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Hydraulic mining for gold near Granada, Spain

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

October 14, 1922

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Government Co-operation in Metal Quotations

SINCE May the *Engineering and Mining Journal-Press* quotations for copper, lead, and zinc (which constitute the only official and accepted quotations as a basis for general buying and selling) have been made, as a further precaution and safeguard, with the co-operation of those federal bureaus in Washington which are specially interested in the mining industries. These bureaus are the Bureau of Mines, the United States Geological Survey, and the Bureau of Foreign and Domestic Commerce. Their active representative has been Mr. H. S. Mulliken, Chief of the Division of War Minerals Supply of the Bureau of Mines. Thus the quotations are now and have been for some months fixed by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and the representative of the federal bureaus. This was an arrangement entered into voluntarily all around, with the consent and approval of the chief factors of the metal-marketing industry, which constitutes the other co-operative element in the arrangement. Office space in New York for Mr. Mulliken has been given by the Bureau of Foreign and Domestic Commerce in the Custom House.

Mr. Mulliken, who has had a long experience in the mining and smelting industries, had administrative charge of the government helium plant at Petrolia, Tex., during its operation. Mr. Francis Winslow, a mining engineer, assists him in Washington. Since this co-operation in arriving at the metal quotations of *Engineering and Mining Journal-Press* has now passed out of the experimental stage to that of a proved success, we deem it advisable to call especial attention to a plan which, so far as we know, is entirely novel. The original miner of metals, especially the small miner, has now a double and renewed assurance that his interests are being watched over, and that a fair appraisal for all is more than ever assured—more than ever in the history of our always respected and standard *Engineering and Mining Journal* metal quotations.

The Division of War Minerals Supply of the Bureau of Mines will have to do with the commercial rather than with the technical aspects of the mining industries, and will, in so far, advance from the established precedent of the Bureau of Mines; and in so doing will conserve the impetus along the direction of commercial studies in mining which the Bureau received during the war, from the work of the War Minerals Investigations. It is accordingly intended, apart from the problem of military supplies of metals, and other problems of policy, to investigate the general field of ore and metal marketing. Its co-operation with *Engineering and Mining Journal-Press* is therefore only part of a movement to establish a division to which the individual miner can eventually come for specific information as to the best market or the best methods of marketing the metal or mineral in which he is most interested.

England and Russian Mining

THE COQUETRY between Great Britain and Russia continues to engross the imagination overseas. An example of the hopes it has sporadically awakened is shown in the reported interview with Sir E. Mackay Edgar reproduced on page 686.

We do not take Sir E. Mackay Edgar as seriously as we once did; and doubtless the same feeling prevails at home. He is the *enfant terrible*, who a few years ago proclaimed the finished plans of Great Britain, whereby she was held to have wrested supremacy in the matter of petroleum from the United States. It took much energy from Sir Auckland Geddes, Sir John Cadman, and others, and a mass of editorial and ambassadorial diplomacy, to soothe the consternation on this side of the water awakened by Sir Mackay's unexpected eruption. Now he exults much along the same line. Great Britain is going to develop Russian non-ferrous metals and thus brilliantly circumvent and triumph over the United States. Sir Mackay is by way of being a seer:

"For the next decade or so, I see America lording it over the world of industry through her control of the non-ferrous metals, and forcing all the countries down to a lower scale of living, but I also see her abusing this as she has abused every other gift and advantage (look at oil and timber) which nature has given her. I see her squandering her heritage with reckless prodigality until she herself falls a victim to the waste she has encouraged, and I see further how it may easily happen that just when America is reaching the end of her resources, Great Britain may be developing in Russia under British management and by the power of British capital, a position in the non-ferrous metal industry that will throw America's past ascendancy into the shade."

The impartial student of Sir Mackay wonders why he prefers a "servitude," as he puts it, to Soviet Russia rather than to the United States and Canada: wonders why, also, he had not considered the possibility of capital other than British in the ultimate development of Russia; wonders at his blissful lack of knowledge of the mineral resources of South America, Africa, Australia, Japan, and Siberia. It is good, however, to know that in this mist he senses the importance of what we have called "political and commercial geology," and we wish that this appreciation were more widely spread and keenly sensed in this country. It is very slowly percolating through our intelligence—far more slowly than the march of events. There is no subject which is more incumbent for both England and America to study, and to study in harmony, than that of investigating and co-ordinating into a scientific policy the problem of mineral supplies. We have enlarged on the matter much before. The daily urge of opportunism, the lure of instant traffic, the human desire to out-trade your neighbor across the street or across the water, has,

however, the prior claim on the attention of the average citizen and statesman. But this is true not only of America but of England and the rest. "The difference between man and man" says Macaulay, in a somewhat different connection, "is by no means so great as the superstitious crowd imagines."

Fire Hits Northern Ontario Again

THREE MONTHS AGO, as one of our editors stood on the dock at the little town of Haileybury, in northern Ontario, admiring the beauty of its setting on the shore of Lake Temiskaming, he little thought that by this time the town would be in ashes, a victim of the scourge of that part of Canada, the "bush fire." Newspaper reports state that fire has ravaged practically all of the country along the T. & N. O. railway from Dane, a station a few miles south of Kirkland Lake, down to and including North Cobalt. This is largely a farming country—the Clay Belt of northern Ontario—with here and there mining prospects and trails leading to them. With much of the land cleared it is difficult to understand how fire could have made such headway, but a long drouth had dried up the grass, and the small timber and undergrowth of the uncleared spaces is intensely combustible, and the fire can jump incredible distances. Dense and blinding smoke adds to the horror.

Early reports indicate that the property loss is around $8,000,000, that 6,000 are homeless, and that from thirty to fifty have been killed. Many mining companies and mining men will suffer. Haileybury was a town of between three and four thousand, of permanent construction, with many brick buildings and a pretentious Roman Catholic convent and cathedral. All is said to be in ruins, with the exception of forty homes and the high school. Situated only five miles from Cobalt, it was the residence town of many Cobalt mining men, communication being maintained by frequent trolley surface and an automobile road. The only hotels in the district were in Haileybury, this condition being the result of pre-prohibition days, when it was against the law to sell liquor within three miles of an operating mine.

The fire recalls memories of the two Porcupine fires, in which many lost their lives. All of that part of Canada is in constant danger of death and destruction from this cause, and the government should spare no expense in fire protection. The numerous signs urging prospectors and campers to be careful must be supplemented by numerous and efficient fire rangers and fire-fighting equipment. Some improvement is reported in the last two or three years in this regard, though one fire ranger was pointed out last summer—a man about seventy years old—with the remark, "Whenever there's a fire, you can depend upon him getting drunk."

An Engineer's View of Religion and Science

ONE OF THE GREATEST of electrical engineers, Charles P. Steinmetz, in an article in *Harper's* some months ago, discussed briefly "Science and Religion." Out of the apparent *impasse* of our limited powers of vision and of perception, he saw two possible avenues for our further understanding of what is now "beyond science," or "transcendental"—questions such as immortality, and the "relations of man with the supernatural." The first avenue was the complex of scientific research, which in physics has culminated in the theory of relativity: the second was the possibility of discovering some force hitherto unrecognized, released by the reactions of chemistry, which force may be "mind," which, he states, is neither matter nor energy, and thus far has been intangible and imponderable, but none the less real.

When an engineer reasons upon these vital topics, other engineers will find a comprehensible, familiar mode of thought for which they will seek in vain among the philosophers and the metaphysicists. Thus, engineers will at once mark Steinmetz's second possible avenue as what he himself calls it—a speculation and a dream, not supported by evidence—and pass on to his application of the principle of relativity to the problems of our mental borderline and hinterland—let us not call it, as Steinmetz does, the supernatural, for the division of phenomena into natural and supernatural is almost evidently an artificial, relative, and fundamentally non-existent one, signifying really that which we do and that which we do not understand.

Steinmetz points out that philosophers, mathematicians, and physicists have united in demonstrating from different angles of approach that "space and time have no absolute existence, but are categories—that is, forms in which the human mind conceives his relation to nature." "Philosophy, mathematics, and physical science agree that space and time cannot be entities, but are conceptions of the human mind in its relation to nature"; and he concludes that, if time has no reality, then these transcendental problems, of birth and death, of life or immortality, have no existence, but are phenomena of the human mind. In other words, there are no such things.

It is easy to follow out further the conclusions of reasoning of this type. The *relative* truth of the premise is evident to one who need not be either physicist, mathematician, or metaphysicist. As Steinmetz points out most instructively, if our perceptions were 100,000 times slower, all events in nature would appear to us to occur 100,000 times faster. Day and night would be alternating "seconds" of light and darkness. Therefore, clearly, time is purely relative. And the same thing is true of space, as, for example, we may imagine if we contrast the dimensions of objects or between objects as seen by our own eyes and what they must appear to the eyes of an insect. A mile was much longer when we were children than now when we are men—not figuratively, but really. Therefore our thinkers, whom we are citing, conclude that time and space are not absolute, but only relative; therefore that they have no existence.

It is inevitable, if all the above be true—and we do not accept the conclusion in the last sentence, as will appear—that the same relativity applies to form and color and all the other properties of matter. Therefore, it applies to matter, which is accordingly non-existent, as many philosophers conclude, except as a function of mind, of which, as Steinmetz shows, we really know nothing. As to the workings of the mind, philosophers have shown that logic also is subject to these same paralyzing restraints of relativity, and, being built on appearances, on material and geometrical bases, cannot be trusted; and they innocently demonstrate these conclusions in logical form. Thus we complete the circle of profound reflection. We prove that neither time nor space, nor matter, nor, of course, our bodies, nor our birth and death, exist; so that even our conclusions in

this respect seem to be an impertinent apparent something out of an illusion—in reality, nothing out of nothing. Thus we attain the complete Nirvana; or, rather, there has never been anything else.

Raw common sense steps in at this juncture and informs us that we are wrong. And the fundamental error which has headed back the curve of thought into a circle appears to be the unwarranted jumping to the conclusion that because time and space are only relative therefore they are fundamentally non-existent. The truth would appear to be that the time between sunrise and sunset exists, though it is as long or longer than a lifetime for certain insects, and only an incident to a man. A house exists, and the space therein, even if only relatively; too vast for the perception of the spider, almost too small for the perception of the aviator; but still a fundamental fact. Matter therefore exists, and its laws; and all the wonderful array of material and psychologic facts and interrelations. We awake from the curious dream that only a profound dreamer could have fallen into, and we arrive, relative to relativity, at a more exact formula: *Nothing has quality except by comparison.* Everything is relative. Does this mean that no quality exists? Not at all: on the contrary, it implies, as an apparent fundamental truth, that quality, whether of space or time, or form or color—yes, of bad and good, truth and error, right and wrong—really exists, but relative to an infinite variety of points of view. The yardsticks by which space is measurable vary infinitely—of that there seems no doubt; nevertheless, space is a fact and each yardstick is a real yardstick; therefore the various human measures of time and space, form and color, man and matter, are real measurements of real entities.

