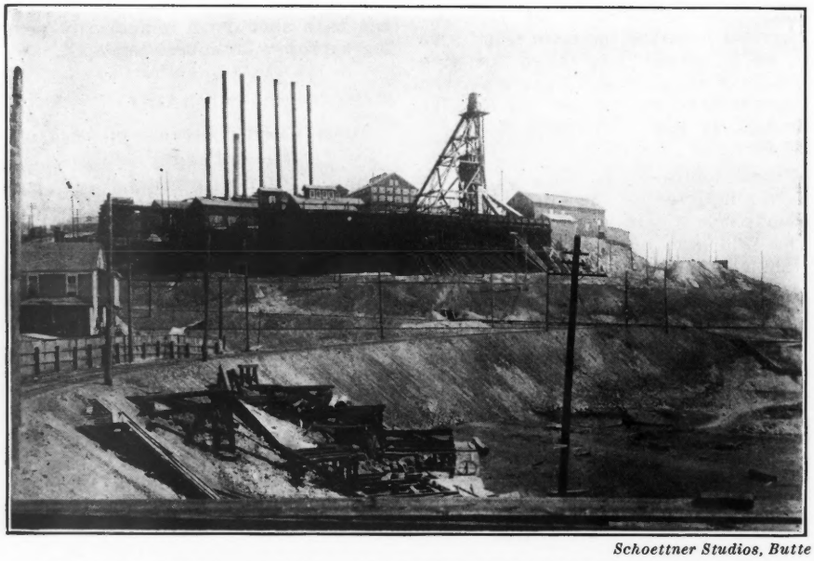
American Gem Mining Syndicate Producing Sapphire in Phillipsburg District

Phillipsburg—The American Gem Mining Syndicate, of Phillipsburg, is mining sapphire such as used in electric meters, watches, chronometers, and for dies used in drawing wire and shaping leads for pencils and for other purposes where a hard substance is necessary. Mining is carried on by the hydraulic method, the material being washed into sluice boxes. When a sufficiently large clean-up is made, the material is jigged to remove as much of the sand and gravel as possible. It is then gone over by hand, and defective stones and waste material are removed. The stones are screened for sizes suitable for the purposes for which they are intended.

The sapphire is found in sand and gravel in the gulches and has probably been carried there from a volcanic capping which previously may have covered the surrounding hills and has been weathered out in time. The company's head office is 509 Merchants-Laclede Building, St. Louis, Mo. L. M. Rumsey, Jr., is president. There is no company named the Gem Mining Co., as previously reported.

Hesperus Mining Co. is making arrangements to resume operations at the shaft of the Butte New England Copper Co., situated to the south of the Colorado mine of the Davis-Daly, and plans now under consideration contemplate the sinking of this shaft from the 250 to the 500 level.

East Butte's smelter, mill and the levels of its Pittsmont property are being overhauled, presumably in anticipation of an inspection, which, rumors have it, is in connection with negotiations concerning a possible sale, to whom is not known, but which gossip connects with the Davis-Daly and the W. A. Clark interests, with opinion veering stronger toward the latter. A drift driven in the Pittsmont mine 230 ft. in length, averaging 6 ft. in height with a 20-in. gage track, by two men in twenty-nine days, the men doing their own piping and track laying, is believed to have established a record, according to William Maxwell, Montana State Mine Inspector.



Schoettner Studios, Butte

ANACONDA COPPER MINING CO.'S NEVER SWEAT MINE, BUTTE, MONT.

Butte—Anaconda Copper Mining Co. will drive a crosscut on the 1,900 level of the Gagnon mine with the object of cutting a vein which on the 2,800 level has disclosed a copper-producing zone in a fissure of great width, which nearer the surface is of a silver-zinc character. The opening of this body of copper ore in a portion of the Butte district, where it was not definitely known that copper existed in tonnage, was regarded by engineers as indicating further possibilities. Anaconda during the last week resumed repair work on the "big" flue at the Washoe smelting works, employing forty men.

Davis-Daly Copper is increasing its daily tonnage, more than 400 tons being hoisted one day in the last week of ore carrying more than 5½ per cent copper. Immediate operations of the company are showing a profit despite the prevailing low current quotation for copper. Station cutting on the 750 level of the Hibernia shaft is nearing completion, and crosscutting for the North and South Hibernia veins will be undertaken soon.

John D. Pope, manager of the Boston & Montana Development Co., says that the 750 mill of the company, in the Elkhorn district, is just about ready for operation and that there is no doubt ore will be run through the mill by Sept. 15, the date set a short time ago. The company has developed about 40,000 feet of workings, or nearly eight miles. There are thirty known veins, only five partly developed. Tests show that the average value per ton of ore is $20. Fully 1,000,000 tons of ore is ready for mill treatment.

Neihart—Drilling rig at the Silver Dike property is working upon its third test hole, two holes having been drilled to a depth of 150 ft. each. General impression prevails that satisfactory results have been had, although nothing official is obtainable. The American Zinc Co. is believed to be back of the testing out of the Silver Dike, the tonnage of which is extensive if an aver-

age of silver values can be had which will assure a profitable milling return.

Jardine—Refinancing plan is announced by the Jardine Gold Mining & Milling Co., whereby a new company, known as the Jardine Mining Co., is launched, with its shares exchangeable for those of the old corporation at the rate of one for one, plus 5c. a share. Pittsburgh interests are back of the refinancing.

Saltese—Wilson Mining & Smelting Co. has let a contract for driving a crosscut 100 ft. This working already is in 420 ft. and it is believed a short distance farther will be sufficient to reach the vein. A depth from 500 to 600 ft. will be attained.

Troy—Montana Morning Mining Co. will resume operations, with a program designed to place the property upon a producing basis soon. The main tunnel cuts a 16-ft. ledge of good milling ore at a depth of 225 ft.

NEVADA

Operations Normal — Mineral County Buys Power Line

Tonopah—All the larger companies are operating under normal conditions. The Tonopah Extension has unwatered the Victor shaft to the 1,880 level, and development operations will start immediately. The Rescue-Eula, North Star, and Midway have begun operations. The eastern part of the Jim Butler Tonopah Mining Co. has been taken over under lease by the New California Tonopah Mining Co. Development work will be carried on from the 900 level of the Wandering Boy shaft. The West End has shipped $62,000, which represents the clean-up for the first half of August.

Divide—The Tonopah Divide, Divide Extension, Brougher Divide, Rosetta Divide, and the Kernick Divide are at present operating. The North Divide Extension and the Victory Divide have reorganized and will begin operations soon.

Klondyke—The Knox Divide is drifting on the 130 level, and shipping a regular tonnage to the Belmont mill. The Ben Hur is carrying on considerable development work, and lessees on the Original Klondyke have been shiping regularly.

Luning—The power line from Lundy to Hawthorne has been purchased by Mineral County from the Nevada California Power Co. The ownership of this line will be transferred on Oct. 31, 1921. Mineral County will complete its power line to Luning, Mina, and Simon by Nov. 1, 1921, and the power purchased from the Nevada California Power Co. at Lundy will be distributed over the county power line to the above mining districts.

The Watson and O'Boyle gold strike, about nine miles north of Luning, has been sunk to a depth of 20 ft. Ore of a good grade is being taken from the shaft. The Silver Chief prospect in the same locality has opened up 2½ ft. of lead-silver ore of shipping grade.

Goldfield—The shaft of the Goldfield Deep Mines has reached the 800 level. When the shaft has reached the 1,000 level, a station will be cut on the 800 level and pumping machinery will be installed.

Tule Canyon—Lessees on the Jaegers property of the Silver Hills Nevada Mines Co. have opened up two feet of high-grade silver ore. A number of new leases have been granted, and considerable work is being done on this section of the property.

Hornsilver—A. I. D'Arcy and associates have taken over the Orleans Hornsilver Mining Co. They will begin underground development and build a mill.

Mina—The work of building a power line to the mine and mill of the Simon Silver-Lead Mines Co. has begun, the county having purchased all material. The Nevada-California Power Co. is expected to begin delivering power in September. The mill is ready to start as soon as power is available.

CALIFORNIA

Carson-Afterthought Suit Being Tried

Placerville — The buildings of the Good Hope mine, twenty-five miles east of here, were destroyed on Aug. 16 by a forest fire which burned about one square mile of timber.

Grass Valley—Thomas Bath reports having cut a vein of good free gold ore in his tunnel on the Ross ranch near Newtown.

The eighty-stamp mill of the Empire mine is operating at capacity and producing about $90,000 per month.

William Landigran and Thomas Scadden have found old workings in the Lost Frenchman mine, on Grizzly Hill, which they believe to be the lost tunnel worked in 1869 and presumably closed down while in bonanza gravel.

San Francisco — The suit of George C. Carson against the Afterthought Mining Co. for infringement of patent is being tried before Judge Van Fleet of the U. S. District Court here. Carson claims as his invention the side feeding of ores and fettling in a reverberatory furnace, with a number of subordinate claims. If successful he will probably proceed against the large copper companies next, as side feeding is the customary practice in the large smelters. It is expected that a decision will be rendered by Sept. 1.

French Gulch—The Hazel Gold Mining Co. has given an option on the Gladstone mine to a San Francisco company. The mine was shut down in 1916 on account of high costs. Hamilton Eddie is in charge of the new operations.

Randsburg—The California Rand Silver, Inc., has placed an order for a 200-ton flotation plant with the Joshua Hendy Co. On the Coyote claim, adjoining the Kelly mine, the Randsburg Silver Co. has found 23 ft. of ore, averaging nearly $100 per ton.

Los Angeles—P. A. Simon, president of the Simon Silver-Lead Mines Co., announces that the company has obtained the old Kirk-Simon smelter at Harbor City and expects to remodel it for the production of zinc oxide from the flotation concentrates of the new mill at Mina. Shipment of the flotation machinery from San Francisco will be completed by the last of August, it is reported.

Oroville—J. A. Coutts, a mining engineer of San Francisco, reports the finding of two rich veins of gold quartz in the old Wyandotte mine. A mill has been built and preparations are being made to sink to the 300-level. B. F. Clark and John Wells have discovered good gold-silver ore near Yankee Hill.

Bridgeport—The Perini group of mining claims at Masonic has been sold by S. L. Perini. The purchasers will begin operations at once.

