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A WEEKLY JOURNAL REPRESENTING THE WORLD'S MINING AND METAL INDUSTRIES

July 8, 1922



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The Birth of Mercury Ores

MOLYBDENITE was cited in a previous editorial as a mineral which is very close to the rock-magma—even a true component mineral of granites and especially pegmatites; so belonging to a comparatively hot, deep zone, a relatively high pressure-temperature zone. At the upper extreme of the column stands mercury, found in nature principally as its sulphide, cinnabar, just as in the depths molybdenum crystallizes as its sulphide, molybdenite; the sulphur combination in both cases probably indicating sulphur emanations from igneous magmas.

While the source of cinnabar is probably magmatic, it is not "close" to the rock-magma, and does not necessarily occur in close connection with an igneous rock. Yet cinnabar deposits are especially characteristic of volcanic regions. Cinnabar is actually being deposited from hot springs, as at Steamboat Springs, and at Sulphur Bank, Cal.; and it is regarded as likely that the water in these springs is magmatic—that is, it is one of the gaseous emanations from the deep magma which, nearing the surface, passes from water gas to water. With the consolidation of a magma-body in depth, this type of hot springs, in which not only the water but the heat is magmatic, becomes gradually extinct.

The temperature of some of the springs from which cinnabar is deposited is around 200 deg. F., or less than 100 deg. C. This is probably a lower temperature than that at which other metallic ore deposits of magmatic origin are deposited: for cinnabar deposits are distinct from and are as a class not closely associated with other ore deposits. Yet cinnabar deposits have been worked downward in some districts for several thousand feet.

The high volatility of mercury of course explains at once why it is distilled first from a magma, and why it travels further upward than less volatile metals, in company with the ever-present sulphurous gases and water or water-gas, and comes to rest as sulphide relatively close to the surface, under low temperature-pressure condition. Owing to its volatile and hence penetrant nature, and the corresponding characteristics of its accompaniments, it impregnates characteristically porous rocks, such as sandstones, filling up the pores; and does not occur so much in bold, definite veins, with clean-cut walls, as so frequently do many other ores.

Another frequent characteristic of cinnabar deposits deserves special consideration and more study than has been given it—the occurrence of abundant bituminous matter in connection with cinnabar and frequently most intimately mixed with it. This is characteristic of the cinnabar deposits of California, of Jugo-Slavia (Idria), of Peru (Huancavelica), and other places. The relation indicates that the bituminous material has come up with the cinnabar and along the same channel. Its close

association comes perhaps from both consolidating or being fixed at about the same temperature. The volatility of hydrocarbons is a more salient characteristic than their solubility. Considering the association with cinnabar, are we to conclude that the associated bituminous material is also a product of distillation? It would indeed seem the natural explanation. Is this bituminous material, then, distilled, like the mercury, from the magma, or is it distilled from organic material in sediments by the heat of an intruding magma? Petroleum has been found in vesicles of basalts, but such an occurrence is rare, and even in such a case may conceivably be exogenous and extra-magmatic. Nevertheless, the rather characteristic coupling of mercury and bitumen would indeed suggest a magmatic origin for the latter in such cases, in spite of the fact that most bituminous material can be shown to be of organic origin, usually derived from certain plant organisms that have been concentrated in sedimentary rocks.

"A Dumb Idea"

FOR A WEEK or so all the papers, including the illustrated Sunday supplements, have been full of the accounts of the discovery, through a divining rod, of a treasure chest full of gold plate, sunk in the Wye River near Penetanguishene, Ont., by Jesuit priests in the early days of exploration. Photographs of the divining rod, looking like a machine gun, were published, with the intrepid inventor and his assistant manning its breech end. This formidable-looking instrument had pointed to gold after being rowed all over the river; and, sure enough, probing had revealed a chest six feet long stuck fast in the mud. But it was stuck fast; it took a week or so with a dredge to expose it. Then a diver went down. His name was Captain Bob Carson, and although we have forgotten the name of the inventor of the divining rod and the Jesuit priests, we think it just as well, for Captain Bob at least spoke the truth, and truth should prevail. When he was hauled up and his helmet unscrewed, he barked: "Up anchor and put for home! There's your blasted treasure." And he produced a piece of black rock. "The blamed thing is six feet long. And to think we wasted all this time on such a dumb idea!"

The marvelous discoveries of science, particularly electrical science, have put everyone into a mood that can hardly be surprised at new wonders. Yet it is necessary to maintain a sane outlook, a shrewd appraisal of probabilities; otherwise one is foolishly and indiscriminately credulous. The earmarks of the hoax are easy to distinguish. Because all things are possible one must not adopt the attitude of believing everything that is told one. Such an attitude is not evidence of a well-cultivated mental balance.

A Peripatetic Institute Council

IN THE COURSE of an address before the Engineers' Club of San Francisco, Mr. Dexter S. Kimball, the president of the American Society of Mechanical Engineers, stated that it was planned in future to hold the council meetings of the society successively in the large cities of the country, instead of restricting them to New York. This is a hint that should not be lost on the directors of the American Institute of Mining and Metallurgical Engineers. The custom of holding the meetings of the board in New York only has the effect of preventing the attendance of directors living in the West and on the Pacific Coast, simply because the expenditure of time and money is too much to warrant the long journey. If the mountain will not come to Mohammed, the remedy is proverbial. The establishment of such a custom would not only cause the directors' meetings to be more nearly representative, it would prevent the control of affairs remaining in the hands of a small group in New York, not because they seek control, but because the exigencies of time and space prevent their fellow-directors from sharing their consultations as often as could be wished. Moreover, if the directors from the various parts of the country were to meet successively in different cities, the effect would be to put them in touch with the sentiments and ideas of the various local sections and thereby promote the solidarity of the Institute; indeed, the foregathering of the directors could be used as an occasion for calling a special meeting of the local section, thereby giving them an opportunity to become better acquainted with the members of the Institute.

Manual and Mental Labor

THE TENDENCY toward the scaling up of the wages for manual work so that they approach, or meet, or even pass the compensation paid for mental work is picturesquely illustrated by the case of a geologist in the U. S. Geological Survey, who, needing to have his house painted, found after close circulation that it would pay him to take absent leave without pay from his Government work and do the painting himself; and did so, the saving effected by using his own time over a union painter's time amounting to the cost of the paint. Another example is that of a geologist who was recently directing drilling operations of national importance, whose salary, however, was less than that of the drillman.

Whatever be the economic results, a leveling process is distinguishable, which will probably not be checked—a development similar to that which has earlier gone on in Australia, whereby the organized manual worker exacts from industry all that the traffic will bear. We are not without a certain sympathy for this process, but as to the best method of obtaining it there is a great deal of doubt, and also—as to what the net results will be to society after it is attained. In Australia it is reported to have stricken industry. Dollars-per-day wages signify nothing to the wage or salary earner, any more than do rubles per day; what he gets is the current cost of necessities, luxuries, and advantages divided by his wage. It is likely, therefore, that any outstanding advantages which one class secures is simply taken away from another class of workers; the coal miners and railroad men pass it on to the factory workers and the farmers, who if and when properly organized will pass it back,

and so on, fast and furious. As to brain workers and manual workers, the fact remains that at a period when the average college graduate cannot secure as high a wage as the average mechanic, the colleges are crowded as never before. The secret is, after all, in the wider opportunities afforded by learning, whereby higher salaries are available to initiative and special ability than are accessible to either the average manual or mental worker; or, if the worst comes to worst, in the greater happiness, opportunity for sounder philosophy, and larger scope of interests which come with mental exercise and development.

African Copper

COPPER FROM AFRICA has become a factor in the statistical status of the metal. Last year the mines of the Union Minière du Haut Katanga, a Belgian company controlling the Tanganyika Concessions in the Congo region, produced 30,464 tons of copper. This was their maximum production to date. Official returns show an estimate of ore reserves amounting to 49,000,000 tons averaging 6 per cent, equivalent to 2,940,000 tons of metal. This refers only to a group of twelve mines in the eastern part of the Concessions; it is stated unofficially that another, western, group shows 20,000,000 tons of 8 per cent ore. Thus the reserves show the formidable total of 4,500,000 tons of metal. Arrangements are being made to increase the output to 100,000 tons per annum, or 200,000,000 pounds of copper, which is equivalent to more than the maximum output of the Utah Copper and only a little less than the record production of the Anaconda group of mines. A competent observer, who was in the Congo region recently, informs us that he was "greatly impressed with the richness of the Katanga copper field," but, he adds, "economically it is choked to death by a railway haul of 1,700 miles." The Union Minière pays £2,000 per diem for coke alone. Incidentally, he remarked that the Kilo goldfield, also in the Congo basin, is too remote for lode mining, until better transport is available, but the placer deposits are fairly good, without being "sensational."

The Get-Together Spirit

MINING ENGINEERING is dependent to a considerable extent upon the more specialized arts; it involves an element of risk that is absent in many businesses, and for this reason it is as well that the mining engineer should stabilize his mental attitude from time to time by an interest in and a full appreciation of the facts and figures that form the basis of science and its application to industry. He has much in common with technical men in other fields of endeavor, with teacher and student, with the researcher and the statistician. He is or should be interested in all subjects that affect human progress—that make for contentment and comfort. He can discourse on his own specialty, but he should welcome an opportunity to hear the opinions and experiences of others on subjects such as electric telephony, serum therapy, a non-oxidizable steel, reading by sound, the moving picture in industry, substitutes for gasoline, monorail transportation, the dehydration of milk, synthetic dyes, the manufacture of magnesium, high-tension power transmission, the metric system, photog-

raphy—to mention but a few of the subjects of scientific and technical interest to all intelligent folk.

In most communities can be found at least one man who has a broad and intimate mental grasp of a particular subject. Engineers as a group, and mining engineers in particular, possess more than enough talent to entertain each other by putting into practice some co-operative scheme for the interchange of specialized knowledge. Within the profession there may not be enough criticism and discussion; but the luncheon hour is too often devoted to "shop." It would be mentally invigorating and stimulative to thought along fresh channels if more attempts were made to encourage the interchange of technical and scientific information among professional men of varied occupation. Indianapolis boasts of a Sciencetech Club of a hundred members, about thirty of whom meet each week for luncheon and discussion. All engineers and technologists are eligible, but absence from four consecutive meetings terminates membership. A strict time schedule is maintained at the meetings, which provide for fraternizing and the discussion of pertinent and interesting subjects. A weekly letter is published containing a report of the previous meeting and notes on current technical events. There is scope for the promotion of the get-together spirit among those who have so much in common.

Copper and Silver Scrap

IT IS a matter of satisfaction to the copper miner to learn that most of the scrap metal containing copper that was left from the War has been consumed. Among the items was 150 tons of bronze service-buttons that were shipped to the refinery at Baltimore. Buttons, like pins, have to be made by the ton, because we need so many of them. Speaking of scrap of another kind, it is noteworthy that from five to six thousand ounces of silver comes once or twice monthly from Los Angeles to the Selby smelter near San Francisco. There are no mines at Los Angeles, but there are many movie-manufacturers. The silver is from the ashes resulting from the burning of cinema films that are rejected or played out. This silver does not receive the benefit of the Pittman Act, for it does not come from domestic mines; it ranks as 'foreign' metal. Although many million ounces of silver are consumed in the business of making moving pictures, it is probable that most of it comes back to the melting-pot of the refiner, to be used over and over again.

Copper Production Statistics

FOR MANY YEARS it has been the custom for the *Engineering and Mining Journal* to publish monthly figures of copper production, the table usually appearing on the same page as the monthly price statistics. Several companies have now decided not to issue this information in the future; inspection of our table in the issue of June 3 will reveal, for example, that production figures for Calumet & Hecla, Chino, East Butte, Inspiration, Miami, Nevada Consolidated, Ray Consolidated, and Utah Copper were missing. As the production of these companies forms so large a part of the domestic output, total production will not hereafter even be estimated, but we shall con-

tinue to print the data given us by those companies willing to have the information published.

The reasons for this attitude on the part of producers have not been announced, but they are not hard to guess. A local statistical agency has recently been collecting this information for private distribution among various producers. These reports are confidential; therefore the producers have the information, but consumers and the general public must get along without. Doubtless it has been felt by the producers that the production statistics had an influence on copper security prices; and also that when production was large and increasing, buyers would hold off in their purchases in an endeavor to depress the market price of the metal. Furthermore, consumers refuse to divulge how much copper they use each month, so why should the producers play with their hand face up on the table? We hardly blame them for their new attitude.

The Institute's Elections

SOME OF OUR READERS have missed the point in our editorials on the government of the American Institute of Mining and Metallurgical Engineers. They imagine that these were essays on government, rather than on the Institute. Evidently we shot above their heads. Subtleties and skillful implications are very pretty for some minds; but others equally as good take in only one thought at a time. And, that our conclusions may be very plain, what we are arguing for is a real, honest-to-goodness American election in the Institute, and an end of these Mexican elections. We want to have the option of casting our vote for one candidate or another, for president; we want to have a choice; we want to know that the next president has been *elected* by the members, not *selected* by half a dozen at headquarters. Is that clear?

Murder Free to Voters

A BELEAGUERED coal-mine superintendent set upon by a mob of strikers in Illinois appealed to the Governor for the protection of troops. The reply was that nothing could be done until soldiers had been requested by the Sheriff. The result was that scores were murdered, including the superintendent and the assistant superintendent of the mine. Then what? A "military board of inquiry" has been created to investigate the report that the miners were forbidding the collection of the bodies of some of the men killed! "Legal action for the recovery of damages" will be started immediately against the United Mine Workers of America and Williamson County!

Shade of Theodore Roosevelt! Why rise, unquiet, from thy resting place! In Washington we can imagine the frown of the quiet Coolidge, a very man on the job when the test came. We can imagine Hoover setting his jaw; and former Governor Oddie, now in the Senate, flushing as this recalls how he squelched organized murder and arson in Nevada. And this what's-his-name Governor of Illinois (his name, by a bitter appropriateness, is Small): how many men of the type of self-seeking politicians like this one we have in the conduct of national affairs! They consider not the right, or their duty, but the vote. Our government is honeycombed with such rotten and cowardly standards of conduct.

The Discovery of the Klondike

BY T. A. RICKARD

THE passing of George W. Carmack is announced from Vancouver, where he had been living recently. To Carmack has been given the credit for discovering the Klondike goldfield and for being the pioneer of the great mining adventure of the North. On August 17, 1896, he found gold on Bonanza creek. He was a fisherman, with an Indian squaw, and maintained a small trading-post on the Yukon 20 miles above the Crossing. He was not the first to find gold in the valleys of the Klondike, for Robert Henderson preceded him, but he started the stampede that led to the development of the Yukon territory. At that time Carmack was fishing for salmon at the mouth of the Klondike, where it joins the Yukon and where Dawson now stands. Two miles up the valley the Klondike is joined by Bonanza creek. Carmack happened to be short of fresh meat, so he went with three Indians, one of them a brother-in-law, on a hunting expedition. At that time Bonanza creek was known as a likely place for moose, therefore he went thither. He knew that Henderson and three other white men were mining on Gold Bottom, on the other side of the watershed, so he crossed the divide with his Indian companions, to see what the others were doing and to sell them some of the fresh meat that he and the Indians had obtained. Henderson and his partners were not getting much gold, and Carmack soon returned to the camp on Bonanza creek. Having seen the mining done by the four men on Gold Bottom, he was prompted to do a little prospecting himself, and, almost at the first try, found gold on the rim of the bedrock projecting above the water of Bonanza creek. This rich spot, recognized as 'the discovery', proved later to be only a patch 20 feet square. Carmack did not test the creek-bottom, for he did not know how to do so, but he did make a location forthwith, and he knew enough to go immediately down the Yukon to Forty Mile, to the nearest recording office. He recorded his discovery claim and the three claims located in the names of his friends, Skookum Jim, Indian Pete, and Tagish Charlie. He exhibited the gold he had found on the rim-rock, but the miners at Forty Mile were sceptical as to the genuineness of his discovery. They had been fooled too often by alleged finds of gold made in the interest of store-keepers. It happened, however, that among the local quidnuncs was one who compared Carmack's gold with that of the Forty Mile diggings, and he noticed the difference in quality, for the Klondike gold contains more silver than that of the lower districts. On this evidence, he and others went up the river. A quiet 'rush' began. David Mackay, Daniel McGillivray and Harry Waugh were the first to start. Each of them made a fortune. Henderson and his partners heard of the discovery and staked claims on Hunker creek, another feeder of the Klondike, on which Andrew Hunker had made the first location. The news of the finding of rich gravel spread throughout the region and prospectors came to the creeks of the Klondike from all the old camps up and down the Yukon. The information did not reach the 'outside' until the best ground had been staked; those who came to Dawson with the stampede at the end of 1897, and in the spring of 1898, found that they were too late. They had to buy claims or work for wages. On July 14, 1897, the steamer 'Excelsior' reached San Francisco with the

tidings of a new Eldorado; in proof thereof she brought half a million dollars in gold. This was the first of many treasure-ships to enter the Golden Gate like Spanish galleons of the olden days. The creeks of the Klondike yielded \$125,000,000 in the next ten years.

The discovery by Carmack started the hectic exploitation of the alluvial deposits of the Klondike creeks, but, as the record shows, the first real prospecting and the first systematic winning of gold was done by Robert Henderson. Carmack knew nothing about gold mining and it was Henderson who showed him the gold and how it was won. Therefore the 'old-timers' have claimed that Bob Henderson was the real discoverer. However, to Carmack is accorded a characteristic even more honorable than that of having stumbled upon an epoch-making discovery. He is remembered in the Yukon and Alaska as a man of his word. He gave his Indian friends a share of his good fortune. They threw it away in the faro-banks of Dawson. Henderson was a man of better education and rearing; his sons now do credit to his memory, and for their sake it seems worth-while to place his name in the Hall of Fame in which the great pioneers find the honor that is their due. The fact must be recognized, however, that the quiet work done by Henderson on the poor gravel of Gold Bottom would never have set the world aflame, and the intensive development of the Yukon district would not have ensued at that time unless Carmack's much richer discovery had sounded the bugle-call of adventure to the prospectors of three continents. Similarly, we credit Marshall with the historic finding of gold in California, on January 24, 1848, whereas most of us know that the Indians had worked sundry small placers in the hills behind Los Angeles for many years previously. Nevertheless, their operations, quiet and inconsequential, played no historic part; that was reserved for those who washed the rich gravel that was found first in the north fork of the American river and immediately afterward in the other streams that flow through the foothills east of Sacramento. Marshall found his gold by accident, yet he is accorded the honor of calling the world to California.

The squaw-man is not highly esteemed, because, presumably, his mating is considered as involving miscegenation; nevertheless, Carmack should be credited with an act of good faith in marrying an Indian woman, instead of abandoning her, as others have done. Moreover, we owe much to the unknown pioneers who have assimilated with the aborigines of the West and thereby prepared the way for the official explorers whose names have won recognition in history. It is curious how often those who are regarded as the pioneers of industry have been enabled to find their way by aid of some Indian that could speak a little English. Who taught the Indian to speak our language? The squaw-man. When, for example, Lewis and Clark, in 1804, first penetrated the unknown country beyond the sources of the Mississippi and descended the Columbia river, they found Indians that spoke a little English. The names of their predecessors are not recorded. They must have been fur-traders or hunters who had become members of the Indian tribe, by marriage. Carmack was one of those humbler explorers who blazed the trail of civilization.

DISCUSSION

Early Days at Ajo

Series of Articles on New Cornelia Elicits a Recital of the Wild and Lawless Conditions Which Caused Abandonment of the Camp Forty-two Years Ago

THE EDITOR:

Sir—The well-told articles in your recent issues by A. W. Allen on the New Cornelia at Ajo, Ariz., recall to my mind the details of a visit made to the district in the summer of 1880, just forty-two years ago, which may be worth recording. At that time Senator J. P. Jones, of Nevada, together with some New York parties, was interested there, and trouble had arisen between the local manager and the workmen through delayed payment of wages, which had resulted in the imprisonment of the former by the latter, who were holding him as hostage for their money and threatening his life unless it was forthcoming at a stated date. On the other hand, the operators claimed that the money had been sent and could not understand the situation. I was employed to investigate and also to report on the commercial probabilities. At that date the Southern Pacific R.R. had been extended eastward from Los Angeles only as far as Tucson, and the Santa Fe in its progress southwestward had not yet reached Deming. Between the two rail heads a stage line was maintained by the Wells Fargo Co., but the route it followed via Cooks Canyon was infested with Apaches and presented no attraction to me.

The order to examine having caught me at Leadville, I went to San Francisco, and after an interview with Senator Jones took the train for Los Angeles, then an unkempt, dusty and unattractive village of perhaps 10,000 population, and from there proceeded eastward to Gila Bend Station, which consisted of a water tank, and a long log hotel and store, built Arizona style, and presided over by a genial Irishman named Noonan. With him I made a deal for transportation over the sixty-mile desert to Ajo. Not a drop of water was to be had on this drive, and at its end only what remained in the few natural tanks in the gulches. We carried therefore in the wagon a couple of barrels of the liquid for the animals and a string of full canteens and kegs for ourselves. The journey began at 4 p.m., continued through the night, with an hour's rest at midnight and at daybreak, and brought us to camp about 10 o'clock of the following morning. Just as the sun was setting after our start we encountered a miner on foot heading for the railroad and in a pitiable condition, dodging from the scanty shade of one big sahuaro to the next one, his water bag empty and his tongue swollen so that speech was impossible. He certainly would have perished in a few more hours but for our coming.

Noonan had declined to comment on conditions at Ajo, but it was easy to gather from his guarded replies to questions that trouble might be expected. And when the miner had been revived so that he could talk, he let

fall enough in the short time we devoted to him to confirm the impression received from the Irishman. In fine, he reported that the water supply and the stock of food at the camp were low, all mining work was suspended, and the manager was in the custody of a crew of rough men who were demanding their money and threatening his life. It looked like an unpleasant tangle to jump into. Fortunately, I had been entirely frank with Noonan, and the miners knew him to be a friend.

I was at once seized on arrival, all money, papers, and valuables were taken from me, and I was conducted to the shack where the manager was held under guard with the cheerful information that I would be held as additional hostage for wages due. However, Noonan made it his business that afternoon and evening to circulate among the men and advise them to give me a chance to talk to them. The opportunity came on the following morning after the manager and I had gone over matters together thoroughly. He was a badly frightened man, though having done no wrong, as I was thoroughly convinced. The money had apparently been sent from San Francisco, but had disappeared somewhere and somehow between there and its intended destination, as Noonan, who acted as station agent, had advised me. But in spite of this the men believed the manager had received and hidden it. I became convinced he had not, and it was my task to pass this belief on to the creditors, if possible, one of whom was Noonan himself, who had not been paid for a considerable amount for stores furnished.

At the talk I was listened to attentively and questioned keenly. Having adopted a tone of absolute frankness, the impression made was good. Fortunately there was no whiskey left in the camp, and most of the men were amenable to reason. A few hours after I had addressed the men, I was released, with permission to examine the mine, but with a warning to make no effort to escape. I put in a couple of days at this work, during which the men held several meetings considering whether they should hold me and send word to San Francisco by Noonan to that effect, or send me back with him to do what was possible to clear up the matter. The latter program prevailed. I have always found the average American miner—when sober—a good sport, if treated as a man should be.

On the afternoon of the third day after my arrival therefore we started on the return trip, reaching Gila Bend by noon of the next day. The coolest place in that young city was under the dripping water tank, and there I awaited the train from Tucson. Arriving at San Francisco in due course, I was able to make the situation clear to the Senator and his associates, and advised the abandonment of the Ajo deal as hopeless under the existing physical conditions. For though my inspection had revealed the presence of copper at the surface over a considerable area, with excellent prospects of its continuance to a reasonable depth, it appeared certain that such ore as could be produced would be of low average grade, and would have to be

handled in large quantities, involving heavy capital outlay, to overcome the unfriendly nature of the region, its remoteness, and the lack of water. Equally serious were the conditions surrounding titles at that time. All the most attractive showings had been located several times, and, in the careless way that prevailed in those days, so that prolonged litigation was assured. My advise was accepted, and I had the satisfaction a few weeks later of receiving word from Noonan that all debts had been paid, the manager released, and the miners brought in.

The incident is of little importance in itself, but it illustrates the haphazard way in which things were done occasionally in the West in the early days, and also the fact that the grade of an ore is sometimes of secondary importance in estimating the value of mining property. The existence of copper at Ajo had already been known at that time for a century or more, and during the twenty years previous to my visit the locality had been fairly shingled with locations. Furthermore, several hundred thousand dollars had been expended up to then by various parties in the effort to reach the main orebody, which was assumed to lie somewhere beneath the maze of surface stringers, for the disseminated form of deposit was a phenomenon with which the miner of the day had practically no experience. Besides, the metal was worth about 22c. a pound in that year. But at even that price profit would have been questionable. When I recall the waterless desert between the camp and the railroad, the terrible summer heat, the desolate and forbidding nature of the region, and then contrast it with the present attractive conditions, it is difficult to realize the changes that have been wrought by the hand of man during the intervening years. But it is only one of many that have been effected in the West since the prospector began his invasion of its wilds. All honor to those pioneers who ventured into these regions and blazed the way for the scientific mining of the present day! Nor should such good sports as Senator Jones and his tribe of Comstockers be forgotten, for they were always willing, so long as a chance for success appeared, to back their efforts. I do not recall a locality in the West where it took more nerve to do this than at Ajo.

Denver, Col.

THEO. F. VAN WAGENEN.

How About This?

THE EDITOR:

Sir—Arthur Brisbane, America's greatest publicist, says:

"There is proposed a world union of engineers to work for world peace.

"The union would include men of the type that build great canals, plan elimination of swamps and deserts, harness water power and develop irrigation.

"Such men should have great influence, but have not got it. For 'ours is a civilization of engineers and a government of lawyers.' Men that make the laws, fill the offices and act as judges are practically all lawyers. It is a lawyers' government from top to bottom. And what the lawyers want is what the people get."

Evidently somebody has been telling Mr. Brisbane things—or else why should he, a rank layman, say that engineers "should have great influence but have not got it"? Has some tattler told him of the woeful state of affairs pertaining to the American Institute of Mining and Metallurgical Engineers or of the inef-

fectiveness of this great organization of engineers with respect to its own business or its ability to protect its members from the spite and "strike" laws requiring engineers to be licensed now prevailing in nineteen states? Has someone tattled to him about the rival overlapping organizations among mining engineers? Surely someone should tell Mr. Brisbane to mind his own business and not to tell the truth about engineers any more.

MEMBER OF THE A. I. M. E.

New York.

The Measurement of Air

THE EDITOR:

Sir—I notice that Walter S. Weeks has been kind enough to point out two possible sources of error in Weymouth's method of air measurement, referred to by me in the Feb. 25, 1922, issue of *Mining and Scientific Press*. It is advisable, of course, that these should be kept in mind, but Mr. Weymouth has laid down such conditions previously.

Perhaps I should have quoted the author more fully, but I thought it would suffice to give the original reference and repeat the diagram. In the article by G. S. Weymouth, *Mining and Scientific Press*, April 20, 1912, p. 562, he says: "This method has been in use here for several months, and would, with slight modifications, measure any quantity of air flowing, provided that the supply pressure is constant during the test, and the flow regular for the few seconds necessary to obtain the reading. . . . The arrangement, which is simply the addition of a few fittings of the same size as the ordinary supply pipe to it, is as follows: . . ."

I trust this statement will reassure those who may have thought the method was always valueless. Our engineers are usually free from the reproach of supplying air at seriously varying pressures, hence the method is generally valuable, as it is both effective and cheap.

ALFRED T. FRY.

Queenstown, Tasmania.

Technical Operations at Kennecott in 1921

According to the annual report of the Kennecott Copper Corporation, production from Kennecott during 1921 was 229,809 tons of ore, averaging 7.66 per cent of copper, and from Latouche, 168,058 tons of 1.83 per cent ore. A four-ton storage-battery locomotive and a mechanical ore loader were added to the equipment at the mines.

Kennecott ores milled totaled 21,723 tons, assaying 5.62 per cent copper. This produced 18,571 tons of 49 per cent concentrate, a recovery of 77.82 per cent, compared with 82.29 per cent in 1920. The decrease was caused by lower-grade ore in the mill feed. The cost of milling was 72c. per ton, 4c. less than in 1920.

The leaching plant at Kennecott was shut down for one month of the year for remodeling the piping system. Mill tailing to the amount of 192,551 tons was treated, assaying 0.95 per cent copper in the form of carbonate, with a recovery of 2,808,000 lb. of copper in the form of precipitates assaying 74.63 per cent copper. The leaching recovery was 76.56 per cent, compared to 74.5 per cent in 1920.

The fact that the leaching plant did not operate continuously added to the lower milling recovery, reducing the total recovery on milling ores to 86.07 per cent, compared with 90.10 per cent in 1920.

Mining Engineers of Note

DANIEL C. JACKLING

IT MAY not be easy, but at least it is not so difficult, to do a thing after someone else has shown that it can be done; more credit, then, to the man who leads the way. Twenty years ago the idea of profitably mining rock that contained only twenty-five pounds of copper

per ton was contemplated with more than a little skepticism by most competent engineers. A mountain of such material existed in Bingham Canyon, in Utah; that this mountain is being eaten away and its copper being converted into useful form is due primarily to the vision, courage, personality, and resourcefulness of Daniel C. Jackling. He foresaw the economies that would be effected by a scale of production hitherto unheard of; he had the courage to back his convictions to the limit; he had the personality to induce capitalists to finance the enterprise because of their confidence in him; and he had the resourcefulness to devise the methods and create the organization for bringing his elaborate plans to fruition. Other companies have followed in the exploitation of huge disseminated copper deposits, but Utah Copper showed that it

could be done. Mr. Jackling was born near what is now Appleton City, Mo., in 1869. At nineteen he had this plan for the future: he would teach school at \$30 per month until he could get a job clerking at \$75 per month. Of this he would save \$60 per month, and since good farm land could be purchased for \$20 per acre, he could buy thirty-six acres per year. In the course of three years he would be the owner of 108 acres, which was enough to insure comfortable independence for life, for a man who knew as much about farming as did Jackling. This illustrates one characteristic of the man—he analyzed his problem and made specific plans beforehand. However, the incident of observing the precision with which a civil engineer conducted a survey of some neighboring land captivated young Jackling's imagination, and he revised his plan, the result being his entrance in the Missouri School of Mines at Rolla, from which he was graduated in 1893. He went to Cripple Creek, where he became acquainted with Charles M. MacNeill, who was later to be instru-

mental in raising the money to start the Utah Copper enterprise.