All this, perchance, does not advance our knowledge very much, but it gets our feet back on the ground; it does tend to reconcile science and religion by restoring our faith in the ultimate efficiency of the mental machinery which the mysterious vital principle has built up as its highest creation; machinery which, at its maximum efficiency, is constantly driving forward into the unknown.

Steinmetz observes that "Our intellect cannot grasp the conception of infinity." On the contrary, our intellect cannot conceive of the ultimate finite; it cannot conceive of a beginning or an end of ultimate space and time, for example, and it is one of the surest evidences of great things to come that the intellect of a finite creation, living in a (relatively) finite system, can nevertheless thus naturally perceive its lack of boundaries.

Industrial Individualism

RECENT DISCUSSION in our columns concerning the engineer and his patents shows what a wide gap ordinarily yawns between invention and financial reward. Occasionally, however, a simple method is found to shorten the stages between the invention and capital, between manufacturing and marketing. We came upon an inventor recently, touring in a most excellent and shiny sedan; and his system is a simple and smooth-working one. A master mechanic by trade, he hit upon certain devices in the machinery of making paper. He set up his own shop in a little country town; he has eight acres and a cow. He himself makes the device which he has invented; he sells it himself, directly from his shop. He has one assistant. He does not push his inventions; they are so good that manufacturers want them when they hear about them. He has some thousands of dollars' worth of orders ahead, which he will get at when he comes back from his tour and reopens his shop. He has prospered so that he is thinking of retiring, but can't think of anything snugger and more comfortable than the life he is already leading.

We have heard much of the independent farmer; but it appears that in the midst of our gigantic and complexly organized industrialism it is sometimes possible for an inventor to strike out and lead an individual and independent existence, as this Scotch mechanic has done. With him was touring an engraver, who engraves designs for wall paper. Another well-worn cog in the industrial machine? Hardly. He also has his acres and his own shop. He runs his own business. He is the boss, foreman, employer, and employee. He was on the six weeks' vacation that he allows himself this year, locking up his shop when he goes. He also is Scotch. He is in the market for a summer home at the right price.

When we consider the contented existence that these friends have discovered for themselves, we are impressed with the fact that all useful inventions and devices are not of the mechanical kind, but that these men had invented and put into operation social devices on which they were reaping rich returns.

Resue

THE USE of a good old Cornish mining term has been revived by the Denny brothers (George A. and Harry S.) in a series of articles on Rand mining affairs in the *Financial Times* of London. The term is "resue." The Messrs. Denny advocate "resuing," or the stripping of the banket ore previous to breaking it down in the stopes, to prevent admixture with the wall rock.

William Pryce in his "Mineralogia Cornubiensis" (published in 1778) spells it "dizzue" and says that it comes from the Cornish *dyz* and *hui*, to discover unto. He adds: "To Dizzue the Lode is this: If it is very small and rich, they commonly only break down the country or stratum on one side of it, by which the Lode is laid bare, and may be afterwards taken down clean and free from waste. To Dizzue the leader of a Lode is much the same thing; for if there is a side or part of the Lode better than the rest, but not a Working Big, they keep the best part separate and let it stand in its place, until they first break and remove the poor part; afterwards they break the Dizzue or best part, and reserve it to be separately handled and dressed; thus the gold Ore is dressed with less charge, and proves better in value than if it were promiscuously with the poor Ore. The refuse or deads of a Dyzhued Lode is called in some places the Dyzha."

Henry English in his "Mining Almanack," published in 1849, says: "Dissueing—is when the lode is small and rich, to break down the strata from one of its walls, by which means it can be taken away afterward without being deteriorated and without waste." In Welsh, a Celtic language that is sister to the now obsolete Cornish language, the word *resgyw* means to liberate, to make loose or set at large. It is probable that "resue" is derived from this source. Even to this day the form "desue" is used in the St. Anges district of Cornwall.

The Argonaut Disaster: the Inquest

By T. A. Rickard

ON SEPTEMBER 25 AND 26 a coroner's inquest over the 46 bodies recovered from the Argonaut mine was in session at Jackson. The testimony showed that in the eagerness to extinguish the fire the officials at the mine overlooked the peril in which the men underground were placed; or, to put it in another way, the officials felt so confident of extinguishing the fire at its beginning that they took no immediate measures to extricate the men in the mine. They were mistaken, for there was no adequate equipment for extinguishing the fire, and what they did toward the accomplishment of that purpose proved pitifully futile. Despite the fact that a fire had devastated the Argonaut mine three years ago the only equipment was a hand fire-extinguisher, which would not work, and a few kegs of water. The filling of the kegs took twenty minutes. The fire was detected by a shift-boss at 11:30 p.m. while he and two skiptenders were at the 4200-ft. station. They went to the 3900-ft. station, where the shift-boss telephoned the news to the hoist-engineer, and then went to the surface in the skip. Later he and others went down to the 2800-ft. level and found the smoke so dense that they could do nothing, so they returned to the surface. Precious time was being lost. The superintendent had been called, but he was not on hand during the first half-hour. He arrived at 12:15 a.m. No fire-drills had been maintained and no prevision had anticipated the steps to be taken in the contingency that had arisen. Meanwhile the men underground had been heard. One of them —Ernest Miller—had telephoned to the hoist-engineer telling him that the station was full of smoke and asking that the skip be sent down. That was not done; instead, the skip was used by the shift-boss in going up and down, as already stated. One skip-tender testified that in his opinion the skip could have been sent down several times; but the superintendent disagreed with this opinion. He said the fire left the shaft open "less than an hour" and the signal system was broken. That may be true, but the only thing worth discussing is what was done and what could have been done in "less than an hour", say, in the first 45 minutes. Evidence was introduced to show that B. I. Hoxie, superintendent of the Fremont mine, advised the reversing of the fan, but it is only fair to record the fact that previously Harry J. Sheafe, consulting engineer to the Argonaut company, and A. J. Stinson, Mine Inspector for Nevada, had insisted that the fan ought to have been stopped and the ventilation reversed. But none of these engineers was on the ground in time to make his advice effective. The men were dead. What was done in the first thirty minutes was more important than anything done in the three weeks that elapsed between the starting of the fire and the removal of the dead men from the mine. The superintendent insisted that reversal of the fan "would have blown out the doors on the various upper levels and short-circuited the air without benefiting the trapped men". The rescue work would have been hindered, he added. To this I answer that it was not necessary to reverse the fan, but only to stop it; that would have checked the flow of smoke-laden air into the levels where the men were working and given them a chance to escape through the Muldoon shaft, which, so long as the fan was running, became a lethal chamber. Every argument against the stopping of the fan assumes that the reversal of the ventilation —by the heat generated by the fire in the shaft—would "blow back the gases on the men". This is unreasonable, because if the fan had been stopped promptly there would have been no "gases" to "blow back"—at the worst there would have been only the first smoke from the fire, and it is to be remembered that it is not the smoke from a bright fire but the gas from the later destructive distillation of the wood that is particularly to be feared. The shift-boss ought to have stopped the fan instantly and he ought to have had the authority to do so, for, in a mine in which the main shaft is the down-cast, there should be an intelligent prevision, and system established, for acting intelligently when that shaft is afire.

The Muldoon shaft was blocked by the action of the fan, which sucked the smoke and gas into this supposed secondary exit. The superintendent testified that an active man would take three hours to make the climb up the ladders of the Muldoon and that an old man would have needed a full day. It is highly improbable that any man, young or old, could have made the climb from the 4800-ft. level to daylight in less than five hours. It was not known whether the Muldoon was practicable as an exit above the 2400-ft. level and it is reported that repairs to the ladders were in progress shortly before the disaster. In any event, a mile of ladderways through old workings is not an exit that accords with any reasonable notion of safety. The inquest did not throw any light on the cause of the fire. The vice-president of the Argonaut company gave his opinion that it was of incendiary origin, but he gave no reasons therefor, and the suggestion serves mainly to divert attention from the probable cause and from the inefficiency shown in the efforts to circumvent the danger that it created for the men in the mine. If the fire was of incendiary origin, it is probable that it could not have been fought successfully, for an incendiary would use means to insure a prompt spreading of the flames. The jury found "that the decedents came to death . . . by suffocation from poisonous gas fumes caused by a fire of unknown origin"; it advised that "more precautions be taken to prevent fires" and recommended that the Argonaut and Kennedy companies "be compelled to keep and maintain an opening with proper doors at one of the lower levels". We shall see what conclusions the committees of investigation reach in due course. One of them has been appointed already by the Governor of California. The committee consists of A. B. C. Dohrmann, a merchant of San Francisco and president of the State Industrial Welfare Commission, William J. Loring, mining engineer and president of the American Mining Congress, and John C. Williams, miner and vice-president of the Grass Valley Miners Union. The mine operators would like to see Mr. Loring use the soft pedal and the miners would like to see Mr. Williams use the loud pedal, so that Mr. Dohrmann will find himself in an interesting position. It remains for him to guide the investigation in a direction most useful to all concerned, for it is certain that the promotion of safety for the men underground is just as much the business, and for the benefit, of the operators, as of the men they employ; it is the duty of the community to see that industrial operations are conducted without needless danger to human life.

DISCUSSION

Shall Mine Cooks Be Licensed?

THE EDITOR:

Sir—The crew became dyspeptic, so I fired the cook, and was homeward plodding my weary way—plowman like—at the end of an imperfect day when a miner hailed:

"Tough, ain't it, Boss?" I agreed fully.

"What you supers had oughter do is get some guy in the Legislature to push over one of these here bills for licensing mine cooks. Hoistmen already has to pack one, an' I hear as how you minin' engineers'll soon have to show a card before you can give a hole the once over. So, why'n'ell ain't it reasonable to make the cooks take out a license before they can slip the hot cakes into us backbones of the minin' industry?"

I gasped, staggered, and sat down by the trail to meditate. Here was an idea! Startling! Think of all the years the purblind mining industry has struggled along without licensed cooks! How has it endured at all minus this potent essential to its welfare? Why, of course mining cooks should be licensed. Crass stupidity alone has prevented this boon.

In its ultimate analysis the proposition can be supported and proved to the benefit of both parties concerned; to wit, (a) the profession, and (b) the public (with apology to the F.A.E.S.).

The windmills loom up before me, and I charge valiantly to attack, clad in archaic armor made of discarded tin cans: tailings from the cookhouse of antediluvian individual initiative.

Competition with other cooks—that fly in the ointment of cookery—will cease to spur cooks on to better pies. Hedged about with this protective statutory barrier, they can stand calm and serene as the iron stove before them. No more need they fear such caustic remarks, as "I wish that long-legged, slab-sided cook hadn't quit. That bird sure wielded a wicked skillet. This guy is the bunk." No longer will mine cooks be good, bad, or indifferent. All can and will be indifferent.

Knowing what cannot be cured must be endured, the mine superintendent will have no cook problem—there won't be any—and the time thus conserved for more useful pursuits will enable him to make two blades grow where one flourished. Mines that declared but Irish dividends will at once pour of their profits into the investing public lap.