Alturas—The Gooselake Mining Co. is arranging to install a five-stamp mill on its property in Willow Valley.

MICHIGAN

C. & H. Cutting Costs—Channing Impressed With Seneca's Developments

Houghton—Three hundred additional men have been let out by Calumet & Hecla as the result of recent orders to curtail to the utmost possible extent in every department. All costs not absolutely essential to the maintenance of the property have been eliminated. The power plant at Lake Linden will be operated to serve the electric pumps and steam will be maintained at the mine to operate the steam pumps and bailers. Sixty-five men have been retained for work on the pumps.

Calumet & Hecla, Ahmeek, Centennial, Osceola, and Allouez have combined their clerical departments, with John G. Bennetts, of the C. & H., as chief clerk. During the period of the suspension at least this work will be centralized at Calumet. Mr. Bennetts also has been made assistant treasurer of Calumet & Hecla.

J. Parke Channing, of New York, president of the Seneca Copper Corporation, expresses himself as favorably impressed with developments in the Seneca property. He has thoroughly inspected conditions in both the Seneca and Gratiot shafts and is satisfied, he says, that the ground opened is equal to that in any of the adjoining properties on the Kearsarge lode, including Ahmeek and Mohawk. No. 3 drift north from the Seneca shaft toward Gratiot, the longest opening in the mine, has reached a length of 1,700 ft. and is in good rock practically all the way. The 4th, 5th and 6th level drifts north also are in good ground. New hoists must be installed before either the Seneca or Gratiot can be deepened, but in the meantime the mine will be opened extensively by means of laterals.

Calumet & Hecla has added to its already large supply of Danish flint pebbles for its grinding mills at Lake Linden. A cargo of 2,200 tons recently was received from Copenhagen. They are used for grinding of conglomerate.

WASHINGTON

New Hope Starts New Tunnel

Spokane—In a letter to the stockholders of the North Bunker Hill Mining Co. of Kellogg, the directors state that the crosscut from the 500-ft. station in the shaft has been advanced 480 ft. and that the work is now in the casing of the ledge, with every indication of cutting into the vein at any time. The present work is attracting considerable attention, as the crosscut is entering a point directly beneath Haystack peak in a quartzite formation where the mineralized area is said to show a width of 340 ft. in surface and upper workings.

Eugene Thomas reports that a new tunnel has been started on the property of the New Hope Mining Co., of which he is manager. The property is north of Osborn, in the Coeur d'Alenes. The tunnel will have to be 1,800 ft. long to reach the main ledge, but a ledge of considerable importance probably will be cut at about 300 ft. from the portal of the tunnel. The new tunnel will give 350 ft. additional depth.

The Walton Mines Co., operating fourteen miles north of Fairfield, Idaho, expects to finish its mill and begin the shipment of concentrates to Salt Lake about Sept. 20. Three hundred tons of mill feed running $20 to $30 has been stoped for milling.

The directors of the Guelph Mining & Milling Co., near Kellogg, Idaho, plan resumption of development work on the property. The mine has been idle for a year. The last work was in the crosscut from the 225 ft. level of the main shaft. This crosscut had been extended 600 ft. and had just cut the Guelph lead and started toward the Ambergris vein, when the flow of water became too heavy for the pumps, and work was discontinued until additional machinery could be installed. The management expects to cut the Ambergris lead in about 200 ft.

Fifty tons of ore has been shipped by the lessees in the No. 4 tunnel of the Western Union Mining Co., in the Coeur d'Alenes. This is the nineteenth car shipped by them this year, and is said to be about the best ore taken out.

Blewett—The Amalgamated Gold Mines Co., which reopened the old Blewett mine about one year ago, has been operating steadily. The old stamp mill has been overhauled and five stamps are now in operation. The ore is being concentrated on tables and vanners, and experimental tests are working out a method of treatment that will increase the percentage of recovery. C. R. Hesseltine, of Seattle, is manager of the property, and Ernest Riebe is engineer in charge.

OREGON

Opp Mine To Be Reopened

Holland—The Boswell Extension Gold Mining Co., a Nevada corporation capitalized at $1,000,000, has been granted permission by the state corporation commissioner to operate in Oregon, with headquarters at Holland. George S. Barton, of Grants Pass, is secretary-treasurer. The new company holds mining ground containing extension veins of the famous Boswell gold mine six miles out from Holland.

The Norden-Fritz syndicate, which is composed of Seattle, Wash., investors, with headquarters at Holland, Ore., has purchased the Siskron mine.

Jacksonville—The Opp gold mine, less than two miles west of Jacksonville, which has been closed down since 1916, is being reopened by J. W. Opp, of Jacksonville, and associates. The mine was discovered many years ago, but its chief development has taken place within the last sixteen years. It is at an elevation ranging from 1,850 to 2,850 ft. and consists of a total acreage of 373 acres of mining lands. It is opened by eighteen adits disclosing three main veins. The longest crosscut entry is about 850 ft., and the total underground workings amount to over 7,000 ft. The surface equipment consists of about 3,600 ft. of tram line, a six-drill Leyner compressor, a 125-ton cyanide plant, and a twenty-stamp mill, equipped with crushers, a Dorr classifier, one Wilfley and six Johnson concentrators, and four plates.

The mine as a whole is in good condition, and has a large amount of excellent equipment. A considerable additional expenditure is warranted in the further development of orebodies already exposed in the mine and in arranging the mill to treat the same according to the best milling practice.

The California-Oregon Power Co., the local power company of this region, with headquarters at Medford, Ore., has announced that it will extend its power line beyond the Opp mine due west toward the Gold Ridge, Millionaire, Centennial, and Roaring Gimlet mines, now in operation in the Gold Hill district. This will accommodate the new properties soon to be developed between the Opp and Gold Hill mines.

Gold Hill—The National Manganese Ore Co., an Indianapolis, Ind., corporation, with headquarters at Gold Hill, has taken over the old Centennial placer diggings, three miles south of here, which have been idle for years. Several carloads of equipment have arrived from the East for the erection of a drag-line type of dredge. A power line has been rebuilt to the mine, which will be operated by electric power. Water will be pumped from Rogue River at Gold Hill through a 3-in. pipe line to the diggings, to enable operations to continue during the dry season. The former owners of this property were the Electric Dredge Co., an Indianapolis concern, and the extensive electrical driven equipment on the property was dismantled in the early days of the war and shipped to war industry centers.

The Red Ribbon group of gold quartz mines out six miles west of Gold Hill, and owned by M. S. Johnson, of Gold Hill, has been taken over for further development by Dr. A. M. Knapp, interested in the Boswell Extension mine at Holland, Josephine County, Ore. The new owner is preparing to drive 200 ft. from the surface and under the old works on the vein. The vein averages about 2 ft. in width, but produces high-grade ore running into hundreds of dollars per ton on the pay shoots characteristic of the district.

Sumpter—Blowing-in of the rehabilitated Sumpter smelter, originally scheduled to take place about Sept. 1, has had to be postponed because of delay in arrival of electrical machinery.

Baker—Because of revived interest shown in mining in Baker and Grant counties, a marked increase has been shown of late in the volume of travel on the Sumpter Valley Ry.

Virtue—White Swan mill is running on some very good ore, of a grade similar to that found in that famous property in the early days.

Bourne—Satisfactory progress is being made in reconstruction and enlargement of the E. & E. mill.

MINNESOTA

Heavy Flow of Water in Boeing Pit

Hibbing—The Winston-Dear Co., stripping contractors, have encountered an abnormal flow of water in the Boeing pit, a property of the Mesaba Cliffs Iron Mining Co. The water has necessitated the installing of three steam pumps and one electric pump of large capacities, which at present are handling from 1,500 to 1,800 gal. per min. It is now planned, to facilitate the handling of the water, to put down three cased drill holes to the present underground workings and handle the greater volume of the water by the underground pumps. This scheme will do away with the present installation of pumps in the pit and will permit more rapid movement of the shovel due to lack of the congestion of pipes and pumps.

Ely—The Zenith mine, operated by Vermilion Mining Co., a subsidiary of Pickands, Mather Co., has again curtailed its forces but to no marked degree. The curtailment consisted of the laying off of forty or fifty men, but the company is still employing approximately 130 men. Present plans of the company, besides the completion of the construction work on the condensing plant, provide for the development of the 13th level. This development work will necessitate the sinking of the shaft to a greater depth and drifting in rock until the ore is encountered, before the development in ore can take place. There will also be some development work on the other levels in anticipation of a larger production during the 1922 season.

THE MARKET REPORT

Daily Prices of Metals

Aug.	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
25	11.375@11.50	25 25	25.50	4.375@4.40	4.20@4.25	4.15
26	11.50	25.625	26.125	4.375@4.40	4.20@4.25	4.15
27	11.50	25 375	25.875	4.375@4.40	4.20@4.25	4.125
29	11.50	25.875	26.25	4.40	4.20@4.25	4.125
30	11.625	26 25	26.75	4.40	4.20@4.25	4.10@4.15
31	11.75	26 50	27.00	4.40	4.20@4.25	4.15@4.20

*These prices correspond to the following quotations for copper, "delivered": Aug. 25th, 11.625@11.75; 26th, 27th, 29th, 11.75; 30th, 11.875; and 31st, 12c.

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

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

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

London

Aug.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
25	66½	66⅞	70½	149	150¾	23¼	22¾	24¾	25¼
26	67½	68⅛	70½	152	154	23⅜	22¾	24¾	25¼
27	...	...	...	...	...	...	...	...	...
29	67⅞	68½	70½	153¼	155¼	23⅜	22¾	24¾	25⅜
30	67⅝	68¼	71½	156½	158¾	23¼	22¾	24⅞	25½
31	68¼	68⅝	71½	157	159¼	23¼	22¾	24¾	25½

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

Silver and Sterling Exchange

Aug.	Sterling Exchange "Checks"	Silver			Aug.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York, Foreign Origin	London
25	368¾	99¼	62½	38⅜	29	369¼	99¼	62⅜	38¼
26	368¼	99¼	62	38	30	370	99¼	62⅜	38⅛
27	368	99¼	62	38	31	372	99¼	62¼	37⅞

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

Monthly Average Prices for August

Copper:	
New York Electrolytic	11.634
London Standard	68.614
London Electrolytic	72.705
Lead:	
New York	4.382
St. Louis	4.217
London	23.489
Silver:	
New York, foreign	61.597
New York, domestic	99,250
London	38.096
Sterling Exchange	364.505
Zinc:	
St. Louis	4.186
London	25.068
Tin:	
99 per cent	25.662
Straits	26.301
London	155.318
Antimony	4.597
Quicksilver	45.028
Platinum	73.222

Metal Markets

New York, Aug. 31, 1921

A much better sentiment has characterized the metal market during the last two days, although no particular reason can be assigned for the changed feeling. The London market has shown a stronger tendency; sterling exchange has improved; business conditions in this country seem to be somewhat better, particularly in the Middle West; and consumers have come to the conclusion that metal prices are not likely to fall much lower: all of these factors have no doubt had an effect.