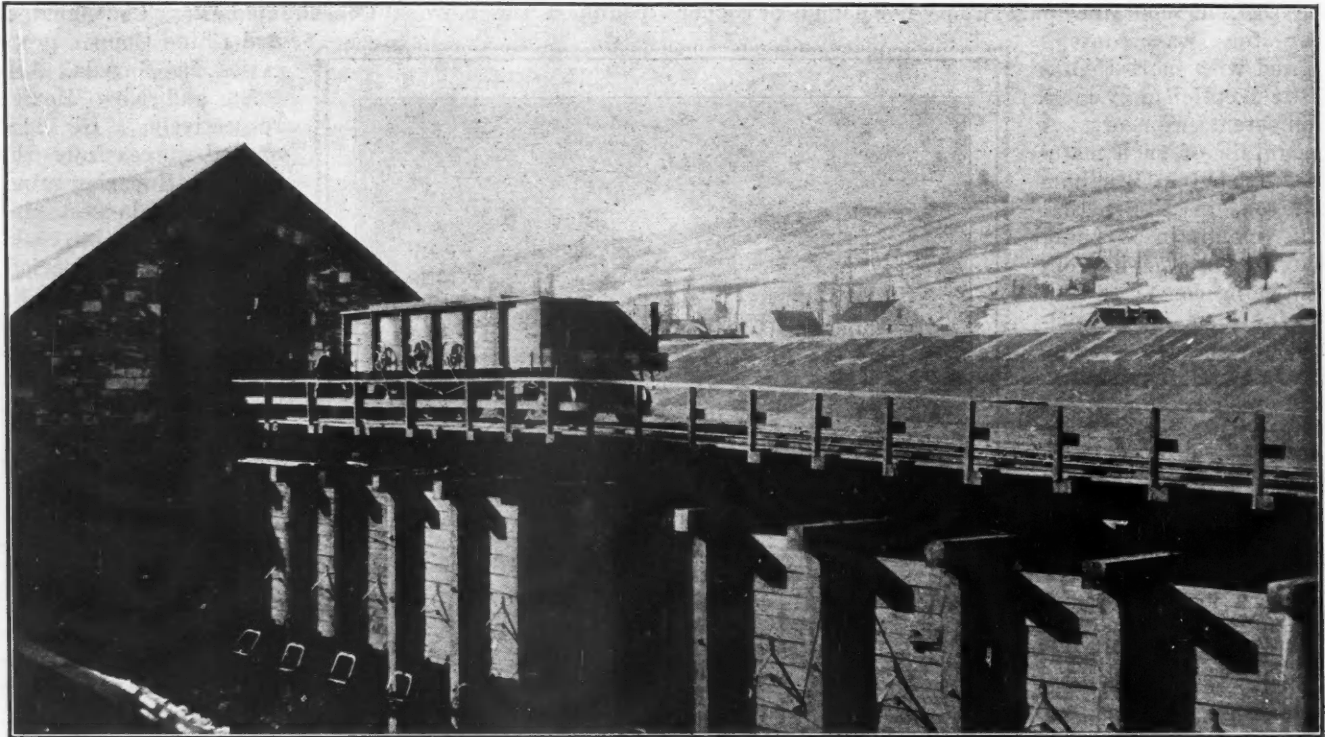
After launching Utah Copper Mr. Jackling, in association with Hayden, Stone & Co., developed and equipped the Nevada Consolidated, Ray Consolidated, and Chino Copper properties in Nevada, Arizona, and New Mexico respectively. He also opened successfully the Butte & Superior mine, one of the largest zinc producers in the country. During this period, also, the Alaska Gold property was equipped with a mill and operations were started on a large scale. It developed, however, that Mr. Jackling had erred in his estimation of the grade of the ore in the deposit. As a result, the enterprise, so far as gold mining is concerned, is a failure, in spite of an investment of many millions of dollars. During the war Mr. Jackling, as Director of Government Explosives Plants, had supervision of the erection of two smokeless-powder plants of sufficient capacity to provide against all possible requirements of this country and the Allies. Recently, the Shasta Zinc & Copper Co. has been organized



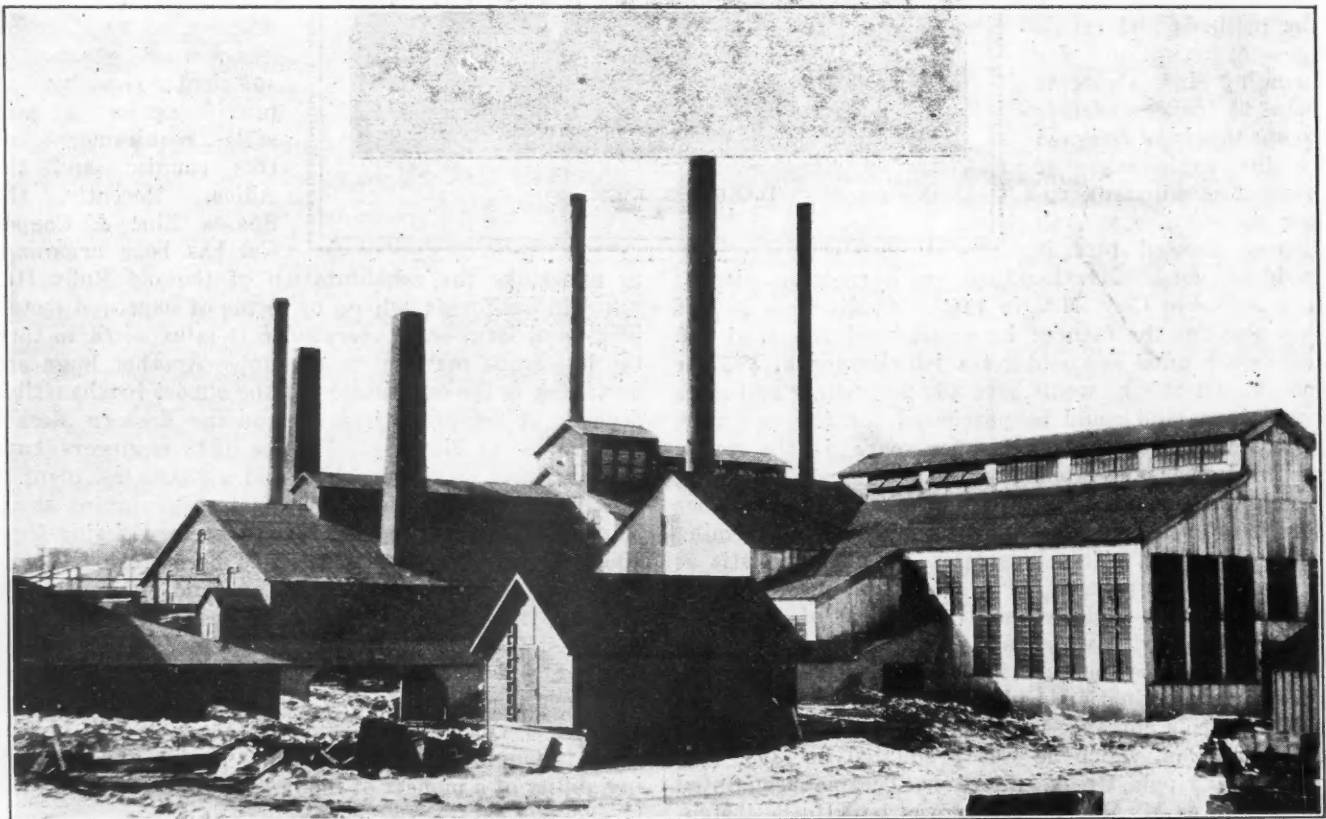
DANIEL C. JACKLING

to undertake the rehabilitation of the old Bully Hill mine, in California, where, by virtue of improved metallurgy and large-scale operations, it is expected to turn the low-grade material to account. Another huge undertaking is the exploitation of the almost inexhaustible deposits of low-grade iron ores on the Eastern Mesabi iron range in Minnesota. Since 1913 engineers have been at work on the problem, and a \$3,000,000 plant is now nearing completion. The material contains about 30 per cent iron in magnetic form, thereby differing from the iron ore that has been mined heretofore. It was necessary to devise new machinery and equipment for treating it before a process that promised profitable operations was developed. Its success, which seems assured, will mark the achievement of another project for converting to the use of mankind raw material that hitherto has been considered worthless; it will be another triumph for the engineering genius and organizing ability of a pioneer of industrial development, Daniel C. Jackling.

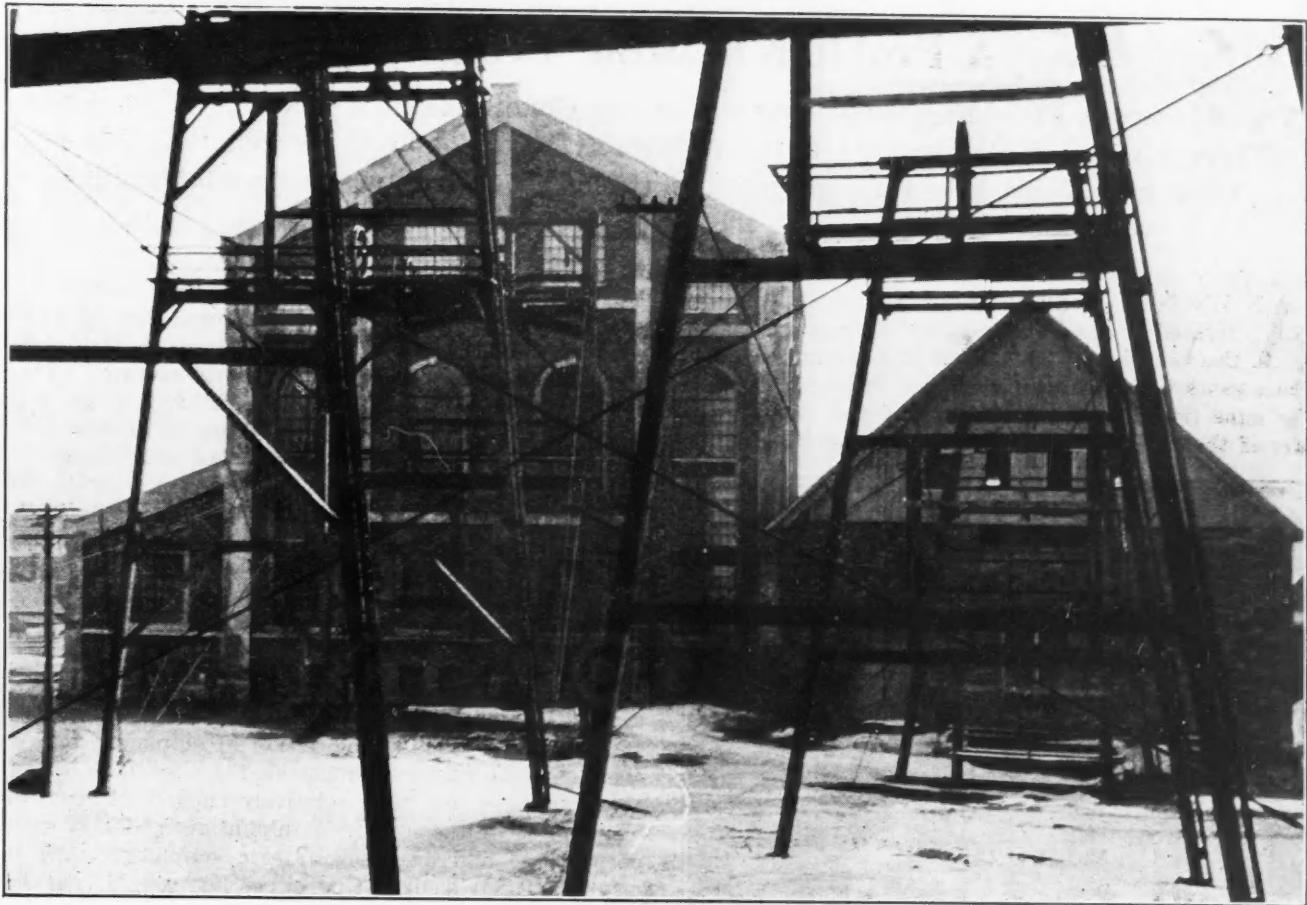
Views from the Michigan Copper Country



Ore-dumping trestle at Quincy smelter



Smelter of Quincy Mining Co., at Hancock, Mich.



No. 2 Quincy hoist house. View from shaft.



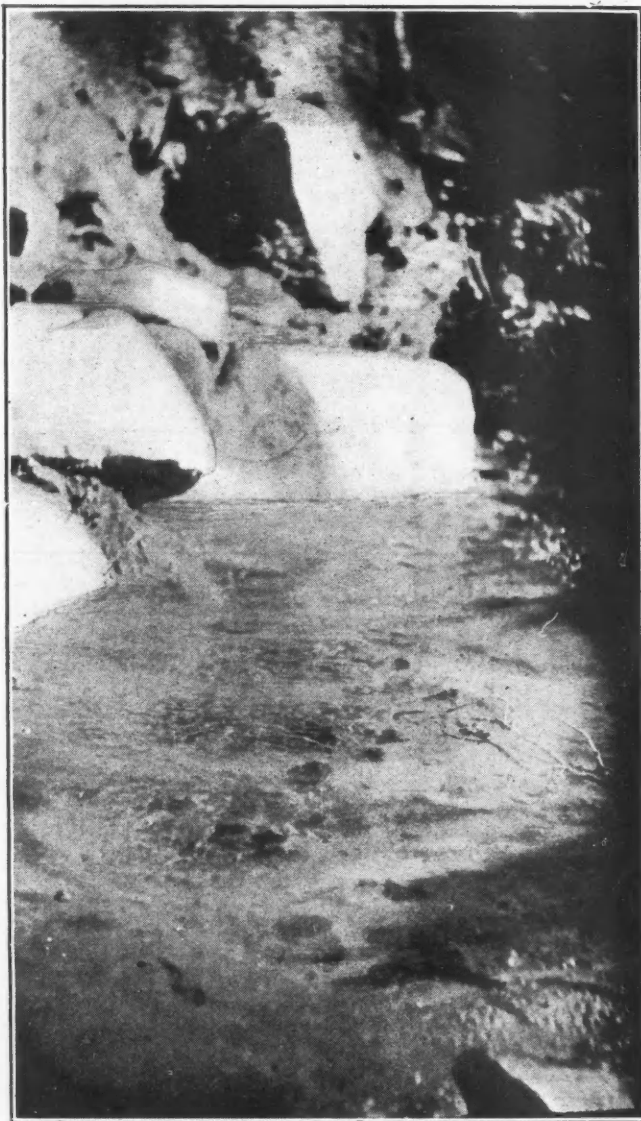
No. 6 hoist house of the Quincy Mining Co., Quincy, Mich.

A Problem in Mine Ventilation

The Manner of Providing Satisfactory Working Conditions in a Colorado Mine Where There Existed Excessive Amounts of Carbon Dioxide and Hydrogen Sulphide — Objective Secured by Bulkheading and Use of Wooden Pipe and Exhauster Fan

By C. N. SCHUETTE

AN UNUSUAL PROBLEM in mine ventilation was created by the issuance of deleterious gases from the vein fissure in a silver mine near Rico, Col. These gases were carbon dioxide and hydrogen sulphide. The mine lies entirely within the Dolores formation, a part of the "Red Beds" of the Rocky Mountain region.



Carbon-dioxide gas bubbling up from bed of Gas Creek

This formation, which is probably Triassic in age, has been described by W. Cross,¹ A. C. Spencer,¹ and F. L. Ransome² and is mapped in part in the "Rico Folio" of the "Geologic Atlas of the United States."³

¹Whitman Cross and Arthur C. Spencer. "Geology of the Rico Mountains." Twenty-first Annual Report, U. S. Geological Survey, 1899-1900.

²F. L. Ransome. "The Ore Deposits of the Rico Mountains, Colorado." Twenty-second Annual Report, U. S. Geological Survey, 1900-1901.

³Whitman Cross and F. L. Ransome. "Geologic Atlas of the United States. "Rico Folio, Colorado." No. 130, 1905.

The mine is situated on Gas Creek at an elevation of about 10,000 ft. Here the Dolores formation shows the typical brick-red color and consists of coarse to fine sandstones and thin layers of conglomerate. These rocks, which form both walls of the nearly vertical vein, are cemented with carbonate of lime and contain disseminated pyrite, which is also in the vein filling.

Gas Creek is well named, as carbon dioxide and hydrogen sulphide issue from the ground at numerous places along its course. Sulphur deposits are in evidence at these points, and elsewhere deposits of limonite have been formed by iron-bearing springs.

ORIGIN AND BEHAVIOR OF THE GASES

The springs probably derive their iron from the disseminated pyrite of the sandstone. The carbon dioxide is probably caused by the action of sulphuric acid on the carbonate of lime cementing the sandstone, and is therefore also due to a relatively superficial reaction. The source of the hydrogen sulphide is probably more deep seated and due to solfataric action. It may be mentioned that a dike of porphyry lies roughly parallel to, and a short distance south of, the course of Gas Creek. Both gases, despite their different origins, reach the surface through the same fissures, one of these being the vein fissure of the mine.

Gas issued with varying intensity all along the vein, and in certain spots was under sufficient pressure to make a hissing noise as it blew from the crevices or bubbled noisily through the water in the ditch of the drifts. The gases issued from the vein only on the lowest of a number of superposed levels, showing that they undoubtedly came up the vein fissure and did not emanate from the wall rocks.

The carbon dioxide, being heavier than air, always escapes by the lowest available mine opening. Dead-end openings on the lowest level always showed an accumulation of gas. In drifts and crosscuts where a natural draft exists, the heavy carbon dioxide flows along the bottom, and, when undisturbed, a fairly sharp line of demarkation is evident when a carbide light is lowered. When the flame reaches the line of demarkation—a foot or two above the floor—it turns yellow, becomes longer, sputters, and is extinguished. When the air and gas in a drift in this condition are disturbed by cars running through it, the air rapidly becomes unbreathable.

TEMPERATURE CONTROLS MOVEMENT OF GASES

The natural movement of air through the mine depends on the atmospheric temperature. When the atmosphere is warmer than the mine air, this condition being prevalent in summer, the cooler, and therefore heavier, mine air flows down all of the mine openings and out through the lowest one. In winter the opposite effect is produced, air entering the lowest opening and leaving the mine through the higher openings. In spring and autumn a daily change takes place soon after

sunrise and sunset. During this change there is no definite draft in either direction, the mine air pulsates, and the lowest workings fill with gas.

EARLY DEVELOPMENT OF THE MINE

A diagram showing the levels affected is given in Fig. 1. The early development and operation of the mine was adversely influenced by the presence of the gases. The winter season in this part of Colorado, and particularly at this altitude, is severe, and the snowfall is heavy. These facts, together with the adverse natural draft conditions in winter, restricted work in the mine to the summer months.

No. 1 level was driven under the natural down-draft condition prevalent in summer, raises to the surface for air being driven at frequent intervals.

No. 2 level was developed by driving a crosscut adit to the vein, no gas being encountered until the vein was reached. When this adit had provided a drain for the gas, a winze was sunk to No. 2 level for air.

It is said that during this time a coal miner appeared on the scene and introduced a modification of the "double-entry" system by running an adit two sets high as shown at A in Fig. 1. The lagging on the lower set was made air-tight by tamping soft vein gouge on it. Fresh air was carried to the face through the upper set while the gas and air flowed out through the lower set.

No. 3 level was also developed through a crosscut adit, and then a raise was carried up to No. 1 level for air. The level was driven by what was locally known as the "cutting-out stope" method. The ore was mined by the shrinkage-stope system, and the method used in driving the level consisted of carrying the cutting-out stope forward with the level face as the latter advanced. Air flowed down from No. 1 level through successive raises as the work advanced, to the cutting-out stope, thence to the working face, and out through the drift and No. 3 adit. Finally connection was made with No. 2 raise, and then the stopes were carried up. In this work it was found that carrying air to the face in the usual manner in pipes was detrimental to working conditions, as the blast of air disturbed the gases to such an extent as to vitiate the mine atmosphere. It was found beneficial to lower the open end of the air pipe to the floor near the face and draw the gas through it with an exhauster.

THE VENTILATION PROBLEM

After the described work had been done the mine was idle for five years, and when operations were resumed conditions were as shown in Fig. 1, the shaded area representing stoped ground and the cross-hatched area the caved ground. The stopes at B had caved to the surface, letting some creek water into the mine, and No. 1 level was caved beyond recovery on both sides of Nos. 1 and 3 raises. In addition to these caves, No. 2 adit had caved and was buried under a landslide for a distance of 120 ft. from its former portal. No. 3 adit and No. 3 level contained a foot or more of slime, and all tracks and air pipe had been destroyed. The main sources of gas were at the points marked A, B, C, D, and E in Fig. 1. It was possible to walk or wade through No. 3 level when a strong down draft prevailed, as the gas was confined to a layer near the floor.

The operators decided to drive north on the vein on No. 3 level. For this purpose it was necessary to satisfy two conditions: first, to bring fresh air to the

working face and, second, to maintain a breathable atmosphere (under working conditions) in the level and adit where the trammers worked. B was the most prolific source of gas, and also of water, and as No. 2 adit was closed, these flowed down No. 2 raise into No. 3 level and out through the adit. A new adit was driven from the surface to connect with the open part of No. 2 adit. When this had been completed, No. 2 level was bulkheaded at F and the gas from B as well as the creek water percolating through the caved ground was carried to the surface.

The gas flow in this new adit was from 1½ to 2 ft.

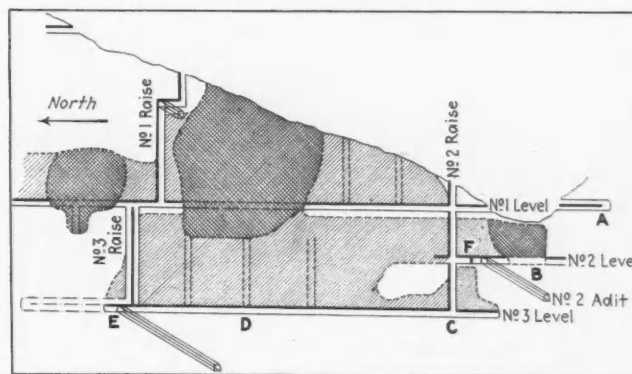


Fig. 1—Diagram of mine levels

deep and showed the following analysis: CO₂, 40.72 per cent; O₂, 12.04 per cent; N₂, 47.24 per cent.

The gas analyses mentioned were obtained from samples taken in vacuum tubes furnished by the U. S. Bureau of Mines through the courtesy of B. O. Pickard and D. Harrington. The samples were analyzed in the U. S. Bureau of Mines laboratory at Pittsburgh, and were also tested for CO, CH₄, H₂, and H₂S, with negative results.

The completion of the drainage adit and bulkhead materially bettered conditions in No. 3 level and made it possible to place track in No. 3 adit. This was a disagreeable job, as the work of bolting and spiking the rails necessarily had to be done in the gas layer. Clearing the level of the accumulated slime was also dangerous, as the slime was a veritable reservoir of hydrogen sulphide gas.

From No. 3 raise the level was driven north one and one-half sets high, the lagging of the drift set being tamped with the vein gouge. The level was supported with either drift sets or stulls, depending on the width of the vein and the condition of the walls. Air came down through Nos. 1 and 3 raises, and was carried to the face through the upper or ventilation set and then back through the drift set to No. 3 adit. This provided good ventilation at the working face.

The movement of cars and men in the level mixed the gases with the air breathed by the trammers. To mitigate this condition as much as possible, perforated wooden pipe was placed along the floor, near the end of the crosscut adit and in the drift, and an exhauster was used to draw the gas to the surface.

As the mine water and gas rapidly corrode galvanized pipe, it was necessary to use wooden pipe, and this was made at the mine of 1 x 10-in. rough lumber and fitted with collars of 1 x 12 in., these collars having a 6-in. lap. Fig. 2 illustrates the construction of the pipe and fittings. After being nailed, the pipe was doweled to prevent collapse after the nails have eaten out, and

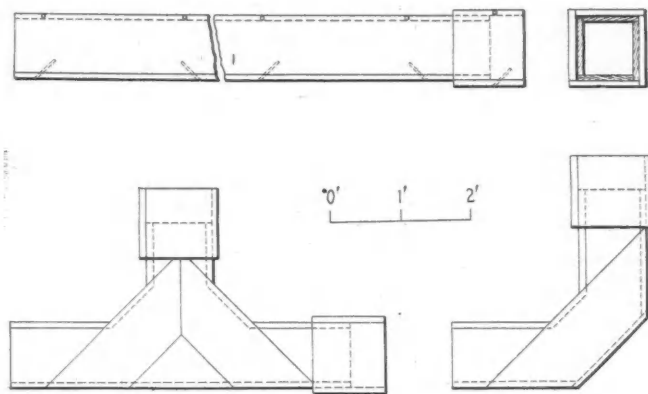


Fig. 2—Wooden ventilation pipe and fittings

the joints were painted with a heavy tar paint. The lumber was sawed in a small sawmill at the mine, the cost being about \$17 per 1,000 bd. ft. The cost of the pipe was 15c. per ft., about 10c. for labor and 5c. for material. The cross-sectional area of this pipe is slightly larger than that of 10-in. galvanized pipe, which cost over 50c. per ft. at the mine. The wooden pipe was easy to install and was remarkably tight when the joints were caulked with waste and tarred, an operation slightly more cumbersome than wrapping and tarring galvanized pipe. The wooden pipe was also used in a part of the adit, where it was supported as shown in Fig. 3, two 2 x 4-in. posts being set under each pipe.

This method of drawing out the gas was fairly effective in keeping the adit and level free from gas. It was most effective when the gas layer was least disturbed. When the gas and air in the mine were mixed, it could

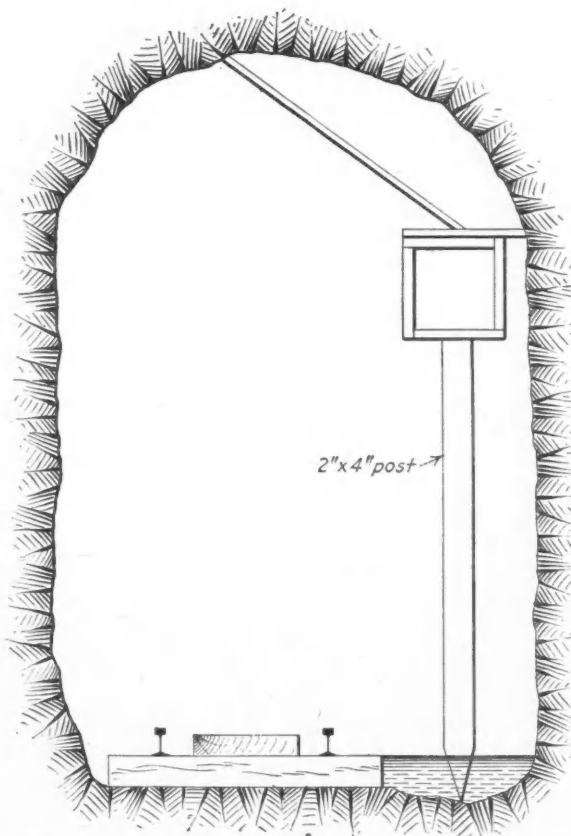


Fig. 3—Method of supporting wooden pipe in No. 3 adit

of course only carry out the mixture. On one of the latter occasions a sample was taken of the gas discharged into the atmosphere by the exhauster, and the analysis gave the following proportions: CO₂, 4.27 per cent; O₂, 19.96 per cent; N₂, 75.77 per cent.

The effectiveness of the ventilation set in carrying air to the face is well illustrated by the following analyses:

	Sample 1, Per Cent	Sample 2, Per Cent
CO ₂	4.07	1.51
O ₂	19.98	20.62
N ₂	75.95	77.87

Both samples were taken at the height of a man's mouth, when a strong down draft prevailed. No. 1 sample gives an analysis of air at the face when the ventilation set was closed, leaving the face as a dead-ened drift. No. 2 sample is an analysis of the return air from the face when the ventilation set is open. It was taken at the end of the adit, and this air had been vitiated on its return through the drift, and particularly by passing over the source of gas marked *E* in Fig. 1. It represents the air breathed by the trammers under ordinary working conditions.

Four other analyses that are of interest because they illustrate the conditions prevalent when there is no draft in the mine are given below. They were also taken at the height of a man's mouth:

	Sample 3, Per Cent	Sample 4, Per Cent	Sample 5, Per Cent	Sample 6, Per Cent
CO ₂	6.42	5.43	.32	3.72
O ₂	19.56	19.69	20.80	20.10
N ₂	74.02	74.88	78.88	76.18

Sample No. 3 was taken at the end of the adit, No. 4 at the north face, No. 5 in the ventilation set at the raise, and No. 6 in the south drift between points *E* and *D* in Fig. 1.