When the grouch committee arrives, how easy it will be. "Some mistake, boys. He's a licensed mine cook. You can all see his license displayed in his kitch—his office. The biscuits are case hardened perfectly. I grant that his hot cakes are a little out of round, but what they lack in symmetry they make up in toughness. The license act in this state, where he can practice only, allows for such equalizing irregularities. In the State of Politics or New Fangle it may be different. The oversize in the coffee is allowable, and he gets 100 per cent recovery in his hash."

All is settled. The cook remains. The boss gleefully takes his trusty pencil in hand to resume calculating the profits resulting from the new order of things.

Reductio ad absurdum. Q.E.D.

DON QUIXOTE DE LA MINA.

What Ails Alaska?

THE EDITOR:

Sir—While in Alaska I read in your issue of Aug. 12 the item on page 295 about the decreased population of that territory. You quote "Officials in Washington familiar with Alaska" and recite the explanation now being made everywhere by these government bureaucrats, and the extreme conservationists, that the exhaustion of the bonanza placers is solely responsible for the 30 per cent decrease in the white population of Alaska shown by the last census.

Then how do they explain the decrease in population in those parts of Alaska where there never was placer mining? How do they explain the empty buildings in the abandoned towns which were once prosperous settlements of an energetic people attracted by the deposits of coal and metals? Why the desolation of communities right along the coast with ocean transportation and abundant timber and wonderful resources other than placer gold? The people who left were not attracted there by placer mining.

I presume these "Officials in Washington familiar with Alaska" are some of the horde who travel to Alaska at government expense each spring with the geese, only later, and return even before the birds start south in the fall. Of course, those men would lose their jobs, or at least their junketing trips, if the government of Alaska were placed in the hands of men compelled to live in the territory the year round. However, if the thirty-eight bureaus now governing Alaska from Washington, several thousand miles away, could be merged into some effective federal organization resident in Alaska, with authority to administer the natural resources of the territory, and a few million miles of government red tape abolished, the pioneer life in Alaska would be more attractive. Then, instead of the splendid type of energetic people leaving the territory, more of that kind would be attracted there, and the population would increase.

Seattle, Wash. MAURICE D. LEEHEY.

Room for Prospectors in Northern Ontario

THE EDITOR:

Sir—H. H. Taft, in his letter of Sept. 2, published in the discussion column of your journal, says: "The prospector is practically gone, and it is well that it is so. The grass-root mines are about all found and are being worked or have been exhausted." His statements may hold in a limited sense for various sections of the United States, but they are certainly not true of Canada, especially northern Ontario.

This much is certain: mines will never be found by writing letters into your discussion column or by the present methods employed by most mining companies. Just as the oil companies, when drilling in a new district, are prepared to put down say ten holes, figuring that they can afford ten dry ones, but yet bearing in mind if only one produces oil it will pay for the other nine and net a substantial profit besides—so the mining exploration companies must plan to develop several most promising prospects at about the same time and must be prepared to secure more if none makes good.

There is but one way to locate new mines, and that only by hard work in the field. Here in northern Ontario, in the midst of a most promising gold area, after two seasons in the "bush," I have yet to meet a bona-fide mining engineer in the field doing some real, honest prospecting. To locate and develop a mine three factors are necessary: the prospector to find it, the technical man to plan development work, and capital to finance the development. If these three can be combined in one man, a holy trinity in mining as it were, by sending out into the field a trained mining geologist with the necessary finances, final success is certain.

There is no question that ore geology is going to play an important part in finding new mineral deposits. Practically every prospector in Ontario is more or less an ore geologist and is using ore geology in his work, though of course he does not realize it. Ask one in the field what kind of country he likes to prospect for mineral (gold), and quick as a flash he will answer, "A schisted country where there is plenty of shearing and which is near some blow-outs of porphyry or is cut by large porphyry dikes."

In conclusion, I might state there is a stretch of mineral country here in Ontario, extending eastward into Quebec, westward into Manitoba, northwestward to the northwest territories, and north to the Arctic, in which our friend, Mr Taft, of Mexico, may find thousands of real, hard-working prospectors. I may also add, had some of our celebrated court geologists spent twenty years in this vast territory, doing the same detailed geological work required for the apex cases in the United States courts, the world, I am sure, would have been richer by several new mining districts.

Gowganda, Ontario R. D. HOFFMAN.

Clay in Metallurgy and Agriculture

THE EDITOR:

Sir—The Faraday Society a little while ago organized a symposium on the physico-chemical characteristics of soils. It may seem a far cry from soils to metallurgy, but such is not the case. The wet treatment of ores necessitates a knowledge of the characteristics of clay, in the colloidal as well as in the non-colloidal state; the soil technologist must be *au fait* with the composition of humus and the results of the addition of alkali to such and similar material. In the present instance, however, he has unconsciously furnished a valuable clue for the guidance of the metallurgist. In one part of the discussion it was shown that clay which has adsorbed an alkali cannot adsorb compounds of copper or nickel; the untreated material, however, is a strong adsorbent of such.

A few years ago I attempted to explain the reason why the residue from a milling-in-cyanide plant invariably contained proportionally more gold than did the residue from a milling-in-water plant, other conditions being similar, by suggesting that the calcium ion of the lime used as a coagulant was adsorbed by the clay during milling, conveying, and thickening operations in the latter instance, thus minimizing the danger of adsorption of the gold or gold-bearing ion at the later, chemical stage of treatment. I maintained also that the absorption by the clay of alkaline water inhibited the absorption later of aurocyanide solution. Recent investigations reported by the Faraday Society seem to confirm this theory, which explains, to a certain extent, why crushing in cyanide solution usually necessitates a more lengthy treatment than that required when the ore is milled in alkaline water. Confirmation was also forthcoming from Mexico. In one instance it was found desirable, owing to prevalent conditions, to mill a silver ore in alkaline water, contrary to common practice. After concentration, the pulp was dewatered to a high density, then thinned with cyanide solution and treated in the usual way by agitation and filtration. The results were highly satisfactory. At a later date the flow sheet was changed so that the ore first came in contact with cyanide solution in the mill. Although no alteration was made in treatment by agitation and filtration, the residues showed an appreciable increase in silver, which could not be reduced except by extending considerably the time allowed for displacement and washing.

Clay is ubiquitous. To date no attempt has been made at co-operation by technologists in the various industries in which a proper understanding of the substance, its physical and chemical properties, is of the utmost importance. The metallurgist has much to learn from the soil technologist; the ceramic engineer might profit by the experiences of both. What is needed is a greater catholicity of interest among technical men—less of the groove spirit. Much could be achieved by some scheme providing for the proper indexing and abstracting of current technical literature in all fields, but proposals in this direction are ignored; the wastage involved by duplicated research continues. This is regrettable, for the world of technical endeavor should be the mining engineer's parish. A. W. ALLEN.

A Vote for Greenawalt

THE EDITOR:

Sir—Patents are the means provided by civilization to encourage men to think, and to prevent others from taking the results of thought without recompense. If an idea is worth using, it has value. It is sometimes cheaper, if the inventor is poor, to claim he is a fool or a rogue, or that the idea was known by Hammurabi, and then use his device, process, or else. "Experting" mines and turning them down often results in indirectly obtaining the property for a modicum of the first price; similar tactics enable "getting around" patents of impecunious inventors. Why not? 'Tis business!

Mr. William E. Greenawalt's letter in the Sept. 16 issue of *Engineering and Mining Journal-Press* is the most terse aggregation of unquestionable facts, pungent epigram, and sarcastically incisive humor that I have seen in many a day. He expresses more in a few lines than did all the preceding verbose nonsense and aspersion on the subject matter which has taken your space for several years. Do get Mr. Greenawalt on your staff. If he can write as tersely and deducively on other pertinent subjects you will have a literary kohinoor that does not require polishing to emit scintillations.

San Francisco, Calif. H. DEC. RICHARDS.

Mining Engineers of Note

FREDERICK HENRY HATCH

By E. P. Rathbone

I FIRST met Hatch when he came to Johannesburg in 1892. On the advice of Mr. A. Moreing he had thrown up his work on the Geological Survey of Great Britain and had come out to the Rand with the late W. Y. Campbell to embark on a mining career. The moment was propitious, and geological problems of the greatest importance were awaiting solution on all sides. Joining the staff of the South African Trust & Finance Co., then under the able direction of Mr. Campbell, Hatch, together with J. A. Chalmers, his colleague, was for some time kept busy in examining the various properties acquired or under consideration by this company. He was then asked to attempt the unraveling of the intricacies of the Far East Rand and to see what relation its auriferous conglomerates bore to those of the Rand. In those days the Main Reef had been traced, as such, only from Johannesburg eastward to Boksburg, where it disappears under an outlier of the Karroo formation. Further east the auriferous reefs were being worked by the Kleinfontein, Van Ryn, and Modderfontein companies, but they again disappeared under a cover of coal measures and dolomite, and speculation was rife as to what course they then took. Conglomerates were also being worked in the Heidelberg district, about twenty miles to the south, but all these outcrops were considered to be independent of the Main Reef. Hatch's report showed conclusively that the Main Reef was continuous from the Central Rand under the intervening patches of coal measures and dolomite to the Far East Rand and to the Heidelberg district, the formation between these last-named districts being that of a shallow syncline concealed under a considerable thickness of unconformable dolomite. His results were subsequently published in a geological map of the southern Transvaal and were produced in a paper read before the Geological Society of London in February, 1898. In 1895 Hatch joined the engineering staff of the Consolidated Goldfields under John Hays Hammond. Together with Chalmers he accompanied Hammond to Rhodesia to report for Cecil Rhodes on the prospects of the Chartered Company. The Jameson Raid and the Boer War then interrupting his work in South Africa, Hatch took the opportunity of enlarging his mining experience in other parts of the world. Thus he visited the United States, Canada, and British Columbia, and spent a year in India reporting for the Indian Government on the gold resources of that country. The results of his investigations in India were published in memoirs of the Geological Survey of India. At the close of the Boer War he returned to Johannesburg as consulting engineer to Messrs. Lewis and Marks, and carried out a long series of investigations on the Far East Rand syncline, the existence of which had been postulated in his previous work. He now had an opportunity to put his theory to the test. Under his direction many boreholes were put down in the country between the Springs and Heidelberg, and the Main Reef was cut at depths of 3,414 ft., 4,299 ft., and 5,540 ft., respectively. In 1909 Hatch made an investigation of the mineral wealth of Natal and Zululand for the Natal Government. Since finally returning to England, he has practiced as a consulting engineer visiting in that capacity, Siberia, Canada, Abyssinia, Spain, France, and Italy. In 1914 he was president of the Institution of Mining and Metallurgy. During the war he was engaged in the Ministry of Munitions in connection with the development of home iron ores for the supply of iron and steel for war purposes, for which work he was made an Officer of the Order of the British Empire. After the war he became Director of the Mineral Resources Development Branch of the Board of Trade and a member of the committee appointed by Sir Auckland Geddes to report on the non-ferrous mining industries of the United Kingdom. At the present time he is Technical Adviser to the Mines Department on matters relating to metalliferous mining. He is also a member of the governing body of the Imperial Mineral Resources Bureau, a member of the Councils of the Geological and Mineralogical Societies, and a member of the Institution of Civil Engineers. He is the author of numerous technical papers.