Copper

Yesterday and today the copper market has taken a marked turn for the better, and we now know of no agency willing to supply September copper for less than 12c., delivered. This is the price which the larger producers have been asking ever since the break came, early in the month, and it seems likely that they will now be able to do some business at that level. In the meantime, however, copper has sold down to 11⅞c., delivered, though the quantity on the market was never large. Producers are not disposed to quote for shipment later than October, but last-quarter delivery could probably be obtained today for 12.25c.

Export demand has continued satisfactory, the bulk of the metal being taken by Germany, Japan, China and France at between 11⅞ and 12c., f.a.s.

Lead

The lead market continues practically unchanged, with producers generally well sold up for current production, and, in some cases, asking a premium because of that fact. Demand has not been great, but neither has it been particularly dull. The St. Louis market has been somewhat depressed by the continued offering of reliable brands at 4.20c., as reported last week, but, on the other hand, a prominent producer has been able to do a fair amount of business at 4.25c. Selling for forward delivery is still not in evidence. Opinion is divided whether the next price movement will be up or down.

A feature of the market during the last few weeks has been the foreign demand, chiefly from the European countries. This has taken away a great deal of bonded lead which would otherwise have had a depressing effect on the market. European supplies are evidently not equal to the demand.

Zinc

The market dropped still lower on Saturday, when weak producers made sales at 4.125c. in the St. Louis market. A day or two later one small producer sold for 4.10c., which is the lowest point reached in the recent decline. The cheap metal was quickly picked up, however, and late yesterday afternoon bids of 4.15c. were turned down. Today most of the producers have not been willing to sell under 4.20c., but consumers have not been willing to meet this figure. Demand has not been great during the week, but there is no doubt that galvanizing interests have been more actively in the market than for some time. Brass special is quoted at 10

points premium over Prime Western, and high-grade is bringing 6c., delivered.

Tin

With a stronger market in London and higher sterling rates, tin prices in New York have risen somewhat without much buying. Consumers seem to feel that the present reaction is only a temporary one, and distrust the spirit of the market. Tin-plate business is reported to be improved. Receipt of two small lots of 99 per cent grade has temporarily allayed the shortage of spot supplies of that variety. Forward delivery Straits continues to be quoted at the same price as spot.

Arrivals of tin, in long tons: Aug. 25th, London, 50; 26th, Straits, 465; Rotterdam, 100; 29th, Rotterdam, 25; London, 25.

Gold in London: Aug. 25th, 111s. 4d.; 26th, 111s. 6d.; 29th, 111s. 4d.; 30th, 111s. 1d.; 31st, 110s. 4d.

Foreign Exchange

The foreign exchange market has inclined toward strength during the last week, but has had no outstanding features. Sterling cables were quoted one-half cent higher than the demand prices given on page 393. On Tuesday, Aug. 30th, francs were 7.815c.; lire, 4.36c.; and marks, 1.175c. New York funds in Montreal, 10⅛ per cent premium.

Silver

The silver market the last week has been steady but dull, with limited business. Supplies have been moderate, with little pressure to sell. The rise in sterling exchange has tended to offset the decline in London price for silver. The market closes dull.

Mexican Dollars — Aug. 25th, 47⅞; 26th, 47⅝; 27th, 47⅝; 29th, 47⅞; 30th, 47⅞; 31st, 47⅞.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 19@20c. per lb.; 18½c. for imports, duty paid.

Antimony — Chinese and Japanese brands, 4.50@4.60c.; market dull. W.C.C. brand, 5½@5½c. per lb. Cookson's "C" grade, spot 9@9½c. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb., 500-lb. lots.

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

Cobalt — Metal, $3@$3.25 per lb., black oxide, $2.35 per lb. in bbls.

Iridium—Nominal, $160@$170 per oz.

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

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@40c.

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

Osmium—$70 per troy oz. Nominal. $70, Los Angeles, Cal.

Palladium—Nominally, $55@$60 per oz.

Platinum—Nominally, $75@$78 per oz.

Quicksilver — Nominal, $45@$46 per 75-lb. flask. San Francisco wires $45.50. Dull.

[1]**Rhodium**—$150 per troy oz.

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

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

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

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $30; ground, $35; f.o.b. Atlantic ports. Quotations are nominal.

Iron Ore—Lake Superior ores, per 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, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $4.85; old bed concentrates, 63 per cent, $5.75; Harmony, cobbed, 63 per cent, $5.75; new bed low phosphorus, 65 per cent, $8.50.

Manganese Ore—22c. per unit, seaport; chemical ore (MnO_2) $50@$55 per gross ton, lump; $70@$75 per net ton, powdered. Nominal.

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

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

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

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

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

Vanadium Ore—$1 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York. Nominal.

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

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

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

Zinc and Lead Ore Markets

Joplin, Mo., Aug. 27—Zinc blende, per ton, high, $23.55; basis 60 per cent zinc, premium $21; Prime Western, $20 @$18; fines and slimes, no sale; average settling price, all grades of zinc, $21.03.

Lead, high, $53.40; basis 80 per cent lead, $50; average settling price, all grades of lead, $51.20 per ton.

Shipments for the week: Blende, 4,180; lead, 1,040 tons. Value, all ores the week, $141,280. Shipment for eight months: Blende, 176,882; calamine, 102; lead, 39,137 tons. Value, all ores, eight months, $5,216,110.

Producers of zinc ore assumed a more liberal aspect toward accepting price offerings a week ago, and buyers again this week found an easy buying market on a lower level of prices. Fewer than 3,000 tons are reported bought at 2 o'clock today, but it is evident at least one purchasing agency is willing to accept all blende offered on the market on an $18 or less basis any time today. Sellers have held firm against a lowering market while the reserve stock has increased from 60,000 to 90,000 tons.

Platteville, Wis., Aug. 27—Lead ore, $51 per ton. Zinc ore, no market. Shipments for the week: Lead ore, 30 tons. Shipments for the year: Blende, 8,461; lead ore, 1,008 tons, correcting error in total heretofore carried forward. Shipped during week to separating plants, 80 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $1,500@ $2,000; No. 2, $850@$1,250; spinning fibers, $350@$850; magnesia and compressed sheet fibers, $225@$350; shingle stock, $95@$150; paper stock, $55@ $70; cement stock, $16@$27.50; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton, f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7@$10 per long ton, f.o.b. Cartersville, Ga.

Bauxite — French bauxite, $8@$10 per metric ton, c.i.f. Atlantic ports. American bauxite, crushed and dried, $8@$10 per gross ton, f.o.b. shipping points; pulverized and dried, $12@$15 per gross ton, depending upon grade; calcined so as to remove most of the combined water, $20 per gross ton, f.o.b. shipping point.

Borax—Granulated, crystals, or powdered in bags, carloads, 5½c. per lb.; in bbls., 5½c.

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

China Clay (Kaolin)—Crude, $6.50@ $8.50; washed, $9@$10; powdered, $13@ $20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $13@

$20, f.o.b. Virginia points. Imported lump, $12@$20, f.o.b. American ports; powdered, $35@$45, f.o.b. New York.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b. New England points.

Feldspar—No. 1 soap grade, $7@$7.50 per ton, f.o.b. North Carolina points; No. 1 pottery, $6@$6.50; No. 2, $5@$5.50. Market dull. Large stocks are available and quotations are nominal. Producers report cancellations of orders. No. 1, Canadian, ground, $26 f.o.b. cars.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$22.50 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $13.50, f.o.b. Lordsburg, N. M. Ground, acid grade, 97 per cent CaF_2, $30, New Mexico.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 6@7c. per lb.; chip, 4½@5c.; dust, 3@4c. No. 1 flake, 5@6c.; amorphous crude, ¾@2½c.

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

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$1.75 per net ton; 1½ in., $1.35@$1.70. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $45@$50 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead-Burned — $33 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $53.80 per ton, f.o.b., Chester, Pa. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); ground roofing mica, $25@$70, all f.o.b. New York.

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

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $11.65; 75 per cent, $10.65; 75@74 per cent, $10.15; 70 per cent, $6.25; 68 per cent, $5.75; 68@66 per cent, $5.50.

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

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport: furnace size. 12c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 11@12c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

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

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $16@$35, talcum powder grade. Southern talc, powdered, carload lots, $7.50@$11 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—6c. per lb.

Sodium Nitrate—$2.10@$2.30 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $12.50 per ton, f.o.b. in bulk, Western mines, spot and six months' contract; $22@$25 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.25 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

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

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 12c. per lb. of chromium contained; 4 to 6 per cent carbon, 13c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $65@$67, f.o.b. furnace; resale, $90, delivered; English, $65@$70, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $26@$25, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works. Imported material, $1.70@$2.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $40; 50 per cent, $65; 75 per cent, $135.

Ferrotungsten—Domestic, 70 to 80 per cent W, 40@45c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

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

Ferrovanadium—$4.25@$4.50 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 19¾@20c. per lb.; wire, 13¼@13½c.

Lead Sheets—Full lead sheets, 7¾c.; cut lead sheets, 8c. in quantity, mill lots

Nickel Silver — 31½c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets, 16¾c.; sheathing, 15½c.; rods, ⅝ to 3 in., 13¾c.

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

Refractories

Bauxite Brick—56 per cent alumina, $50 per ton; 76 per cent, $90@$95 f.o.b. works.

Chrome Cement—40@45 per cent Cr_2O_3, $30@$32 per net ton, and $31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—$52@$55 per net ton.