It is of interest to note that in all eight gas samples given, the proportion of oxygen to nitrogen is that found in normal air, showing that the carbon dioxide is added to the air from an outside source and is not derived from any chemical action with the oxygen of the air. The low carbon-dioxide content of Sample 5 confirms the statement previously made, that this gas is not found above the lowest openings even when no draft prevails in the mine. Breathing becomes excessively labored when the carbon-dioxide content is approximately 5 per cent, and under such conditions physical exertion is not possible.

An up draft maintains ventilation, but conditions then are not nearly as good as when a down draft prevails. It should be possible to simulate the natural down draft during the winter by blowing air into No. 1 raise through a bulkhead or by carrying air into the ventilation set through air pipe or tubing, in the latter operation closing the connection between No. 3 raise and the ventilation set. If this were done the ventilation set would serve as a conduit of large cross-section and give the low velocity to the air that is required to prevent its disturbing the gas layer.

The hydrogen sulphide gas presented a problem of its own. During the cleaning operations in the adit and drift the odor was unusually strong. The workmen's eyes were severely affected, a few days' exposure resulting in an affliction similar to snow-blindness. After the adit and drift had been cleared of slime the odor was less strong but still noticeable. This gas is difficult to analyze in small quantities, and can be determined only when samples are analyzed immediately

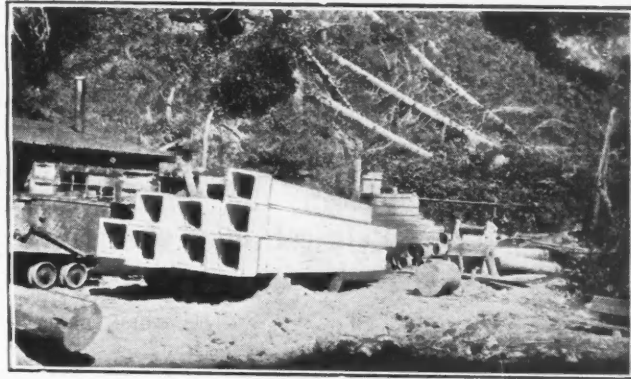
after taking, which was not possible with the vacuum-tube samples.

The hydrogen sulphide which was present in the gas probably did not exceed 0.01 per cent, but caused more annoyance than the carbon dioxide if it really was the "sore-eye" gas. On this point I have no data, nor have I read in the literature on mine ventilation that this effect may definitely be ascribed to carbon-dioxide gas.

Upon one occasion I spent seven consecutive hours underground when breathing was slightly difficult and a faint hydrogen sulphide odor prevailed. Other than a slight "drawn" feeling of the eyes, no effect was noticed underground, but on coming into the sunlight everything was seen as through a heavy black smoke. My vision became normal, however, on the following day.

The degree to which the men were affected varied greatly in different individuals. With some the eyes smarted severely and watered copiously. Long exposure resulted in temporary loss of vision. It was claimed that by breathing through the mouth instead of through the nostrils the eyes were not affected to so great an extent.

The effect of mine gases on the vision is a subject



Wooden ventilation pipe

that has received little attention, though this difficulty exists to some extent in many mines around Rico and also in other districts. I am inclined to attribute it to the sulphide gas, as other sulphide gases, notably sulphur dioxide in smelting plants, do affect the eyes. The carbon dioxide absorbed by the blood, and also the rarity of the air at an elevation of 10,000 ft. may, however, be contributory factors in producing the effects here described.

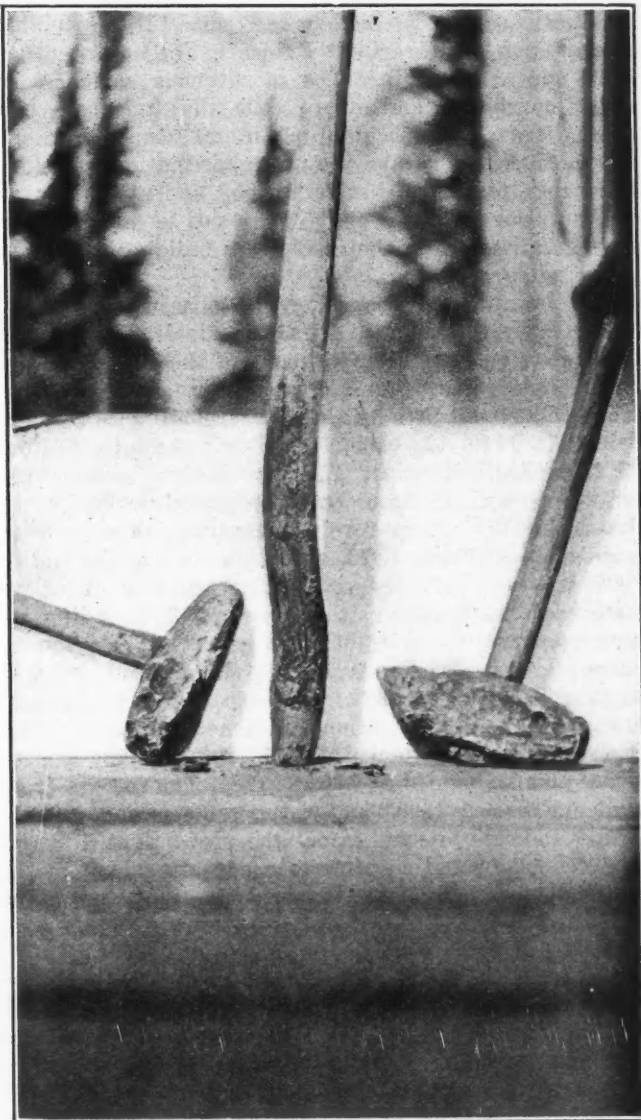
In conclusion it may be said that though operating conditions were more seriously affected by the ventilation problem than is usual in metal mines, the methods of ventilation adopted were fairly effective, and it is hoped that this description may aid others in overcoming similar difficulties in mines where dangerous gaseous conditions exist.

Spanish Iron-Ore Situation*

Exports of iron ore from the port of Bilbao in the period from Jan. 1 to April 30, 1922, totaled 384,674 metric tons, against 162,762 tons in the corresponding period of last year and 753,076 tons in the first four months of 1920. The 1920 figures represent an approximate normal since 1914. Of the exports during the current year, 62,169 tons was shipped to Rotterdam for transshipment to Germany, 14,562 tons to Belgium, and the remainder to England. The exports of the low-grade and washed ores to Germany and Belgium are still far below the pre-war normal.

Labor troubles in the British metallurgical industry have caused a slump in the demand from that quarter for Bilbao ore, which showed some signs of revival at the beginning of the year. The North African ores are continuing to offer keen competition to the product of the Vizcayan mines, as they are said to be practically equal in quality, and the cost landed in England averages about 3 s. less per ton. Vizcayan mine operators recently reduced the miners' wages about 15 per cent. The general impression in local mining circles is that there will have to be a further reduction in production costs before any definite revival in the industry can be expected.

While the bulk of the ore mined in this section is exported, the depression in the local iron and steel industry is affecting the mining industry adversely. Just at present the two principal iron and steel plants of the district are at a standstill, due to a strike of workmen which was brought about by a 20 per cent reduction in wages.



Effect of mine gases on iron tools. Wood is not affected

*Consul H. M. Wolcott, in *Commerce Reports*.

Mining Curriculum at the Massachusetts Institute of Technology

Trend in Selection of Technical Subjects by Students—Engineering Administration Receiving Important Recognition in Technical Branches Other Than Mining and Metallurgy—Political and Social History and Economics a Part of Mining Course

BY GEORGE J. YOUNG

Western Editor, *Engineering and Mining Journal-Press*

MORE THAN TEN YEARS AGO I visited the mining division of the Massachusetts Institute of Technology when it was sheltered in red brick buildings on Boylston St., in Boston. The laboratories were in a basement and looked much the worse for wear. Nevertheless, I have not forgotten the warm welcome I received from Professor Richards and Professor Hofman. I spent several days, and left with considerable respect for the personnel and the work in mining and metallurgy. Recently I visited the school again. The new buildings were impressive and indicated a tremendous rejuvenation in physical appurtenances. On leaving the car I joined a stream of students

here was efficiency with its two side sisters, order and time-saving.

Throughout the day I could not get away from the thought that I was in the grip of a system akin to a well-regulated card index, nor from the idea that some one was practicing in the conduct of the school that which was preached from the class-room rostrum to students as a guide to the efficient administration of business. There was in the air a definite purpose. The institution did not remind of a school at all, but rather of a large business organization under an efficient manager.

The students were on the go. The interior of the building suggests a factory. Architecture is a thin veneer upon the exterior. Evidently the engineer had ruled supreme within. The monotonous sameness of walls, corridors, and doors and the uniform color scheme reveal the peculiar quality of some engineer's mental make-up. Have they no appreciation of color? Have they forgotten that technology and utilitarianism are mere means to an end? Why not let an architect have a little rope on the inside of a building as well as upon the surroundings?

The Institute of Technology is in a manufacturing and business environment. Its students are drawn from many countries and from all parts of the United States. About half come from Massachusetts and two-thirds from the North Atlantic States including Massachusetts. In 1919, 129 came from South Atlantic States; 79 from South Central; 271 from North Central; 120 from Western; 13 from outlying parts of the United States, and 205 from foreign countries. The number enrolled in 1919 was 3,078, and attendance at the end of 1920 is given as 2,884. The total number of active members of the faculty in 1919 was 293, including research associates, assistants, and lecturers. The money outgo for the fiscal year ending June 30, 1920, was \$1,659,096, of which \$639,181 was paid to teachers and \$252,825 for administration and general expense. The investment assets totaled \$14,930,203 and the educational plant is valued at \$10,792,758. The income from students totaled \$800,350 for the same period. These figures indicate to some extent the proportions attained by Technology and the intricate educational, financial, and business problems involved in this important scientific school.

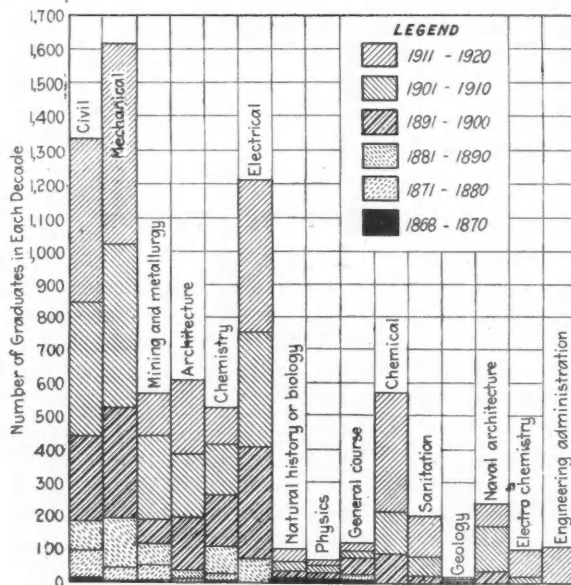


Fig. 1. Comparative trend indicated by the number of graduates in technical and other courses at the Massachusetts Institute of Technology

hustling their way toward the building, and received from one of them the needed directions. Wending my way through a line of laboratories which suggested by their wealth of machinery the packed engine rooms of ocean liners, I landed in the business office of the Institute. A small boy in knee breeches, in response to my query for full information upon the courses in mining and metallurgy, placed on the counter in rapid-fire order six pamphlets and four schedules and answered my question as to where I could find Professor Lindgren by saying: "Turn to the right, go to the first staircase, take the second floor, turn to the right, take the first corridor, and you will find the name on the office on the right hand side of the corridor." The whole transaction occupied about a minute and a half and I was on my way, not, however, without reacting to the thought that

TRENDS OF TECHNICAL EDUCATION

The total number of graduates, beginning with 1868 and ending in 1920, is 7,651, which number includes the recipients of higher degrees. The number of graduates for some fifteen separate divisions by ten-year periods is indicated in Fig. 1. The relative importance of the several courses is indicated by the height of the vertical sections of each column in the figure. The recent trend

in the selection of courses is shown in Fig. 2, in which I have compared 1914 with 1920. The year 1914 marks the end of an historical epoch, the year 1920 the beginning of a new era. Necessarily, succeeding years may be expected more accurately to indicate trends. The diagrams indicate the trend at one large institution; but they are probably indicative of what is taking place generally. This is only an opinion, as I have not investigated in detail. It is interesting, however, to note the relative decrease in enrollment in civil, mechanical, electrical, and sanitary engineering, and architecture, and the increase in mining, chemical, and electrochemical engineering, and in engineering administration. The most notable trend is toward engineering administration. This was conspicuously deficient in the pre-war epoch in technical education. Mining and metallurgy show an increase, but this is probably due to local causes, for the condition of the mining industry has not been such as to account for it. The trend toward chemical engineering is a result of war activities in the chemical industries.

The mining school at Technology is a relatively small part of a large organization. The enrollment at the end of 1920 totaled 133. This is an inconspicuous number in a total of 2,884. Nevertheless, the school does maintain an entity, although it must be greatly influenced by the immediate environment. On the whole this influence is good. The total number of graduates in mining and metallurgy since 1868 is 564. Not only from the work of its graduates, but also from the researches of Richards and Hofman and other members of the staff, the mining industry has been stimulated and advanced to a material extent. There is no adequate valuation of the influence of a school upon an industry, but M. I. T. has contributed its share to mining and has won an important place in the world of mining and metallurgical education.

The present faculty lacks conspicuous leadership in both mining and metallurgy. It probably never had important leadership in mining. Professors Richards and Hofman, notable men in their respective specialties, have retired. Professor Lindgren is a conspicuous leader in economic geology. Professors Locke, Hayward, and Bugbee are tried and experienced teachers in their respective subjects. The important element in the personnel of the faculty is experienced teaching ability.

Three important laboratories have been organized and equipped in the new building, and all are well worth the attention of other schools, both for their arrangement and the selection of equipment and for the convenience and lighting of the rooms. The assaying laboratory is equipped with coal-fired muffle and miscellaneous melting furnaces. The metallurgical laboratory is equipped with a small blast furnace, a Dwight-Lloyd sintering machine, and electric melting and roasting furnaces. Quantitative experiments are carried out upon various lots of ore. The ore-dressing laboratory includes small machines for coarse and fine concentration, amalgamation, flotation, and magnetic separation, together with accessories. The equipment of all the laboratories appears to have been wisely selected and to be especially suitable for the work of instruction. Research is provided for by separate small laboratories as well as by the larger general laboratories.

Entrance to Technology is predicated upon having reached the age of seventeen and the passing of satisfactory examinations in algebra, plane and solid geometry, trigonometry, physics, chemistry, English and either

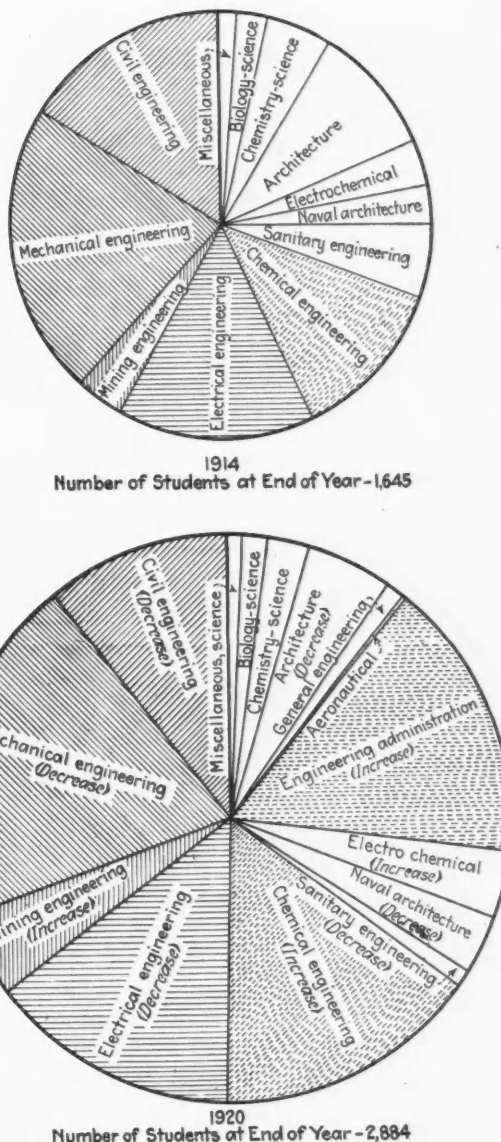


Fig. 2. Trend of selection of subjects. Areas of circles are in proportion to total number enrolled

French or German. Certificates must be presented for one unit of the following subjects or its equivalents: Biology, history, Latin, mechanical drawing, mechanic arts, or in additional work in the subjects taken by examination. There is thus a specific inquiry into the intrant's ability. These entrance requirements do not materially differ from the general high-school preparation.

ANALYSIS OF MINING CURRICULUM

The mining instruction is based upon a four-year course, with two principal options, one in mining and one in metallurgy. A third option similar to the mining option, but requiring a larger proportion of work in geology and accessory subjects, is also given. The first year of instruction is general, and is common with that of all other Technology students. Beginning with the second year the student must exercise his option and start his technical and related work. There are three ten-week terms in the year, together with some summer-session work.

The curriculum presents no special novelty. It stresses fundamentals and leads out in technical subjects in the usual fashion. The engineering element finds coordination to some extent in a course in mine-plant

design. Geology is scant and economic geology is represented by only fifty hours of class work. Metallurgy and mining are given only moderate time. The mechanical and electrical element is probably given all the time it deserves, but some question may be raised as to the appropriateness of its treatment from a mining viewpoint.

The mining curriculum is indicated in the following table, and Fig. 3 is a time analysis:

MINING CURRICULUM AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

	Recitations Lectures and Laboratory Hours	Preparation Hours	Total Hours
Mathematics.....	180	360	540
Chemistry			
General.....	360	170	900
Determinative.....	320	50	
Physics.....	240	300	540
English and history.....	180	300	480
Political economy.....	90	90	180
Drawing			
Descriptive geometry.....	180	...	180
Mechanical and machine drawing			
Summer-school surveying.....	...	...	360
Miscellaneous			
Military science, physical training, general study.....	310	90	400
Engineering element			
Applied mechanics.....	90	180	550
Stationary structures (theory).....	30	50	
Testing materials (laboratory).....	20	10	
Hydraulics.....	30	50	
Mechanism.....	30	60	
Mechanical and electrical			
Heat engineering.....	80	140	510
Electrical engineering and laboratory..	90	130	
Forging.....	30	0	
Engineering laboratory (power measure- ments).....	20	20	
Geology and mineralogy			
Mineralogy.....	120	20	530
General geology.....	120	100	
Economic geology.....	50	60	
Geology-mapping.....	40	20	
Metallurgical			
Ore dressing.....	40	40	430
Ore dressing-laboratory.....	80	20	
Metallurgy.....	120	55	
Metallurgy-laboratory.....	40	35	
Mining			
Elements of mining and mine-plant design.....	240	210	450
Thesis.....	170	...	170
Total.....	3,300	2,560	6,220

The cultural element gets a slice of time, as also does political economy. The cultural studies consist of three courses in English and history. The first covers recent European history, the second is a continuation, and the third deals with recent problems in the government and history of the United States. In the first two,

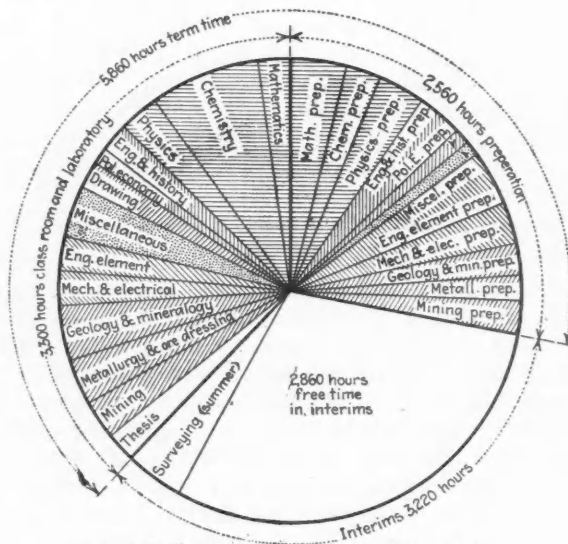


Fig. 3. Time analysis of mining curriculum of Massachusetts Institute of Technology

Vol. 2 of Hayes' "A Political and Social History of Modern Europe" is used as a text, and in the third, Charles R. Lingley's "Since the Civil War."

It is of interest to note that provision is made for a course in special composition which may be required, after the first year, of any student who shows inability to write clear and correct English. According to the description of this course, "it consists of theme work and consultation and is continued in each case as long as the needs of the student require."

The course in political economy is described as "elementary but comprehensive. It consists of an analysis and description of the existing economic structure of society, a brief study of economic theory, and the application of that theory to some of the more important economic questions. Special attention is given to fundamental business processes, including principles of accounting, corporate organization and finance, credit and banking, labor problems, and business management." Ninety hours of class-room and ninety hours of preparation are given to the subject of political economy. English and history are given throughout the first year and political science is given in the third. These are logical positions, and both courses appear to be entirely appropriate for technical students.

Apparently, petrology has been omitted, as I am unable to find it mentioned in the list of prescribed courses. As it would be essential to a course in geological mapping, it either finds expression in one of the other courses or is an elective subject. Neither the human nor the psychological elements find separate expression in the curriculum. A more specific development of the engineering element than its use in mine-plant design appears to me to be desirable. Very likely the thesis plays a part in such a development.

In the time analysis a conservative position is indicated. The total of 3,300 hours for class-room and laboratory work is rather under than over the usual time given. The total, including preparation, is 5,860 hours during the term and 360 hours in the summer school of surveying. The total is slightly over forty-eight hours per week, or averages eight hours per day for a six-day week. This is a humane requirement, and no student need undermine his health in meeting it. It leaves ample latitude for the slow student and opportunity for additional work for the stronger students.

The fundamental criticism which might be given to Technology as a whole is the absence of definite contrasts in the educational scheme. It points strongly in one way. It is true that Technology counters this by encouraging athletics and other subordinate activities, but are these a satisfactory solution? Why should technical students not know something of music and art? Would not a series of concerts with accessory explanations of motives and technic and a series of lectures on various aspects of art be an entirely practical way of securing contrasts? Another thought which recurred during my visit was: How could a faculty member escape feeling like an employee? Unless some definite plan is in vogue at Technology to counteract such a feeling among instructors the tone of the institution as a whole must suffer. It is interesting to note that in the description of courses there is no mention of instructors' names, and one is unable without inquiry to find out who gives a specific course. This is a fundamental mistake, as one must needs know something of the personality of a man giving a subject as well as the content of the subject.

THE PETROLEUM INDUSTRY

Factors Influencing the Value of Oil-Shale Lands

Many Considerations Other Than the Unit Content of Recoverable Oil Affect the Value of a Deposit—A Careful Analysis of These Factors
Based on the Opinions of a Number of Specialists

BY DEAN E. WINCHESTER

THE WORLD-WIDE INTEREST in oil shale has been growing by leaps and bounds during the last few years, especially since the advent of the general use of the motor truck and the tractor, and the consequent phenomenal increase in the consumption of liquid fuel. Much has been written concerning the vastness of the oil-shale deposits of Colorado and Utah, but little has been published regarding the question: What lands are valuable for oil shale and what factors influence the relative value of such lands?

On May 23, 1916, the Commissioner of the General Land Office, at the suggestion of the U. S. Geological Survey, classified certain lands in Colorado, Utah, and Wyoming as "Mineral (oil shale) lands valuable as a source of petroleum and nitrogen." Up to date some-

thing over 3,500,000 acres of land have been so classified. Ever since the first shale-land classification, and even before, geologists, engineers, and chemists have been trying to answer the following questions: (1) What is oil shale? (2) What lands are valuable for oil shale? (3) How can the oil shale be exploited? In this paper questions (1) and (3) will be considered only in so far as they affect the answer to question (2).

THE ESSENCE OF OIL SHALE IS "KEROGEN"

Oil shale may be defined as a fine-grained argillaceous (clay) rock which contains material—"kerogen"—from which it is possible to manufacture an oil, similar to petroleum, by distillation. But what is kerogen? Is the kerogen of all shales the same? What is the behavior of



Clear Creek Canyon, sixteen miles from De Beque, Col. Adequate space for plants and dumps is available.

kerogen when it is heated? McKee and Lyder¹ have given us some data on the effect of heat on the kerogen of certain oil shales, but we are still not completely informed as to what kerogen is or what its origin may be. Under the high-power microscope we observe that oil shales of the Greenriver formation contain a large amount of vegetal matter, most of which is macerated beyond recognition. Similarly, ordinary bituminous coal is found to be made up of vegetal material; yet when the two are subjected to dry distillation the products are quite different. Perhaps some day it will be proved that the original vegetal material in the oil shale is quite different from that of coal. It is my opinion that kerogen, the vital substance of the oil shales, is not a consistent, definite substance, but is, like petroleum, a mixture of hydrocarbon compounds, and that the different types of shale will be found to contain kerogen made up of different proportions of those several substances. This will account, in part at least, for their different physical and chemical characteristics. In other words, we may find that the kerogen of the oil shales from Elko, Nev., has different properties from that in the "massive black" or "bog-head" shales of the De Beque-Grand Valley fields of Colorado, or the "mahogany" shale of the same region. If this be true, it may explain some of the apparently contradictory data presented by different investigators. It is, therefore, highly important that every report of investigation include a careful and complete description of the material used and the locality of the deposit whence it came.

OUTPUT OF OIL PER TON OF SHALE VARIES WIDELY

Almost any carbonaceous shale or material will give a liquid hydrocarbon when distilled. That being so, are all shales containing carbonaceous material oil shales? Perhaps the problem is better stated—"What is commercial oil shale?" Let us look to the history of developments in the countries where oil shales are being exploited today. In Scotland shales which yield only 18 to 25 gal. of oil per ton are the basis for a large industry; in fact, in 1907 the average of all shale treated (approximately three million tons) was only 24.6 gal. per ton; in Australia, oil shale which yields 100 to 160 gal. per ton has been worked with a profit for only a few years, despite the fact that its development was begun about the middle of the last century. It is evident, therefore, that factors other than the richness of a shale influence the commercial workability of the deposit.

What lands are valuable for oil shale? This question was given extended study by the U. S. Geological Survey in 1916, at the time of its first recommendations to the Commissioner of the General Land Office regarding the classification of oil-shale lands; and, after a digest of the data published on the mining conditions and practices in Australia, France, and Scotland, where oil shales are exploited, regulations were promulgated to govern the classification of lands valuable for oil shale.

During January, 1922, the subject was discussed at length during the hearing of a shale-land contest before the Receiver of the General Land Office at Glenwood Springs, Col. Interesting and valuable information was offered in the form of sworn testimony by men who have spent years in the study of problems connected with the development of the American oil-shale industry. Among

those testifying were R. D. Burnham, geologist for the Union Oil Co., of California, in charge of oil-shale operations; A. S. Crossfield, petroleum chemist for the Union Oil Co.; William C. Russell, mining engineer; and Dean E. Winchester, oil-shale engineer and a member of the committee which drew up the regulations for the classification of oil-shale lands by the U. S. Geological Survey. The following discussion is based upon data contained in the evidence presented by these men:

WIDE DISTRIBUTION OF SHALE FORMATIONS

In the United States, oil shale is to be found in nearly every geologic formation from the Devonian to the Quaternary, but, exclusive of the cannel coals, the richest, thickest and most extensive shales belong to the Greenriver formation (Eocene) of the public-land states of the Rocky Mountain region. The Devonian is reported to contain oil shales yielding as much as a half barrel of oil per ton, over large areas in Indiana, Ohio, and Kentucky, but the shales of the same age in the Rocky Mountain region so far have been found barren. Shales of Carboniferous age in both Eastern and Western states, locally, will yield as much as a half barrel of oil per ton, and it is possible that even richer oil shales may be discovered. Cretaceous shales of the Western states in many places yield a small amount of oil, but, as far as I am aware, none yielding more than eleven gallons per ton have so far been found. The oil shales of the Tertiary of the Rocky Mountain region are confined almost entirely to the Greenriver formation, although locally, in Montana, the Oligocene contains shales yielding as much as thirty-six gallons per ton.

Over many townships in northwestern Colorado and northeastern Utah, the Greenriver formation contains one bed of oil shale 10 to 25 ft. thick, yielding more than a barrel of oil per ton, and in most places several beds of valuable oil shale are present. By far the most important deposits of oil shale in the Greenriver formation are to be found in that part of the Uinta Basin which lies in northwestern Colorado and in northeastern Utah, east of the Green River. In this area the formation has been divided into three parts, the upper and lower of which have until recently been considered as lacking commercial beds of oil shale. Recent detailed examination, accompanied by distillation tests, has, however, proved that, although the thickest rich beds of oil shale are to be found in the middle part of the formation, there are in both the upper and lower members beds of oil shale which cannot be disregarded.

Careful studies of the middle part of the formation have proved that the individual members are remarkably persistent, over comparatively large areas, both in thickness and richness, so that although the oil-shale beds of the lower part of the formation have not as yet been traced over large areas, but have been observed at several isolated localities, it is reasonable to assume that within 200 to 300 ft. above the base of the Greenriver formation there will be found one or more important beds of oil shale. Where studied, these lower beds have been found to have sufficient thickness and richness to warrant the classification of the lands underlain by them as being "mineral" (oil shale) under the regulations promulgated by the U. S. Geological Survey.

The regulations adopted on April 5, 1916, for the classification of oil-shale lands, provide: (1) Where the oil-shale beds are too deep to be mined by open-cut methods, such lands must contain shale capable of yielding 1,500 bbl. of oil per acre, in beds not less than one

¹McKee, R. H., and Lyder, E. E. "Thermal Decomposition of Shales." Columbia Univ. Eng. & Sci. Paper, August, 1921, pp. 1-32.

foot thick, yielding not less than 15 gal. per ton and within a reasonable depth below the surface. (2) Where the oil-shale beds are at or sufficiently near the surface to be mined by open-cut methods, such lands must contain shale sufficient to yield 750 bbl. of oil per acre in beds not less than six inches thick and yielding not less than 15 gal. per ton. In computing the acre value of the oil shale, it is considered that a yield of one gallon of oil per ton of rock is equivalent to yield of 50 bbl. (42 gal. each) of crude shale oil per acre-foot of rock.