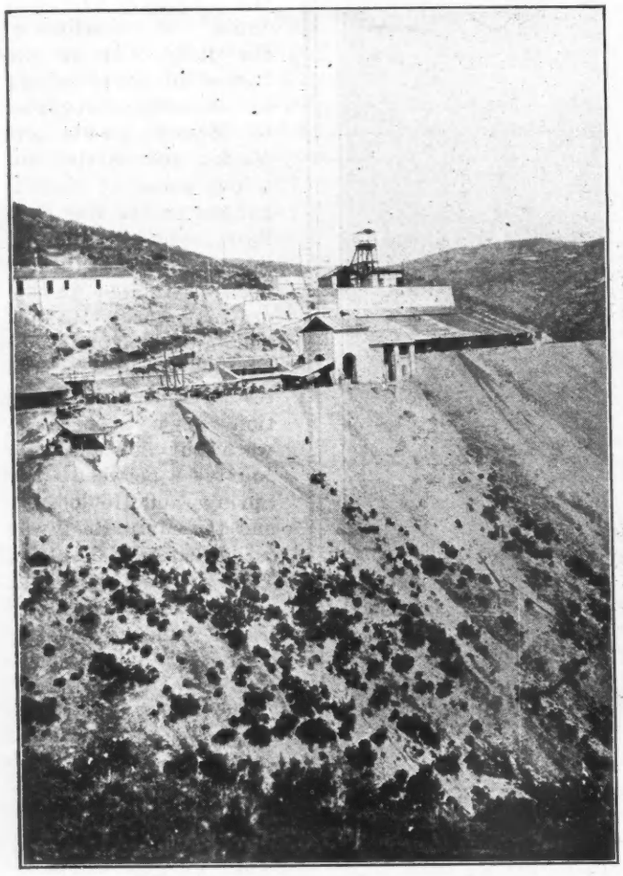
FREDERICK HENRY HATCH

The Lead Mining District of Linares and La Carolina

An Old Spanish Mining Camp Worked Many Centuries Ago— Activity Retarded by Lack of New Developments— Geology and Technical Processes Described

BY ETIENNE A. RITTER

SPAIN is one of the few countries of Europe with metal production of importance. At the end of the nineteenth century it held the first place in the production of lead, whereas today the United States has wrested that place from it. Spain, however, still produces 13 per cent of the world's yearly output of this metal. Half of it comes from the district of



General view of the Araceli mine and mill

Linares and La Carolina, in the Province of Jaen. Linares is situated 150 miles directly south of Madrid, close to the trunk line from Madrid to Cordoba, Sevilla and Cadiz, to which it is connected by a short railroad. Its nearest harbor, also connected with it by rail, is Almeria.

The mines of the district were exploited early by the Phœnicians and afterwards by the Romans, as were many others in Spain. Idle for a long period, after the barbaric invasion of the Goths and during the sanguinary wars with the Moors, they were started again during the latter part of the sixteenth century and operated with increasing activity up to the second half of the nineteenth century, when they were at the height of their prosperity.

Today the district barely holds its own, and with increasing difficulty, because too few new mines are being opened up to take the place of the old ones, as these are gradually worked out. The future of the district depends partly on the results of the development of the veins at greater depth. There seems to be a lean zone at a fairly uniform depth, ranging between 1,200 and 1,600 ft. below the surface. No deeper mining has been tried. The veins keep their full sizes as to lengths and widths to that depth, and there are some good reasons for the belief that possibly a richer horizon may be found below the lean one.

Some important mine operators think also that the mineral belt extends towards the higher parts of the Sierra Morena, to the west and to the northwest. In their opinion, the lack of good roads and of a railroad sufficiently near, more than anything else, delays opening up the extension of the district in that direction. The mines are situated in a good agricultural country, and, broadly speaking, the labor is both relatively cheap and efficient. Electric power is used in all the up-to-date mines. It is thus possible to exploit at a profit some deposits which at other places and under less advantageous conditions might not be of economic value.

I owe much of the information given in this article to Messrs. Gilbert de Neufville, director; Marcel Bechard, manager, and J. Lestable, mines superintendent of the La Cruz company.

VEINS WELL DEFINED

The district of Linares and La Carolina is located partly in the granite and partly in the Cambrian and the Silurian schists, outside but on the edge of an important batholith of granite, which forms the main eastern part of the Sierra Morena.

De Launay has tried to show that most of the ore deposits were connected genetically with eruptive rocks brought near the surface by the formation of three successive mountain ranges. Some ore deposits can be connected with the creation of the pre-Cambrian or Caledonian chain, and others with the post-Carboniferous or Hercynian chain. The greatest number of ore deposits, by far, are genetically connected with the great uplift which occurred at the end of the Cretaceous and the beginning of the Tertiary, and which formed all the mountains known in geology under the name of Alpine Ranges, whether they are the Caucasus, the Alps, the Rocky Mountains, or the Andes.

It seems that most of the ore deposits of Spain, which are located in a broad east and west belt, on both sides of the Sierra Morena, such as the copper deposits of Rio Tinto and of Tharsis, the quicksilver deposits of Almaden, and the lead deposits of Penarroya and of Linares and La Carolina, are connected with the Hercynian mountain uplift of late and post-Carboniferous age.

In the district of Linares proper, the veins are well-defined fissures in granite, with a gangue composed almost exclusively of calcite. At La Carolina the veins

are formed by a network of fissures, with a main one as the leader, in black schists. They are filled by a quartz gangue. The schists are very fissile and not much indurated. They contain a large amount of carbonaceous material, which has precipitated the lead sulphides from the hot ascending waters.

The number of the producing veins is upwards of fifty, according to L. Mallada.[1] Some of them are remarkably persistent in length. Their lengths vary from two to seven and one-half miles. For instance, the vein known as Socorro-San José-Coto La Luz y Encarnacion is proven for a distance of 30,000 ft. along its strike, and the San Miguel y Carmen vein for a distance of 36,000 ft. Many others are as long and possibly longer.

Different Periods of Fissuring Indicated

The veins are distributed somewhat like the ribs of a fan. The center of this fan would be placed at a point 25 miles east of the district. The strike of the important La Cruz y Pozo Ancho vein is north 68 deg. 36 min. east. The veins located further south than this diverge even more toward the north, from the direction east-west. On the contrary, toward the north end of the district, the veins not only are directed east-west, but reach even a direction east 14 deg. south.

According to Mallada, it is possible to recognize four different periods of fissuring, the veins of the oldest period being east-west and being located near the center of the district.

Then came the veins with a west-northwest direction, followed by others running east-northeast, and finally a last set running almost north and south. Only the veins of the first three periods have an economic importance and the main orebodies have been found at the points of intersection of the two systems of veins.

At Linares, the width of the veins along their strike varies from 1 to 24 ft. between walls, but the places where the width decreases to less than 3 ft. are rare. A gouge seam of talc is found occasionally along the foot wall, but is rare. The hanging wall is not so well marked as the foot wall and it is often quite rough; horses of country rock and numerous broken pieces of country rock forming a sort of breccia in the midst of the vein are not scarce. The gangue is exclusively of calcite, often compact, in solid masses, and with only occasionally some quartz and some talc heavily colored by iron salts. The calcite itself is often colored by brown and black iron and manganese salts around the masses of galena, even in the lowest levels.

Evidences of "Gossans"

Resting directly upon the granite, and forming the top of the Meseta of Linares, are sedimentary beds of Triassic sandstones and quartzites, 24 to 30 ft. thick. The vein fractures can be seen to continue through them, along the outcrop. I am inclined to think that this extension near the surface of the vein fissure through the Triassic sandstones is the result of a movement and of a fracturing later than the main period of vein formation of the district. There are no marked indications of "iron hats" and other signs characteristic of important vein outcrops, where this fissuring shows in the Triassic sandstones, while, at other places not far away, these same sandstones are so rich in iron as to constitute almost small iron-ore deposits. I believe these to be the result of the local erosion, during the Trias, of the true "iron hats," at the outcrops of the veins, and their deposition not far away, on the sandy beach of the Triassic sea. The true interpretation of these facts is important, as it would thus fix the age of the primary deposition of the ore found in the district of Linares and La Carolina as later than the Silurian and older than the Trias.

A view of the "Rumbo"

In plan, many veins show in places the structure of a fishbone, the main vein being joined by others, which meet it at an angle of 25 to 30 deg. The point of junction is always a point of enrichment. As a rule, the side vein is about one-half to a third as wide as the main one. It thins out and disappears at distances varying from 150 to 200 ft. from the point of junction.

Silver-Lead Ores Predominate

The ore is of pure galena, in large crystals, carrying from 3 to 10 oz. of silver per ton of lead. Blende, chalcopyrite or pyrite are rare. Near the surface, in the upper levels, are phosphates or vanadates of lead and rarely copper carbonates. The galena occurs in masses more or less elliptic in form, measuring from 3 to 5 ft. in diameter, in the direction of their elongation and connected together by regular seams a few inches in thickness. The galena is often distributed in two or more parallel layers through the gangue filling. Whether there is one or several seams, these are indifferently located near the foot wall, near the hanging wall or in the middle of the vein. The total width of the galena in the vein varies from a few inches to a maximum of six feet in the richest parts.

The vein contains numerous channels of former underground water circulation, connected together by

[1] L. Mallada, Memorias de la Comision del mapa geologico de Espana; Vol. I, page 163, A.D. 1895.

a series of cavities of a size from a few square inches to several square feet in cross-section, but more or less elliptical in form. They are lined up by rhombohedrons of calcite, covered by iron pyrites. It seems that the base level of this part of the district was formerly much lower than it is at present and that these channels, now 800 to 1,000 ft. lower than the lowest point of the present valley, were feeding some surface springs at a former time.

The Meseta of Linares borders the valley of the Guadalimar, a tributary of the Guadalquivir. It is a tableland crowned by sandstones and quartzites of Triassic age, covering a mass of granite, flanked by Cambrian and Silurian schists. It is elevated only from two to three hundred feet above the main valley to the south. A series of low and broad ridges connects this mesa with the northern part of the mineral belt, where the district of La Carolina dominates. This northern part of the district is characterized by the important foothills of the Sierra Morena. These have been carved by the erosion into a series of parallel mountain ranges, rising to elevations of 1,000 to 1,500 ft. above the bottom of the valleys between them.

Although the two districts of Linares and of La Carolina pass gradually into one another and are parts of the same broad mineral belt, and although the veins were formed at the same time and by the same agencies, the differences in the history of the two neighboring districts, since the period of ore deposition, as well as the great difference in the country rocks through which the fissuring took place and in the midst of which the mineralizing waters deposited their burden, has given two sets of widely different results.