Fire Brick—First quality, 9-in. shapes, $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35.

Magnesite Brick—9-in. straights, $65@$70 per net ton; 9-in. arches, wedges and keys, $77; soaps and splits, $98, f.o.b. works.

Silica Brick—9-in., per 1,000: $35@$45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, Aug. 30, 1921.

There has been a slight further improvement in demand for sheets and tin plates, but other branches of the finished trade show no improvement, and some have probably lost a little ground.

Steel prices show little change except in sheets. Late in July the open market declined to 3c. on black and 4c. on galvanized, and for a time these prices were shaded $1 or $2 a ton on particularly desirable orders. Then one producer came out with a $5 a ton cut, four other independents following, and the Steel Corporation met the new prices, making 2.75c. on black and 3.75c. on galvanized the regular market. Merchant bars remain at the 1.75c. price developed a month ago, and shapes and plates are hardly quotable at over 1.80c., or $1 a ton below the price as it declined a month ago. Tin plate is unchanged at $5.25, daily-newspaper reports last week of a "reduction" to $4.75 having been based on imagination.

Pig Iron—A sale of 2,000 tons of basic iron has been made at $19, Valley basis, or half-way between the old market of $18 and the asking price of $20 recently adopted by many producers. Foundry is up about 50c. We now quote: Bessemer, $20; basic, $19@$20; foundry, $20, at Valley furnaces, freight to Pittsburgh being $1.96.

Coke

Connellsville — Furnace, $3@$3.25; foundry, $4.25@$4.50.

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

METAL STATISTICS

Monthly Average Prices of Metals

Silver

	New York		London		Sterling Exchange	
	1920	1921	1920	1921	1920	1921
January	132.827	65.950	79.846	39.985	367.082	372.650
February	131.295	59.233	85.005	34.745	337.466	385.932
March	125.551	56.023	74.194	32.479	370.870	383.806
April	119.779	59.337	68.848	34.250	392.438	391.784
May	102.585	59.810	60.010	34.165	383.360	396.580
June	90.957	58.510	51.096	34.971	393.663	377.236
July	91.971	60.260	53.736	37.481	385.538	362.565
August	96.168	61.597	59.875	38.096	360.404	364.505
September	93.675	.....	59.476	.....	350.370	.....
October	83.480	.....	54.197	.....	346.460	.....
November	77.734	.....	50.952	.....	342.333	.....
December	64.774	.....	41.845	.....	348.101	.....
Year	100.900	.....	61.590	.....	364.840	.....

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

Copper

	New York		London			
	Electrolytic		Standard		Electrolytic	
	1920	1921	1920	1921	1920	1921
January	18.918	12.597	118.095	70.964	123.238	79.119
February	18.569	12.556	120.188	70.925	126.950	75.925
March	18.331	11.976	109.533	67.565	118.348	71.190
April	18.660	12.438	103.025	69.381	111.500	71.786
May	18.484	12.742	96.750	73.196	109.200	74.298
June	18.065	12.697	87.864	71.852	101.909	75.682
July	18.576	12.170	90.148	71.155	106.455	75.286
August	18.346	11.634	93.935	68.614	111.143	72.705
September	18.144	.....	96.381	.....	111.905	.....
October	15.934	.....	93.327	.....	104.905	.....
November	14.257	.....	84.807	.....	94.614	.....
December	13.188	.....	75.702	.....	85.905	.....
Year	17.456	.....	97.480	.....	108.839	.....

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

Lead

	New York		St. Louis		London	
	1920	1921	1920	1921	1920	1921
January	8.561	4.821	8.300	4.747	47.095	23.387
February	8.814	4.373	8.601	4.228	50.256	20.650
March	9.145	4 084	8.894	4.000	46.054	18 911
April	8.902	4.356	8.618	4.272	39.225	20.589
May	8.576	4.952	8.352	4.784	38.488	23.399
June	8.323	4.485	8.169	4.293	34.330	22.563
July	8.338	4.410	8.283	4.260	34.960	23.399
August	8.687	4.382	8.725	4.217	36.304	23.489
September	8.177	.....	8.160	.....	35.452	.....
October	7.070	.....	7.018	.....	35 238	.....
November	6.159	.....	6.127	.....	32.489	.....
December	4.727	.....	4.717	.....	24.089	.....
Year	7.957	.....	7.830	.....	37.832	.....

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

Tin

	New York				London	
	99%		Straits			
	1920	1921	1920	1921	1920	1921
January	61.596	36.000	.....	36.000	376.512	190.464
February	58.466	28.534	59.932	32.142	395.750	166.250
March	61.037	27.296	61.926	28.806	369.489	156.024
April	61.120	28.990	62.115	30.404	345.450	163.905
May	53.230	31.431	55.100	32.500	294.813	177.411
June	46.125	28.514	48.327	29.423	250.614	167.506
July	45.798	26.755	49.154	27.655	261.886	164.530
August	43.856	25.662	47.620	26.301	274.048	155.318
September	41.940	.....	44.465	.....	270.120	.....
October	39.310	.....	40.555	.....	258.190	.....
November	35.667	.....	36.854	.....	241.080	.....
December	31.135	.....	34.058	.....	212.440	.....
Year	48.273	.....	49.101	.....	295.866	.....

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

Zinc

	St. Louis		London	
	1920	1921	1920	1921
January	9.133	5.413	58.643	25.262
February	8.708	4.928	61.338	24.850
March	8.531	4.737	53.467	25 077
April	8.184	4.747	47.388	25.530
May	7.588	4.848	45.088	26.923
June	7.465	4.421	41.193	26.750
July	7.720	4.239	41.886	26.262
August	7.835	4 186	41.220	25.068
September	7.661	.....	39.690	.....
October	7.150	.....	39.756	.....
November	6.247	.....	35.028	.....
December	5.824	.....	27.762	.....
Year	7.671	.....	44.372	.....

New York and 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	
	1920	1921	1920	1921	1920	1921
January	10.577	5.258	90.192	48.440	154.23	73.400
February	11.588	5.250	84.432	49.545	151.59	70.227
March	11.056	5.282	92.611	46.796	138.56	72.463
April	10.500	5.137	102.192	45.423	127.04	73.404
May	9.655	5.250	89.560	47.000	97.50	73.740
June	8.289	5.087	90.154	46.846	85.19	74.942
July	7.500	4.735	90.333	44.950	83.94	70.440
August	7.177	4.597	83.806	45.028	111.44	73.222
September	7.113	.....	75.000	.....	115.20	.....
October	6.723	.....	67.200	.....	101.70	.....
November	6.109	.....	58.417	.....	84.75	.....
December	5.534	.....	49.577	.....	79.62	.....
Year	8.485	.....	81.123	.....	110.90	.....

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

Pig Iron, Pittsburgh

	Bessemer		Basic		No. 2 Foundry	
	1920	1921	1920	1921	1920	1921
January	$40.47	33.96	$39.88	31.96	$39.86	33.88
February	42.95	28.96	42.61	26.96	43.40	30.25
March	43.40	28.16	42.90	26.46	43.40	27.85
April	43.72	26.96	44.22	24.46	43.90	26.77
May	44.00	26.21	44.88	23.84	45.36	25.56
June	44.89	24.96	45.41	22.66	46.40	24.38
July	47.21	22.84	47.42	20.76	46.56	22.36
August	48.90	.....	49.88	.....	49.35	.....
September	50.46	.....	50.46	.....	51.96	.....
October	49.21	.....	44.38	.....	48.58	.....
November	41.26	.....	39.20	.....	42.61	.....
December	36.96	.....	34.90	.....	37.73	.....
Year	44.45	.....	43.85	.....	44.93	.....

In dollars per long ton.

Monthly Crude Copper Production

	1921			
	April	May	June	July
Alaska shipments	5,615,500	4,216,920	3,234,693	3,019,812
Arizona Copper	2,000,000	2,000,000	(a)	(a)
Calumet & Arizona	2,204,000	(a)	(a)	(a)
Cons. Ariz. Smelting	(a)	(a)	(a)	(a)
Inspiration	1,100,000	(a)	(a)	(a)
Magma	378,900	(a)	(a)	(a)
Miami	4,262,625	4,625,000	3,939,000	4,112,000
New Cornelia	1,864,772	1,327,415	1,300,000	1,502,927
Old Dominion	984,000	(a)	(a)	(a)
Phelps Dodge	1,461,000	(a)	(a)	(a)
Shattuck Arizona	(a)	(a)	(a)	(a)
Ray	(a)	(a)	(a)	(a)
United Verde	2,600,000	(a)	(a)	(a)
United Verde Extension	3,092,746	(a)	(a)	(a)
Calumet & Hecla	(a)	(a)	(a)	(a)
Other Lake Superior	5,000,000	4,500,000	4,500,000	4,250,000
Anaconda	2,935,840	(a)	(a)	(a)
East Butte	1,047,140	1,641,176	1,350,000	1,000,000
Nevada Cons	(a)	(a)	(a)	(a)
Chino	(a)	(a)	(a)	(a)
Utah Copper	(a)	(a)	(a)	(a)
Others, estimated	12,400,000	7,000,000	10,300,000	8,150,000
Total United States	46,946,523	25,310,511	24,623,693	22,033,739
Imports: Ore and concentrates, matte, etc	6,539,005	3,072,707	5,129,065	10,924,973
Imports of blister, unrefined,	10,109,145	5,171,662	12,531,637	20,749,969
Imports of refined, etc	19,459,418	7,517,134	3,306,349	595,835
Grand total	83,054,091	41,072,014	45,600,744	54,304,516
Granby Cons	2,459,250	2,539,000	2,254,639	2,255,425
Boleo	728,000	727,098	1,433,804	943,740
Cananea	(a)	(a)	(a)	(a)
Phelps Dodge Mexican properties	407,000	(a)	(a)	(a)
Cerro de Pasco	5,344,000	4,444,000	4,012,000	4,346,000
Chile	3,993,802	3,999,016	4,008,000	4,000,000
Katanga	4,862,025	6,275,430	6,032,880	7,031,745
Backus & Johnston	1,400,000	1,600,000	1,506,000	1,310,000
Hampden Cloncurry	(a)	(a)	(a)	(a)
Mount Lyell	983,360	974,400	902,000	892,000
Mount Morgan	(a)	(a)	(a)	(a)
Cons. M. & S. of Canada	338,000	318,000	152,000	284,000
Falcon Mines	544,000	540,000	.....	486,800

(a) No copper produced during this month.