In the accompanying table the number of barrels per acre is given for each foot thickness (up to six feet) for

TABLE USED IN THE CLASSIFICATION OF OIL-SHALE LANDS

Yield Per Ton of Shale in Gallons	Yield in Barrels Per Acre					
	Thickness of Bed in Feet					
	1	2	3	4	5	6
15	750	Surface 1,500	2,250	3,000	3,750	4,500
20	Surface 1,000	2,000	3,000	4,000	5,000	6,000
25	Surface 1,250	2,500	3,750	5,000	6,250	7,500
30	Surface 1,500	3,000	4,500	6,000	7,500	9,000
35	1,750	3,500	5,250	7,000	8,750	10,500
40	2,000	4,000	6,000	8,000	10,000	12,000
45	2,250	4,500	6,750	9,000	11,250	13,500
50	2,500	5,000	7,500	10,000	12,500	15,000
55	2,750	5,500	8,250	11,000	13,750	16,500
60	3,000	6,000	9,000	12,000	15,000	18,000

different shales yielding from 15 to 60 gal. per ton. The upper figure in each box is an expression of the depth in feet to which the particular oil shale will warrant the land underlain by it to be classified as oil-shale land.

SUMMARY OF FACTORS IN APPRAISAL OF SHALE LANDS

Among the factors which influence the value of lands for their oil shale may be listed the following:

- A.—Thickness and richness of the oil-shale beds.
- B.—Geological attitude of the oil-shale beds: dips, faults and other characteristics.
- C.—Persistence and uniformity of oil-shale beds in thickness and richness.
- D.—Relation of oil-shale beds to the surface, as influencing the method of mining.
- E.—Topography of the tract and the position of the oil-shale outcrop.
- F.—Total area of lands underlain by oil shale, available for mining operation.
- G.—Physical character of the oil shale as influencing mining, crushing, and transportation.
- H.—Chemical character of the oil shale as bearing on its behavior in the retorts, and on the character of the products of manufacture.
- I.—Location of lands with regard to transportation, present and possible.
- J.—Location of lands with regard to available water supply.
- K.—Location of the lands with respect to supply of mining timber.
- L.—Location of the lands with respect to lands available and appropriate for plant site, camp site and waste dump.
- M.—Location of the lands with respect to markets.

N.—Value and demand for products possible to manufacture.

O.—Location of property with respect to labor, machinery, and miscellaneous supplies.

From the above list it is apparent that the value of land for its oil shale is more dependent upon the cost of extraction and treatment of the shale, and upon the cost of marketing the products manufactured, than upon the amount and richness of the oil shale on the property. To judge and compare properly the value of an oil-shale property, therefore, all the above factors must be considered.

A.—Thickness and richness of the oil-shale beds. What can and will be done in the American oil-shale industry in respect to the mining and treatment of thin and lean shales is a matter of conjecture; but what has been done in other countries is more or less a matter of record, and upon that record we must base our prophecies for the American industry. In Scotland oil-shale beds as thin as 20 in. and yielding 34 to 35 gal. of oil per ton have been and are being mined profitably. In Australia an oil-shale bed 2 to 3 ft. thick but yielding more than 100 gal. of oil per ton is being developed by underground mining methods.

It appears, then, that beds less than 2 ft. thick are being mined on a large scale. It is probable that with the exhaustion of the thicker beds in this country it will be profitable to mine thinner deposits. Today, beds of coal formerly considered valueless because of their thinness are mined with profit; also, coals which were once considered too low in heat value to warrant development are being mined. It is well, therefore, that in developing the oil-shale industry we look to the future and avoid the destruction of oil-shale deposits which may now be less attractive than others because of their thinness or leanness.

Inasmuch as most of the oil shale belonging to the Greenriver formation occurs in horizontally bedded deposits, mining will probably be accomplished by methods similar to those practiced in the coal-mining industry, and therefore data respecting the commercial mining of bituminous coal beds having a thickness of only 12 to 20 in. are informing, as is the fact that sub-bituminous coal is mined which has a thickness of only 19 in. In Europe the mining of bituminous coals having a thickness of 11 to 18 in. is practiced.

BEDS GENERALLY HAVE SLIGHT DIP

B.—Geological attitude of the oil-shale beds. Within the area known to contain the best oil-shale beds in Colorado and Utah, the formations dip only slightly, and are practically unbroken by faults. Slight dips (less than 2 deg.) may be considered an advantage in the development of an oil-shale property, especially if it is possible to arrange the haulageways with reference to the working faces so that the loaded cars and water will gravitate toward the mouth of the mine. If, however, it is necessary to pull the loaded cars up this dip and pump the water (if any is made by the mine), then even a slight dip becomes a perpetual expense and, therefore, decreases the value of the property.

C.—Persistence and uniformity of the oil-shale beds. Careful study of the principal oil-shale bed by A. S. Crossfield, over areas greater than a township, in northwestern Colorado, has proved that the thickness and the oil-yielding capacity of that bed varies but little within that large an area, and it is suspected that when detailed studies have been made, similar conditions will be found

to obtain over much larger areas. Most of the oil-shale beds of the Greenriver formation are of similar physical character and were probably deposited under similar conditions, so that it is safe to assume that probably each of the oil-shale beds, except the "massive black" of the upper part of the formation, are persistent and uniform over large areas. The mining of these beds, therefore, should be most simple, owing to that uniformity.

The massive black shale which at many places occurs in the upper part of the formation is, however, radically different. The shale itself is twisted and contorted, and the beds are erratic in thickness, so that

mining will be possible only when the valuable bed is overlain by a comparatively small thickness of rock or soil (a maximum of perhaps 50 ft.). Where open-cut methods are practiced the cost of delivering the shale to the retorts will probably not exceed half the cost where it is done by underground operations. This reduction in cost was taken into account in the classification made by the U. S. Geological Survey.

E.—Topography and oil-shale outcrops. The position of the oil-shale outcrop with respect to the topography of any tract is vital. If the shale beds do not outcrop upon the property, access will necessarily be through a shaft, and the cost of raising the shale, in addition to



Narrow Canyon, thirteen miles north of De Beque, Col., showing topography of oil-shale lands.

careful study should be made of such beds to prove their extent and variations on the property before detailed development is undertaken. It is certain that the mining of such erratic beds is likely to be much more expensive than the mining of evenly bedded shales. This type of shale has other peculiarities which will be mentioned later and which influence its value as an oil-shale resource.

METHOD OF MINING AN IMPORTANT FACTOR

D.—Relation of oil-shale beds to the surface. The cost of mining shale will depend first upon whether or not it can be won by stripping the overburden and mining by open-cut methods with steam shovels. Open-cut

the expense of sinking and equipping the shaft, will add to the expense of mining operations.

If the shale beds outcrop at or near the level of the lands available for the reduction works, the cost of transporting the shale from the mouth of the mine to the retorts will be negligible, and the property, therefore, proportionately more valuable.

If, as in much of the Grand Valley-De Beque district, the valuable beds outcrop several hundred feet above the plant sites, the costs of installing and maintaining transportation equipment is an item which must be charged against the value of the oil-shale property.

If the available point of attack on the outcrop of the shale bed is on the down-dip side of the property, the

item of expense for underground transportation and for drainage (if such is necessary) will be much less than if it is necessary to enter the shale at a point on the upper side of the property.

PROFIT PER TON WILL BE SMALL

F.—Area of oil-shale deposit. Because of the fact that the costs of mining and treating oil shale are going to be large in comparison with the market value of the primary products, the margin of profit on each ton of shale will probably be reckoned in cents; and, because of the added fact that the cost of equipment for mining, transportation, and treatment will be large, it is evident that to be profitable the operation must be on a large scale and must be continuous over a long period of years. Therefore, it is important that a large oil-shale reserve be available for each operation. It is the unanimous opinion of those testifying in the case at Glenwood Springs that no commercial operation should be undertaken on a tract containing only 160 acres of oil shale, and that any large-scale operation should be backed by at least one section of 640 acres, or more.

G.—Physical character of the oil shale. Today little is known regarding the cost of mining oil shale, and still less is known regarding the cost of crushing the shale. The amount and character of the explosive necessary, and the details of mining practice (drilling, cutting, shooting, and other operations) will depend to a considerable extent upon the physical character of the shale. The cost of crushing may be greater than that for crushing ordinary ore, owing to the "rubbery" character of the shale. The fineness demanded by the retorts of course will influence the cost of crushing, and it is possible that some shales may be reduced to a powder at much less cost than others, because of their peculiar physical properties.

TREATMENT DIFFICULTIES NUMEROUS

H.—Chemical character of the oil shale. Preliminary experiments with different types of shale from the Grand Valley-De Beque region indicate that some of the richer shales may fuse or slag easily, so that their treatment may be accomplished with difficulty and at comparatively high cost. This is particularly true of the "massive black" or "bog-head" shales of the upper part of the Greenriver formation. It is suggested that perhaps the most successful treatment of such material will be to mix with lower-grade shales, such as those which occur in the lower part of the formation. Therefore, it may be possible to mine, at a profit, some of the leaner oil shales in order to make possible the treatment of some of the peculiar but unusually rich shales.

Chemical research may determine that certain of the shales contain excessive amounts of sulphur or other injurious elements, so that although they may yield a large amount of oil, that oil will contain impurities of such a character and in such proportion as to make an inferior product. Likewise, it may be found that certain thin deposits or lean shales will yield peculiarly valuable compounds, so that lands bearing them will be more valuable than lands containing shales of greater richness and thickness.

I.—Transportation. Railroad transportation will be necessary not only for bringing in men and supplies but for the removal of the products of the industry to market. It is obvious, therefore, that shale lands that are many miles from present transportation lines are less valuable, other factors being equal, than lands

within a mile or so of such transportation, and that the relative value will depend upon the cost of connecting the properties with present lines of transportation.

J.—Water supply. The quantity of water which will be required in connection with the oil-shale industry is partly dependent upon the demands of the reduction works, a factor which at the present is unknown. However, it is certain that a large amount of water will be required to supply the domestic needs of a mining camp tributary to a mine producing from 1,000 to 5,000 tons of crude shale per day. It is, therefore, important that an adequate supply of water be available, and in a region like that near Grand Valley and De Beque, Col., where most of the normal flow of all the streams is already covered by irrigation rights, the water question is one requiring careful and complete consideration.

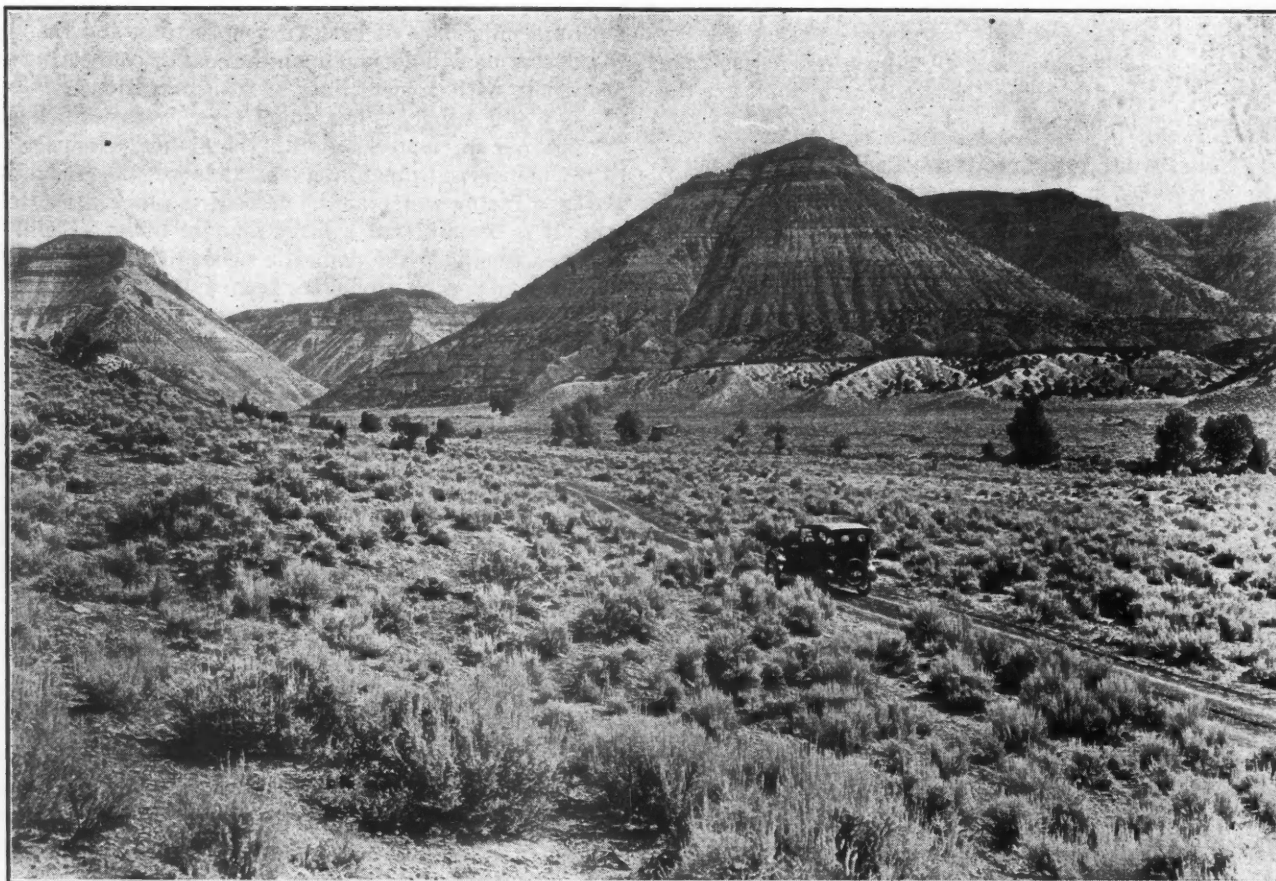
K.—Timber supply. Every underground mine requires more or less timber. Certain of the oil-shale lands in northwestern Colorado are covered by timber suitable for these purposes, but in no place is the supply sufficient to meet the requirements of a large-scale underground operation. The cost of timber, therefore, must be charged against the value of the oil-shale property.

L.—Camp sites, works sites, and waste dumps. It has been estimated that a mine producing 1,000 tons of shale per day must be accompanied by a camp for the accommodation of at least from 600 to 800 individuals. In the Grand Valley-De Beque region, where the oil-shale beds outcrop in nearly vertical cliffs at the head of steep slopes, several hundred or even as much as 2,000 ft. above the valleys, it is not possible to establish such camps immediately adjacent to the oil-shale beds; furthermore, it will be unwise to build such camps at the foot of the steep slopes, because of the fact that rocks, both large and small, are continually being loosened from the cliffs above, and once loosened they do not come to rest until they reach the bottom, and they sometimes leave a trail of destruction several hundred feet out into the valley. For the protection of life and property, therefore, lands outside this danger zone must be available for camps, machine shops, yards, and reduction works.

The topography of the lands suitable for reduction works is of great importance, the ideal condition being one where bench lands of considerable area are at hand. They should be located with reference to areas available for waste dumps, so that the waste or spent shale from the retorts may be disposed of by the use of gravity transportation systems. The question of available and advantageous dumping ground for the spent shale is important, inasmuch as for every cubic yard of raw shale taken from the mines nearly two cubic yards of dump space must be provided. It is vitally important, therefore, that lands underlain by valuable beds of oil shale be adjacent to available and appropriate lands for camps, works, and waste dumps. It is evident that the relative value of any tract of oil-shale land is dependent to a remarkable large extent upon the availability of such lands.

M.—Markets. The value of the products of any industry is affected by the proximity of the market. The costs of transportation must be considered in determining the value of the property.

N.—Products. The primary products to be derived from the distillation of oil shale will probably be (1) crude shale oil, (2) hydrocarbon gas, (3) ammonia, and (4) spent shale. The shale oil will no doubt be refined



Oil-shale land in Colorado. The beds outcrop in cliffs 1,500 to 2,000 ft. above the valley. Here the bench lands are suitable for plant sites and afford dumping space.

to make many marketable products, the number, character, and value to be determined largely by the demand. Like petroleum, shale oil is probably capable of being converted into gasoline, kerosene, lubricating oils, paraffin, dye compounds, explosives, rubber substitutes, paints, alcohols, asphalt, and other byproducts. Which of these it will be profitable to manufacture will depend upon the costs of production and upon the demand.

The hydrocarbon gases evolved in the distillation of oil shale probably will contain a certain percentage which can be converted into liquid fuel in much the same way as natural-gas gasoline is produced from oil-field gas. The gas, even after the removal of this valuable product, will probably have sufficient heat and illuminating value to be of use in such operations as the heating of shale retorts and of shale-oil refinery retorts. It has also been suggested by Franks² that it may be possible and practicable to produce alcohol, ethers, and explosives by the proper treatment of the oil-shale gases.

All oil shale contains nitrogen, a portion of which is converted into ammonia when the shales are distilled. In Scotland the lack of domestic supply of fertilizers has given rise to the treatment of the oil shales in such a way that a maximum percentage of the nitrogen is converted into ammonium sulphate. In our American oil shales the percentage of nitrogen increases in a more or less direct ratio to the oil-yielding capacity, so that in the treatment of the richer shales it may be practicable to recover the nitrogen compounds despite the added cost. To date no use has been found for the spent shale, so that the disposal of this immense volume of valueless

material will add to the cost of producing the marketable products.

O.—Labor, machinery, and miscellaneous supplies. The costs and difficulties of transportation and the problem of obtaining labor, machinery, and miscellaneous supplies for the development of the oil-shale properties which are distant from industrial centers will be a factor in determining the value of a shale deposit.

SUMMARY OF THE OUTSTANDING FEATURES

(1) Oil shales vary in both physical and chemical characteristics. Very little is yet known regarding the real nature of the vital substance kerogen, or its behavior under treatment.

(2) Oil shales are of wide distribution, both geologically and geographically, but in the United States the most valuable deposits are of Tertiary age and are to be found in the Rocky Mountain states.

(3) Valuable oil shales occur throughout the total thickness of the Greenriver formation, instead of being confined to the middle member as heretofore supposed.

(4) The value of any oil-shale property, and the cost of its development, depend upon a great number of factors. To be of most value, lands must not only contain thick beds of rich oil shale, but the outcrop of the shales must be situated near, both in altitude and in location, abundant lands available and suitable for erecting reduction works, mining camps, and for waste dumps. They must also have an abundant supply of water and must be near transportation.

(5) Comparatively little has yet been done toward the solution of the many problems connected with the mining of the oil shale and the recovery of its constituents.

²Franks, A. J., "Possibilities in the Utilization of Oil-Shale Gases," Railroad Redbook, Vol. 37, No. 5, pp. 509-527, 1920.

New Books

An Argument for World Metric Standardization

World Metric Standardization. By Aubrey Drury and others. World Metric Standardization Council, San Francisco. \$5.

"Of all wastes which affect our happiness and prosperity," said Mr. James H. McGraw at the annual convention of the Associated Business Papers during October, 1921, "the waste of time and human effort is the greatest and has the most damaging influence." This might well be taken as a text by anyone advocating the meter-liter-gram standard of weights and measures in the United States. In this book a conservative estimate of the loss to the United States and the British Empire since 1783, in consequence of a neglect to adopt the metric system is given at over thirty-three billion dollars. Educators seem agreed that the extra time needed to teach, not master, the present antiquated system amounts to eight months per pupil. Thanks to Congressional action in 1783, when metric coinage was introduced, we are far ahead of Great Britain. A child from there, in consequence of the time involved in attempting to understand and acquire facility in the monetary system in vogue across the Atlantic, finds, if he wishes to complete his education in the United States, that he is a year or so behind those of a similar age who have had the advantage of familiarization with decimals and a logical currency system.

The children of both the two great English-speaking groups, so long as the present chaotic system of weights and measures is in vogue, must learn the alternative to the meter-liter-gram system, which includes the following units: yards, fathoms, rods, leagues, perches, links, feet, inches, chains, furlongs, miles, knots, hands, spans, two different quarters, quarterns, ounces, minims, drams, grains, samples, pennyweights, three different hundredweights, two different tons, and one tun, ten different stones, four different pounds, two different gallons, two different quarts, two different pints, gills, barrels, many different bushels, many pecks, and so on: dry measure, wet measure, wine measure, beer measure, avoirdupois, apothecary and troy weight, and others.

How came this muddle? We are reminded that "The British pounds, both sterling and avoirdupois, originated with the old German Hanseatic League, which for hundreds of years controlled the trade in England. The Germans forced these old standards on the British, who in turn landed them on America. The Germans [later] utilized the genius of the British inventor, James Watt [the originator of the metric system]; they utilized the labors of the

British Parliamentary Committee. . . . In 1871 they adopted the metric system." Other nations have followed suit, the most recent being Japan and Russia, with China already in line.

In view of the conclusive array of facts and testimony that the book under review presents, it seems extraordinary that the demand for definite official action is not unanimous. The Britten-Ladd bill is now under consideration at Washington. It provides for the introduction of metric weights and measures after a period of ten years. The anti-metricists harp on the cost of the change—to a very small minority it must be admitted. Had Congress in 1783 adopted the same attitude, we should still be wasting time and money on the archaic system of coinage and monetary units that still survives in the less progressive part of the British Empire.

The book that is under review combats the arguments of the minority that is always on hand to prevent change of any kind. It offers evidence to the mining and metallurgical industries, among other things, that world standardization of weights and measures would facilitate a general advance in technology. A unit such as "grains per gallon," used so extensively in the hydrometallurgy of copper, is meaningless and confusing; it is incapable of being translated into commercial quantities without considerable labor. Compare such a system with one that gives grams per liter or kilogram, easily convertible by merely altering the decimal point into kilograms per cubic meter or metric ton. The troy system is so unsatisfactory that mining and metallurgical engineers in Canada and in the United States have adopted the metric money system to represent weights of precious metals. This has led to much confusion, for when a silver-gold ore is quoted as containing \$10 per ton we have no means of ascertaining the weight of either the gold or the silver.

Prompt Congressional action is necessary. Reforms such as this can be brought about in no other manner. One week after the change is made the number of those who cannot understand the new system and who wish to revert to the present jumble of weights and measures will be few indeed. It is not a question of individual likes or dislikes, based often on personal impressions and lack of experience with both systems; what is best for the country as a whole, for the future as well as the present, should decide the question. A. W. A.

The Principles Underlying Radio Communication. Second edition. By the Signal Corps, U. S. Army. Sold by the Superintendent of Documents, Washington, D. C. \$1.

The wireless telephone has recently aroused such widespread interest that books on the subject have appeared like mushrooms. Most of the popular publishers have put out manuals giving information which will make it possible

for an amateur to understand the manual working of the sending and receiving sets, and also to build his own set with the help of a few ready-made component parts. This book goes more into the theory of radio communication, and yet is not so abstruse that the ordinary trained engineer cannot understand it. It should serve well as an elementary textbook of radio and general electricity in schools and colleges.

Metal Statistics—The second annual issue of the "Year Book of the American Bureau of Metal Statistics," 115 Broadway, New York City, for 1921, contains eighty pages instead of the sixty necessary for the data presented in the first edition of the work. The book covers production and operating statistics, imports and exports, consumption, and prices, of copper, lead, zinc, gold and silver.

Technical Papers

Hoisting Equipment—The January, February, March and April issues of *The Metropolitan-Vickers Gazette* (Metropolitan-Vickers Publicity Bureau, 14, Long Millgate, Manchester, England; price, 1s. each) contain a continued article on "The Reconstruction of the Devastated French Winding Equipments." The work was done in coal mines, but the information given is of interest as the conclusions drawn are quite different from common practice in this country.

Electrodeposition of Zinc—In a twenty-page paper presented before the American Electrochemical Society, U. C. Tainton discusses "Hydrogen Overvoltage and Current Density in the Electrodeposition of Zinc." In his summary, he states that best conditions are a free-acid concentration of about 250 to 300 grams per litre, with a current density of about 100 amperes per square foot, and the presence of a minute quantity of gelatine or similar colloidal matter in the solutions. The paper may be obtained from the Secretary of the society, Bethlehem, Pa. Price not stated.

Arizona Geology—Professional Paper 129-H of the U. S. Geological Survey, Washington, D. C. (17 pages; price, free) is entitled "Geology of the Lower Gila Region, Arizona." The paper gives a brief summary of the mineral deposits in the region and includes a large map in color.

Safety Fuse—The *Hercules Mixer* for May, 1922, published by the Hercules Powder Co., Wilmington, Del., includes a paper "The Manufacture of Safety Fuse," by H. E. Ellsworth and J. K. Brandon. Although the article is non-technical, the information contained therein gives the reader a good idea of the processes used in manufacture and the best procedures in the utilization of fuses.

SOCIETIES, ADDRESSES, AND REPORTS

Drill Steel Survey Reports Practices in Various Districts

A progress report to members of the Advisory Board to the Bureau of Mines and the Bureau of Standards on the breakage and heat treatment of rock drill steels and other steels and alloys subjected to similar impact stresses has been made by Dr. H. Foster Bain, director of the Bureau of Mines, and Dr. S. W. Stratton, director of the Bureau of Standards, covering the month of April.

On April 1, a survey was begun to determine the present status of the types and sizes of drills as related to the heat treatment and breakage of rock drill steels. Up to May 1, the following mines were visited by F. B. Foley and H. S. Burnholz, metallurgists of the Bureau of Standards: Osceola, Ahmeek, Isle Royale; Champion; Mesabi Iron Co.; Ray Consolidated; Copper Queen; Calumet & Arizona; Inspiration; Consolidated Copper; Old Dominion, and Miami.

At the Calumet & Hecla mines the investigators were told that the development of the Carr bit was the biggest forward step taken by that company in the development of their drill steel. A 40-per cent increase in tonnage per drill is claimed as a result of the change to this type of bit. The increase in the speed of drilling is attributed to the fact that the maintenance of gage enables them to use smaller gage steels, thus removing less rock per hole, because the speed of drilling increases inversely with the amount of material removed. Breakage is not considered a problem at the Calumet & Hecla mines. This company considers that a properly timed heating equipment, under an experienced eye, is as good as, if not superior to, pyrometric control used in connection with the present types of drill heating furnaces where it seems out of the question to place a thermocouple in such a position that it can be depended on to tell the temperature of steels being constantly put into and withdrawn from the furnace. The drill-sharpening shop of the Calumet & Hecla mines has a capacity of 3,000 drills per day, and the shop men have run through as many as 4,000. In 1919 and 1920 the Calumet & Hecla company, including all subsidiaries, used 750,000 pounds of drill steels, and in the same period removed 8,893,334 tons of rock.

At the Champion mine, Painesdale, Mich., the operators use a double or cross type of Carr bit, which they consider better than the chisel Carr

used by Calumet & Hecla. They use mostly 90 per cent of $\frac{1}{2}$ -in. hexagon steel. By the change to $\frac{3}{8}$ -in. hexagon from $1\frac{1}{4}$ -in. round steel and the change from the old style cross bit to the modified double Carr bit, the company considers that it has been able to make a saving which has offset the increase in price of drill steel due to war conditions. They paid from 5 to 10c. per lb. for steel in pre-war days, and in 1919 the average price was 23c. per lb. The hardening furnace at this mine has a capacity of about 700 drills per day, but is at present being called on to treat 900 steels. For this reason they are now running their furnace at a temperature of about 1,525 deg. F. The shanks are heated to an eye-estimated temperature of 1,425 deg. F. and quenched in oil. The furnace which heats the steels for sharpening is similar to the hardening furnace, excepting, of course, that it is run hotter. It is similarly provided with a pyrometer with which the furnace temperature is regulated to about 1,800 deg. Sharpening is done with a Leyner sharpener.

The drilling at the Mesabi Iron Co.'s mine at Babbitt, Minn., is entirely a surface operation. The bits are 5 in. in diameter and are operated by a churn drill. Each drill weighs about 200 or 300 lb., and with the stem makes a train of tools weighing about 1,200 lb. The sharpening at Babbitt is done by heating the bits in a forge and roughly shaping them in a mechanical sharpener similar to that used in sharpening small mine drills, the edge is dressed up by sledging and the proper gage is given by the same means.

The greatest improvement so far attained at Babbitt has been in a change of the shape of the bit. Formerly the bit was chisel shaped, with two reaming edges. This bit held its gage fairly well, but was unusually slow in drilling. Straight chisel bits, without reaming wings, drilled faster, but lost gage rapidly. The bit now in use is called a Gill bit and has given 8 ft. per drill shift where formerly only 3 ft. was effected. The gage of the Gill bits holds up better than anything the management has formerly used and gives good drilling speed. The company feels that, with improved methods in the smith shop, it may be able to get much better footage per sharpening than is now possible. Records for the first two weeks in April show an average footage per sharpening of 1 ft. $3\frac{1}{4}$ in.

Officials of the Ray Consolidated Copper Co. at Ray, Ariz., feel that they have no real drill steel problem. They have tried the Carr bit, and state that

they found no advantage in it in their rock, probably because of its soft nature. They are, therefore, using the straight cross type of bit with an angle of about 15 deg. between the cutting edge and the side, which might be called a clearance angle. The sharpening and hardening at this mine are done underground. Their furnace is oil fired and is run at an intense heat, probably 2,200 deg. F., for both hardening and sharpening. Cruciform steel was once used at this mine, but the operators found that the use of quarter octagon produced better results, as their breakage has been greatly reduced.