Variable Dip of La Carolina Veins

The veins in the district of La Carolina dip often at a fairly flat angle. Their dips vary mostly between 70 deg. and 45 deg., while at Linares the dips of the veins vary only between the vertical and 60 deg. The veins in the Cambrian black schists are also very persistent in their strike, having been followed for distances similar to those indicated for the veins near Linares. Among them are the veins known as Los Guindos, Sinapismo Castillo-La Rosa, and La Reforma-Santa Paula-La Carolina, for instance, which have been traced for more than 30,000 ft. along their respective outcrops. The splitting of the veins by horses of country rock is more common. At times the veins send into the country rock regular seams, like the apophyses of an eruptive rock. These end sometimes in mushroom-like deposits, along horizontal planes. The ore of higher grade rarely bulges into elliptic masses, as at Linares, but keeps more like a persistent seam, several inches to a foot or more thick. The gangue is a quartz gangue in parallel layers. The vein shows less signs of an open fissure and more those of a sheared zone. The gouge seam along the foot wall is more frequent and better defined, and the vein often shows signs of later movements.

The galena is usually in smaller crystals and it is necessary to note the almost complete absence of any mineral other than the quartz and the galena. I believe that here the veins show the original primary ore deposition, from ascending hot waters as a rule, while the bulk of the ore mined at Linares has been redeposited in its present place and reconcentrated by descending vadose waters.

The veins in the Cambrian and the Silurian black carbonaceous schists at La Carolina have given as high a production of lead as those of Linares. The proportion of the silver to the lead is about double in the veins in the black schists to what it is in the veins in the granite. There was perhaps a much greater precipitation of the silver in the primary ore, due to the large amount of carbonaceous matter in the black schists. In both cases, some oreshoots have been large, rich, and remarkably persistent in length. The differences in the gangue, quartz in one case and calcitic in the other, coincide exactly with the differences in the country rock, as black carbonaceous schists in one case and granite in the other.

Hydro-Electric Installations Furnish Power

The power used is electric current furnished by the Mengemor company from several hydraulic power plants built on the river Guadalquivir and its tributaries. The largest now in operation is located at Mengibar and another, even larger, is being built at El Carpio, near Cordoba. Many of these plants are of several thousand horsepower capacity.

These power plants are connected and send the electric power to the mines of Linares and of La Carolina over a line at 23,000 v. They are also connected with another line, 100 miles long, carrying 75,000 v., belonging to the Penarroya company, and which has its power plant at Belmez. The electric power is generated there by a steam plant, burning the coal from the coal mines near by. At La Carolina, a substation steps down the current from 75,000 to 23,000 v., for its distribution in the mining district. During the winter, there is an excess of power from the hydro-electric plants, and these send some electricity to Belmez, for use in the coal mines. During the summer, the rivers are very low in this dry part of Spain, and the steam plant sends enough power to make up what the hydro-electric plants are unable to furnish.

Some mining companies, like the La Cruz company, for instance, have their own power plants. This company has a hydro-electric plant of 1,500 hp. at El Arquillo, on the Guadalimar. The hydro-electric plant is duplicated by a steam one, erected alongside of it, and of the same capacity, which replaces it in part during the late spring and the early fall and can replace it altogether, if need be, in the middle of the summer. The Province of Jaen is celebrated for its immense plantations of olive trees. Close to the power plant, a factory extracts their oil from thousands of tons of olive stones. The wooden residue, left after this operation, is burnt instead of coal in the boilers of that steam plant.

Ground Occasionally Heavy

The veins are exploited in much the same way and by the same methods, throughout the district, except that although the ground holds well in the granite, and requires little timbering, it is heavy in the schists and the problem of keeping the drifts and crosscuts open is a serious and expensive one, requiring a great deal of timbering.

The timber used is made of round logs, not of sawed lumber. It comes from the higher parts of the Sierra Morena. In the stopes, ladders, made of iron bars and iron chains, and carried from place to place, are most common.

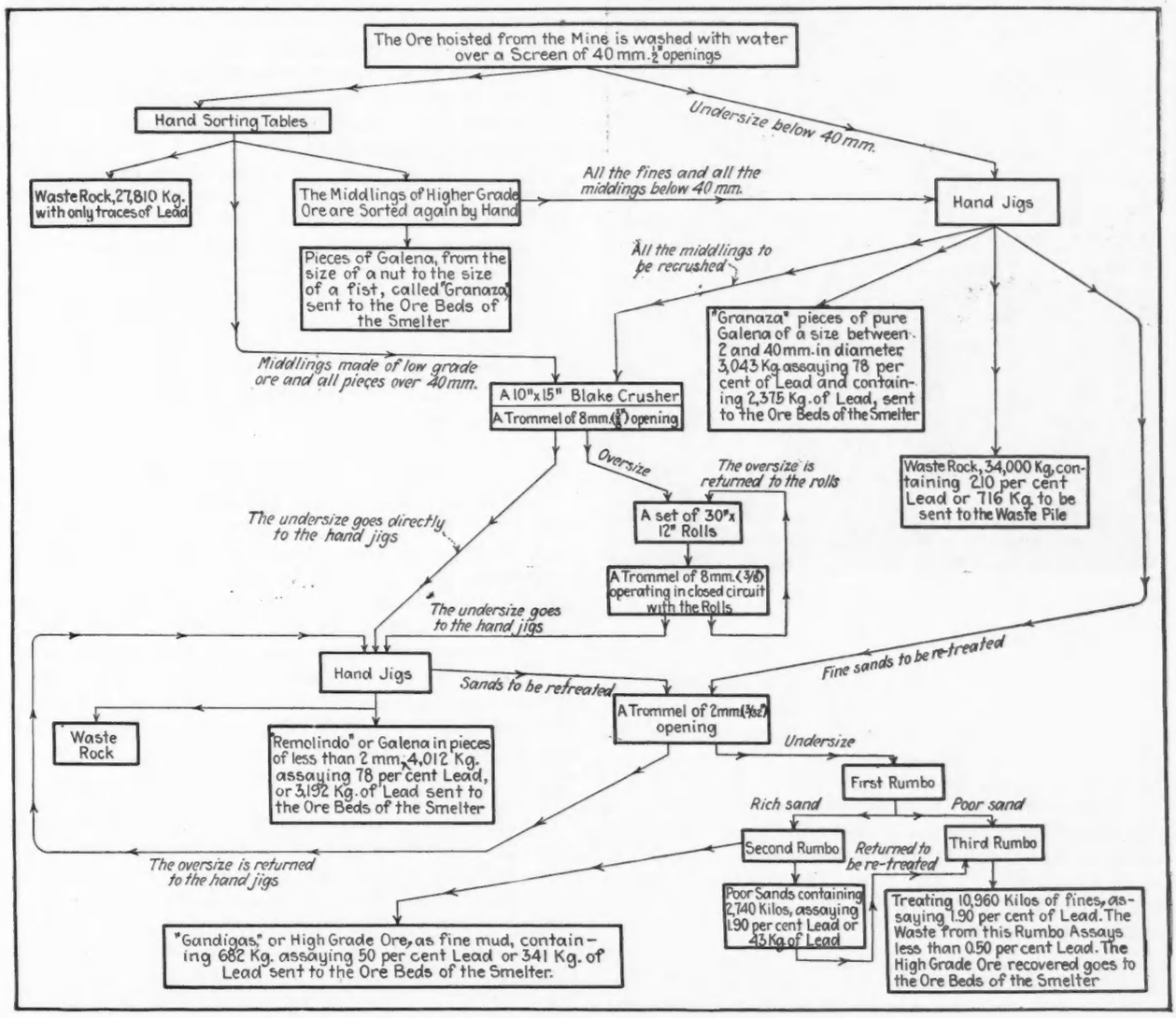
The stopes are either overhand or underhand stopes, and both kinds are used in about equal numbers. Their location depends on the size of the pay-streak at the top and the bottom of the drifts driven on the vein at

the various levels, and whether it is more convenient to follow the ore up or down at a given place.

The ore blasted in the stopes is raked by a sort of large hoe, called *legon*, which is used to fill baskets with two handles, made either of rope or of sheet iron. These baskets, called *espuertas*, contain about 50 lb., or from a third to half a cubic foot of broken ore. The miner carries it a short distance to the ore chutes, where he dumps it, and from where the ore is run into ore cars

in much the same way and air drills are used almost everywhere. In driving the drifts, eighteen holes are drilled perpendicularly to the face of the drift, in six rows of three holes each. The upper holes are 2 ft. deep. The lower ones are 4 ft. deep. The holes are driven deeper at each row from top to bottom between these depths.

The force of blasting is exerted in a plane perpendicular to the direction of the drill holes and the result



Flow sheet of treatment of ore and concentrates.

at the level below, trammed to the shaft and hoisted to the surface. The ore from the underhand, as well as the ore from the overhand, stopes is sent by ore chutes to the level below.

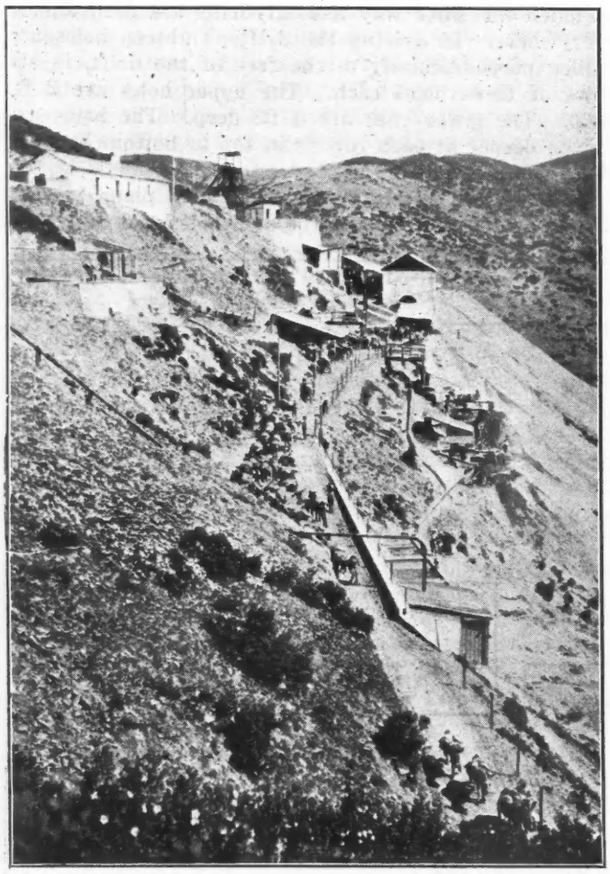
With the veins in the granite, the empty and barely timbered stopes are left standing, and have been standing thus for a long time. But in the veins in the Cambrian schists, it is difficult to open up much ground ahead of stoping. The stopes are closely filled in by waste from the crosscuts and the other workings. The drifts are heavily timbered and the continuous retimbering necessary to maintain them in good condition keeps a gang of timbermen always busy.

The dynamite used contains either 50 or 75 per cent nitroglycerin. The drifts and the crosscuts are driven

of blasting leaves a very straight, even face, 3½ ft. beyond the preceding breast of the drift. The size of the drifts and of the crosscuts is 4x7½ ft.