Comparative Annual Copper Production

	1919	1920	1921
January	135,733,511	121,903,744	90,586 597
February	111,649,512	117,450,000	86 632,941
March	102,040,460	120,309,316	91,046,345
April	98,808,998	116,078,871	46,946,523
May	92,652,975	114,964,207	25,310,511
June	95,856,570	116,107,856	24,623,693
July	100,369,247	109,729,510	22,033,739
August	107,994,040	116,460,654	.....
September	108,703,075	104,919,262	.....
October	115,143,143	105,231,571	.....
November	117,289,735	106,700,178	.....
December	102,997,633	95,709,009	

COMPANY REPORTS

Utah's Deficit for Second Quarter, $1,256,475

A report of operations of Utah Copper Co. for the second quarter of 1921 states that, owing to the suspension of mining operations on March 31, the gross production of copper contained in concentrates for the quarter was only 1,406,085 lb., as compared with 23,424,502 lb. for the preceding quarter.

The net production of marketable copper derived from concentrates and from the precipitates produced in the clean-up of the leaching plant was 1,480,697 lb., as compared with a net production of 22,726,411 lb. for the first quarter of 1921.

Mining operations and shipments of ore were entirely suspended on March 31, but a small yardage of capping was removed by one steam shovel kept in service a few days in April to complete a new entrance to the "A" level, which was under way when the mines were closed down.

The Arthur concentrator plant was continued in operation for two days in April in the treatment and clean-up of the tonnage of ore in mill bins at March 31, when the mill was also closed down completely.

Only a limited number of employees are retained in service in the various departments of mine, mill, and ore delivery, employed solely in the necessary caretaking and protection of property, improvements, and equipment. All expenses have been cut to the minimum, including a reduction of 20 per cent in salaries of all company officials. The details of the financial outcome for the quarter are shown in the following statement:

Net loss from copper production	$42,022.20
Plant shutdown expense	547,583.68
	$589,605.88
Miscellaneous income, including payment for precious metals, etc	145,376.21
Total loss	$444 229 67
Distribution to stockholders	812,245 00
Deficit	$1,256,474.67

The item of "plant shutdown expense," covered in the profit-and-loss statement above, includes, in addition to the actual and necessary cash outlay, the regular monthly accruals for taxes, insurance and the usual fixed and general overhead charges. The quarterly distribution to stockholders made on June 30 was at the rate of 50c. per share. As there will be no production to report during the period of temporary suspension, the issuing of further quarterly reports will be discontinued until such time as operations are resumed.

Barnes-King Development Co.

The records of the Barnes-King Development Co. show the following operating results for the quarter ended June 30, 1921:

Earnings		
Shannon property		$16,290 07
Interest received		1,338.02
		$17,628.09
Deduct		
North Moccasin property expenses, less royalties received	$805.82	
Piegan-Gloster property expenses	2,743.39	
Kendall property expenses	177.81	
Black Hawk development expenses	2,618.03	
Betsy Baker development expenses	2,146.32	
Miscellaneous expense	2,179.55	
		10,670.92
Difference being net profit on operations for quarter ended June 30, 1921		$6,957.17

The above figures include provisions for depreciation on the various plants of the company on the same basis as has been used heretofore.

Ray Consolidated Deficit $370,210 For Second Quarter

A report of operations of Ray Consolidated Copper Co. for the second quarter of 1921 states that as all operations at mine and mill were suspended early in April, gross production of copper in concentrates for the quarter was only 1,605,654 lb., compared with 8,802,186 during the first quarter, 1921. After smelter deductions, net production was 1,546,535 lb. of copper, compared with 8,563,596 for the preceding quarter. No direct smelting ore was shipped. Earnings for the last four quarters compare as follows:

	1921		1920	
	June 30	Mar. 31	Dec. 31	Sept. 30
Operating loss	$85,619	$207,811	$178,081	$113,519
Plant shutdown expense	289,994	.....	.....	.....
Miscellaneous income	5,403	26,515	117,350	61,370
Gross income	(a) 370,210	(a) 181,296	(a) 60,731	(a) 52,149
Dividends	.....	.....	394,294	394,294
Deficit	370,210	181,296	455,025	446,443

(a) Loss.

No underground development work has been done during the quarter, mine operations having been suspended and concentrator shut down as soon as mine and mill could be put in condition for indefinite closing.

Working forces at mine and mill have been reduced to lowest limit consistent with proper care and protection of plant and equipment, all expenses have been reduced to a minimum, and salaries of company officials have been cut 20 per cent.

Current sales of copper have disposed of all the first-quarter output, and made appreciable inroads upon the stock of refined metal carried in inventory at the beginning of the year. Issuance of quarterly reports is suspended until operations are resumed.

Wolverine Copper Mining Co. Shows Operating Loss

Copper, Michigan

A report of the operations of the Wolverine Copper Mining Co., for the year ended June 30, 1921, states that 3 649,303 lb. of copper was produced, at an operating cost of 16.423c. per lb., to which should be added the cost of smelting, freight, and marketing, 2.480c., the charge for taxes, 0.700c., depletion amounting to 4.249c. and depreciation of 1.154c., giving a total of 25.006c. per lb. Operating statement follows:

Sales:		
3,769,754 lb. of copper at 15.684c		$591,237.47
Cost of sales:		
Copper on hand July 1, 1920	$191,919.24	
Operating expenses at mine	597,859.34	
Smelting, freight and New York and Boston expenses	90,262.99	
Taxes	25,477.07	
	$905,518.64	
Less copper on hand June 30, 1921	172,956.55	732,562.09
Loss on sales of copper		$141,324.62
Deduct:		
Interest on Liberty Bonds	$15,018.79	
Other interest	1,790.20	
	$16,808.99	
Less interest paid	13,182.55	
		3,626.44
Operating loss for the year		$137,698.18
Capital investments:		
Pump intake shaft and tunnel	$12.00	
400-ft. extension to sand conveyor	346.28	
Pumping station at old mill dam	1,855.33	
		$2,213.61
Less insurance recovery on dwelling destroyed by fire		600.00
		$1,613.61

Balance July 1, 1920, was $720,725.19, plus appreciation of $111,428.72, or $832,153.91. Deducting operating loss for the year of $137,698.18, depreciation, $42 008.06, depletion, $154,683.75, and loss on sale of Liberty bonds of $50,887.50. leaves a balance June 30, 1921, of $446,876.42.

METAL STATISTICS

Monthly Average Prices of Metals

Silver

	New York		London		Sterling Exchange	
	1920	1921	1920	1921	1920	1921
January	132.827	65.950	79.846	39.985	367.082	372.650
February	131.295	59.233	85.005	34.745	337.466	385.932
March	125.551	56.023	74.194	32.479	370.870	389.806
April	119.779	59.337	68.848	34.250	392.438	391.784
May	102.585	59.810	60.010	34.165	383.360	396.580
June	90.957	58.510	51.096	34.971	393.663	377.236
July	91.971	60.260	53.736	37.481	385.538	362.565
August	96.168	61.597	59.875	38.096	360.404	364.505
September	93.675	.....	59.476	.....	350.370	.....
October	83.480	.....	54.197	.....	346.460	.....
November	77.734	.....	50.952	.....	342.333	.....
December	64.774	.....	41.845	.....	348.101	.....
Year	100.900	.....	61.590	.....	364.840	.....

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

Copper

	New York		London			
	Electrolytic		Standard		Electrolytic	
	1920	1921	1920	1921	1920	1921
January	18.918	12.597	118.095	70.964	123.238	79.119
February	18.569	12.556	120.188	70.925	126.950	75.925
March	18.331	11.976	109.533	67.565	118.348	71.190
April	18.660	12.438	103.025	69.381	111.500	71.786
May	18.484	12.742	96.750	73.196	109.200	74.298
June	18.065	12.697	87.864	71.852	101.909	75.682
July	18.576	12.170	90.148	71.155	106.455	75.286
August	18.346	11.634	93.935	68.614	111.143	72.705
September	18.144	.....	96.381	.....	111.905	.....
October	15.934	.....	93.327	.....	104.905	.....
November	14.257	.....	84.807	.....	94.614	.....
December	13.188	.....	75.702	.....	85.905	.....
Year	17.456	.....	97.480	.....	108.839	.....

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

Lead

	New York		St. Louis		London	
	1920	1921	1920	1921	1920	1921
January	8.561	4.821	8.300	4.747	47.095	23.387
February	8.814	4.373	8.601	4.228	50.256	20.650
March	9.145	4.084	8.894	4.000	46.054	18.911
April	8.902	4.356	8.618	4.272	39.225	20.589
May	8.576	4.952	8.352	4.784	38.488	23.399
June	8.323	4.485	8.169	4.293	34.330	22.563
July	8.338	4.410	8.283	4.260	34.960	23.399
August	8.687	4.382	8.725	4.217	36.304	23.489
September	8.177	.....	8.160	.....	35.452	.....
October	7.070	.....	7.018	.....	35.238	.....
November	6.159	.....	6.127	.....	32.489	.....
December	4.727	.....	4.717	.....	24.089	.....
Year	7.957	.....	7.830	.....	37.832	.....

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

Tin

	New York				London	
	99%		Straits			
	1920	1921	1920	1921	1920	1921
January	61.596	36.000	.....	36.000	376.512	190.464
February	58.466	28.534	59.932	32.142	395.750	166.250
March	61.037	27.296	61.926	28.806	369.489	156.024
April	61.120	28.990	62.115	30.404	345.450	163.905
May	53.230	31.431	55.100	32.500	294.813	177.411
June	46.125	28.514	48.327	29.423	250.614	167.506
July	45.798	26.755	49.154	27.655	261.886	164.530
August	43.856	25.662	47.620	26.301	274.048	155.318
September	41.940	.....	44.465	.....	270.120	.....
October	39.310	.....	40.555	.....	258.190	.....
November	35.667	.....	36.854	.....	241.080	.....
December	31.135	.....	34.058	.....	212.440	.....
Year	48.273	.....	49.101	.....	295.866	.....