The Copper Queen mine of the Phelps Dodge Corporation, Bisbee, Ariz., is standardizing on 1-in. hollow round steel for all drilling operations. The operators have used and still have in use some 1-in. cruciform and $\frac{3}{8}$ -in. hexagon steel. They use a taper cross bit entirely. This is the type of bit commonly used at present, excepting in the Ray mines, where drilling presents no difficulties. The bits at this mine are hardened by heating a small portion of the end and quenching cold in water. Their shanks are carefully made to avoid breaking near the collar or lugs. The operation of shanking takes three and sometimes four heats. The fact is recognized at the Copper Queen mine that attention to smith shop practice has improved the company's drill steel and resulted in better performance. Experiments were made with a signal light type of pyrometer, and it was found that it did not meet requirements. Instead, a Shore pyroscope is used to check temperatures from time to time. The bulk of the drilling in the Copper Queen properties is in ground in which tests have given drilling speeds varying from 4.5 to 12 in. per minute, with an average of 8.75 in. per minute of reciprocating time. The ground has been carefully tested and classified in this connection, and the average speed given can be considered an accurate index to the "drillability" of the rock. Feet drilled per sharpening are as follows: Stopping, 7.5; drifting, 4.16; and sinking, 2.5, with an average of approximately 5 ft.

At the Calumet & Arizona mine, at Bisbee, Ariz., the double taper bit is used, and the results are satisfactory.

The reasons for changing the practice at this mine from the old style, straight taper cross bit are the same as those found elsewhere. The ground is considered to be somewhat harder than that at the Copper Queen. No serious drill steel trouble has been experienced since the double taper bit was adopted. Breakage is not a serious problem. The

general opinion is that the steel provided by the manufacturers is satisfactory and that breakage results from the peculiarities of the service and is small and confined to the neighborhood of the shank for the most part. This is the first mine visited where bits were being drawn. For some of the harder drilling, their smith was observed quenching the bits in water and permitting the heat in back of the bit (only about $\frac{1}{2}$ in. was submerged in quenching) to draw the edge to a point where a light straw was just appearing, after which he quenched the entire bit and withdrew the steel when it was at a temperature decidedly uncomfortable to the touch, say 150 deg. The steels were then piled in a horizontal position. No temperature control was provided save the smith's eye. The furnaces at this shop are oil fired furnaces and are run at higher temperature than is necessary for sharpening.

At the mine of the Inspiration Consolidated, Miami, Ariz., a double taper bit is used, and standardizing on 1-in. round hollow steel is being considered. The mine now uses $\frac{3}{4}$ -in. hexagon, 1-in. cruciform and 1 $\frac{1}{4}$ -in. hollow round. Bits are hardened at this mine by quenching from a medium dark cherry in water. The steels are sharpened at a fairly high temperature. At present some trouble has developed with shanks because of unskilled workmanship. At the Inspiration properties the drillability of the ground is estimated to give an average drilling speed of 10 in. per minute. Stopping performance is estimated as about 8 ft. per sharpening and drifting performance as about 6 ft. Breakage is estimated to be 5.8 per cent of the steel sharpened.

Drill steel is not regarded as a vital problem at the mine of the Old Dominion Co., Globe, Ariz. At this mine the company uses a double taper bit and have been able thereby to cut gage changes in half. Smithing work has been reduced a third by the introduction of the double taper bit, through less wing breakage. The blacksmith shop foreman says they have no breakage whatever. The bits are quenched cold in water and the shanks are quenched in oil. In the Old Dominion properties the estimated drilling speed is 7-in. per minute. In drifting the estimated performance per sharpening is 4 ft. From estimates given stopping performance figures about 19 ft. per sharpening.

At the mine of the Miami Copper Co., Miami, Ariz., experiments with a detachable bit are being made. This bit is fastened to the bar by a left-hand thread into a collar, which in turn, is screwed on to the bar. This company also uses the Shore pyroscope for checking its smith shop temperatures. The sharpening furnace runs at about 2,000 deg. F. and provides steel for sharpening at a temperature which permits the sharpener to finish at from 1,500 to 1,600 deg. in a single heat. For hardening the bits a second heat is given in an oil furnace in which the temperature is maintained at from 1,800 to 2,000 deg.

F. The bits are brought to a temperature of from 1,450 to 2,500 deg. and quenched in running water 1 in. deep. Shanks to be hardened are heated for about one inch from the end, at a temperature of 1,500 deg.; solid steel shanks are quenched in oil; hollow steel shanks are dipped in water, drawn to a dark straw color and quenched in oil. For forming lugs on shanks, 8 in. of the shank is heated for treatment. The method of handling drill steel at all of the properties visited in the Arizona district is similar. A nipper, or tool boy, loads a car with sharpened steel at the smith shop, and takes it to the shaft. The steel is lowered and taken to one of several distributing points without being discharged from the car. From the underground distributing centers the steel is delivered to the working faces by the nipper. In some cases the machine men themselves take a sufficient number of steels to the face to keep them supplied for a shift, as they pass the distributing centers mentioned above. Dull steel is picked up and delivered to the shaft by the nippers, who are required to make at least two rounds of the working faces every shift.

John Fritz Medal Awarded to Marconi

The John Fritz Medal, one of the highest distinctions bestowed by the engineering profession in this country, has been awarded for 1922 to Guglielmo Marconi.

The medal was formally presented to Senor Marconi at a gathering of engineers in the Auditorium of the Engineering Societies Building, New York City, on July 6. The meeting was in the nature of an international celebration, marking not only the advance of science but the progress of closer relationships between American engineers and the engineers of Italy and other European countries.

The following committee arranged for the presentation ceremonies: Benjamin B. Thayer, New York, chairman; George S. Webster, Philadelphia; Walter M. McFarland, New York; William McClellan, Philadelphia.

Prof. Comfort A. Adams, chairman of The John Fritz Medal Board of Award presided at the ceremonies. Addresses were made by James R. Sheffield, president of the Union League Club; Prof. Michael I. Pupin of Columbia University, and Ambrose Swasey.

The John Fritz gold medal is presented for achievement in applied science as memorial to John Fritz, American engineer, who was the first recipient. Other recipients of the medal have included Lord Kelvin, George Westinghouse, Alexander Graham Bell, Thomas Alva Edison, Charles T. Porter, Alfred Noble, Sir William Henry White, Robert W. Hunt, John Edison Sweet, James Douglas, Elihu Thomson, Henry Marion Howe, J. Waldo Smith, George W. Goethals and Orville Wright.

Bureau of Mines To Study Iron Mining Problems

An investigation in progress at the Southern experiment station of the Bureau of Mines, Birmingham-Tuscaloosa, Ala., relates to the location of low-grade high silica iron ores, the support of mines and the ventilation of the mines of that district. Large blocks of iron ore will be cut to uniform size and tested with a view to determining their crushing strength as a basis for the calculation of size and arrangement of pillars in the mines. Subsidence in iron mines will also be investigated, involving a careful study of surface and underground conditions. Metalmine ventilation and the dust problem are to be studied in a manner similar to that which has been followed in certain districts of the North and West.

First Aid Instruction Given in Several Metal Mining Districts

The personnel of mine-rescue car No. 6 of the Bureau of Mines has recently given first aid training to employees of lead mines and smelters at Flat River, St. Francois, and Desloge, Mo. The crew of rescue car No. 7 has trained employees of the Barnsdall Zinc Co. and the Chanute Spelter Co. in the Joplin, Mo., district. Car No. 9 recently completed training in the Butte, Mont., district and proceeded to the Coeur d'Alene district of Idaho. First aid, mine rescue and allied safety work has been done by car No. 10 on the Mesabi and Vermilion iron ranges of Minnesota. Jesse Henson, station foreman at the Wilkes-Barre, Pa., safety station of the Bureau of Mines, recently gave first aid training to employees of the New Jersey Zinc Co., Franklin, N. J.

MEN YOU SHOULD KNOW ABOUT

P. A. Robbins is visiting New York.

Felix E. Wormser has returned to New York after spending eight weeks in the field in the Pacific Northwest.

Albert Roberts of the Salt Lake City office of the Minerals Separation Co., is in New York.

Daniel M. Drumheller has been appointed superintendent of the Talache Mines, Inc., at Talache, Idaho. Mr. Drumheller has been active in mining in British Columbia, Washington and the Coeur d'Alenes.

A. E. Vandercook has purchased the plant and goodwill of the California Ore Purchasing Co. at Sacramento, Cal. The company will be known in the future as the A. E. Vandercook Engineering Co., and in addition to operating a laboratory and ore-testing plant will act as metallurgical engineers and manufacturers, designing and erecting complete milling units. C. Tilton remains with the new company as chemist.

H. R. Chartran is on his way to Paris and Russia.

Frederic H. Sexton, of Halifax, Nova Scotia, is at Santa Barbara, Cal.

F. J. Siebert has returned to Reno from a professional visit to Randsburg, Cal.

Edwin J. Collins has returned to Duluth from a six weeks' examination trip in Nevada.

W. W. Mein was in San Francisco recently. He visited Ely, Nev., on his way back to New York.

J. E. White spent several days recently in the White Hills mining district, near Kingman, Ariz.

George M. Hall left June 28 for Billings, Mont., for a few months of field work in Fergus county.

J. C. Kinnear, of the Nevada Consolidated Copper Co., McGill, Nev., was recently in San Francisco.

C. D. Avery has returned to Washington from Wyoming, where he has been making oil investigations.

M. R. Campbell and K. K. Kimball are engaged in a survey of the Deep River coal field of North Carolina.

Edwin Higgins has returned to San Francisco after attending the American Mining Congress conference at Denver.

T. A. Rickard attended the International Mining Convention at Nelson, B. C., and delivered an address on July 4.

G. R. Mansfield, of the U. S. Geological Survey, who has been working in Tennessee, has returned to Washington.

N. J. Tubbs reached San Francisco June 22, and left immediately for Eel river, where he will make power investigations.

Robert N. Bell, of Boise, Idaho, who is operating the Red Bird mine in Custer County, returned recently from Rochester, Minn.

Adolph Knopf was in Washington June 26-30 in connection with the preparation of his report on the Rochester district of Nevada.

Howard D. Smith, of New York, was in San Francisco recently in connection with the reorganization of the Consolidated Coppermines Co.

A. M. McQueen, vice president of the Imperial Oil Co. is making a tour of inspection of the properties of the company in western Canada.

C. E. Van Orstrand will make temperature tests in some of the oil fields of Ohio, Indiana, Illinois, Wyoming, Montana, California and Oklahoma.

G. A. Jahn, chief engineer of the Mahoning Ore & Steel Co., at Hibbing, Minn., has been transferred to the Philadelphia office of the Midvale Steel Co.

E. E. Jones has temporarily discontinued work in Colorado to make a geological examination near Fallon, Nev., at the request of the Secretary of the Interior.

C. W. Newton, general manager of the Callahan Zinc-Lead Co., in the Coeur d'Alenes, returning the last week in June after attending the annual directors' meeting of the company.

Teshihisa Sato, chief engineer for the South Manchurian Railroad, at Daiyen, China, recently made a tour of inspection of the open pits and underground mines on the Mesabi iron range.

F. L. Hess, D. F. Hewett, C. W. Cooke, G. R. Mansfield, W. T. Lee, K. C. Heald and W. T. Thom, Jr., geologists in the service of the U. S. Geological Survey, have returned to Washington after field trips.

F. A. Mott, assistant general superintendent in the Virginia district, Minnesota, for the Oliver Iron Mining Co., has been promoted to the position of general superintendent of that district effective June 1.

G. F. Loughlin is making a western trip in the interest of the U. S. Geological Survey. The trip will include visits to Leadville, Denver, Los Angeles, and San Francisco. He will return to Washington on July 15.

George Washington University has conferred the degree of Doctor of Philosophy on Oliver Bowles, an engineer connected with the non-metallic minerals section of the U. S. Bureau of Mines.

Perry Harrison, recently appointed general manager of the Portland Gold Mining Co., at Cripple Creek, Col., to succeed George M. Taylor, has resigned. J. W. Ady, of Colorado Springs, has been named to take his place.

G. M. Butler, dean of the Arizona School of Mines, at Tucson, expects to complete this fall a geological map of Arizona, which will indicate every ore deposit and show the general character of the formation in each section of the state.

L. W. Stephenson, of the U. S. Geological Survey, was in Raleigh, N. C., June 29, in conference with Dr. Joseph Hyde Pratt concerning the publication of a co-operative report on the Cretaceous formations of North Carolina.

Justice Grugan has just returned from a six-weeks' trip to the mines and prospects in the vicinity of Timmins and Kirkland Lake in northern Ontario. Mr. Grugan inspected the underground workings of the Dome, Hollinger, and Lake Shore Mines.

J. J. Dirzulaitis and D. S. Wallace, of the U. S. Geological Survey, are establishing gages on the Potomac River near Brunswick, Md., to determine the relation of slope to discharge for use as a factor in computing records of flow at the Survey's station at Point of Rocks.

W. B. Daly, assistant general manager of the Anaconda Copper Mining Co., Butte, Mont., was a recent visitor on the Mesabi and Vermilion iron ranges in Minnesota where he studied the un-

derground mining methods. His trip also included the copper and iron regions of Michigan.

Dr. G. A. Young, of the Canadian Geological Survey, in collaboration with the British Columbia Department of Mines, will begin a detailed investigation of the iron-ore deposits of the province in connection with the proposed establishment of an iron and steel industry on the Pacific Coast.

H. Kenyon Burch has been engaged to design a 5,000-ton concentrating plant for the New Cornelia Copper Co. of Ajo, Ariz. Mr. Burch has opened offices at 806-9 Junior Orpheum Building, Los Angeles, Cal., and will continue his work on the design and construction of mining and metallurgical plants.

James A. Stader has been placed in charge of the minerals section of the iron and steel division of the Bureau of Foreign and Domestic Commerce. He will give special attention to non-metallic mineral products and to the non-ferrous metals. Mr. Stader received his technical training at the University of Missouri. He has had extended practical experience in Mexico and in the Far East. He was one of the technical advisers of the Inter-Allied Industrial Commission.

SOCIETY MEETINGS ANNOUNCED

The American Chemical Society will hold its annual fall meeting at Pittsburgh, Pa., September 4-9. The divisional meetings will be held at the Carnegie Institute of Technology, and the general meetings are scheduled at Carnegie Music Hall.

The program of the Eleventh Annual Safety Congress of the National Safety Council at Detroit, Aug. 28-Sept. 1, has been completed. All meetings will be held in the new Cass Technical High School. Other facilities for sectional and committee meetings are provided in the same building. A pageant on the history of Detroit from the early pioneer days up to the present city with its manufacturing and safety development, will be staged at the annual banquet.

OBITUARY

Captain S. Burk Burnett, aged seventy-three, died recently at Fort Worth, Tex. Captain Burnett was the owner and manager of thousands of acres of Texas land. The oil town, Burkburnett, was named after him, and in addition to his vast grazing lands, his oil interests were immense. His land was among the first in Texas to reveal presence of oil.

THE MINING NEWS

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Leading Events

ANNOUNCEMENT is made by officials of the American Smelting & Refining Co. that a by-product coke plant will be erected in Coahuila, Mexico, if final negotiations with the Obregon government turn out as expected.

Hollinger Consolidated has abandoned its exploration work at Elbow Lake, in Manitoba, after spending a large sum.

Merger of the Columbia Steel Co. on the Pacific Coast with interests controlling coal mines and iron-ore deposits in Utah presages development of a Western basic iron and steel industry.

H. N. Lawrie has addressed a letter to companies

producing silver in Mexico urging that co-operative measures are necessary to sustain the price of silver.

New Cornelia will increase the scale of operations at its leaching plant at Ajo, Ariz. The output is to be 4,000,000 lb. of copper monthly by Aug. 1.

Discovery of a new vein that should increase the life of the Success mine in the Coeur d'Alene region, of Idaho, is reported.

The Federal Lead Co. is overhauling No. 4 concentrator in Southeast Missouri lead district. The plant has been idle for two years, but the improved lead market warrants resumption on a basis of 4,000 tons per day.

Byproduct Coke Ovens Planned by A. S. & R. Co. in Coahuila

Erection of \$7,000,000 Plant Awaits Final Agreement with Obregon Government

The American Smelting & Refining Co., according to an announcement by William Loeb, Jr., vice-president, will erect a new by-product coke plant in Mexico at an estimated cost of \$7,000,000 as soon as negotiations with the Mexican Government, now pending, are consummated. Mr. Loeb, who was in Mexico in April conferring with President Obregon and other officials, said that the proposal was enthusiastically received. He explained that construction will not begin until official authorization has been received from the Mexican Government and a definite agreement reached as to matters pertaining to taxation.

The site for the new plant will be in Coahuila, in the district of Sabinas. Mr. Loeb said the plans in addition to the necessary technical equipment provide for the erection of a model village to house the workers. The new plant, when completed, will have a capacity of about 20,000 tons per month.

It is understood that the Mexican Government, while favoring the proposal, has not yet been able to see its way to grant all the company has asked in the way of taxation concessions. It is believed, however, that an agreement acceptable to both parties will be reached during the next few weeks and that instructions to commence construction will follow.

Fifteen Million Dollar Corporation Will Establish Basic Steel Industry on Pacific Coast

W. E. Creed, president of the Columbia Steel Co., of San Francisco, announced on June 30 that negotiations had been completed for the organization of a new company for the manufacture of iron, steel, and steel products. Involved in the new corporation are the steel foundries of the Columbia Steel Co. at Portland, Ore., and at Pittsburg, Cal., and extensive coal and iron mines and properties in Carbon and Iron Counties, in Utah, that have been controlled by the Utah Coal & Coke Co., of Salt Lake City. The details of the organization are not yet definitely announced but the plan to utilize the raw materials from Utah for the production of iron and steel either in Utah or on the Coast marks an important step in the development of the West.

New Cornelia Copper Co. Starts Leaching Plant at Full Capacity

According to announcement from the Boston offices the New Cornelia Copper Co. at Ajo, Arizona, resumed the operation of its entire plant on July 5, with the expectation of reaching a capacity production of approximately 4,000,000 lb. monthly by August 1, as against the present output of 1,500,000 lb. The company has let the contract for the erection of the new 5,000-ton flotation mill.

Simon Silver-Lead Absorbs Smaller Companies

Smelter Near Los Angeles and Nevada Mines Acquired

P. A. Simon, president of the Simon Silver-Lead Company has announced the organization of a new corporation to be known as the Simon Silver-Lead Mines Co. to take over the Simon Contact and Simon Sterling mines situated near Mina, Nev., and the Kirk-Simon smelter at Harbor City, Calif.

To accomplish this consolidation the capitalization of the Simon Silver-Lead Mines Co. will be increased by 1,000,000 shares, 245,390 of which are to be exchanged for the outstanding stock of the other companies and the balance to remain in the treasury.

This merger has been underwritten by a syndicate which Simon says will assure adequate working capital to carry on the extensive improvements that have been planned for both the mill and mine and the smelter.

Results of development work on the 400 level of the Simon Silver-Lead mine are satisfactory. In two short crosscuts off the main southwest crosscut five feet of ore has been exposed which averages 60 oz. silver and 4 per cent lead. The mine is producing about 180 tons of ore per day and the usual shipments of lead-silver concentrate are being made to Utah smelters. Work has been started on a new three-compartment shaft and contract bids for the shaft sinking to a depth of 600 ft. are being received. This new shaft is necessary to maintain an output of 250 tons daily.

Hollinger Abandons Exploration at Elbow Lake

Work Fails to Disclose Workable Ore in Manitoban Property

BY ALEXANDER GRAY

Noah A. Timmins, president, and A. F. Brigham, general manager of the Hollinger Consolidated Gold Mines, have returned from their inspection of the work done on the Murray properties, at Elbow Lake in Northern Manitoba. In the course of a few days they will formally announce an adverse decision. Meanwhile the field force has been withdrawn. To all intents and purposes, Elbow Lake is a past issue with them. Considering the fact that they built a road from the railway, a distance of fifty miles or more, equipped camps, provided facilities for thorough testing, and had supplies for an extended period, the abandonment of the project will be a disappointment to those interested in the northwestern fields. However, the series of cross-trenches, test pits, and sampling precluded further work.

It is understood other interests have had similar experiences. Of course Mr. Timmins will not speak for the London Exploration, Tonopah, Nipissing, McIntyre, and the Mining Corporation of Canada. The story he will tell will detail exactly what was accomplished, by an expenditure that will be written off on profit and loss account.

The so-called Hollinger undertaking impelled various corporations to take over Elbow Lake areas. The Murray claims involved in the Hollinger deal were represented to have spectacular gold showings which were the theme of descriptive writers from New York to Vancouver. Specimens were captivated. Quartz outcropped for a lateral distance of approximately 3,000 ft., and across a zone of about 300 ft.; numerous "splotches" of free gold indicated that the high grade might provide a workable low-grade average over the whole section.

It was realized that the horizontal splotches and cooling cracks—all flat—might be mere evidences of surface enrichment. The geologic structure was of the "something-of-everything" sort resting upon granite.

It has been demonstrated to the satisfaction of the Hollinger people that the enrichments noted have little or no vertical continuity. Pits sunk on the spots sampled by the engineer, who brought the matter to the attention of Hollinger directors, entered barren ground; a few stringers carried pyrite but pay streaks were conspicuous by their absence.

Equipment for Sinking 3-Compartment Shaft Needed at Cobalt

The Noranda Mines Co. will install a mining plant on the Colonial property in Cobalt, Ontario, to sink a three-compartment shaft 900 ft. deep. Skips will be used in sinking.

Johns-Manville Company Bonds Quebec Asbestos Property

The Johns-Manville interests have taken an option on the property, including two mills, of the Bennett Martin Asbestos & Chrome Mines, Ltd., at Thetford, Quebec. The terms provide for a three-year lease with the privilege of purchasing for \$2,750,000. The mines are in operation, the output being consumed by the Johns-Manville manufacturing plants.

International Nickel Co. Pays Smoke Farmers \$925 on Claims Totaling \$20,000

In the first awards under the new Fumes Arbitration Act of 1921, four claims totalling \$20,000 for smoke damages in the Sudbury district of Ontario were settled by the International Nickel Co. for \$925. The judge found that the claims had been grossly over-exaggerated and that injuries from frosts, crop diseases, and other blemishes had been charged up without distinction to sulphur fumes. The Fumes Arbitration Act provides legislation under which litigation is supplemented by arbitration, the awards of which are final.

New A. S. & R. Board Re-elects Old Officials

Following the election of the new board of directors of the American Smelting & Refining Co. on June 27 the old officers were named to succeed themselves. The directors who do not hold executive positions are represented on the finance and executive committees. The latter is composed of Simon Guggenheim, president, ex officio; E. L. Newhouse, chairman of the board, ex officio; F. H. Brownell, William Loeb, Jr., H. A. Guess, H. A. Prosser, Hamilton Brush, Roger W. Straus, C. A. H. de Saulles, Lyman Candee, E. C. Jameson, Wilfred Shore, Frederick T. Walker, E. C. Wagner, and Charles D. Hilles.

An advisory committee has been appointed to act as an operating committee and to advise the board of directors on operations and policies. Its personnel is as follows: Simon Guggenheim, ex officio; F. H. Brownell, chairman; E. L. Newhouse, William Loeb, Jr., vice president; H. A. Guess, vice president; Roger Straus, assistant to president; C. A. H. de Saulles, manager zinc operations; Hamilton Brush, manager sales department; F. R. Raiff, traffic manager; E. R. Reets, director of purchases; H. W. York, chief engineering department; F. W. Hills, controller; J. C. Emison, treasurer; Charles Earl, general counsel; G. P. Bartholomew, general manager coal department; L. G. Eakins, consulting metallurgist; H. H. Alexander, refining operations, and William H. Pierce, refining operator.

Lawrie Urges Measures for Price Stabilization

Addresses Letter to Producers of Mexican Silver—Sees Fall in Price Unless Systematic Marketing Is Arranged

With the replacement by purchases under the Pittman Act of the Government's silver reserve more than half completed, and with the acceleration of production caused by the increased activity in the mining of other non-ferrous metals, it is estimated that not more than eighteen months will elapse before the reserve will have been replaced. Domestic silver will then be sold in the open market. In this connection, it is pointed out that the international price doubtless will be affected adversely prior to the expiration of the Pittman Act. In connection with the necessity for meeting the situation by providing for the more systematic marketing of silver produced in Mexico and in the United States, H. N. Lawrie, of the American Gold and Silver Institute, has written the operators of mines in Mexico as follows:

"When the purchases of domestically produced silver under the Pittman Act are concluded it seems inevitable that the open market price of silver will be subjected to the selling pressure of the newly produced silver of the United States. Unless something is done to establish the machinery by which the sale of newly produced silver, both in the United States and Mexico, may be regulated in a more orderly manner, the silver producers throughout the world will feel the adverse effect of this new condition in the international market.

"The price will probably decline before the Pittman Act purchases expire as the psychology of the buyer, in the absence of a well-organized selling agency, will dominate the situation in anticipation of the lowered price. Purchasers under the Pittman Act amount approximately to 114,000,000 oz., leaving the balance yet to be purchased of 94,000,000 oz.

"The interest of every silver producer throughout the world is so vitally affected that as a business proposition they should be willing to unite in an organized effort in this country to stabilize the price of silver at a level which would insure the future profitable operation of the industry.

"As has been pointed out previously, the interest of the silver consumer can be protected in no more effective way than to stabilize the production of silver.

"Since the American interest in the production of silver in the world from an investment standpoint is dominant, it would seem necessary in order to insure the success of such a movement that the American producers assume the initiative in creating the organization.

"There is a vast amount of work to be done in designing the credit and selling machinery of such an organization and in obtaining in advance of actual operations the united support of the world's silver producers. There is no time for delay in developing the details of such an organization if the future interest of the silver mining industry is to be protected."

News from Washington

By PAUL WOOTON
Special Correspondent

Production of Copper Increased; Lead Decreased in May

With copper production in May 16 per cent greater than in April, and exceeding by 266 per cent the production of May, 1921, the Federal Reserve Board in its analysis of the economic situation, issued July 1, sees promise for a continuation of the expansion of non-ferrous mining operations. The board's statement is as follows:

Mining operations continued to expand during June in the case of all important non-ferrous metals except lead. Copper production amounted to 88,713,900 lb., which was 16 per cent larger than in April and about 266 per cent greater than in May, 1921. Despite the impressive increase in production during the past three months, the general trend of copper prices has continued to be upward. Domestic demand for copper slackened considerably during June, but foreign demand was well maintained.

Zinc production in May amounted to 27,419 tons, which was about 8 per cent in excess of the April output and 51 per cent larger than in May, 1921. Stocks of zinc continue to decline and totaled only 40,409 tons at the end of May, as compared with 83,721 tons on May 31, 1921. Production is being materially augmented by the reopening of properties which have been idle for over a year.

The output of pig lead in May was about 1.8 per cent less than in April, but was 12 per cent greater than in May, 1921. The May silver production totaled 4,257,973 oz., in comparison with 4,138,580 oz. in April.

Cost of Gathering Copper Statistics Infinitesimal, Says Dr. Smith

The cost to the Government of gathering mineral and metal production statistics is infinitesimal when compared with the value of the product. This fact has been brought out strikingly by George Otis Smith, the Director of the U. S. Geological Survey, in reply to a correspondent who suggests that Government expenditures could be reduced greatly if fewer statistics were collected. Director Smith points out that it would be hard to prove just who pays this expense, but granting that in the end such a tax is paid by industry in general, Dr. Smith has calculated the direct cost of all expenses to the Government of collecting and publishing the production statistics in copper. This service to the general public and to the mining industry costs eight-tenths of one mill per ton of copper, he figures.

Dr. Smith calls attention, however, to the fact that the cost to individual companies in answering the inquiries from various Government bureaus is doubtless large and probably is larger

than necessary; but, he remarks, the direct cost of Geological Survey copper statistics, if done away with, would not do much toward lowering living costs.

Stocks of Coal Are Depleted

Reserve supplies of coal have been depleted very considerably throughout the country, say agents of the Federal Reserve Board in reporting on the coal situation. The agent in Atlanta reports that Western railroads are making heavy purchases in Alabama. The board in its July 1 analysis of the business situation, states that "prices are steady since the agreement of the operators as to fair spot prices at the mines."

As a result of the shortage of beehive coke, the board says in its report, many steel manufacturers are relying chiefly upon by-product ovens and as a result the stocks of by-product coke have been much reduced. The agent of the Federal Reserve Board at Philadelphia, states that some of the steel producers in his district have been forced to close down or curtail operations because of the shortage and the high cost of coke.

Problems in Mine Ventilation Will Have Intensive Study

More exhaustive determinations with regard to the flow of air in restricted passages and the flow of air through pipes, than have been undertaken ever before, are to begin at once under the Bureau of Mines' auspices at Butte. For several years Daniel Harrington of the Bureau of Mines staff has been conducting studies in mine ventilation in Butte district. Much work has been done by the safety department of the Anaconda company. During the next fiscal year, the Bureau of Mines expects to do more intensive work on these problems. Mr. Harrington will have the assistance of George E. McElroy and K. T. Sparks, mining engineers, who have had extended experience with the problems involved. The Montana School of Mines has provided headquarters from which the work will be conducted.

Silver Purchases Under Provisions of the Pittman Act Total 116,197,506 Oz.

Purchases of silver by the Bureau of the Mint during the week ended July 1 amounted to 150,000 fine ounces. This brings the total purchases under the Pittman Act to 116,197,506. The total to be purchased before the provisions of the act become ineffective is \$208,000,000. The rate of production is expected to increase materially.