The drill most in use is the Ingersoll-Rand Jackhamer, weighing 36 lb. Another in use is from Flottmann's, a German firm. These machines were replaced by American drills during the war and have failed to recover their old favor since then. The drills have a single bit, similar to that of the hand drills, or a double bit. The cross-bit is not used as a rule. Air-drill sharpeners are used, and I have seen a number of Imperial-Duplex, Ingersoll-Rand air compressors.

The amount of water in the veins is not large. At several mines, both at Linares and at La Carolina, the amount of water raised amounts barely to the quantity



The Araceli mine and concentration mill with pack train carrying concentrate to the smelter

needed for the milling operations. The drainage of a vein, for a distance of 12,000 ft. along its strike, and to a depth of 1,200 ft., giving 180 gal. of water per minute, represents a fair average of the amount of water encountered in the veins of this district.

Several mines at the northern end of the district carry their ore from the mine to the nearest railroad station of La Carolina, with some important tramways of the Bleichert, or Polig, type. The Los Guindos mine has a tram four miles long and the Centenillo mine has another eight miles long.

Concentration of the Ores at the Surface

All the ore broken in the stopes is first brought out to the surface, to be sorted there on sorting tables. The flow sheet gives the detail of the work done. The hand-jigs, the jaw-breaker of the Blake type, the sets of rolls and the trommels are of the same types as those used in the United States.

An interesting local apparatus is called the *rumbo*. In a way, it acts somewhat as a sort of crude Dorr thickener, but is a well-known local development of the district of Linares. It is formed by a tank 12 ft. in diameter and 2 to 3 ft. deep. The pulp is poured in at the center and the water is raked out at the rim of the tank, by four surface paddles, rotating slowly, and with canvas attached to them. The *rumbo* is filled, stopped and emptied in about 5½ hours. The product obtained is divided into three concentric layers. The high-grade ore, nearly pure galena, collects near the center of the cone thus formed and the poorest part near the outside.

The pulp, when poured in, is about two parts of water to one part of sand. When shoveled out, the sand contains only from 10 to 20 per cent water. The *rumbo* is emptied by shoveling, and the workers know exactly by experience what to shovel out as high-grade ore, which is sent directly to the smelter; what to take as middlings to be re-treated, and what to shovel away as tailings. At present, the tailings, sent to the tailings pond, contain considerably less than 1 per cent lead. A *rumbo* treats from thirteen to fourteen tons of pulp in an eight-hour shift.

The concentrating plant is working only during the day shift of eight hours. The mines work two shifts and, of course, the smelter runs continuously. The mines and the concentrating plants do not work on Sundays or on feast days.

The product of the concentrating plants is sent to the smelters. The Los Guindos company is building a lead smelter at Malaga to treat its own ores. Some other companies ship to plants outside of the district, but the bulk of the ore is treated on the spot, in two smelters of a daily capacity of sixty tons of lead each. One is the La Tortilla smelter, which makes bars of lead bullion, lead pipes and lead sheets. The other is the smelter of the La Cruz company, which also makes bars of lead bullion, and besides, minium, litharge, and small lead shot of all sizes for shot guns.

Slag Disposal at Anaconda

In a recent issue of the Anaconda publication, *The Anode*, the method of disposing of the slag from the reverberatory furnaces is described. All of this slag is granulated with water, the largest slag particles being about ⅛ in. in diameter. The slope of the main slag launders is ⅝ in. per foot, this being the minimum grade on which the slag will flow with the amount of water available. The launders are lined with cast-iron liners part way, and then with cast-slag liners the remaining distance. At the end of the discharge launders are placed two pits, approximately 90 ft. long and 40 ft. wide. While one pit is filling with slag, the other is draining and being excavated.

Two tracks parallel the pits; one is for the crane that does the excavating and the other for the train that takes the slag to the dump. These tracks are about 10 ft. above the top of the pits. Loading is done by a thirty-ton electrically driven locomotive crane with a 3-cu.yd. clamshell, handling a load of three and one-half tons every thirty seconds. The train consists of a forty-five-ton electrically driven motor operating from a third rail inside of the track, hauling four 20-cu.yd. side-dump cars, each with a capacity of twenty-five tons of slag. One trip is made every fifteen minutes, and the daily capacity is 4,500 tons.

A Jordan spreader with a side-arm reach of 15 ft. is used to spread the slag away from the track as it accumulates after dumping. The plow arms are operated by air, furnished by the locomotive that pushes the plow. Four trips with the plow are necessary to level the slag after each dumping.

When the slag has reached a point about equal to the reach of the spreader, the track is moved by hand, the new level being somewhat above the old each time, to increase the capacity of the dump. The present slag dump is filling up on top of the old slag which was run out and sluiced away by gravity prior to 1916. The fill at the present time is 100 ft. deep at the deepest spot. There is capacity for some years to come.

Experiments in Electrical Prospecting—II*

Results of Surveys at a Number of Important Canadian Mines —Value of the Method Is Principally in the Preliminary Determination of Advantageous Locations for Diamond Drilling

By Sherwin F. Kelly

FROM Kirkland Lake I went to Cobalt, and there traced a few profiles on the properties of the Coniagas and Nipissing mines. The mineralization is a vein filling of smaltite, native silver, and calcite in fractures in the Cobalt series of sediments, the Nipissing diabase sill, and the Keewatin complex. The veins are seldom over an inch or two thick and are sometimes almost paper thin.

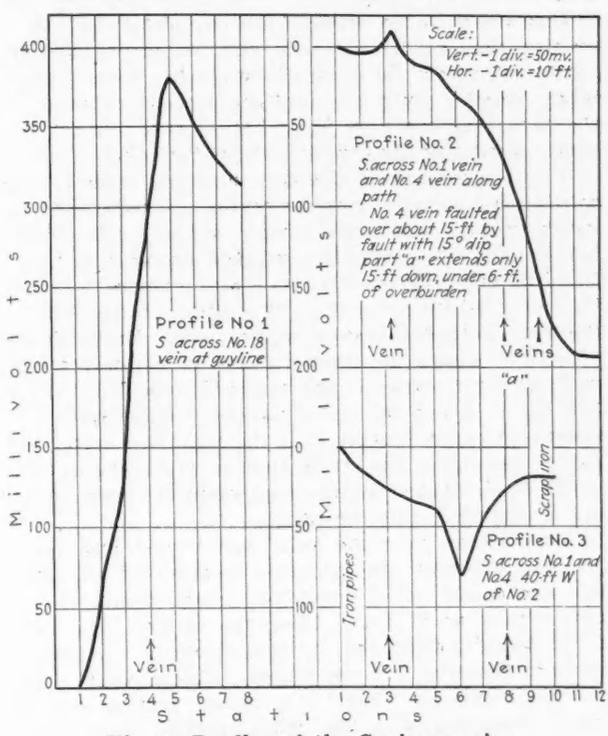


Fig 9—Profiles of the Coniagas mine

The Cobalt series of sediments, mainly conglomerates, because of its greater liability to fracture, has been productive of nearly 80 per cent of the ore produced in its area, and it was on the veins in this formation that these experiments were made.

The profiles drawn at the Coniagas mine (Fig. 9) were made under difficulties, because this region is thoroughly exploited, with the result that there are piles of scrap iron, buried pipes, and buildings to interfere with the normal electrical field. Moreover, the mines have been stoped practically to the surface, leaving little mineralization to generate electric currents.

Profile No. 1 gives strong indications of the presence of the vein between points 4 and 5. Profile No. 2 is all right so far as the vein just past point No. 3 is concerned, but is less satisfactory where crossing the veins near points 8 and 9. It should be remarked that the vein underlying the region between points 9 and 10 has been faulted over 15 ft., having been a part of the one at point 8. This latter is under 6 ft. of overburden and extends only 15 ft. down, below which point it is stoped out. Therefore these two points do not represent advantageous conditions. Profile No. 3 was run across the same two veins, but 40 ft. to the east, and is a clear illustration of the effect of a cast-iron air line at one end and a pile of scrap iron at the other end of the profile, but not of vein action.

The profiles drawn on some of the Nipissing veins are far more conclusive and were made under more normal conditions (Fig. 10). Profile No. 1 is rather difficult of interpretation, as it crossed a rather complicated network of veins, which were more or less concentrated between points 5 and 7. The profile was drawn at an angle to 96 vein, not far from where the latter had been trenched.

This rather confusing jumble of veins led me to carry my apparatus down into the shallow valley to the east, which ran nearly at right angles to the trend of the mineralized fractures which crossed it. This profile clearly indicates the effect of even these paper-thin veins. Fortunately, I was able to locate the veins, as the overburden had been sluiced off in prospecting, leaving the bedrock exposed, except for a width of 10 ft. or so and a depth of 2 or 3 ft. in the little gully. The fractures were thus easily traced from one side to the other, and although very narrow, the mineralized ones were fairly evident. They have been indicated on the profile. I did not see a vein lying between points 2 and 3, but no doubt whatever exists in my mind that one is there, probably covered by remnants of the overburden. An interesting point of this profile is the manner in which the three veins at points 11 to 13 nearly mask the action of their neighbor close to point 10. Because of the narrowness of these veins, the distance between electrodes was extremely short (5 to 10 ft.).

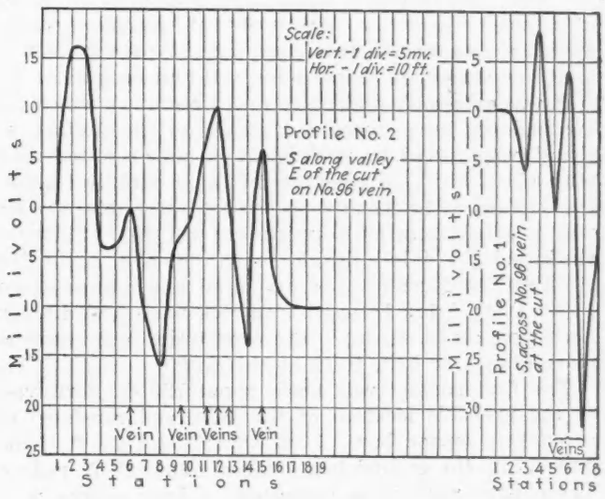


Fig. 10—Electrical profiles obtained at the Nipissing mine

*Conclusion of a paper published in the Oct. 7 issue of the *Journal-Press*.

The results of the experimentation described warrant, I believe, the conclusion that it is entirely possible that electrical prospecting could be applied with advantage to the search for silver-cobalt veins of this type, where they are not masked by more than 3 or 4 ft. of overburden, and deeper if they are wider than the ones in the Cobalt region. Considerable expense in sluicing might thus be avoided.

The profiles obtained from measurements in the proximity of the native copper deposits, both amygdaloid and conglomerate, of the Calumet & Hecla properties on the Keweenaw peninsula, indicate that the mineralization, as found here, is not sufficiently continuous to produce an electrical current. This statement applies even to the "Mass Fissure Vein," which consists of native copper filling a narrow fissure a few inches across. None of the profiles (Fig. 11) presents a sufficiently characteristic peak distinct from the remainder to make possible the definite location of a vein by this means.