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

Zinc

	St. Louis		London	
	1920	1921	1920	1921
January	9.133	5.413	58.643	25.262
February	8.708	4.928	61.338	24.850
March	8.531	4.737	53.467	25.077
April	8.184	4.747	47.388	25.530
May	7.588	4.848	45.088	26.923
June	7.465	4.421	41.193	26.750
July	7.720	4.239	41.886	26.262
August	7.835	4.186	41.220	25.068
September	7.661	.....	39.690	.....
October	7.150	.....	39.756	.....
November	6.247	.....	35.028	.....
December	5.824	.....	27.762	.....
Year	7.671	.....	44.372	.....

New York and 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	
	1920	1921	1920	1921	1920	1921
January	10.577	5.258	90.192	48.440	154.23	73.400
February	11.588	5.250	84.432	49.545	151.59	70.227
March	11.056	5.282	92.611	46.796	138.56	72.463
April	10.500	5.137	102.192	45.423	127.04	73.404
May	9.655	5.250	89.560	47.000	97.50	73.740
June	8.289	5.087	90.154	46.846	85.19	74.942
July	7.500	4.735	90.333	44.950	83.94	70.440
August	7.177	4.597	83.806	45.028	111.44	73.222
September	7.113	.....	75.000	.....	115.20	.....
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November	6.109	.....	58.417	.....	84.75	.....
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April	43.72	26.96	44.22	24.46	43.90	26.77
May	44.00	26.21	44.88	23.84	45.36	25.56
June	44.89	24.96	45.41	22.66	46.40	24.38
July	47.21	22.84	47.42	20.76	46.56	22.36
August	48.90	.....	49.88	.....	49.35	.....
September	50.46	.....	50.46	.....	51.96	.....
October	49.21	.....	44.38	.....	48.58	.....
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Shattuck Arizona	(a)	(a)	(a)	(a)
Ray	(a)	(a)	(a)	(a)
United Verde	2,600,000	(a)	(a)	(a)
United Verde Extension	3,092,746	(a)	(a)	(a)
Calumet & Hecla	(a)	(a)	(a)	(a)
Other Lake Superior	5,000,000	4,500,000	4,500,000	4,250,000
Anaconda	2,935,840	(a)	(a)	(a)
East Butte	1,047,140	1,641,176	1,350,000	1,000,000
Nevada Cons	(a)	(a)	(a)	(a)
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Distribution to stockholders	812,245 00
Deficit	$1,256,474.67

The item of "plant shutdown expense," covered in the profit-and-loss statement above, includes, in addition to the actual and necessary cash outlay, the regular monthly accruals for taxes, insurance and the usual fixed and general overhead charges. The quarterly distribution to stockholders made on June 30 was at the rate of 50c. per share. As there will be no production to report during the period of temporary suspension, the issuing of further quarterly reports will be discontinued until such time as operations are resumed.

Barnes-King Development Co.

The records of the Barnes-King Development Co. show the following operating results for the quarter ended June 30, 1921:

Earnings		
Shannon property		$16,290.07
Interest received		1,338.02
		$17,628.09
Deduct		
North Moccasin property expenses, less royalties received	$805.82	
Piegan-Gloster property expenses	2,743.39	
Kendall property expenses	177.81	
Black Hawk development expenses	2,618.03	
Betsy Baker development expenses	2,146.32	
Miscellaneous expense	2,179.55	
		10,670.92
Difference being net profit on operations for quarter ended June 30, 1921		$6,957.17

The above figures include provisions for depreciation on the various plants of the company on the same basis as has been used heretofore.

Ray Consolidated Deficit $370,210 For Second Quarter

A report of operations of Ray Consolidated Copper Co. for the second quarter of 1921 states that as all operations at mine and mill were suspended early in April, gross production of copper in concentrates for the quarter was only 1,605,654 lb., compared with 8,802,186 during the first quarter, 1921. After smelter deductions, net production was 1,546,535 lb. of copper, compared with 8,563,596 for the preceding quarter. No direct smelting ore was shipped. Earnings for the last four quarters compare as follows:

	1921		1920	
	June 30	Mar. 31	Dec. 31	Sept. 30
Operating loss	$85,619	$207,811	$178,081	$113,519
Plant shutdown expense	289,994	.....	.....	.....
Miscellaneous income	5,403	26,515	117,350	61,370
Gross income	(a) 370,210	(a) 181,296	(a) 60,731	(a) 52,149
Dividends	.....	.....	394,294	394,294
Deficit	370,210	181,296	455,025	446,443

(a) Loss.

No underground development work has been done during the quarter, mine operations having been suspended and concentrator shut down as soon as mine and mill could be put in condition for indefinite closing.

Working forces at mine and mill have been reduced to lowest limit consistent with proper care and protection of plant and equipment, all expenses have been reduced to a minimum, and salaries of company officials have been cut 20 per cent.

Current sales of copper have disposed of all the first-quarter output, and made appreciable inroads upon the stock of refined metal carried in inventory at the beginning of the year. Issuance of quarterly reports is suspended until operations are resumed.

Wolverine Copper Mining Co. Shows Operating Loss

Copper, Michigan

A report of the operations of the Wolverine Copper Mining Co., for the year ended June 30, 1921, states that 3 649,303 lb. of copper was produced, at an operating cost of 16.423c. per lb., to which should be added the cost of smelting, freight, and marketing, 2.480c., the charge for taxes, 0.700c., depletion amounting to 4.249c. and depreciation of 1.154c., giving a total of 25.006c. per lb. Operating statement follows:

Sales:		
3,769,754 lb. of copper at 15.684c		$591,237.47
Cost of sales:		
Copper on hand July 1, 1920	$191,919.24	
Operating expenses at mine	597,859.34	
Smelting, freignt and New York and Boston expenses	90,262.99	
Taxes	25,477.07	
	$905,518.64	
Less copper on hand June 30, 1921	172,956.55	732,562.09
Loss on sales of copper		$141,324.62
Deduct:		
Interest on Liberty Bonds	$15,018.79	
Other interest	1,790.20	
	$16,808.99	
Less interest paid	13,182.55	3,626.44
Operating loss for the year		$137,698.18
Capital investments:		
Pump intake shaft and tunnel	$12.00	
400-ft. extension to sand conveyor	346.28	
Pumping station at old mill dam	1,855.33	
		$2,213.61
Less insurance recovery on dwelling destroyed by fire		600.00
		$1,613.61

Balance July 1, 1920, was $720,725.19, plus appreciation of $111,428.72, or $832,153.91. Deducting operating loss for the year of $137,698.18, depreciation, $42 008.06, depletion, $154,683.75, and loss on sale of Liberty bonds of $50,887.50. leaves a balance June 30, 1921, of $446,876.42.

MINING STOCKS

Week Ended August 27, 1921

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	42	40	42	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	*32	*29	*29		
Allouez	Boston	18	17½	17½	Mar. '19	1.00
Anaconda	New York	34¼	31⅞	33¼	Nov. '20, Q	1.00
Arcadian Consol.	Boston	†2	†1½	1⅝		
Ariz. Com'l	Boston	7⅛	7⅛	7⅛	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*25	*21	*22		
Bingham Mines	Boston	10	†9½	9½	Sept. '19, Q	.25
Calumet & Arizona	Boston	46	44	45½	June '21, Q	.50
Calumet & Hecla	Boston	224	220	224	June '20, Q	5.00
Canada Copper	N. Y. Curb	*27	*25	*25		
Centennial	Boston	7⅛	7⅛	7⅛	Dec. '18, SA	1.00
Cerro de Pasco	New York	25⅛	24	24½	Mar. '21, Q	.50
Chile Copper	New York	10	9⅛	9⅛		
Chino	New York	21⅛	20	20⅞	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*23	*16	*16½		
Con. Arizona	N. Y. Curb	....	....	*3	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1	*89	1		
Copper Range	Boston	30⅜	30	30⅛	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*42	*34	*38		
Davis-Daly	Boston	6	5⅛	5⅞	Mar. '20, Q	.25
East Butte	Boston	7	7⅛	7⅛	Dec. '19, A	.50
First National	Boston Curb	*54	*53	*54	Feb. '19, SA	.15
Franklin	Boston	1⅛	1⅛	1⅛		
Gadsden Copper	N. Y. Curb	....	....	*25		
Granby Consol.	New York	15⅜	15	15⅜	May '19, Q	1.25
Greene-Cananea	New York	20⅛	20	20	Nov. '20, Q	.50
Hancock	Boston	†3	†2	2½		
Howe Sound	N. Y. Curb	2⅛	2	2	Jan. '21, Q	.05
Inspiration Consol.	New York	31	29⅛	30	Oct. '20, Q	1.00
Iron Cap	Boston Curb			5⅛	Sept. '20, F	.25
Isle Royale	Boston	†18	†16½	16½	Sept. '19, S	.50
Kennecott	New York	18⅜	16⅛	17⅞	Dec. '20, S	.50
Keweenaw	Boston	†1½	†1	1		
Lake Copper	Boston	†3	†2	2½		
La Salle	Boston	†1⅞	†1⅜	1⅞		
Magma Chief	N. Y. Curb	*7	*6	*7		
Magma Copper	N. Y. Curb	17	17	17	Jan. '19, Q	.50
Majestic	Boston Curb	*5	*5	*5		
Mason Valley	Boston	†1⅛	†1	1⅛		
Mass Consolidated	Boston	1⅛	1⅛	1⅛	Nov. '17, Q	1.00
Miami Copper	New York	20⅛	19	19	Aug. '21, Q	.50
Michigan	Boston	†2	†1½	1½		
Mohawk	Boston	46	44	44	Nov. '20, Q	1.00
Mother Lode Coa	N. Y. Curb	4	3⅞	3⅞		
Nevada Consol.	New York	10	9⅛	9⅛	Sept. '20, Q	.25
New Baltic	Boston Curb			3		
New Cornelia	Boston	12⅛	†12⅛	12⅛	Aug. '20, K	.25
North Butte	Boston	9	8½	8½	Oct. '18, Q	.25
North Lake	Boston	†*25	†*15	*15		
Ohio Copper	N. Y. Curb	....	....	*6		
Old Dominion	Boston	21	20⅛	20⅛	Dec. '18, Q	1.00
Osceola	Boston	22⅛	22⅛	22⅛	June '20, Q	.50
Phelps Dodge	Open Mar.	†1.55	†1.40	....	July '21, Q	1.00
Quincy	Boston	34	33⅛	34	Mar. '20, Q	1.00
Ray Consolidated	New York	12	11⅛	11⅜	Dec. '20, Q	.25
Ray Hercules	N. Y. Curb	*21	*17	*17		
St. Mary's Min. Ld.	Boston	31⅛	31	31	June '20, K	2.00
Seneca Copper	Boston	15	13⅛	13⅛		
Shannon	Boston	*90	*90	*90	Nov. '17, Q	.25
Shattuck Arizona	New York	5⅜	5⅛	5⅛	Jan. '20, Q	.25
South Lake	Boston	*1⅛	*50	1		
Superior Copper	Boston	2⅜	2⅜	2⅜	Apr. '17,	1.00
Superior & Boston	Boston	1⅛	1⅛	1⅛		
Tenn. C. & C. cfs	New York	7⅛	6⅛	6⅛	May '18, I	1.00
Tuolumne	Boston	*42	*36	*36	May '13,	.10
United Verde Ex	Boston Curb	23	20	22⅛	May '21, Q	.25
Utah Consol.	Boston	3⅛	3⅛	3⅛	Sept. '18,	.25
Utah Copper	New York	44⅜	41⅛	42⅞	June '21, Q	.50
Utah Metal & T	Boston	1⅛	1⅛	1⅛	Dec. '17,	.30
Victoria	Boston	†1⅜	†1⅛	1⅛		
Winona	Boston	*50	*43	*43		
Wolverine	Boston	11	10⅜	10⅜		
NICKEL-COPPER						
Internat. Nickel	New York	12⅛	11⅛	12	Mar. '19,	.50
Internat. Nickel, pf.	New York	†80	†80	80	Aug. '21, Q	1.50
LEAD						
National Lead	New York	72	68½	72	June '21, Q	1.50
National Lead, pfd.	New York	†106	†103	103	June '21, Q	1.75
St. Joseph Lead	New York	10⅜	10	10⅛	June '21, Q	.25
QUICKSILVER						
New Idria	Boston	†*50	....	*50		
ZINC						
Am. Z. L. & S.	New York	7⅛	7	7	May '20,	1.00
Am. Z. L. & S. pfd.	New York	23	22⅞	23	Nov. '20, Q	1.50
Butte C. & Z.	New York	4	3⅞	4	June '18,	.50
Butte & Superior	New York	11⅛	10⅛	10⅜	Sept. '20,	1.25
Callahan Zn-Ld	New York	4⅜	3⅞	4	Dec. '20, Q	.50
New Jersey Zn	N. Y. Curb	....	....	116½	Aug. '21, Q	2.00
Success	N. Y. Curb	....	....	*2	July '16,	.03
Yellow Pine	Los Angeles	*50	*35	*55	Sept. '20, Q	.03