Bureau of Mines Has \$1,580,900 Available for Next Fiscal Year

For the fiscal year which began July 1, the Bureau of Mines has at its disposition appropriations totaling \$1,580,900. A portion of this amount is reserved for contingencies and certain allotments still are to be made, but the principal distributions of the year's fund have been made. The following list indicates the scope of the work done by the Bureau:

Technical work at the Pittsburgh experiment station in connection with mine explosions.....	\$53,154
Investigations as to causes of mine explosions.....	64,490
Mine-rescue stations.....	50,004
Tests of explosives.....	50,737
Tests of coal-mine dusts and gases.....	31,655
Investigations of accident prevention appliances.....	10,400
Use of electricity in mine operations.....	16,240
Investigations of sanitary and health conditions in mines.....	29,400
Collection of mine-accident statistics.....	18,840
Other technical investigations pertinent to mining industries.....	53,080
Operation of mine-rescue cars.....	211,000
Equipment of mine-rescue cars.....	75,000
Technical service at Pittsburgh in connection with mineral-fuel investigations.....	20,210
Tests of mineral fuels.....	40,890
Investigations of mineral fuels with a view to their more efficient use.....	40,020
Investigations of mineral fuels with a view to their more efficient preparation and treatment.....	34,880
Elimination of waste in the mining, preparation and treatment of ores.....	14,430
Investigations concerning the preparation and treatment of ores.....	32,370
Investigations concerning the utilization of ores.....	64,685
Economic studies of the production and preparation of ores.....	13,515
Investigations with a view of developing more efficient methods of oil drilling.....	22,420
Investigations with a view of developing more efficient methods of storing and transporting petroleum.....	38,773
Oil-shale investigations.....	8,920
Economic studies of petroleum.....	40,842
Mining experiment stations.....	170,000
Maintenance of buildings and grounds and other expenses at the Pittsburgh station.....	55,000
Investigations with a view to improving conditions in the mining, quarrying and metallurgical industries.....	35,000
Supervising oil and gas leases.....	123,490
Supervising coal, phosphate and potash leases.....	14,540
Administrative expense connected therewith.....	16,970
Purchase of land for the Pittsburgh station.....	28,000
Technical and scientific books.....	1,000

Leases on Indian Reservations Proposed by Smoot

A bill authorizing twenty-year leases under regulations of the Interior Department for mining purposes, including the production of oil and gas, on Indian reservations in Arizona, New Mexico and Utah created by order of the President or the Interior Department, has been introduced by Senator Smoot of Utah. Proceeds from the leases shall be divided equally between the Indians, the state in which located, and the Reclamation Service.

News by Mining Districts

London Letter

Oroville Dredging Co. Profits from Share Holding in Other Companies Reorganization Planned—Falcon Mines Development Gives Hope

By W. A. DOMAN

London, June 23—From profits from its various interests the Oroville Dredging Co. has paid dividends for several years, and judging by the optimism officially expressed a period cannot yet be put to the company's good fortune. In connection with a scheme for taking over the Nechi Mines, which it already controls, the directors of the Nechi company say that the Oroville company is now paying dividends at the rate of 15 per cent per annum "and should continue to do so for many years to come, based upon revenue to be derived from the assets controlled by that Company." The Oroville company's interest in Pato and Nechi is shown by the following figures appearing in the reports issued a few days ago.

	Dividends received	
Nechi—125,993 ordinary shares of 10s.....	£62,997	
Pato—89,227 shares of £1,	£93,616	
Following is a comparison of the operations of the two mines for the twelve months ended September 30.		
	Nechi	Pato
Cubic yds. dredged	2,628,684	1,555,937
Value	653,088	608,511
Average value per cubic yard, cents	24.8	39.1
Average depth dredged, feet	43.9	33.1
Field cost per cubic yard, cents	6.40	11.33
Other expenses, cents	3.63	4.65
Total production cost per cubic yd., cents,	10.03	15.98

There are many notable differences, value, depth, and cost standing out prominently. The Oroville Dredging Co. is now offering to exchange two of its own £1 fully paid shares for seven Nechi preference shares of 10 s. each, fully paid, the attraction to the latter being Oroville's dividend paying with a free market. In order to carry out the scheme the Oroville company's capital is to be enlarged from £700,000 to £740,000. The Oroville company also owns a controlling interest—255,000 shares—in the Columbian Corporation, which is working the Constancia mine. The ore reserves at this mine are estimated at 300,000 tons above the 3rd level, of an average value of from \$6 to \$8 per ton, with probable ore between the 3rd and 4th levels amounting to 70,000 tons of an average value of from \$8 to \$10 per ton. With an extraction of 85 per cent \$3 is estimated to cover working costs including development, and on the completion of the 300-ton mill an annual profit of £70,000 to £100,000 is estimated. In connection with this property an expenditure of £100,000 is anticipated, and arrangements have

been made to borrow this sum on advantageous terms.

A good deal of interest is being taken at the moment in Falcon Mines (Rhodesia) from which encouraging development is reported. An auxiliary shaft is being sunk from No. 12 level to No. 14 level, and between 40 ft. and 50 ft. down reef appears, part of which is dipping through the shaft. The shaft seems to have been sunk through about 30 ft. of reef, and "an average sample" assays 5 dwt. gold, 9 dwt. silver, and 1½ per cent copper equal to 33 s. 4 d. over 65 in. exposed. At the end of June, 1921, the reserves of 417,000 tons of sulphide ore were valued at 44 s. 7 d., while there were 52,000 tons of lower grade stuff at 32 s. 8 d. per ton.

Johannesburg Letter

Production Statistics for April Indicate Rapid Return to Normal Operating Basis

By JOHN WATSON

Johannesburg, May 30—The value of the gold produced in the Transvaal for April showed a drop of nearly £1,000,000 in value as compared with that of December, 1921. The comparison of individual mines is instructive as showing to what extent the operations of gold-winning are being resumed:

Company	December, 1921		April, 1922	
	Oz. fine gold		Oz. fine gold	
Aurora West.....	2,917		2,135	
Brakpan.....	22,594		14,201	
City Deep.....	34,288		27,033	
Consolidated Langlaagte.....	12,686		7,742	
Cons. Main Reef.....	17,788		13,039	
Crown Mines.....	44,440		43,988	
Durban R. Deep.....	8,699		8,183	
E. R. P. M.....	32,371		22,997	
Ferreira Deep.....	7,219		4,464	
Geduld.....	17,065		15,781	
Geldenhuis Deep.....	13,332		10,160	
Government Areas.....	59,998		47,283	
Knight Central.....	6,883		4,773	
Langlaagte Estate.....	13,550		11,988	
Luipaardsvlei.....	4,193	No return		
Meyer and Charlton.....	8,618		6,895	
Modder B.....	28,640		20,700	
Modder Deep.....	22,997		20,561	
Modder East.....	10,499		8,136	
New Modderfontein.....	48,441		28,801	
New Goch.....	3,908		3,390	
New Primrose.....	5,122		3,283	
New Kleinfontein.....	13,393		6,846	
New Unified.....	2,545		1,826	
Nourse Mines.....	14,859		11,421	
Randfontein.....	33,788		25,798	
Robinson.....	8,772		4,447	
Robinson Deep.....	18,897		13,224	
Rodepoort U. M. R.....	3,669		1,918	
Rose Deep.....	13,109		9,882	
Simmer and Jack.....	14,203		8,548	
Springs Mines.....	18,813		13,635	
Van Ryn Estate.....	9,851		6,223	
Van Ryn Deep.....	27,680		16,285	
Village Deep.....	15,423		14,796	
West Rand Cons.....	9,390		9,001	
Witwatersrand.....	11,139		6,423	
Witwatersrand Deep.....	10,393		8,340	
Wolhuter.....	7,757		6,313	
Miscellaneous.....	4,991		2,943	
Glynn's Lydenburg.....	1,468		1,575	
Sub-Nigel.....	6,511		5,597	
T. G. M. Estates.....	4,776		5,622	
Miscellaneous.....	4,157		2,943	

The position as regards native mine-workers is rapidly improving. At the beginning of April 125,331 "boys" were at work; by the end of April this figure was increased to 139,072. By May 10, another 8,000 has been added to the labor force on the gold mines. The number of natives employed on the gold mines in December last was 177,836.

BRITISH COLUMBIA

Nickel Plate Mill Near Hedley Is Started Again—Rambler-Cariboo Lessee Ships Concentrate Regularly

Three Forks—A. W. Cameron, lessee of the Rambler-Cariboo mine, has shipments underway to Trail smelter, following resumption of milling operations. It is likely that production will be maintained for the balance of the season.

Sandon—Silversmith Mines, Ltd., is producing at capacity, with the mill output averaging 500 tons per month. Upwards of 100 men are employed.

Revelstoke—Drilling for oil has started at Hall's Landing, on the Columbia River, a few miles south of here. The company undertaking the exploration work is known as Atlas Petroleum Co., and is financed by coast and local capital.

Kaslo — International Royalty & Leasing Co., in which Kaslo and Spokane capital is interested, has been formed with the object of acquiring and developing mining properties along the South Fork of Kaslo creek, and in the Slocan. It is understood that the first mining properties acquired were the Flint, Index and Revenue groups, all of which have been inactive for two years. Head offices of the company are in Spokane.

Kimberley—Preliminary work on the big concentrator to be erected by the Consolidated M. & S. Co. for the milling on Sullivan mine ores, is under way.

Rossland—Appearance of the War Eagle, Centre Star, and other big structures and shaft houses of the Consolidated company mines here is being greatly improved by long-deferred coats of paint. Some concrete work is being done around the shaft houses also.

Hedley—The 40-stamp mill at the Nickel Plate mine, which was closed early in the fall of 1920, has been put into operation again. The Nickel Plate has been one of the best gold-producing mines in the province. Development work at the mine was commenced early in the present year, and it is expected that milling operations will be continued. The mill is crushing about 200 tons daily, and sixty men are employed at mine and mill. The company expects to spend about \$30,000 in diamond drilling during the present year.

Nelson—W. Y. Williams, at one time mine superintendent for the Granby company and now manager for Cork-Province Mines, Ltd., has made a thorough examination of the latter's property and together with W. E. Zwicky, president of the company, has laid out a plan for the development of the mine. The 45-ft. winze on the cast orebody is to be sunk to the 100-ft. level. A three-compartment shaft

is to be started, and when this reaches the 100-ft. level, drifting will be started to connect with the winze. A hydro-electric plant is to be erected on Kaslo Creek, and will have sufficient capacity to supply all the power required at both mine and mill. The mill will be started early in August, and the zinc-blende, which in the past has been allowed to run away with the tailings, will be saved by flotation. Blende is the predominating mineral in the ore, and preliminary tests indicate that the zinc concentrate will net the company about \$15 per ton under the new schedule at Trail.

Stewart.—C. A. Banks, consulting engineer of the B. C. Silver Mines, Ltd., has returned from London, where, it is understood, financial arrangements have been made for development. The Selukwe Gold Mining Co., of the Rand, South Africa, owns a two-third interest in this company, the remaining third being owned by the Premier Gold Mining Co., which bought out the interests owned by O. B. Bush and Grant Mahood last fall. The B. C. Silver Mines' claims adjoin the Premier property on the north.

The bullion plant for working up the precipitate from the cyanide plant at the Premier mine has been completed, and the first consignment, weighing about 800 lb., has been shipped from the mine. The Premier company is about to erect a number of bungalows for its married employees.

Trail.—Ore shipments received at the smelter during the second week in June totaled 8,117 tons, of which 7,193 tons came from the company's own mines. The other shippers were: Bell, Beaverdell, 42 tons; Highland, Ainsworth, 87 tons; Quilp, Republic, 106 tons; Sally, Beaverdell, 37 tons; Silversmith, Sandon, 452 tons; Silver Horde, Ainsworth, 17 tons; Silver Standard, New Hazelton, 40 tons; Surprise, Republic, 104 tons; and White-water, Retallack, 39 tons.

ONTARIO

Vipond Seeks \$250,000 for Development—New Hydro-electric Power for Porcupine Expected by Year End

Cobalt.—The McKinley mill is now treating 4,000 tons per month, with heads running 13 to 14 oz.

Crosscutting on the 400 level of the Genessee has resulted in the discovery of several small veins, some of which carry silver.

Kirkland Lake.—Boston-McRae will shortly start work on its Gull Lake claims in Lebel Township.

During May the Lake Shore mill treated 2,212 tons, and recovered \$40,834, or an average of \$18.36 per ton. This is the lowest average recovery per ton made in any month during the present year.

The Harvey-Kirkland Mines, Ltd., is the name of a new company having a capital of 5,000,000 shares of \$1, which will undertake development of the Harvey claims.

Lightning River Gold Mines is meeting with good results in its campaign for further development work.

Porcupine.—The committee of directors of the Vipond, who were given the task of finding means of raising money to continue operations after the present finances are exhausted, will meet on July 7. No definite source of money has yet come to light. Approximately \$250,000 is the amount needed to put the mill in shape and complete development work according to present estimates.

During May the Dome Mines treated 28,400 tons and produced \$325,000, an average of \$11.40 per ton. Costs were approximately \$5 per ton.

Work on the hydro-electric power development below Sturgeon Falls is being rushed and unless any unex-

Russian Soviet Government To Stop Exploitation of Siberian Mines

By Cable from Reuters to "Engineering and Mining Journal-Press."

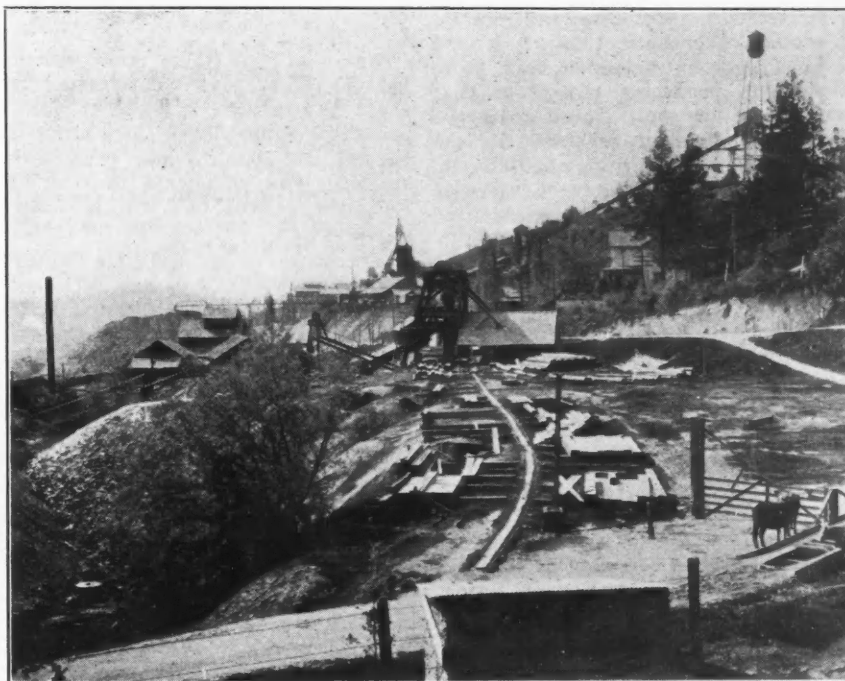
Moscow, June 26.—It is reported that the government intends to stop the exploitation of all Siberian gold mines, as the state is unable to provide food for the workers.

CALIFORNIA

Platinum in Hayfork District—Work at Oro Mine—Prospecting for Oil Near Oakland

Special Correspondence

San Francisco.—The Security Trust Co. and Bert McBride have brought suit in the Superior Court at Redding, Cal., to foreclose on a trust deed given by



A shaft of the Kennedy Mining & Milling Co., Jackson, Calif., and shaft of the Argonaut Gold Mining Co. in the background

pected setbacks are met with, Porcupine mines will be able to obtain power from this source before the end of the year. The new plant is expected to supply an additional 7,000 hp., of which McIntyre has first call on 50 per cent.

Funds are being supplied for the further development of the Herrick property in the Shining Tree district. It is proposed to sink the shaft to 500 ft. and do 2,000 ft. of lateral work on the several levels.

Toronto.—The Canadian government has issued a proclamation extending the embargo on the export of gold coin, gold bullion and fine gold bars, which terminates July 1 for another year. The proclamation is issued under an act passed three years ago authorizing the continuance of the measures taken during the war to prohibit the export of gold.

the Afterthought Copper Co. in 1912 to secure the payment of \$800,000 in 6 per cent bonds.

The discovery of small amounts of platinum in the Hayfork district, near Weaverville, Trinity County, has led to an influx of prospectors. Successful work on a small scale is being done.

A 1,000-ft. tunnel is to be driven at the Oro mine, near Downieville, to intercept the vein at depth. The work is expected to take over a year. A wagon road from Downieville is under construction and additional mine equipment is being installed.

New equipment has been found to be needed for the satisfactory development of the Normandie mine, Grass Valley. Prompt sinking of the 1,000-ft. shaft will now be assured. The property is being financed by Mack Sennett and associates.

ARIZONA

**Ray Hercules Mill Will Be Enlarged—
Five Furnaces in Blast at Copper
Queen Smelter at Douglas**

By J. H. McCLINTOCK

Ray—Ray Hercules Mines, Inc., has started the rehabilitation of its Ray Hercules property. It will enlarge the mill to a capacity of 1,800 tons per day, with some changes in its equipment. The company has 207 acres of ground, within which is reported the development of 3,744,000 tons of ore, said to average 2.43 per cent copper. The overburden averages 257 ft.; the orebody is said to average about 73 ft. in thickness. The main shaft, 862 ft. deep, is well equipped; ore is hoisted by skips from stations to which haulage is by electric locomotive. The mill is at Hercules, about seven miles away. It shut down in April, 1920. It is said to have made extraction of from 75 to 83 per cent, producing concentrate that ran over 27 per cent. There was gross production of about 5,000,000 lb., the largest month returning 800,000 lb. Under the new arrangement there is expectation of a monthly product of 2,000,000 pounds with mining and milling costs expected to approximate \$5 per ton.

Miami—The Miami Copper Co. is reported to be preparing for "extensive expansions and additions," of which no details have been given. The company is employing 1,300 men, about a maximum force.

Bisbee—According to the announcement of General Manager J. C. Greenway, the designing of the new mill of the New Cornelia company at Ajo will be in the hands of H. Kenyon Burch. Excavation will be started within a few months and there is expectation that the plant will be in operation in fourteen months. It will have capacity of 5,000 tons per day, with concentrate output monthly representing about 3,300,000 lb. of copper. The concentrates are to be shipped to the Calumet & Arizona smelter at Douglas, if satisfactory freight arrangements are made. Otherwise a reverberatory might be built at Ajo. Development work has opened immense bodies of low-grade sulphide milling ore.

Douglas—At the Copper Queen smelter are being operated three blast furnaces and two reverberatories with production of about 10,000,000 lb. per month. Concentrates are being received from the Moctezuma mill at Nacozari and from the Phelps Dodge Morenci branch, which is operating one section of the No. 6 mill. Copper Queen is on a 5,500,000-lb. basis.

Tombstone—Operation of a small cyanide mill on a lease of the North Bonanza mine at Tombstone is returning 600 oz. of silver a week. Several such mills are proving successful in the Tombstone section.

NEVADA

**United Comstock Plant Scheduled for
Completion in August—Tonopah
Bullion Shipments Total
\$310,000 in Fortnight**

Virginia City—Construction work on the milling plant of the United Comstock Mines Co. at Gold Hill continues normal. The crushing plant will be completed early in August and the cyanide plant late in August. Mine conditions are satisfactory and the mining plant is about completed.

Leadville—The Leadville Mines Co. is mining and milling 40 tons of ore daily. Concentrates average 200 oz. silver and 35 per cent lead. Three carloads of concentrate have been shipped during the past month. On the 400 level, which is the deepest level of the mine and 600 ft. below the surface, the vein continues to produce good ore.

Mina—At the Mabel mine, operated by the West End Consolidated, the shaft has reached a depth of 185 ft. below the tunnel level. A station will be cut at 200 ft. and crosscutting started. Ore shipments to the West End mill at Tonopah will be started in July.

Argentite—The first payment, amounting to \$15,000, has been made on the Mohawk group of claims in this district. The main shaft, on the vein, is 200 ft. deep and lateral work is being done on this level. Preparations are being made to sink the shaft to the 500 level.

Tonopah—Bullion shipments from this district, representing the first 15 days operations in June, are as follows: Tonopah Belmont \$107,000, West End \$85,600, Tonopah Extension \$68,000. No report has been issued by the Tonopah Mining Co. as yet but their regular shipment should be about as usual, or above \$50,000. This makes production for the first half of June about \$310,000 in gold and silver.

COLORADO

Cresson Consolidated Disburses \$122,000—Vindicator Leased to United Gold Mines Pending Ratification of Sale

From Our Special Correspondent

Cripple Creek—The Cresson Consolidated Gold Mining Co. has declared a regular quarterly dividend of 10c. per share payable July 10. The dividend amounts to \$122,000. The mine is said to be in better physical condition than at any time for the past three years.

A promising orebody was recently struck in a crosscut off the 2,600 station of the Portland shaft. It is believed to be the same shoot which yielded so handsomely on the 2,400 level.

A special meeting of the stockholders of the Vindicator Consolidated Gold Mining Co. has been called for July 18, to approve the sale of the Cripple Creek holdings of the company to the United Gold Mines Co. for

500,000 shares of its treasury stock. Pending the ratification of the sale, the Vindicator property has been turned over to the United Gold Mines Co. under a ninety-day lease on a royalty basis.

E. E. Quentin, of Denver, former president of the Isabella Mines Co., has taken over the Cripple Creek holdings of that company which were recently sold at sheriff's sale and will reorganize the company. It is announced that Isabella stockholders will be afforded an opportunity to participate in the reorganization on a favorable basis.

There is a shortage of good miners in the district both on company account and with lessees. While not acute at this time, operators are apprehensive that increased activity in the mines throughout Colorado and adjoining states may seriously affect operations.

Breckenridge—The dredge formerly owned by the French Gulch Gold Dredging Co. was recently sold to the Florence Gold Dredging Co. of Denver. The plant is being overhauled preparatory to resumption of operations. H. W. Wade has been appointed superintendent.

WASHINGTON

Deposit of Ochre and China Clay Being Developed Near Deer Park—Gladstone Mountain Mine Ships Good Lead Ore

Deer Park—American Ochre Co. has been investigating a bed of high-grade China clay, together with deposits of sienna, ochre paint, and kalsomine material. Drilling has shown the area covered to be more than 100 acres; it determined a large tonnage of material to exist in beds several feet thick. It is likely a plant will be constructed shortly and a marketing organization perfected.

Chewelah—The concentrator of United Silver-Copper Mining Co. resumed operations the end of the first week in July.

Mead—The \$60,000 plant of Western Materials Co., situated between this point and Hillyard, is now in active operation. The product is magnesite "chips" for use in manufacture of stucco in building material, and magnesite cement. Crude magnesite and calcined magnesite is brought to the plant from the company's quarry and calcining plant near Valley.

Keller—The Addison Copper Co., which has been developing mining property in this vicinity for a number of years, plans to ship this summer.

Northport—A small crew is sinking on No. 2 ore chimney at Gladstone Mountain mine, and the ore taken out is to be shipped. Several extra men will be put on shortly to run a crosscut to the No. 7 chimney. Recent shipments to the Bunker Hill smelter ran as high as 78 per cent lead, with some silver, netting the company about \$50 per ton.

UTAH

Utah Consolidated Mill Started—Will Treat 1000 Tons Daily by Flotation—Park City District Is Active

By Our Special Correspondent

Bingham—The new mill of the Utah Consolidated, situated at Tooele a short distance from the International smelter, and which started operation the beginning of June is giving excellent results, and will gradually be brought up to its capacity of 1,000 tons daily. The mill is a Callow pneumatic-flotation plant, and was designed and built by the General Engineering Co., of Salt Lake City. Ore is sent from the mine at Bingham to the mill by aerial tramway over a distance of four miles and this is stored in a storage bin of 1,200 ton capacity.

The Bingham-Galena company, which represents a consolidation of the old Silver Shield and neighboring property in Bingham, is understood to have taken an option on the Bone group of claims in Park City, adjoining the Glen Allen, and situated about 2,000 ft. from the Park-Utah. The company has just levied an assessment of $\frac{1}{8}$ c. per share.

Alta—The Wasatch Mines is shipping four or five cars of ore weekly to the loading station at Wasatch.

Salt Lake City—The Alta Tunnel & Transportation Co., operating in Big Cottonwood Cañon, has its twenty-fourth car of ore at the Murray smelter, awaiting settlement.

Park City—Shipments for the week ended June 24 amounted to 4,896 tons as compared with 4,523 tons the week preceding. Shippers were: Ontario, 2,190 tons; Silver King Coalition, 1,183; Park-Utah, 974; Judge, Daly, and Daly West, 549 tons.

The Park-Utah has over forty teams employed in hauling ore on the road from the mouth of the Ontario tunnel to the railroad at Heber City. The increasing output by this new producer and the increase of activity in the eastern part of the district makes it likely that the railroad will be extended to the mouth of the Ontario tunnel, and the haul to Heber City eliminated. In this regard, it is reported that the Union Pacific and Denver & Rio Grande railroads have checked over surveys previously made to the eastern end of the Park City district. In general the tonnage from almost all of the producing mines of the district is increasing, a notable example being the Silver King Coalition, which during the week ended June 24 shipped 400 tons more than it did the week preceding. New companies are being formed to exploit new territory, and more work is being done throughout the district. Miners are in demand, and houses and rooms are hard to obtain.

Eureka—Tintic shipments for the week ended June 24 amounted to 151 cars. Shippers were: Chief Consolidated, 50 cars; Tintic Standard, 33; Iron Blossom, 15; Grand Central, 12; Colorado, 8; Victoria, 7; Eagle, Blue Bell, 6; Mammoth, 3; Tintic Drain

Tunnel, 3; Gemini, 2; Eureka Hill, 2; Swansea, 2; Bullion Beck, 2; Centennial-Eureka, 2; Dragon, 1; Dragon (Fuller's earth), 1; Sioux, 1. The recently declared dividend of 5c. per share by the Tintic Standard amounts to \$58,130. The physical condition of the mine is reported to be much better, and the mill is stated to be making a large recovery. The second-class ore will be gotten out of the way as rapidly as possible, so as to allow a larger output of ore of shipping grade.

IDAHO

Fire Destroys Pump House and Interrupts Mining at Talache—Success in Coeur d'Alene Opens New Orebody

Special Correspondence

Talache—Fire of unknown origin broke out at the Talache Mines, Inc., camp, on the evening of Monday, June 26. Before it could be checked the pump house was destroyed and some of the equipment put out of commission. The building loss has been put at \$800, but some of the machinery had to be replaced, and several days' cessation of mining operations was necessary.

Clark's Fork—After driving 1,450 ft. from its portal, the long tunnel at the Clarinda mine encountered a wide fault, which gave considerable trouble because of its being filled with a very soft material that caved. It was thought at first that it might be the vein for which the tunnel was being driven, but after driving through it a strong vein was cut showing eight feet of mineralized quartz and some gouge.

Adair—Engineer's estimates are that the long tunnel of Montana-Idaho Copper Co., which has been continued without serious interruption for about two years, will be at a point directly underneath the old shaft workings by the end of the first week in July. When that point is reached it is planned to crosscut both north and south with a view to cutting through the vein system.

Coeur d'Alene—A stringer of ore a half inch thick in the west wall of the shaft station on the 700 tunnel level leading into virgin ground in the Success mine has been followed 80 ft. and in that distance has widened into an oreshoot of undetermined width, but which more than fills the face of the drift. The ore is both lead and zinc and makes an average of 30 per cent mineral content. The ore is west of the shaft on the opposite side from the productive area. In fact, the ground in which this ore shoot is being developed has heretofore been classified as monzonite and therefore regarded without mineral possibilities. This work, however, has demonstrated that the formation is Burke quartzite in which the mineral deposits of the Coeur d'Alene district are generally found. The Success mine has been idle for the past three years on account of low price of zinc, together with the high cost of mining in the lower shaft levels. The

discovery of this new ore shoot is important.

In driving a crosscut to gain more convenient access to the upper workings of the Morning mine, owned by the Federal Mining & Smelting Co., lessees cut a vein about 200 ft. south of the Morning vein and parallel to it, which promises to add immensely to the value of their lease, and also to prove a big additional asset to the Morning mine. The vein where cut is 25 ft. wide, made up of stringers and bunches of lead-silver ore. A sample assay from one of the stringers returned 65 per cent lead and 45 oz. silver.

The Paragon Consolidated Mining Co., control of which is owned in St. Paul, will extend the electric power line of the Washington Water Power company to the mine, the work to begin about July 1. The company has a mill of 100 tons capacity, which has recently started running on lead-silver and zinc ore.

A representative of an eastern company engaged in the manufacture of radio equipment recently purchased 800 lb. of extremely pure lead ore from the Jack Waite mine to be used as a detector in the cheaper apparatus.

SOUTHEAST MISSOURI

Revival Noted in "Disseminated Lead" District—Deeper Shafts to Be Sunk

St. Louis—The excellent price for lead that has prevailed for the past month has stimulated activity in the disseminated-lead belt and has resulted in a general increase in wages of 10 per cent throughout the district. The No. 4 mill of the Federal Lead company, which has a capacity of 4,000 tons and has been shut down for about two years, is being repaired and is expected to start up on September 1. The Federal company has leased the Doe Run shaft No. 11 at the old Ludington mine and will use this for drifting to an orebody on the north side of the Farmington road.

The National Lead Co. has let a contract for sinking a shaft on the large, low-grade orebody on the Pim tract, two miles southeast of Elvins, which will be about 870 ft. deep. This will be the deepest shaft in the district and the upper half will be in the "Potosi" formation, which latter had been regarded by the Missouri Geological Survey as forming a prohibitive cap or cover for orebodies in the lower or "Bonne Terre" horizon. As this orebody is said to be exceptionally large, it presents gratifying evidence that the earlier ideas of Buckley and Buehler are not correct. This shaft is a conspicuous example of the development of the district, as the first shafts of the disseminated orebodies were only 50 to 200 ft. in depth. Formerly it was believed that if disseminated lead did occur at a greater depth than 200 ft. it would not pay to work. Within the next five to ten years, the future shafts will probably range from 1,000 to 1,200 ft. in depth.