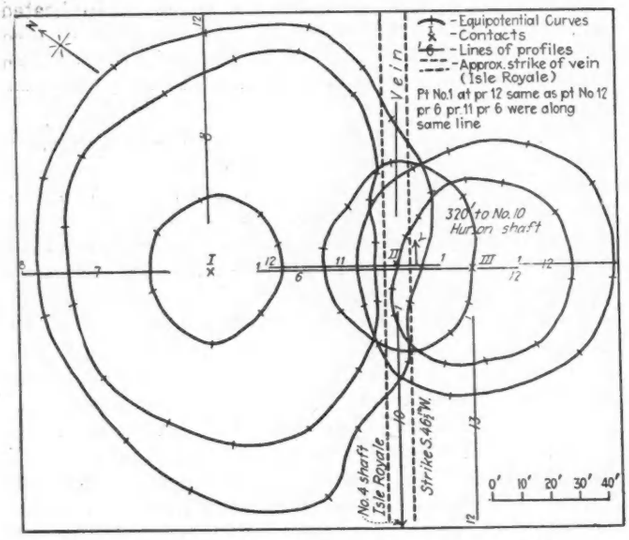


Fig. 12—Equipotential curves at Calumet & Hecla.

Following this failure, the officials of the company requested me to make a trial of Professor Schlumberger's first method, and they very kindly furnished me with the necessary apparatus, consisting of a set of storage batteries, 2,000 ft. of insulated cable, switches, an ammeter, two dozen metallic pegs about 2 ft. long, and some bare copper wire, and two assistants.

It was extremely difficult to find a region in which the ore had not been stoped out almost to the surface, so that I was forced to experiment on an exploited vein, with about 50 ft. of poor ore left as a back to support the surface. The locality chosen for these experiments was a small clearing between the old No. 10 Huron shaft and No. 4 Isle Royale shaft, and only about 300 ft. from the former. The ore is an amygdaloid about 18 ft. thick, lying between trap-rock walls and dipping northwest about 51 deg. The overburden was nowhere more than 4 or 5 ft. thick at this locality.

The first contact was made about 120 ft. northwest of the probable location of the vein, and consisted of about ten copper bars, ½ in. square and 1½ ft. long, driven into the ground in a circle of about 10 ft. radius. These bars were then connected by bare copper wire which was run around the periphery of the circle. with one or two strands diametrically across it, and connected with a peg driven at the center. Thus the accidental breaking of a strand did not cut more than one or two pegs out of the circuit.

Fifteen hundred feet to the southeast—that is, at right angles to the strike—another similar contact was made, and the two contacts were connected by insulated cable to the two poles of a 100-v. storage battery. A double-throw, double-pole knife switch was connected so as to serve as a reversing switch; and finally an ammeter was connected in the circuit.

An equipotential curve of about 25-ft. radius was traced about the contact near the vein (Fig. 12), lying wholly within the hanging-wall trap, and presents a nearly circular form. A larger curve outside of this one, of sufficient radius to intersect the vein, presents a marked flattening along its southeast boundary where it crosses the lode. A second curve, 20 ft. outside of this, is bent decidedly outward as it crosses the vein, so that the distance between the two along the lode is greater than at the opposite side, except toward the southwest, where the outer curve pinches inward somewhat, possibly owing to surface irregularities or to the fact that ore may have been stoped out at this point, decreasing the conductivity of the vein.

With the contacts in the same position, three profiles were traced radially from the center, one parallel to the strike and the other two at right angles to it. Profile No. 6 (Fig. 13) presents a marked decrease in potential differences between points 6 and 8 where it crosses the vein, indicating that at this point conductivity of the rock is higher than at either side. Profile No. 7 (Fig. 14) shows the normal curve in non-mineralized rock, at right angles to the strike. Profile No. 8 (Fig. 15) shows a normal curve parallel to the strike, its lessened slope indicating that the rock is a better conductor parallel to the strike than at right angles to it, which is also shown by the equipotential curves, which are elongated in this direction.

The contact near the vein was moved and placed immediately over the probable location of the apex, and one equipotential curve was traced around it and two profiles were traced along the strike. The curve is noticeably elongated in the direction of strike—more so than the first one traced. Profile No. 9, drawn to the northeast (Fig. 16), shows marked flatness when compared with the other profiles, indicating a slow drop of potential, and therefore a conducting body. Profile No. 10 (Fig. 17), drawn to the southwest along the strike, shows by its irregularity that the vein in that direction is less regular or has been more completely stoped out in spots than beneath the line of profile No. 9.

The same contact was again moved, this time 80 ft. toward the foot-wall side of the vein, and two more equipotential lines were traced, together with three profiles. The deformation of these curves over the vein is slightly less marked than that produced in the second and third curves traced about the first contact. The reduced effect of the vein is due to two causes: first, the curves are of lesser radii, and therefore a lesser amount of their circumference penetrates the vein; second, being on the foot-wall side, the vein dips away from them, thereby still more reducing the surface of contact between the equipotential surface and the vein. The other two curves referred to have a greatly increased surface of contact with the vein, because it dips toward them.

Profile No. 11 (Fig. 18), traced across the vein, shows the same sort of depression where it crosses the

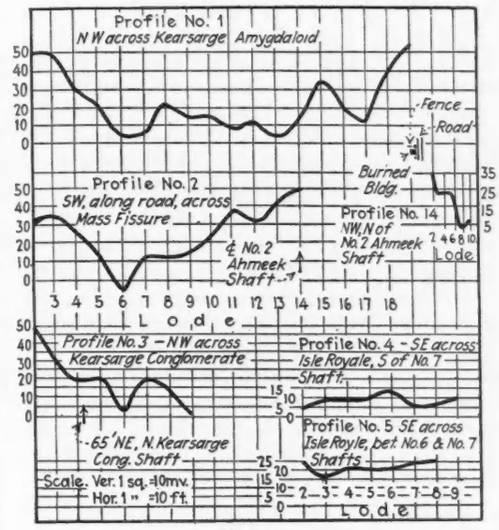


Fig. 11

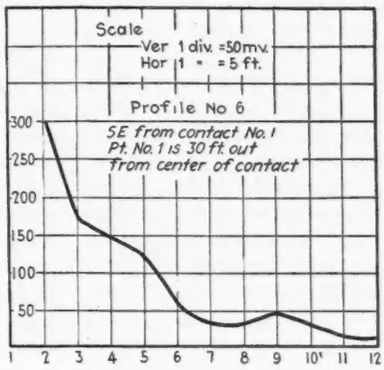


Fig. 13

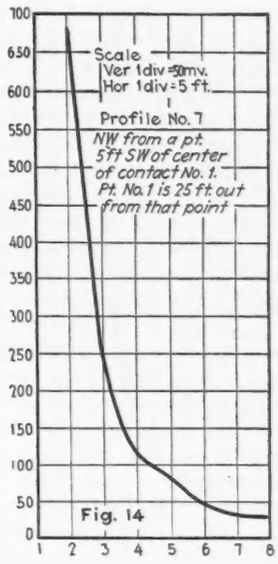


Fig. 14

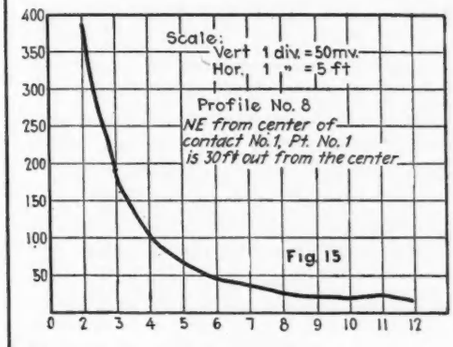


Fig. 15

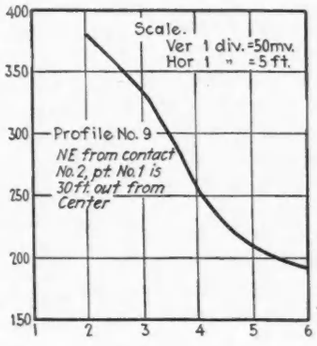


Fig. 16

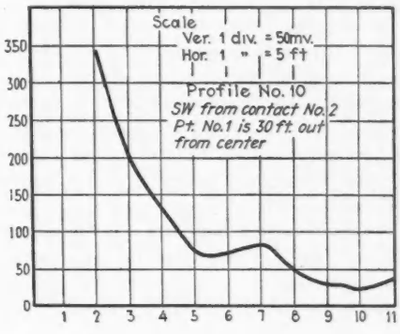


Fig. 17

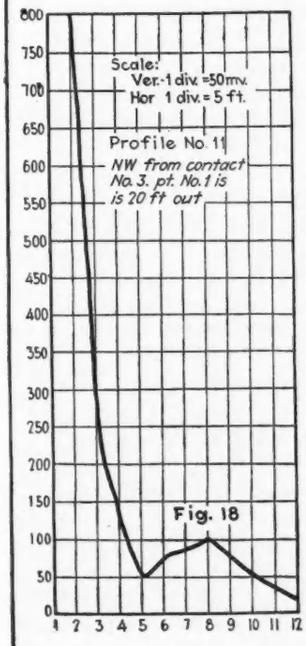


Fig. 18

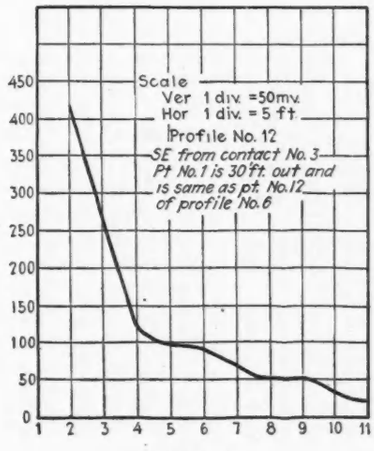


Fig. 19

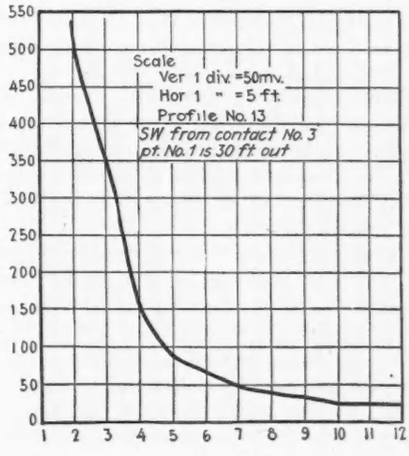


Fig. 20

Ordinates are in Millivolts, Abscissas are in Feet

Figs. 11, 13, 14, 15, 16, 17, 18, 19 and 20—Electrical profiles obtained at the Calumet & Hecla mines

vein as that shown in profile No. 6 at the same point. Profile No. 12 (Fig. 19), traced to the southeast, shows some slight irregularities, due to the fact that it crosses a series of trap and barren amygdaloid beds. Profile No. 13 (Fig. 20), traced along the strike, is quite normal and regular.