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	⅜	⅛	⅜		
Alaska Juneau	New York	1⅜	1⅜	1⅜		
Carson Hill	Boston	14⅛	13⅛	13⅛		
Cresson Consol. G	N. Y. Curb	1 1/16	1 1/16	1⅛	June '20, Q	$0.10
Dome Extension	Toronto	*65	*62	*62		
Dome Mines	New York	17	16⅜	16⅛	July '21, Q	.25
Florence Goldfield	N.Y. Curb	*39	*34	*37		
Golden Cycle	Colo. Springs	*69⅜	*58	*58	June '21, Q	.02
Goldfield Consol.	N. Y. Curb	*6	*6	*6	Dec. '19,	.05
Hollinger Consol.	Toronto	7.35	7.20	7.35	Aug. '21, 4 wks.	.05
Homestake Mining	New York	57	57	57	Aug. '21, M	.25
Kirkland Lake	Toronto	*43	*37	*43		
Lake Shore	Toronto	1.24	1.21	1.24	Aug. '21, K	.02
McIntyre-Porcupine	Toronto	2.01	1.97	2.00	May '21, K	.05
Porcupine Crown	Toronto	*15	*14	*15	July '17,	.03
Porcupine V. N. T.	Toronto	19	16½	18		
Portland	Colo. Springs	*42	*40	*40	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	....	....	*4	May '19,	.05
Schumacher	Toronto	*24	*20	*24		
Silver Pick	N. Y. Curb	*11	*9	*11		
Teck Hughes	Toronto	*17	*14½	*17		
Tom Reed	Los Angeles	....	†*65	*71	Dec. '19,	.02
United Eastern	N. Y. Curb	2 1/16	2 1/16	2⅛	July '21, Q	.15
Vindicator Consol.	Colo. Springs	....	....	*27	Jan. '20, Q	.01
White Caps Mining	N. Y. Curb	*4	*4	*4		
Yukon Gold	N. Y. Curb	*94	*85	*94	June '18,	.02½
SILVER						
Arizona Silver	Boston Curb	*20	*17	*17	Apr. '20, M	.03
Batopilas Mining	New York	⅛	⅛	⅛	Dec. '07, I	.12½
Beaver Consol.	Toronto	*28½	*27	*28	May '20, K	.03
Coniagas	Toronto	1.60	160	1.60	May '21, Q	.12½
Crown Reserve	Toronto	*10	*8	*10	Jan. '17,	.05
Kerr Lake	N. Y. Curb	3⅛	3⅛	3⅛	July '21, Q	.12½
La Rose	Toronto	*22	*18	*22	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*17	*14	*17	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.14	1.05	1.14	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	4⅛	4⅛	4⅛	July '21, Q	.15
Ontario Silver	New York	3⅛	3⅛	3⅛	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	*13	*13	*13	Jan. '12,	.10
Temiskaming	Toronto	28	22	22	Jan. '20, K	.04
Trethewey	Toronto	*14	*9½	*11	Jan. '19,	.05
GOLD AND SILVER						
Barnes-King	Butte	*75	*65	*60	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*69	*65	*68		
Cash Boy	N. Y. Curb	*6	*4	*4		
Consol. Virginia	San Francisco	†*27	*16	*21		
Dolores Esperanza	N. Y. Curb	1⅛	1⅛	1⅛		
El Salvador	N. Y. Curb	*18	*11	*14		
Jim Butler	N. Y. Curb	....	....	*7½	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	....	....	*4	June '16,	.05
Louisiana Con	N. Y. Curb	....	....	⅛		
MacNamara M.& M.	N. Y. Curb	*17	*15	*15	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	....	....	4	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1 1/16	1⅛	1 1/16	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*74	*67	*67		
Tonopah-Extension	N. Y. Curb	1⅜	1 1/16	1⅛	July '21, Q	.05
Tonopah Mining	N. Y. Curb	1⅜	1⅛	1 1/16	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	*80	*77	*77	Dec. '19, SA	.05
SILVER-LEAD						
Caledonia	N. Y. Curb	*9	*8	*8	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	†1.20	†1.05	....	Dec. '21,	.15
Chief Consol.	Boston Curb	2⅛	2 1/16	2⅛	Aug. '21, Q	.05
Consol. Ariz. S.	Montreal	15	15	15	Oct. '20, Q	.62½
Daly Mining	Salt Lake	†2.50	†1.30	....	July '20, Q	.10
Daly-West	Boston	†3⅛	†2	2⅜	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	....	....	2	Apr. '21, K	.05
Electric Point	Spokane	*6⅜	*5	*5	May '20, SA	.03
Eureka-Croesus	N. Y. Curb	*35	*28	*32		
Federal M. & S.	New York	†9	†5⅛	7	Jan. '09,	1.50
Federal M. & S., pfd	New York	22⅛	22⅛	22⅛	June '21, Q	1.00
Florence Silver	Spokane	*11⅛	*11	*11⅛	Apr. '19,	.01½
Grand Central	Salt Lake	†*65	†22	....	June '20, K	.03
Hecla Mining	N. Y. Curb	4	3 1/16	4	June '21, Q	.08
Iron Blossom Con.	N. Y. Curb	*18	*18	*18	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	†3.00	†2.00	....	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*3	*3	*3	June '21, I	.02
Prince Consol.	Salt Lake	*23	*17	*17	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*3	*2½	*3	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*8	*6	*8		
South Hecla	Salt Lake	*35	*35	*35	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	*12	*10	*12	Oct. '17,	.05
Stewart Mining	N. Y. Curb	*4	*3	*4	Dec. '15	.05
Tamarack-Custer	Spokane	1.75	1.75	1.75	Jan. '21 K	.04
Tintic Standard	Salt Lake	2.20	2.05	2.05	July '21, Q	.05
Utah Apex	Boston	2	2	2	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	....	....	*2	Nov. '17,	.01
VANADIUM						
Vanadium Corp.	New York	27⅛	25⅛	27	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	40⅛	38⅛	39	July '21, Q	1.50
Asbestos Corp., pfd.	Montreal	70	67	68	July '21, Q	1.75
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	34⅛	29⅜	31⅛	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf	New York	69⅜	63⅛	63⅛	June '21, Q	1.75
Am. Sm. pf. A	New York	†66	†61	67⅛	July '21, Q	1.50
U. S. Sm. R. & M.	Boston	28⅛	27⅛	27⅛	Jan. '21, Q	.50
U.S.Sm.R.& M. pf.	Boston	38⅛	37⅛	37⅛	July. '21, Q	.87

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

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.