MICHIGAN

The Copper Country

June Shipments Reached 10,000,000 lb. of Copper—Mostly Domestic Business—Mayflower-Old Colony Looks Good

By M. W. YOUNGS

Houghton—June copper shipments have been indicative of a healthy demand for the metal and it is believed official figures for the month will approach closely those of May, when 10,000,000 lb. was shipped out of the Lake districts. The last copper cargo

New Baltic shaft. After passing through 100 ft. of unusually rich ore, the drift got into vein matter of indifferent character. After proceeding 20 ft., however, the ore was cut. Drifting here will be temporarily abandoned while the shaft is being sunk an additional 150 ft. to prove up the lode at greater depth.

WISCONSIN

June Production of Zinc Concentrate Reached 1,400 Tons

Platteville—June production of 60 per cent zinc concentrate exceeded the

produces 200 tons of 45 per cent zinc concentrates and 25 tons of lead concentrate per week and its Dale mine near Livingston has been producing 250 tons of 25 per cent zinc concentrate and 10 tons of lead concentrate per week.

The Middie mine owned by the Frontier Mining Co. at Benton has recently sold the entire surplus of 5,000 tons of 45 per cent zinc concentrate to the National Zinc Separating Co. at Cuba City. This mine has not been producing for the past two years but had accumulated a large surplus of ore.

MINNESOTA

Mesabi Range

New Equipment for Boeing Property at Hibbing and for La Rue Property at Nashwauk

Hibbing—To facilitate the loading of ore from the Boeing property this season, the Mesabi Cliffs Iron Mining Co. has placed another shovel with a dragline attachment in its open pit.

The Mahoning Ore & Steel Co. has entered the shipping list of ore producers by shipments from the large Mahoning open pit. Stripping has been in progress for several months and under the present plans one shovel will continue in stripping while the other shovels will load ore.

Total weekly shipments from the state-owned mines in Minnesota are showing a large increase each week. The last week in June shows a gain of over 50,000 tons with total shipments of 203,568 tons divided between the different properties as follows: Woodbridge, 13,502 tons; Wanless, 2,820 tons; Pilot, 816 tons; Hill-Annex, 8,736 tons; Kevin, 1,100 tons; Smith, 314 tons; Fay, 15,094 tons; Missabe Mountain, 156,800 tons and Leonidas, 40,368 tons.

Gilbert.—The Elba mine has been reopened by the Pickands Mather Co. This property is worked by underground methods; it is the intention of the company to work it to full capacity.

Nashwauk.—Preparations have been started by the Cleveland Cliffs Iron Co. for the shipping of its stockpile at the Crosby mine. The moving of this tonnage requires the starting of the Crosby concentrator as the ore is a washable product. No work is contemplated in the open pit or underground.

The M. A. Hanna Ore Co. has resumed stripping operations at its La Rue property. One Model No. 300 shovel with dragline attachment has been placed in the dirt overburden, while a second shovel is removing a paint rock capping lying on top of the ore. It is not anticipated that ore shipments will be made from this property the present season.

Chisholm.—The Wellington mine has been reopened by the Oliver Iron Mining Co. after being closed for over a year. It is expected that the property will be worked to its full capacity and ship ore to the Minnesota Steel Co.'s plant at Duluth.

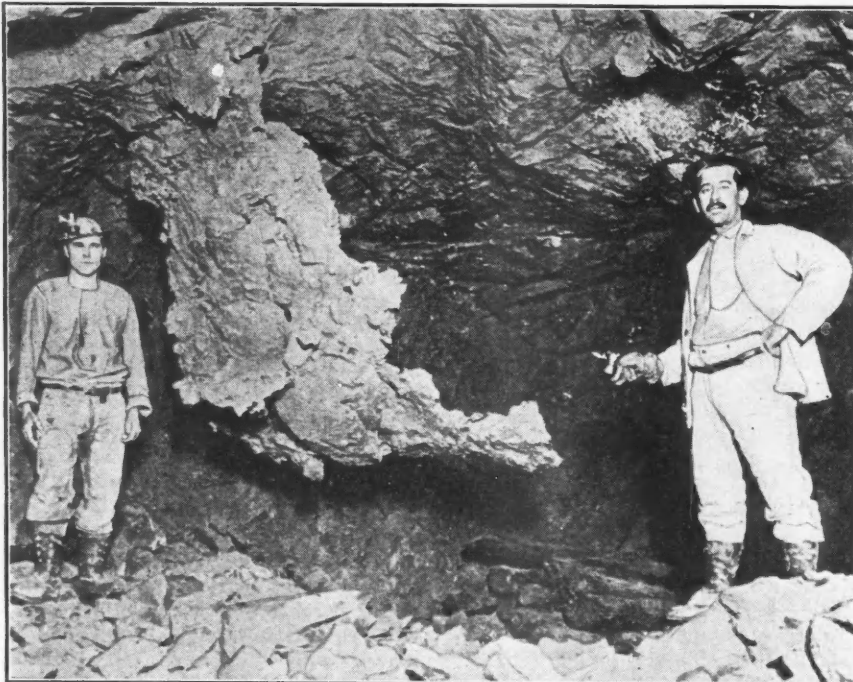


Photo by Ewing Galloway, New York

"Mass" copper in a Michigan copper mine

out for June totaled 3,200,000 lb. The bulk of the metal has gone to domestic buyers. Detroit particularly has been a heavy buyer. But little export business is being done by the Lake companies.

Quincy is shipping mass copper to its smelter. The east branch of the Pewabic lode continues to yield much mass, which is contributing largely to refined copper production. No. 2 shaft is the greatest source of mass copper.

Mayflower-Old Colony drifts on both the 1,400 and 1,700 levels continue in commercial copper ground. The copper content is fairly good across the breasts of the drifts and although the vein changes direction at times the miners are having no difficulty in following it. The drift on the 1,400 level will shortly be turned northward to check up with operations in the bottom level. The showing in both levels is the most encouraging in the history of the property.

Arcadian Consolidated is again in sensational ground in its south drift on the 1,100 ft. or bottom level of the

May figures by 200 tons, the tonnage recovered by roasting and magnetic separation being approximately 1,400 tons. The Illinois Zinc Co., Peru, Ill., and the United Zinc Smelting Corporation, Moundsville, West Va., were the principal buyers. The Grasselli Chemical Co., Grasselli, Ind., also made a small purchase of 200 tons during the month. A close survey of the district shows a surplus of about 4,000 tons of 60 per cent zinc concentrate as of July 1. The market for zinc concentrates ranged from \$3 to \$3.50 during June.

The Connecting Link Mining Co. near Cuba City, has been producing about two carloads of 31 per cent zinc concentrates per week.

New owners of the Pacquette mine near Shullsburg have just completed a new jig and will be a steady producer. This mine has a fine showing of both lead and zinc in sight.

The Nightingale Mining Co. near Leadmine has been producing about 150 tons of 25 per cent zinc concentrate per week.

The Vinegar Hill Zinc Co. operating the North Unity mine near Galena

The Present Situation at the Mines

Lake Superior Iron Ranges Now Active—Copper Production Holding Pace Though Affected by Labor Shortage—Coal Strike Without Visible Effect on Operations—Lead Producers Busy

By A. H. HUBBELL.

IN contrast with earlier conditions, activity is now marked on the iron ranges of the Lake Superior district, the establishing in June of ore prices for the season at a figure 50c. under that of 1921 having put operations on a definite basis. Directly, this is a result of the announced reduction in freight rates. The district is now producing at about 75 per cent capacity and it is likely that more mines will be opened as additional sales of ore are made.

Elsewhere the freight reduction has yet been without visible result, though it is expected to stimulate production in many districts where rates have not already been lowered.

The coal strike has not as yet affected operations but nervousness is indicated in some districts as stocks grow less with no settlement apparently in sight.

Labor shortage is reported in several districts, particularly at Butte and in the Michigan copper country. Wages have been generally raised in the southeast Missouri lead belt but no other recent changes are reported.

In the copper camps, practically all domestic producers of importance are in operation. Exceptions are: the Phelps Dodge branches at Tyrone and Clifton-Morenci and the companies in the Shasta region in California. At Butte, 10,000 men are working with 3,700 more at Anaconda and Great Falls. Operations in Arizona continue as of late, save that New Cornelia's leaching plant is about to run at full capacity. At Miami, the International smelter is making copper at the rate of 16,500,000 lb. a month. Greene Cananea in Sonora will resume next month.

Elsewhere, Granby, Engels and the two producers in Tennessee are operating with little change.

In northern Michigan production of refined copper has decreased somewhat owing to labor losses. For June the total was 43 per cent of normal or 9,500,000 lb. (estimated) as compared with 11,550,000 for May.

In Washington, mining is gradually reviving from the serious depression of last winter and is now about 30 per cent of normal with about ten companies producing regularly and shipping to Trail, Tacoma, or Kellogg. The Tacoma smelter is running at half capacity. The Northport plant remains down. Considerable development work is being done. Similar conditions obtain in southern British Columbia. In northeastern Oregon, several gold and silver producers are operating.

The improved market for lead and zinc has bettered the outlook for producers of these metals. In the Coeur d'Alenes, in Idaho, the Hecla, Morning and Bunker Hill companies are producing 4,000, 5,000 and 6,000 tons of ore per month, respectively, as of late, all other operations yielding an additional 1,200 tons. The Tamarack & Custer and the Hercules mines are about to resume work, which is expected to create a temporary labor shortage.

In Utah, ore shipments in general have increased owing to better roads and the higher price for lead. Park City's output is much larger than in a long time, shipments in June amounting to 17,223 tons, including 11,475 tons of siliceous silver ore and tailings shipped by Ontario Silver. Bingham is producing at the monthly rate of about 16,000 tons of concentrating and shipping lead ores, aside from the output of Utah Copper which is mining over 15,000 tons of copper ore per day. Tintic's production continues over 31,000 tons monthly. The Midvale smelter is running three lead furnaces and one on matte, Murray four lead furnaces, and the International at Toole has one reverberatory on copper and has just started its lead furnaces.

In the Wisconsin zinc-lead district, production of zinc concentrates is about 40 per cent of normal, the output in June having increased to 1,400 tons or 16 per cent over

that of May. The principal producers, numbering six, are employing about 500 men on mining, their zinc output going to the National roaster at Cuba City which has the only acid plant in operation. Lead ore is being sold as rapidly as produced.

In the Joplin-Miami district, production is estimated at 10,500 tons of concentrates weekly. Several mines that have been idle started during June and approximately 110 are now operating, this compared with seventy-five on Jan. 1. Labor shortage caused by workmen leaving for the harvest fields has hampered operations considerably.

In the southeast Missouri lead district, improvement continues steadily under the influence of the excellent prices obtained for lead. All companies are running at capacity and have increased wages 10 per cent. New development work is being undertaken.

Zinc operations in the Mascot district of Tennessee continue at 30 per cent of normal, all ore produced going to make zinc oxide.

In California, gold mining is making steady progress. Grass Valley's monthly output is estimated at \$200,000, that of the Mother Lode being about the same. The year's output will equal that of 1921. Activity in the Randsburg district continues; the silver output there to date is reckoned at 6,000,000 oz. In the Shasta belt, operations are confined to the Shasta Zinc & Copper Co. which is smelting over 100 tons of ore daily and producing high-grade zinc oxide.

Conditions are normal in Nevada. Tonopah's output is running about \$650,000 per month, unchanged from May, with skilled miners rather scarce. Labor conditions are satisfactory at Virginia City once more and United Comstock's project is making normal progress. Candelaria's new mill is ready for operation. There is noticeable activity in the small outlying districts throughout the state.

Conditions throughout Colorado continue to improve. The A. V. smelter at Leadville and the Cripple Creek mills handled an increased tonnage during June. The Durango smelter shows a slight falling off in tonnage. Work on the \$200,000 Coolbaugh process plant for handling complex zinc ores has been started by the American Smelting & Refining Co. at Durango. Resumption of operations by many properties in the northern districts is reported. Coal mines are making an increased output which is meeting all demands.

In the Black Hills of South Dakota the Homestake and Trojan companies continue the only gold producers, their combined output for June being \$570,000, or somewhat over that for May. Labor is plentiful.

In Ontario, a better feeling pervades the Sudbury nickel district, owing to greater demand for nickel. At Cobalt, the increased price of silver has caused McKinley Darragh and Dominion Reduction to resume. The Mining Corporation has started its sands retreatment plant and Coniagas has begun work underground on the Ruby. Kirkland is active and deals are reported daily. Lake Shore is producing over \$40,000 a month. The Noranda has started operations. At Porcupine, Dome heads continue high and the dividend has been increased. Hollinger has bought the Schumacher and McIntyre is enlarging its mill. Labor in all these districts continues plentiful.

In the Birmingham iron district, about 500,000 tons of iron ore is being consumed a month; the production is not readily estimated. Twenty-two furnaces are making pig iron compared with six on Jan. 1, their output in June having been about 200,000 tons. Twelve steel furnaces are in operation. Coal production has increased to about 330,000 tons monthly to meet demand from the outside strike-affected districts. Labor is becoming scarce.

THE MARKET REPORT

Daily Prices of Metals

June	Copper, N. Y., net refinery, Electrolytic	Tin		Lead		Zinc
		99 Per Cent	Straits	N. Y.	St. L.	St. L.
29	13.50@13.625	30.00	30.75	5.75	5.50@5.55	5.30@5.325
30	13.50@13.625	30.25	31.00	5.75	5.50@5.55	5.35
July 1	13.55@13.625	30.25	31.00	5.75	5.50@5.55	5.35
3	13.625	30.75	31.50	5.75	5.50@5.525	5.375
4	.....	.....	.....	.....	.....	.....
5	13.625	30.50	31.375	5.75	5.50	5.40

*These prices correspond to the following quotations for copper delivered: June 29th, 13.75@13.875c.; 30th, 13.75@13.875c.; July 1st, 13.80@13.875c.; 3rd, 13.875c.; 5th, 13.875c. The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

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

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

June	Copper			Tin		Lead		Zinc	
	Standard	3M	Electro-lytic	Spot	3M	Spot	3M	Spot	3M
29	61 ⁵ / ₈	62 ¹ / ₈	69 ¹ / ₂	151 ⁷ / ₈	153	24 ⁷ / ₈	24	27 ⁵ / ₈	27 ⁵ / ₈
30	62	62 ³ / ₈	69 ³ / ₈	152 ³ / ₈	153 ³ / ₈	25	23 ³ / ₈	28	27 ³ / ₈
July 3	62 ³ / ₈	63	69 ³ / ₈	154 ¹ / ₈	155 ¹ / ₈	24 ¹ / ₈	23 ¹ / ₈	27 ¹ / ₈	27 ¹ / ₈
4	62 ³ / ₈	62 ⁷ / ₈	70	153 ¹ / ₈	154 ¹ / ₈	24	23 ¹ / ₈	28	27 ¹ / ₈
5	62 ³ / ₈	62 ⁷ / ₈	70	153 ¹ / ₈	154 ¹ / ₈	24	23 ¹ / ₈	28	27 ¹ / ₈

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

Silver and Sterling Exchange

June	Sterling Exchange "Checks"	Silver			July	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
29	439 ¹ / ₂	99 ³ / ₈	70 ³ / ₈	36 ¹ / ₈	3	441 ¹ / ₂	99 ³ / ₈	71 ¹ / ₂	36 ¹ / ₈
30	440 ¹ / ₂	99 ³ / ₈	70 ³ / ₈	36 ¹ / ₈	4	.....	.....	.....	36 ¹ / ₈
July 1	441 ¹ / ₂	99 ³ / ₈	71 ¹ / ₂	36 ¹ / ₈	5	443 ¹ / ₂	99 ³ / ₈	71 ¹ / ₂	36 ¹ / ₈

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

Metal Markets

New York, July 5, 1922

Yesterday being a holiday the week's activity, so far as the metal market was concerned, was unusually quiet. Copper and zinc showed a slight improvement while lead business continued dull. The easing of the railroad strike situation and the improbability of additions to the ranks of the striking shopmen by other railroaders is viewed with satisfaction by the trade. The effort of the Federal Government to effect a settlement in the coal strike is another event that is

considered helpful to a better metal situation. With these two great labor difficulties eliminated the metal market will be able to take advantage of improved industrial conditions. Transatlantic and Pacific freight rates are reported unchanged.

Copper

Sales of copper have been light, particularly in the export market. Earlier in the week copper could have been obtained in small amounts for 13.75c. delivered especially where a low freight rate ruled, but this metal was soon absorbed. Prices of producers throughout

Average Metal Prices for June

Copper	
New York Electrolytic.....	13.575
London Standard.....	61.988
London Electrolytic.....	68.333
Lead:	
New York.....	5.745
St. Louis.....	5.563
London.....	24.685
Silver:	
New York, foreign.....	71.149
New York, domestic.....	99.625
London.....	35.900
Sterling Exchange.....	444.615
Zinc:	
St. Louis.....	5.346
London.....	27.893
Tin:	
99 per cent.....	30.707
Straits.....	31.497
London.....	152.512
Antimony	5.145
Quicksilver	55.115
Platinum	87.212

the week have been generally 13.875c. delivered and slightly higher. There is an impression in the trade that requirements for copper that have been postponed because of strike conditions will be filled in the near future. At any rate the market has noticeably strengthened and it would be difficult to obtain metal below 13.875c. delivered today. Reports from copper producing centers indicate that a shortage of labor is proving detrimental to an efficient operation of copper properties and consequently the production of lower cost metal. This has prevented some companies from reaching quickly their most economical rate of copper output.

Foreign buying has been disappointing, only small quantities being sold abroad. Competition has been a little more active for what foreign business has been available.

Lead

The official contract price of the American Smelting & Refining Co. continues at 5.75c., New York.

The easiness in the lead market continues and metal is freely offered in the Middle West and in New York at prices which we quote. Sales have been made in small volume only. The statistical position of lead is still good so that there is no disposition on the part of producers to cut prices sharply. In New York plenty of metal can be had at 5.75c. of both domestic and foreign production. High-grade Spanish lead of corroding quality is still on the market at but a small premium

over the price of common lead, 5.775 to 5.80c. per lb. being asked. Paint, storage battery and cable manufacturers remain the strongest supporters of the lead market. Paint business is reported exceptionally good. In St. Louis earlier in the week lead was offered at 5.525c. but this price can be shaded today without much difficulty.

Lead for future shipment—as far ahead as late August—can be obtained at prices five points above those current.

Zinc

Some improvement in the zinc market is noticeable although sales, as for the other metals, have been nothing unusual. The price of zinc in the St. Louis market is below that of lead but in the New York market it is slightly above it. Encouragement has been given the galvanizers by the attempt to settle the coal strike which so seriously affects their business. Producers are not pressing their metal actively for sale at present price levels. Zinc for future shipment is offered at 2½ to 5 points premium for late August shipment. High-grade zinc business showed its customary activity at 6½c. per lb. with 30c. per 100 lb. freight allowance.

Tin

This is the season of the year when little activity is to be expected in the tin trade. Transactions have been few and far between, consumers are practically all out of the market. Forward tin is generally quoted the same as the spot market.

Arrivals of tin in long tons: June, Atlantic ports, 5,450; Pacific ports, 130; total 5,580 tons.

Gold

Gold in London: June 29th, 94s. 2d.; 30th, 93s. 7d.; July 3rd, 93s. 5d.; 4th, 93s. 2d.; 5th, 92s. 7d.

Foreign Exchange

The movements of foreign exchange have been irregular, marks being particularly weak. Early strength in exchange has usually been followed by reactions. On Monday, July 3, francs were 8.36c.; lire, 4.69c.; marks, 0.2394c. Canadian exchange in New York was on a par. Checks 1⅞ per cent discount.

Silver

Silver prices have advanced on China buying, and in New York and San Francisco the improvement in sterling exchange has added to the rise.

There are no new developments in the market, the tone being steady and the future dependent upon the position of China.

Mexican Dollars—June 29th, 53½; 30th, 54½; July 1st, 54½; 3rd, 54½; 5th, 54½.

Other Metals

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

Aluminum—20c. per lb. for 99 per cent grade; 19c. for 98@99 per cent;

18c. for 94@98 per cent. Outside market nominal at 17.25@18.25c. for 98@99 per cent virgin grades.

Antimony—Chinese and Japanese brands, 4.95@5c. W.C.C., 5.75c. Cookson's "C" grade, spot, 7@7.5c. Chinese needle antimony, lump, nominal, 3.5@4c. per lb. Standard powdered needle antimony (200 mesh) nominal at 5¼c. per lb. White antimony oxide, Chinese, guaranteed 99 per cent Sb₂O₃, 6.75@7c.

Bismuth—\$2@2.10 per lb.

Cadmium—\$1.20@1.25 per lb.

Cobalt—Metal, \$3@3.25 per lb., black oxide, \$2 per lb. in bbl.

Iridium—\$170@175 per oz.

Magnesium—Sticks, 1½ in., 99.9 per cent, \$1.25 per lb.

Molybdenum Metal—In rod or wire form, 99.9 per cent pure, \$32@\$40 per lb., according to gage. Powder, 95 per cent, \$5 per lb.

Monel Metal—Shot, 32c.; blocks, 32c. per lb., f.o.b. Bayonne, N. J.

Nickel—Standard market, ingot and shot, 36c.; electrolytic, 39c. Outside market quiet at 31@33c. per lb.

Osmium—No quotation reported. Recently \$70 per troy oz.

Palladium—\$55@60 per oz.

Platinum—\$87.50 per oz.

Quicksilver—\$55 per 75-lb. flask, San Francisco wires \$54.70. Firm.

Rhodium—\$100@115 per troy oz.

Selenium—Black powdered, amorphous, 99.5 per cent pure, \$1.75@\$1.85 per lb.

Thallium Metal—Ingot, 99 per cent pure, \$20 per lb.

Tungsten Metal—Powder, 97 to 98 per cent, 45@60c. per lb. contained tungsten. Improving.

Metallic Ores

Chrome Ore—Many inquiries, but prices on imported material considered too high. Indian ore, \$18.50 per ton. Refractory ore, \$15.

Iron Ore—Lake Superior ores, per long ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, \$5.95; Mesabi bessemer, 55 per cent iron, \$5.70; Old Range non-bessemer, 51½ per cent iron, \$5.20; Mesabi non-bessemer, 51½ per cent iron, \$5.05.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, \$4.50 per long ton; old bed concentrates, 63 per cent, \$5.25; Harmony, cobbled, 63 per cent, \$5.25; new bed low phosphorus, 65 per cent, \$7.50.

Manganese Ore—27½c. per long ton unit, seaport. Many inquiries for prompt shipment.

Molybdenum Ore—45@50c. per lb. of MoS₂, for 85 per cent MoS₂ concentrates. Demand is good.

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

Titanium Ores—Ilmenite 52 per

cent TiO₂, 1¼@2c. per lb. for ore. Rutile, 95 per cent TiO₂, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Chinese ore, \$3.15@3.25 per long ton unit of WO₃.

Uranium Ore (Carnotite)—Ore containing from 2 to 2½ per cent U₃O₈. \$3.50 per lb. of contained U₃O₈.

Vanadium Ore—No quotation. Recently \$1 per lb. of V₂O₅ content.

Zircon—Zirconium silicate, f.o.b. Pablo, Fla., 4¼@13c. per lb.

Zinc and Lead Ore Markets

Joplin, Mo., July 1.—Zinc blende per ton, high \$35.35; basis 60 per cent zinc, premium, \$33; prime western, \$32; fines and slimes \$31@30; average settling price, all grades of blende, \$33.31; calamine, basis 40 per cent zinc, \$18.

Lead, high \$82.45; basis 80 per cent lead, \$80; average settling price, all grades of lead, \$79.52 per ton.

Shipments for the week: Blende 9,297, calamine 31, lead 1,536 tons. Value of all ores for the week, \$434,110.

Purchase of 7,500 tons was consummated on prices unchanged from the previous week, sellers accepting offerings late today, after an effort to further lower the price level was abandoned by the buyers.

A large number of the mines suspended operations tonight, to resume on July 5, giving employees an opportunity to have a three-day vacation.

Platteville, Wis., July 1—Blende, basis 60 per cent zinc, \$33 per ton. Lead ore, basis 80 per cent lead, \$77.50 per ton. Shipments for the week: Blende, 389 tons; Lead ore, none. Shipments for the year: Blende, 8,034; Lead ore, 1,014 tons. Shipments during week to separating plants, 950 tons.

Non-Metallic Minerals

Asbestos—No. 1 crude, \$700@750 per ton, f.o.b. Quebec mines; No. 2, \$400@450; long spinning fibre, \$300@400; spinning fibre, \$175@300; shingle stock, \$75@110; paper stock, \$32.50@40; cement stock, \$14@17; floats and shorts, \$8. Inquiries better than for some time past, with short fibre in particularly good demand. Most of the mines in Canada are operating again.

Barytes—Washed crude ore, 92 per cent BaSO₄, guaranteed, \$8 per long ton, Georgia; \$9, New York. Ground, off-color, No. 1 grade, \$20, New York; No. 2, \$15. Shipments of crude have slowed down, and the market in the South is poor.

Bauxite—American, crushed and dried, \$6@\$9 per gross ton; pulverized and dried, \$12@\$14 per gross ton; calcined, \$22@\$25 per gross ton, all f.o.b. shipping points. Foreign bauxite offered at \$5@\$8 per metric ton, c.i.f. Atlantic ports, depending upon grade.

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

Borax—Granulated, crystals or powdered, in bags, carloads, 5½c. per lb.; in bbls., 5½c. Boric acid, 11c. Dull.

Chalk—English, extra light, 5c. Domestic light, 4½@4¼c.; heavy, 3½@3¼c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, \$6@ \$8; washed, \$8@\$9; powdered, \$12@ \$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, \$13@ \$20, f.o.b. Virginia points. Imported lump, \$14@\$20, f.o.b. American ports; powdered, \$35@\$45, f.o.b., New York. 1A grade, refined, \$14@\$15 per ton, Delaware. Market slow.

Emery—Turkish and Greek manufactured emery, 6@8c. per lb. American, 5@6c. Inferior grades, 4c., f.o.b. from New England points. Market good and improving.

Feldspar—No. 1 pottery grade, active at \$6.50 per ton, North Carolina. Maine producer reports good market for pottery grade at \$18 per ton.

Fluorspar—Gravel, \$17.50@\$20 per ton, f.o.b. mines in Middle West. Acid, \$40@\$45 in bulk. For enameling and glass uses, \$35@\$40. Market more active.

Fuller's Earth—16 to 30 mesh, \$18 per ton; 30 to 60 mesh, \$17; 60 to 100 mesh, \$12; 100 mesh and finer, \$10; f.o.b. Florida mines. Exceptionally poor demand in Florida.

Graphite—Ceylon lump, first quality, 5@5½c. per lb.; chip, 4@4½c.; dust, 3½@3¼c. Market weak. Mexican, crude amorphous, in bulk, 75 to 78 per cent carbon, \$39; 80 per cent, \$46; 81 to 84 per cent, \$50. Extremely dull; market has been overstocked for two years. Orders being placed only for actual requirements or on account of proposed tariff.

Gypsum—Crushed rock, \$3 per ton in most states. Ground, \$3.50@\$4, f.o.b. shipping points.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ½ in. and larger, \$1.10 @\$1.35 per net ton. Agricultural limestone, \$2.50@\$3 net ton, f.o.b. eastern shipping points.

Magnesite—Crude, \$8@\$12 per ton. High-grade caustic calcined, lump form, \$30@\$45 per ton. Plastic calcined, \$45@\$50 in bbls., carload lots, f.o.b. California points. Atlantic seaboard, \$60.

Dead-Burned—\$33 per net ton, Chewelah, Wash.; \$58@\$64, Chester, Pa. Austrian grains, \$30 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.; No. 6, 35c.; No. 5, \$1.25; No. 4, \$2.25; No. 3, \$2.90; No. 2, \$4; No. 1, \$5.20. Clear block: No. 6, 50c.; No. 5, \$1.75; No. 4, \$3; No. 3, \$4.75; No. 2, \$6; No. 1, \$7.50; A1, \$9; ground, wallpaper grade, \$90@\$200 per ton (depending upon quantity); ground roofing mica, \$25@\$70, all f.o.b. New York. Water-ground mica, 100 and 160 mesh, 6½c. per lb., f.o.b. Virginia points.

Monazite—Minimum 6 per cent ThO₂, 6@8c. per lb.

Phosphate Rock—Per long ton, Florida ports, pebble grade, for export: 77 per cent tricalcium phosphate, \$7.50 (\$8.50 for hard rock); 75 per cent, \$6.50; 70 per cent, \$4.50; 68@66 per cent, \$4.25. Market quiet, with European buying largely on a hand-to-mouth basis. 72 per cent B. P. L., \$6.50 per long ton, Tennessee. Light demand, with fertilizer manufacturers well stocked with acid phosphate.

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

Pyrites—In boulder form, \$7 per long ton, f.o.b. Massachusetts; concentrates, \$9 per long ton. Resumption of shipments is indicated.

Silica—Glass sand, generally \$1.75@ \$2.50 per ton, f.o.b. shipping point; sand-blast material, \$2.50@\$5.

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

Talc—200 to 300 mesh, including containers, \$13.50@\$14.75, f.o.b. New York state mills. Demand is good.

Mineral Products

Arsenious Oxide (White Arsenic)—7.25@7.50c. per lb.

Copper Sulphate—Large crystals, 6.25c. per lb. Prompt shipment scarce.

Potassium Sulphate—Powder, domestic, \$1 per unit, basis 90 per cent, f.o.b. New York.

Sodium Nitrate—\$2.50 per 100 lb. ex-vessel Atlantic ports.

Sodium Sulphate—\$20@\$25 per ton, New York.

Ferro-Alloys

Ferrocerium—Per lb., \$12@\$15.

Ferrochrome—1 to 2 per cent carbon, 25c. per lb.; 4 to 6 per cent carbon, 10½c. per lb.

Ferromanganese—Domestic, 78@82 per cent, \$67.50 per gross ton, f.o.b. furnace. English, \$67.50, c.i.f. Atlantic seaports. Spiegeleisen 19@21 per cent, \$36, f.o.b. furnace; 16@19 per cent, \$35.

Ferromolybdenum—\$2@\$2.50 per lb. of contained molybdenum for 50 to 55 per cent grades.

Ferrosilicon—10 to 15 per cent, \$38 @\$40 per gross ton, f.o.b. works; 50 per cent, \$58@\$60; 75 per cent, \$115@\$120.

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

Ferrotungsten—Domestic, 70 to 80 per cent W, 42½@45c. per lb. of contained W, f.o.b. works. Improving.

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

Ferrovandium—\$3.50@\$4 per lb. of V contained, f.o.b. works. Market active.

Metal Products

Copper Sheets—New York base, 20.50c. per lb.; wire, 15.75c.

Lead Sheets—Full lead sheets, 8.75c.; cut lead sheets, 9c. in quantity, mill lots.

Nickel Silver—26.75c. per lb. for 18 per cent nickel Grade "A" sheets.

Yellow Metal—Dimension sheets, 17.75c.; rods, 14.75c.

Zinc Sheets—\$7.50 per 100 lb. less 8 per cent on carload lots, f.o.b. works.

Refractories

Bauxite Brick—\$50 minimum, per net ton, f.o.b. St. Louis.

Chrome Brick—\$42 per net ton, f.o.b. shipping point.

Chrome Cement—\$24@\$35 per net ton, f.o.b. shipping point.

Firebrick—First quality, 9-in. shapes, \$32@\$35 per 1,000, Pennsylvania, Ohio, Illinois, and Kentucky.

Magnesite Brick—9-in., straights, \$56 per net ton, f.o.b. works.

Magnesite Cement—\$35@\$40 per net ton, f.o.b. shipping points.

Silica Brick—9-in., per 1,000, \$33 @\$41, f.o.b. shipping points.

Zirkite—Powdered, \$50@\$60 per ton; brick, \$100 per ton.

The Iron Trade

Pittsburgh, July 3, 1922—Production of steel ingots in the half year has been about 16,000,000 tons, against 9,000,000 tons in the second half of 1921 and 10,000,000 tons in the first half. In view of the drastic liquidation of stocks in 1921, both of steel and of manufactured wares, and allowing for a partial restoration of stocks in the last few months, the figures are consistent with there being a reasonable and easily understood increase in the rate of consumption, say an increase of one-fourth or one-third. The present rate of production, however, is 39,000,000 to 40,000,000 tons a year, and to support this there must be further increase in consumption. This is expected, as very few of the 92,000 freight cars ordered in the first half of the year have been made, while much structural work is on books, and regular manufacturing consumers have planned for heavy operations in the next two or three months or longer.

The market is quiet, as to actual turnover, while mills are very well filled with business, for two months in most cases and for longer periods in some cases. The prospect of the summer being dull marketwise, as usual, is faced with entire equanimity by producers.

The trend in steel production continues upward rather than downward, showing that even after three months of the coal strike the steel industry can take care of itself. Steel prices either for prompt delivery or delivery at mill convenience have had no important change of late.

Pig Iron—The market remains quiet with consumers less interested than it was expected they would be by this time. The market remains quotable at \$25 for bessemer and basic and \$24 for foundry, f.o.b. valley furnaces, with the undertone scarcely as firm as formerly. July 1 the valley-Pittsburgh freight rate came down from \$1.96 to \$1.76.

Connellsville Coke—Offerings are still more limited, and prices are \$1 higher, at 9@\$9.50.

COMPANY REPORTS

Dome Mines, Ltd.

Producing Between \$3,500,000 and \$4,000,000
Yearly—Dividends at Rate of 10 Per Cent
—Two Levels To Be Opened in 1922

BY ALEXANDER GRAY

THE eleventh annual report of Dome Mines, Ltd., of Porcupine, Ont., is more than a record of operations during the year ended March 31. It is an explicit presentation of what shareholders ought to know about the profits won, the details of production, and of underground developments accompanied by varying encouragements and disappointments, creating a situation on balance that is considered satisfactory. The general manager, H. P. De Pencier, has told his "plain, unvarnished tale," and, taking as his text "Past Performances," he thinks the policy of at least replacing what is extracted enables the company to "look forward confidently to similar results from our future operation." For example, he offers "the treatment results" during the fiscal year in review, which are given as follows:

	Value Recovered	Value Per Ton	Per Cent Recovered
Heads 360,000 tons		\$8.203	
Amalgamation bullion	\$1,622,012.48	4.506	54.924
Cyanidation bullion	1,187,439.90	3.298	40.209
Total	\$2,809,452.38	\$7.804	95.133
Operating costs, per ton milled		4.558	
Operating profit, per ton milled		\$3.346	

Of the tonnage milled, 333,081 tons, averaging \$8.05, came from stopes, and 26,919 tons, averaging \$10.16 per ton, came from development. The tonnage dealt with in 1921-22 was the greatest, and the total value was more so in ratio, owing to the higher value per ton. The result brings the grand total of Dome Mines' income to approximately \$15,000,000.

"UGLY DUCKLING" HAS GRACEFUL LINES

Porcupine at first was thoroughly misinterpreted. Dome Mines was an "ugly duckling." Even when development had proceeded far enough to justify its influential capitalists in providing a mill, its grade was estimated at \$4 or \$5, and so much of it below \$4 that the feasibility of selective mining was doubted. A bush fire destroyed the plant. When another plant was completed, a prolonged labor strike delayed production and prevented development. Upon the resumption of operations, it was affirmed the ore reserves had been brought up to a valuation of about \$16,000,000. Then the war and a series of writings down and off revived doubts, which the latest reports should serve to dispel, notwithstanding the unwillingness of Mr. De Pencier to place an estimate upon what is in sight or indicated. Dividends now are at the rate of 10 per cent, and justification for the refunding of capital at the rate of \$1 or \$2 per annum. The net surplus as of April was \$1,758,165, against an issued capital of \$4,260,879, besides which \$29,124 has been allotted but is unused, leaving \$209,997 in the treasury. Among the wholesome liabilities are \$2,695,844.57, on account of depreciation and replacements, buildings, plant, and equipment; operating equalization, and depletion of mining claims and properties, the latter item standing at \$1,030,410.28. Current liabilities amount to \$809,184.44, of which \$476,667 applies upon the repayment of \$1 of capital stock as ordered by the board. Manifestly the asset position of the company will stand scrutiny, for beside the reserves enumerated, amounting to about 50 per cent of claim and plant valuation as carried in the balance sheet, there are cur-

rent assets of \$2,457,505.81 over and above deferred charges of \$109,843.63. Two-and-a-quarter millions of that is in bonds, taken at cost although selling at a premium; \$625,000 is out in call loans, and a quarter of a million is in cash and bullion en route. The "ugly duckling" has swan-like proportions, even though certain contours could be improved, especially in the matter of the irregularity of individual orebodies. In the mineralized zone, the mine has many potentialities which Mr. De Pencier will not emphasize. At any rate, Dome workings are more than 1,000 ft. below the point at which the first drill hole was stopped. A policy of aggressive development and exploration is expected (to quote Mr. De Pencier) to maintain continuous performances.

TWO NEW LEVELS TO BE OPENED THIS YEAR

Since 1911 and until now, 2,500,000 tons of ore in round figures was milled for approximately \$16,000,000, reckoning to the end of May. During the last two years an altered policy dealt with individual orebodies, whereas the original idea was that operations were contingent upon the large masses of low-grade ore, what better grade there was to be used for "sweetening." Dome's foot and hanging-wall sections have become interesting and productive; diamond drilling results are such that the area between the eighth and twelfth levels will provide strenuous occupation for another year or two. On the tenth level a crosscut located an important ore zone. As this is characteristic of what is transpiring elsewhere in the mine, it is explained that the zone was opened up by drifting, and a stope of 8,750 sq. ft. area was silled out. The drift gave an average of \$10.74 for a length of 253 ft. The stope sill yielded 8,409 tons, averaging \$13.98. Mr. De Pencier regards this as "a very important orebody" and he expects it will be found on the levels above. Diamond drilling from the tenth level practically to the twelfth level, 300 ft. below, intersected 83 ft. showing \$16.47; 53 ft., \$3.46; 22.5 ft., \$33.60; 18.52 ft., \$13.66; 28 ft., \$37.31; 7.66 ft., \$8.36; 18.5 ft., \$9.38; 12.5 ft., \$4.97; 13.17 ft., \$8.89; and 14.08 ft., \$5.05. As those results gave the management vertical continuity, it was decided to sink the main shaft deeper. Already the eleventh level is being opened up. When shaft sinking is finished, work on the twelfth floor will be started, and Mr. De Pencier expects during this year to "open up at least two more levels which should yield a large amount of ore."

Heavy development expenditure is largely necessitated by the fact that the more important orebodies are situated 450 to 900 ft. from the shaft. Notwithstanding this, the lenticularity of the orebodies, and finer grinding and longer treatment necessitated by harder and less amenable rock, operating costs were only 12.9c. higher per ton milled than they were in 1920-21. The broken ore reserve was increased by 70,000 tons last year.

EXPECTATIONS REGARDING DOME EXTENSION

When the eleventh and twelfth levels are far enough along, "it is expected," writes Mr. De Pencier, "that important orebodies will be developed during the coming year." The dip of Dome orebodies being in that direction, the acquisition of Dome Extension was a fortuitous event. On the whole, as an intricate mining proposition, Dome Mines has magnitude and educational importance. Its current rate of production is between \$3,500,000 and \$4,000,000 per annum, and the management by its accomplishments thus far has inspired confidence in its ability to repeat its performances.

Mining Stocks

Week Ended July 1, 1922

Table with columns: Stock, Exch., High, Low, Last, Last Div. (repeated). Sections include COPPER, GOLD, SILVER, GOLD AND SILVER, LEAD, QUICKSILVER, ZINC, VANADIUM, ASBESTOS, and SULPHUR. Each entry lists a stock name, exchange, and its price performance over time.

Current Prices of Mine Materials and Supplies

RISE AND FALL OF THE MARKET

Advances—Steel shapes up 10c. in New York and 20c. per 100 lb. in Chicago. Mill price \$1.60@\$1.70 per 100 lb., Pittsburgh. Cast-iron pipe advanced \$2 in New York, \$2.50 in Chicago, and \$3 per ton in Birmingham. Lower discounts in New York and Cleveland on bolts and nuts. Structural timbers up \$1@\$6 per M ft. b.m. in five important centers. Fuel costs advance cement prices above month ago quotations, regardless of freight rate reductions. Linseed oil and pneumatic hose prices tending upward.

Declines—Pittsburgh and Birmingham quote slightly lower prices on spikes and track bolts. Wire and cut nails decline at Pittsburgh mill and in Chicago warehouses. Lime prices reduced owing to freight rate revision. Fire hose, manila rope, cotton waste, 40 and 60 per cent gelatin dynamite, slightly lower throughout the country.

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

	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
Blue Annealed	\$2.40	\$3.62½	\$3.63	\$4.15	\$3.63
Black					
No. 28	3.15	4.30	4.45	5.65	4.35
Galvanized					
No. 28	4.15	5.30	5.45	6.50	5.35

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

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

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

	Pittsburgh					
	Current	One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ½-in. and larger	\$2.25@2.35	\$3.25@3.40	\$2.55	\$3.00	\$4.10	\$2.80
Track bolts	3.25	4.00@4.35	3.65	4.25	5.10	3.80
Standard section angle bars	2.40	2.50	2.40	3.00	4.00	3.00

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

	Pittsburgh, Mill	Birmingham, Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	\$1.60@1.70	\$1.95	\$2.68	\$4.00	\$2.57½	\$2.68	\$3.10
Channel, 3 to 15 in.	1.60@1.70	1.95	2.68	4.00	2.57½	2.68	3.10
Angles, 3 to 6 in., ½ in. thick	1.60@1.70	1.95	2.68	4.00	2.57½	2.68	3.10
Tees, 3 in. and larger	1.60@1.70	1.95	2.68	4.00	2.57½	2.68	3.10
Plates	1.60@1.70	1.95	2.68	4.00	2.57½	2.68	3.10

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

Hercules red strand, all constructions	30%
Cast steel round strand rope	32%
Galvanized steel rigging and guy rope	17½%
Round strand iron and iron tiller	15%
Plow steel round strand rope	45%
Special steel round strand rope	40%

Drill Rod (from list)

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

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

	Inches	Steel Black	Galv.	Inches	Iron Black	Galv.
BUTT WELD	1 to 3	71	58½	½ to 1½	44½	29½
LAP WELD	2½ to 6	68	55½	2½ to 6	42½	29½

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

	New York	Black Chicago	St. Louis
2½ to 6 in. lap welded	61%	59½%	56%

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

	New York				
	Current	Year Ago	Birmingham	Chicago	San Francisco
6 in. and over	\$50.80	\$48.30	\$37.50	\$46.60	\$39.70 \$51.00

	New York		Cleveland	Chicago
Nuts, hot pressed, sq., per 100 lb. Off list		\$2.00	\$3.50	\$4.00
Nuts, cold punched, sq., per 100 lb. Off list		2.00	3.50	4.00

MACHINE BOLTS

1½ and 1½x3 in. up to 12 in.		New York	Cleveland	Chicago
Button head bolts, with hex. nuts		33½%	60%	60-10%

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

	New York					
	Current on Trucks	One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco
4x12x12	\$0.11120	\$0.12320	\$0.0707	\$0.10	\$0.0635	\$0.108
6x12x12	.16670	.16420	.0973	.18	.08	.156
8x12x12	.20840	.219	.1326	.18	.12	.244

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

	6-8 and 10-16-18 and 22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	\$28.00	\$31.00
3x6 and 8	28.00	31.00
4x4-6 and 8	28.00	31.00

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

	New York		Chicago	
	20 Ft. and Under	22-24 Ft.	20 Ft. and Under	22-24 Ft.
3x4 to 8x8	\$38.00	\$39.00	\$42.00	\$45.00
3x10 to 10x10	41.00	42.00	46.00	48.00
3x12 to 12x12	44.00	45.00	49.00	51.00

	8 x 8-In. x 20 Ft. and Under	12 x 12-In. 20 Ft. and Under
	Pine	Fir
Boston	\$50.00	\$52.00
Cincinnati	39.00	50.00
Montreal	78.00	45.00
Denver	38.00	38.00
Minneapolis	45.00	41.00
Kansas City	33.00	34.00
Birmingham	23.00	

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	\$2.40	\$3.10	\$3.90	\$5.00	\$3.25	\$4.95
Cut	2.25	5.50	5.90	7.75		5.00

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

	Current	One Month Ago	One Year Ago
New York, del. by truck	\$2.40@2.50	\$2.40@2.50	\$2.80
Chicago, f.o.b.	2.05	1.97	2.17
Cleveland, f.o.b.	2.31	2.26	2.43

LIME—Warehouse prices:

	Hydrated, per Ton	Lump, per Barrel
	Finishing	Common
New York	\$15.80@16.17	\$12.29
San Francisco	22.00	18.00

LINSEED OIL—These prices are per gallon:

	New York		Chicago	
	Current	One Year Ago	Current	One Year Ago
Raw in barrel (5 bbl. lots)	\$0.90	\$0.80	\$0.96	\$0.75

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

	Red		White	
	Current	1 Year Ago	Current	Yr. Ago
100-lb. keg	Dry 12.50	In Oil 14.00	Dry 13.00	In Oil 14.50
25 and 50-lb. kegs	12.75	14.25	13.25	14.75

HOSE

Underwriters' 2½-in. coupled	Fire	50-Ft. Lengths 47c per ft.
	Air	
½-in., 3 ply per ft.	First Grade \$0.31	Second Grade \$0.22½

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

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

	Discount from list
Medium	40-5%
Heavy	35%

RAWHIDE LACING

- For cut, best grade, 50-10%, 2nd grade, 60%.
- For laces in sides, best, 41c. per sq.ft.; 2nd, 39c.
- Semi-tanned: cut, 50%; sides, 43c. per sq.ft.

PACKING—Prices per pound:

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

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

Boston	\$0.20	New Orleans	\$0.17½
New York	.17	Los Angeles	.16½
Chicago	.19	Seattle	.18

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

	New York	Cleveland	Chicago
White	7.50@10.00	12.00	11.25
Mixed	5.50@9.00	9.00	8.00

EXPLOSIVES—Prices per pound of dynamite in small lots:

	Gelatin	
	40%	60%
New York	\$0.2950	\$0.3250
Kansas City	.24	.2750
Denver	.2250	.2550
Baltimore	.2550	.27
Cincinnati	.2350	.255
New Orleans	.2725	.3075
San Francisco	.195	.235

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

Pine oil, steam dist., sp. gr. 0.930-0.940	gal.	\$1.00
Pine oil, pure, dest. dist.	gal.	.95
Pine tar oil, ref., sp. gr. 1.025-1.035	gal.	.46
Pine tar oil, crude, sp. gr. 1.025-1.035 tank cars f.o.b. Jacksonville, Fla.	gal.	.53

NEW MACHINERY AND INVENTIONS

A Continuous Weighing Machine

The Schaffer Poidometer Also Assures the Correct Proportioning of Crushed Materials

A MACHINE which has an extensive application in the non-metallic mining industry, although it is by no means limited to that work, is the poidometer, which provides a means of accurately weighing material and securing correct proportioning continuously and automatically. The Schaffer poidometer is now being manufactured in three sizes and capacities: From 5 to 175 lb. per minute on finely ground or fine granular materials; 20 to 2,000 lb. on pulverized and granular materials up to 1½-in. cubes, and 75 to 15,000 lb. per minute on pulverized and granular material up to 4-in. cubes. Among the material handled by the poidometer may be included: Clays and shales, dolomite, feldspar, gypsum, limestone, manganese, iron ore, asbestos, salt and calcined products.

The poidometer is mounted on a substantial steel frame and the weighing apparatus proper is equipped with dust-proof ball bearings, all pivot joints and knife edges in connection with the beams being case-hardened and also dust-proof in their enclosures. The hopper is of a special type so arranged that the belt in passing under it pulls the material from the hopper instead of the hopper spilling the material on to the belt. Two shoes, one on each side of the hopper and set at the proper angle, further assist and cause the materials handled to be delivered on to the belt in the form of a ribbon wherein the angle of repose is determined the instant the belt receives the material from the hopper. The regulating gate on the hopper has double-knuckle joints and is connected to the walking beam by means of pivot points and knife edges. The hopper gate has an action which is absolutely free, thus practically eliminating friction. It moves on rollers enclosed in a special housing and is properly polished on the inside to prevent any material which touches the gate causing any friction. The roller under the center of the belt (which primarily functions by supporting the belt with its load and causing a compensating mechanical reaction against the scale beam) is ball-bearing.

The method of weighing is simple. The distance between the center of the tail pulley and the center of the last supporting roller under the hopper acts as a continuous scale platform. When the material is delivered to the belt the weight on this continuous platform compensates by means of the supporting roller, and the transmission of this impulse to the scale beam with its weight and counterweights causes the gate to fluctuate as is necessary to give

a predetermined weight per foot of running belt per minute.

The general method of operation is on a continuous basis, but where beam operation is desired this is accomplished by means of a mechanical weighmaster attachment which upon being set for a predetermined amount causes the machine to stop when this quantity has been delivered.

By means of a liquid measure attachment, liquids can be delivered in conjunction with solids. However the machine will not handle wet materials and the admixture of the dry material passing over the belt and the liquid which is passed synchronously through the liquid measure must be made at some point after leaving the poidometer.

In practically every instance the poidometers are equipped with automatic electrical devices which cause the poidometer or any number of poidometers in battery to automatically stop when for any reason they do not receive the proper amount of material called for. By means of an automatic hopper arrangement the machines can be automatically started upon receipt of material. The productometer is part of the standard equipment and from a simple reading of this it can be ascertained the amount of material that the machine has handled for any given unit of time. The Schaffer poidometer is manufactured by the Schaffer Engineering and Equipment Co., 2828 Smallman St., Pittsburgh, Pa.

Joining the Ends of Belting

Probably the greatest source of annoyance in the use of any kind of power transmission belt is that arising from the difficulty of properly joining the two ends. This is often done with lace leather, and a laced joint is a good one, if well made, and it still is a favorite. There is, too, a wide variety of metal fastenings for this purpose. In the various fabric belts resort must be had to lace leather or to the metal devices, for though it is possible that rubber belts and some other varieties of fabric belts may be made endless in the process of manufacture, they are troublesome to install on their pulleys, necessitating often the taking down of shafting, and they will run but a short time when they have stretched enough to make it necessary to cut the belt to shorten it, and then resort to lace leather or metal fastenings becomes necessary. Where these belts run with a tightener, which will take up all the stretch of service, this endless joint will make no trouble, but where there is no provision for taking up the stretch, or where the swing of the tightener is not large enough to provide for all the stretch, there is frequent trouble with the lace holes cutting out, or the metal fastenings breaking, or the ends of the belts tearing. The joining of the two ends, therefore, is the weakest and most troublesome point in any belt.

The requirements of a good method

of fastening the ends of belts are, first, that it shall be strong. The tensile strength of leather belts is from 3,500 to 5,000 lb. per square inch, and of the fabric belts even higher, and the strength of the fastening should be approximately as much, even though the strains of operation are much less, for the belt is no stronger than its weakest point. It is true that no belt ever operates under any such load. The research director of the Leather Belting Exchange Foundation, at Cornell University, reports that the greatest load he has ever been able to place on a belt and keep it upon the pulleys, is about 1,000 lb. per square inch on a leather belt, and the difference between that figure and the ultimate tensile strength of the belt seems to be an ample margin of safety; indeed, much greater than it is customary to provide in other materials, but the high tensile strength requirements of leather and other kinds of belting are considered necessary to insure the presence of other qualities which are requisite to a good belt. It seems foolish, however, to spend money for a belt to stand a tensile strain of 2,500 to 3,500 lb. and then to fasten the ends with devices that will pull out at 1,500 to 2,000 lb.

Second, the joining device must not only be strong itself, but it must not weaken the ends of the belt. Lace leather, even when skilfully applied, makes necessary holes of a size that reduces the cross section of the belt, and when improperly applied cuts into the belt seriously. The various wire lacings do not cut anything from the belt, but they result in a series of perforations which make it easy for the end to be torn off, just as the bank check-book makers perforate the checks, so that they may be readily detached. The various plate hooks distribute their load better over a larger area of belt, and are not so likely to tear out the belt.

Third, the joint must be smooth and even in its operation over the pulley, more especially at high speeds. A badly laced joint, or a plate hook, strikes the pulley with a hammer blow, and even a well-laced joint makes itself heard and felt, all to the injury of the belt and its fastening, and to the machine of which it is a part. The wire lacings and fasteners are comparatively smooth in their operation, but the testing machine of the Leather Belting Exchange Foundation shows that there is a momentary slippage on the pulley as such a joint passes over it, and a consequent reduction in power transmission.

Fourth, any successful method of fastening must be durable. Some changes are required while the belt is new and stretching to its place, but when once run-in the fastening should serve for a long time. Proably nothing is so annoying as to have to stop production to repair a belt joint. Lace leather, though long lived, wears out, and the metal fastenings crystallize and break, so that none of them have the same permanency as the belt.

INDUSTRIAL NOTES

The Hercules Powder Co., have announced a reduction in their prices of high explosives and blasting powder effective July 1. Details are obtainable at any of their offices.

Charles M. Schwab has been elected chairman of the board of directors of the Chicago Pneumatic Tool Co., succeeding John R. McGinley, who will continue to retain his active interest in the company by remaining on the board of directors.

F. W. Gay, of the William Cramp & Sons Ship & Engine Building Co., who has been in San Francisco since March 1 in connection with the acquirement of the Pelton Water Wheel Co. by the Cramp organization, has returned to New York.

Wilson Welder & Metals Co., Inc., 132 King St., New York City, recently appointed King-Knight Co., Underwood Building, San Francisco, Cal., exclusive representatives in central and northern California for Wilson Plastic-Arc Welding Machines and Wilson "Color-Tipt" Metals.

Ely C. Hutchinson returned to San Francisco on June 12 after a month spent in New York and Philadelphia. This was Mr. Hutchinson's first trip East since his appointment as first vice-president and general manager of the Pelton Water Wheel Co., following the acquirement of that company by the William Cramp & Sons Ship & Engine Building Co.

TRADE CATALOGS

Turbines—Allis Chalmers Mfg. Co., Milwaukee, Wis., have issued Bulletin No. 1123 which illustrates and describes small steam turbines suitable for driving condenser auxiliaries, exciters and small generators.

Hydro-Electric Installations — The Pelton Water Wheel Co., San Francisco and New York, has issued an attractive sixteen-page pamphlet, "Kern River Number Three Plant of the Southern California Edison Co." This monograph is written by Ely C. Hutchinson, and consists of a complete and authoritative account of the project, with special reference to the hydro-electric installation.

Blasting — "Eliminating Waste in Blasting" is the title of a 56-page booklet, issued by the Hercules Powder Co. and written by N. S. Greensfelder. The selection of the material is well made and brings out the point which is emphasized by the text. There are chapters on planing the work; drilling; choice of explosives; advantages of No. 8 blasting caps; use of stemming and

preventing waste in firing, all of which represents the best methods for reducing blasting costs.

Blowers—Connersville Blower Co., Connersville, Ind., have issued Bulletin 21 which describes the "Victor" positive pressure blowers. These blowers are of relatively small capacity and are adapted to moving air under pressures of $\frac{1}{2}$ to 5 lb. per sq.in. or vacuums of 1 to 10 in. mercury. They have considerable application in the mining industries in furnishing air for oil and gas furnaces, blacksmith forges, pneumatic conveying, flotation mills, sludge systems, and priming centrifugal pumps.

Recording Thermometers—The Bristol Co., Waterbury, Conn., have recently issued Bulletin No. 311 which describes their recording wet- and dry-bulb thermometer or recording psychrometer. This instrument is used to obtain a continual record of temperatures, from which the relative humidity or atmospheric moisture may be figured. It has two complete operating systems, including two bulbs and two pens, both pens recording on the same chart. The operation of the psychrometer is based on the principle that evaporation varies with the amount of moisture in the atmosphere.

Boiler Feed Water Regulators—Northern Equipment Co., Erie, Pa., have just issued a 20-page booklet, "Regulating Boiler Feed Water," which describes the Copes system of boiler feed control. The subject has been treated in an entirely new way, the object being to cover the subject of boiler feed water regulation completely and yet very briefly. To accomplish this purpose, free use has been made of a graphical method of presentation: charts showing the effect of feed water regulation on water input, steam output, feed water temperature, etc., also other charts, and photographs.

Diamond Drills—Sullivan Machinery Co., Chicago, Ill., have issued Bulletin 69 M., "Sullivan Diamond Core Drills." A number of illustrations are given and considerable information relating to the subject of prospect drilling. This company manufactures 30 different styles and sizes of diamond drills, which range in capacity from 300 to 6,000 ft. in depth. Operation may be obtained by hand, by belt from gasoline or oil engine, or by steam or air power. The "specimen list of equipment" which is included in the bulletin is of particular interest to those operating or contemplating operation of diamond drills.

Acid Pumps—Oliver-Sherwood Co., San Francisco, Cal., have recently issued the "Olivite" pump bulletin, which describes the characteristics of the acid-proof, non-corrosive centrifugal pumps that are handled by the company under that name. Hard lead pumps, bronze pumps, and the other types heretofore adapted to acid service have suffered from electrolysis, structural weakness, or other well known

sources of failure. The corrosion-resistant material used in the Olivite pump is not hard rubber, but is a new composition with a rubber base, and is said to be a successful resistant of the dilute acids found in copper leaching plants.

CONSTRUCTION NEWS

New Utah Consolidated Mill at Tooele Is Success

The 1,000-ton flotation plant of the Utah Consolidated Mining Co. built near the International smelter at Tooele, Utah, commenced operations in June. The mill, designed by the General Engineering Co., is fully meeting expectations in capacity and recovery.

Stamp Mill at Moore Mine in California Nearing Completion

The twenty-stamp mill now being erected at the Moore mine, near Jackson, Amador County, Calif., is expected to be in operation the latter part of August. New hoisting equipment will facilitate the opening up of the 600 level, which should be reached within a month.

Zinc Concentrator Will Be Erected at Big Dick Mine

The Zinc Hill Mining Co., operating the Big Dick mine near Cuba City, Wisconsin, has been steadily producing about 100 tons of 23 per cent zinc concentrate per week. Prospecting has developed another orebody adjacent to this mine on which a mill will be erected within the next ninety days.

Cyanide Gold Co. Is Finishing Milling Plant in Idaho

Preliminary construction work on the new cyanide plant of Cynide Gold Co. at the Buckhorn mine, near Bonners Ferry, Idaho, in the northeastern part of Boundary County, is well under way. The company also has placer holdings near the big hydraulic development of Idaho Gold & Ruby Mining Co., and arrangements are being completed for development of the placer deposits by other parties.

Asbestos Mine in Arizona Will Be Equipped

While the asbestos mines of the Sierra Ancha district in Arizona are closed owing to the high cost of production and the low price of the mineral, machinery has been ordered for the Robinson, Anderson & England asbestos mines, 6 miles southeast of Globe on the Apache reservation. These claims are so situated that profit is expected even at present prices and the plant will be erected at once.