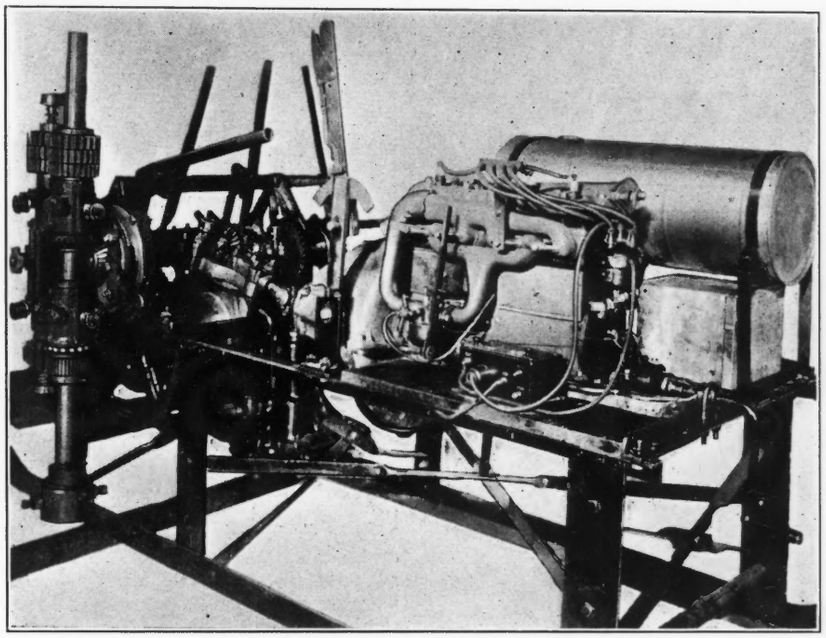
INDUSTRIAL NOTES

Gasoline Driven Diamond Drill Portable and Efficient

A compact, self-contained diamond drill, operated by a gasoline engine, has been placed upon the market by the Diamond Drill Contracting Co. of Spokane, Wash. The drill is mounted on a steel frame provided with steel skids. It contains the drilling head and feed arrangements, a rope drum one foot in diameter by one foot long, for hoisting the drill rods, a pump, and the gasoline engine. The engine is of the gasoline automobile pattern. The rig complete weighs 1,650 lb. By means of the steel skids and the rope drum it can haul itself into many difficult positions, and after leveling up is ready to operate. With a crew of three and the aid of its own power a distance of four miles over comparatively rough country has been made in two days. The outfit is made particularly for use in prospecting in rough, mountainous country.

In one instance a machine of this kind was moved a distance of thirty-five miles under its own power and our views show stages in this journey. For the first three and one-half miles the machine was placed upon a cedar-pole raft, together with all tools and supplies, including 600 gal. of gasoline. The swivel-head of the drill was inclined at a suitable angle and a screw propeller attached to the end of a section of drill rod. This arrangement enabled a speed of two and one-half miles an hour to be attained and about half this speed when the raft was sent upstream on a river discharging into the lake. The machine was next moved under its own power eight miles over a mountain trail by means of a cable attached to trees and the hoisting drum. A sled loaded with supplies and gasoline was "snaked" behind the drill. It was transferred to another lake, and then three and one-half miles over a steep mountain trail to the drilling site at an elevation of 2,500 ft. above the lake.

With the ordinary arrangements a steam boiler and engine are required. This greatly increases the weight and difficulty of getting a drill outfit into position. The gasoline rig is a light weight unit compared with the ordinary rig, and its operating cost is such that it is cheaper to operate under gasoline power than by cutting and using wood in a steam boiler at the drill site. The unit presents many advantageous points for prospecting purposes.



PORTABLE POWER DRILL ON SKIDS

The Hercules Powder Co. has announced a reduction in price of twenty-five cents per hundred pounds on all Hercules high explosives, effective August 20.

RAFT CARRYING DRILL OUTFIT PROPELLED BY DRILL ENGINE

DRILL OUTFIT ON SKID MOVING DOWN HILL

Special Fabric Used as Covering for Concentrating Tables

"Minefab," a new covering for concentrating tables, is described in a folder issued recently by E. I. du Pont de Nemours & Co.

The development of a large number of special fabrics by this company for varied industrial uses has led to the production of "Minefab," which is described as a specially treated fabric of great tensile strength made permanently impervious and flexible by the thorough impregnation of both its surfaces with a non-deteriorating waterproof compound, highly resistant to chemical action and to abrasion.

It is stated to be the only material ever made for the specific purpose of covering concentrator tables. A long period of service tests which gave the most satisfactory results have led the du Pont company to recommend it as thoroughly satisfactory for the treatment of all ores.

Self-Cleaning Attachment for Burners of Carbide Lamps

A self-cleaning attachment for burners of carbide lamps has been invented by two Michigan copper country men, John Emil Turja and Jacob W. Jacobson, both of Hancock, Mich.

The invention, for which patent was allowed May 10, 1921, relates to carbide lamps and especially to a means for cleaning the burners without having to extinguish the light or to remove the lamp from its position or provide other means of light while cleaning the burner opening. The invention is of such nature that dirt may be discharged from the burner outwardly and not forced inwardly into the gas conduit as the present cleaning method does.

The present method of cleaning burners of carbide lamps, especially of miners' carbide lamps, is for the wearer to carry upon his person a cleaning wire which he inserts from the outside through the burner opening, pushing the foreign matter in the opening into the base of the burner tube, where the dirt repeatedly arises with the gas flow and causes continuous clogging of the burner. This method of cleaning demands that the light be first extin-

guished and other means of light be provided while inserting the wire into the burner opening. In many instances carbide lamps are used for igniting dynamite charges; when the fuse ignites it spits powder and this powder clogs the burner opening. When this occurs, the miner is subjected to hazard unless he has provided other means of light.

The invention overcomes all the above objections and makes the cleaning of the burners of carbide lamps a momentary one which may be accomplished by simply pressing a button on the outside of the lamp and without having to remove the lamp from its position or extinguish the light. Furthermore, any possible clogging in the gas conduit is eliminated.

The inventors of this attachment can be addressed at 735 Elm Street, Hancock, Mich., for full particulars.

Motor Trucks Demonstrate Worth in Great Emergency

During the memorable "Outlaw Strike" some months ago, not a few of the country's very large shippers turned to the motor truck as a solution of their freight problems. Among them perhaps none was in a better position to meet the emergency than the Linde Air Products and Prest-O-Lite companies. The accompanying photograph shows that the trucking alternative is not always a bed of roses. The trucks shown are loaded with Linde Oxygen, and much of their way they had to fight a passage through mud up to the hubs, but they got through, delivered their cargoes where the oxygen was urgently needed, and brought back their burden of empties for refilling.

MOTOR TRUCKS IN EMERGENCY SERVICE

The Linde company and the Prest-O-Lite company are now operating several fleets of motor trucks. Other large companies that have not the advantage of picking up return loads of their own are, in some instances, carrying return freight for other shippers, thus making their trips pay both ways.

Campaign Launched in Southwest To Boost Copper Sales

The El Paso office of the Mine & Smelter Supply Co., of which J. L. Harman is manager, is launching a campaign for every one in the Southwest to "Buy Something Made of Copper." Every one in that section of the country, says Mr. Harman, is directly or indirectly dependent upon the copper industry for prosperity and should aid in the movement. Some of the ideas suggested are as follows:

Stamp outgoing letters "Buy Something Made of Copper."

Insert the same slogan in advertisements and in window cards. "No matter whether you are a milliner or an undertaker, put the window card in action just the same. The lady who buys a new fall hat may be a miner's wife. Also, they make copper coffins nowadays."

Display copper wares in store windows.

Have a copper week, the same as California has her Orange Day and Pennsylvania her Apple Day.

Hauling Gold Ore in Alaska

Until recently, the transportation of the ore was one of the most serious problems confronting the Guggenheims' Premier Gold Mining Co. The "Caterpillar" Tractor solved the problem, and two of the five-ton models are now engaged in the work. It is expected that during the winter the tractors will have no difficulty in bringing to the wharf all the ore that is mined—a total estimated at 3,000 tons. A short haul out of the mine, over trails so winding that trailers cannot follow the tractors, is handled by teams. The balance of the haul to the wharf is handled by the "Caterpillar" Tractors, which make one round trip daily, each pulling three trailers. A minimum of 20 tons of ore is delivered to the wharf daily.

In the spring, when the roads become soft, it is planned to use trailers equipped with "Caterpillar" tracks.

The Redwood Manufacturers Co. of San Francisco, manufacturers of "Remco" continuous and machine bound redwood pipe and tanks, has just been awarded a contract by the City of Norfolk, Va., for a 10-mile pipe line from Lake Prince to the City of Norfolk. The contract is for 39,600 ft. of 36-in. pipe and 12,700 ft. of 30-in. pipe. When constructed the pipe line will carry water at pressures of 70 ft. to 250 ft. head.

TRADE CATALOGS

Hoisting Equipment—National Hoisting Engine Co., Harrison, N. J., have issued the sixth edition of their catalog, "Improved Hoisting Equipment." The publication gives illustrations and specifications of an extensive line of electric hoists, gas and gasolene engine hoists, belt-operated hoists, derricks and derrick fittings, trench cableways and pile drivers.

Hoisting Equipment—S. Flory Manufacturing Co., Bangor, Pa., have recently issued their catalog No. 26, "Flory Hoists." This issue includes illustrations and data covering the company's standard special types of hoists and hoisting machinery.

Steam Tables—The Wheeler Condenser & Engineering Co., Carteret, N. J., has issued a sixth edition of the company's "Steam Tables for Condenser Work." The calculations for these tables, which range from pressures of $\frac{1}{10}$ to 214 lb., are specially made for this work by Prof. Marks, on the basis of the latest Marks & Davis tables for saturated steam. The convenient, pocket-size book and the legible well-arranged tabulations will appeal to all users. A section on correction of readings is a necessary and useful portion of the work.

Rotary Pumps — The Connersville Blower Co., Connersville, Ind., have recently issued Bulletin 196, "Valveless Rotary Pumps," which describes the design and construction and refers to some of the applications of Connersville pumps. These are used extensively in mining operations, in handling liquids as well as serving as vacuum pressures in vacuum filtrations.

Damper Regulator—The Atlas Valve Co., Newark, N. J., has just issued, as Bulletin No. 5, a description of the company's Victor damper regulator No. 3, for boiler pressures up to 250 lb. The damper-actuating piston is moved by hydraulic pressure, and has a compensating attachment which permits the damper to be fully opened or closed only on extreme boiler pressure variations.

Magnetic Clutches — Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has recently issued a pamphlet, entitled "C-H Magnetic Clutches," describing the use of magnetic clutches in connection with synchronous motors for heavy work. Several installations are illustrated and considerable valuable data are included in the bulletin.

Hoists—Bulletin No. 1819 of the Allis-Chalmers Manufacturing Co., Milwaukee, Wis., is issued by the mining machinery department and is entitled "Electric Hoists." Photographs and general descriptions of the various types now installed in the mining field are given, together with such supplementary information as will be of value to the mine executive.