From these experiments I conclude that the method of spontaneous polarization is not applicable with certainty to the prospecting for native copper deposits of the Calumet type. On the other hand, the method of utilizing an independently generated current seems to give promise of fairly good results on such deposits. The copper conglomerate would probably give more definite reactions than the amygdaloidal copper, upon which I conducted these experiments.

From these experiments upon native copper, pyritic, and anthracite coal deposits, it is reasonable to believe that prospecting by the spontaneous polarization method is applicable to pyrite, pyrrhotite, smaltite and other metallic sulphides when these are present as a vein, or segregation, or replacement body, and when the mineralization is sufficiently concentrated to present a practically continuous metallic path for the transmission of the spontaneously generated electric current. Such are the types represented by the Ducktown, Sudbury, Porcupine, and Cobalt deposits.

If, on the other hand, the mineralization is disseminated through a non-conducting gangue, such as quartz, spontaneously generated currents, if present, cannot be detected, and this method is inapplicable to such orebodies. In this category are the gold deposits in silicified porphyry at Kirkland Lake. However, pyritic gold in the schistose rocks of this same region gives a decided reaction.

Native copper deposits of the Calumet & Hecla type are not readily identified by this method of prospecting, although the more cumbersome one, making use of an independently generated current, may be applied with success.

Anthracite coal, when in strata that are steeply tilted, may easily be discovered by making use of the phenomenon of spontaneous polarization currents.

Utilizing independently generated current, one may also make a stratigraphical study over a wide region where tilted strata are hidden by a slight thickness of overburden or horizontal strata, by taking advantage of the fact that such strata present lower resistance parallel to their bedding than at right angles to it. Faults, presenting greater conductivity than the country rock, because of the presence of included water, may also be detected.

Professor Schlumberger has recently been working along lines looking to the wider application of electricity to the solution of stratigraphic problems.

Prospecting by electricity will probably find its most useful field in preliminary surveys of mineral districts for the purpose of determining the most advantageous locations for putting down diamond-drill holes. Professor Schlumberger's method gives one a general idea of the location and trend of mineral zones, but is incapable of discovering precise information as to the character and value of the metals present. Diamond drilling, on the other hand, does give exactly such precise information, but is too expensive a process to be adopted generally in making thorough surveys of large areas. The two methods thus supplement each other, one making up for the disadvantages of the other.

The economic geologist should find electrical prospecting a valuable addition to his field kit.

Thirteenth International Geological Congress, Brussels, August, 1922

By R. A. F. Penrose, Jr.

FROM Aug. 1 to Aug. 9 no regular sessions of the Thirteenth International Geological Congress were held, but many excursions were made throughout Belgium, to see its geologic and topographic features. These excursions were led by various local geologists familiar with the ground over which they traveled, and were of great interest.

The second ten days of the month—that is, from Aug. 10 to Aug. 19—were devoted to actual meetings in Brussels of the members of the congress. Numerous papers of great geologic importance were read and discussed. No one subject monopolized the attention of the congress, though the general discussion of the tectonics of Asia and of different parts of Europe, Africa, and America created great interest. Many other important papers were read relating to various structural, igneous, and economic phases of geology.

During the meeting of the sessions, almost daily meetings of the council or of its committees were held, and at the last meeting of the council certain statutes for the International Geological Congress were drawn up and approved.

During the sessions, numerous short excursions were taken to points of geologic interest within easy traveling distance of Brussels, thus enabling the members to intersperse these trips with the more serious work of listening to papers and taking part in discussions.

The official dinner of the congress in the Pavillon de la Laiterie du Bois de la Cambre was a most enjoyable occasion, and was attended by the members of the congress and by invited guests. A number of speeches were made both by the Belgian geologists and by those from other countries.

No mention of the Brussels Congress, no matter how brief, would be complete without an expression of deep thanks and appreciation to the officers and members of the Committee of Organization, who prepared the details and carried them out with such perfect precision. M. Lebacqz, the president, did everything possible, as a presiding officer, to direct the meetings of the congress in a competent and dignified manner. The secretary-general, M. Renier, who had direct charge of the details of the congress, was most tireless in his efforts, both during the meeting and for months before it, to make the congress a success, and did everything possible that would add to the comfort, to the enlightenment, and to the enjoyment of the members.

The other members of the committee, consisting mostly of well-known Belgian geologists, gave their splendid efforts to the conducting of the excursions, to the details of the meetings and the sessions, and to all other matters which pertained to the interest and comfort of the visiting members.

In addition to the excellent official management of the meeting, the American members who were present left with the kindest recollections of the cordiality and hospitality of Millard K. Shaler, an American geologist living in Brussels and having charge of the great Congo Concession known as the Société Internationale Forestière et Minière du Congo. His genial, cordial, and always thoughtful assistance and hospitality will long be remembered by those of his countrymen who had the good fortune to meet him.

Flotation in the Slocan District, B. C.*

Silver-Lead-Zinc Ores Offer Difficult Problems in Differential Separation—Hynes Disk Machine, by Its Excellent Aeration of Pulp, Improved Results —Copper Sulphate Coagulated Slime and Kept Graphitic Matter in Tailing

By J. P. MacFadden

THE OPERATIONS of the company of which I am privileged to be superintendent, though rather meager at present, have included mining and milling the ores of four widely separated Slocan mines—namely, the Surprise mine, on the north side of Carpenter Creek; the Ivanhoe, and the Canadian group, on the south side of Carpenter Creek, both above Sandon and at respective altitudes of 6,700 and 5,500 ft., and the Bosun mine, at the level of Slocan Lake and halfway between New Denver and Silverton. The ores from these four mines were delivered by aërial tramway and by either rail or barge to either our concentrator at Sandon or that at Rosebery. Our efforts and results in the milling of these ores I shall attempt to outline.

The flow sheet of both mills called for gravity concentration, with the usual equipment of crusher, rolls, trommels, jigs, tables, and flotation, with machines differing as to type in the two plants.

Gravity concentration in the Slocan naturally is similar to the same process elsewhere on lead-zinc ores, but at the same time it has differences that should be mentioned. The mechanical separation of lead and zinc from each other and from their gangue ordinarily is a simple matter, and calls for only a minimum of outlay in the way of milling equipment and construction. The facts, however, that the Slocan ores are high grade as to silver, and have their sulphides of lead and zinc often intimately mixed, in hard gangue, together with the presence in the ores from some of the mines of large proportions of pyrite and iron carbonate, make the problem more complex, and the outlay for milling equipment and construction was more costly than that usually considered necessary elsewhere.

The Slocan mines are primarily silver mines, for whereas the lead and zinc derived, of course, are necessary and acceptable products, they are, nevertheless, secondary from the point of gross value. The difference in equipment and construction is largely occasioned by the need for re-grinding a middling from all of the jigs. This means additional rolls, elevators, trommels, and jigs.

The lead concentrate derived from the milling of a Slocan ore runs from 100 to 175 oz. per ton in silver. The lead is soft and easily slimed; it is necessary therefore to "step on" these products in the coarsest possible state. Where the amount of lead in the mill feed will warrant it, picking belts are used. The next best device is the one- or two-compartment bull jig, where a lead concentrate only is saved as a finished product, this product being as coarse as ¾ in. From a rich lead feed, a considerable part of the lead can be removed at this stage.

If a general sample of the lead concentrate is sized and assayed, it will be found that the silver content decreases rapidy with the fineness. At every crushing of a piece of lead mineral a certain amount of very fine lead and slime is produced, which is difficult to save, especially in the presence of the large volume of water needed for the process. Certainly, as far as water concentration goes, the silver, as argentite, tetrahedrite, proustite, or other mineral, in the galena or blende, must be saved while it is in association with the sulphides of lead or zinc. The sliming of the lead and zinc sulphides, more especially the galena, frees a large proportion of the silver minerals, and once this is accomplished one can say goodbye to the silver. Our experience has been that it is practically impossible to settle it.

A stranger, examining the assay returns of our lead shipments, might comment reasonably that we were making a dirty or zinky product, and either wonder why this was so, or assume that the association was so complex that a better separation could not be made. With our ore, at least, it is perfectly possible to make a lead concentrate running 65 to 70 per cent lead and 6 to 7 per cent zinc, but we determined that it was greatly to our advantage to produce a finished concentrate assaying about 55 per cent lead and 10 to 12 per cent zinc—the purpose of this being to recover the silver at the earliest possible stage in the operation, and thereby avoid, as much as possible, the re-grinding of a rich middling, with its consequent loss of lead, and especially of silver, through sliming. The higher zinc content, of course, entails a higher smelting charge, but the increased recovery obtained, especially in silver, much more than offsets this. This procedure would not necessarily be applicable in the production of a lead concentrate that was not rich in silver. Just where to draw the line depends largely on the price of the metals, smelting charges, and freight.

Rosebery Equipment and Flow Sheet

With the above stated object in view, practically all the concentrators in the Slocan have been designed on much the same lines. The personality and experience of different men find expression more in the technique of operations than in the use of widely varying styles of machines. A list of the equipment and the outline of a flow sheet for one mill will, generally speaking, cover them all.

The equipment of our Rosebery concentrator, with a capacity of 150 tons per day, consists of:

One 20 x 30-in. Blake crusher
One Gates D-2 gyratory crusher
One set of primary rolls
One set of intermediate rolls
One set of fine rolls
Two two-compartment Harz bull jigs
One four-compartment Harz jig
Five five-compartment Harz jigs
One 4 x 6-ft. Chalmers & Williams ball mill
One Dorr duplex classifier
Eight Wilfley tables
One Deister slime table
One 8-ft. Callow cone
One 28-ft. Dorr thickener for flotation feed
One 18-ft. Dorr thickener for flotation zinc-concentrate
One Callow pneumatic cell
Four Hynes disk flotation machines
One 4 x 6-ft. Portland filter

The ore is received, direct from the mines, in railway dump cars, and is either crushed direct or dumped into

*A paper read before the International Mining Convention at Nelson, B. C., on July 5, 1922.

storage bins of 1,500 tons' capacity. When crushed direct, the car is dumped over a small bin beneath the track, under which travels an 18-in. belt conveyor, the car acting as a bin until its contents have been removed by the conveyor to the Blake crusher, which is set for crushing to 2 in. From the crusher the ore is carried by a belt conveyor, which is also utilized for picking, to the gyratory, which reduces it to 1 in. From the gyratory the ore goes to the mill-feed bin by elevator.

The ore is fed to the primary rolls by means of an Allis-Chalmers style H feeder. At this point a sample is taken every fifteen minutes by catching the full discharge of the feeder in a pan during a period of thirty seconds. The large sample obtained from the accumulation of the interval samples during a period of twenty-four hours is then cut down to a 10-lb. sample, as representative of the previous day's mill feed. Every alternate interval sample is weighed to determine the tonnage going through the mill.

After passing through the primary rolls, the ore is raised by bucket elevator to the trommels, which include four 48x60-in. trommels, of 12, 9, 6 and 3 mm. The trommel product goes to jigs. All material finer than 3 mm. goes to a Culver hydraulic classifier, from which the coarse sand is sent to a fine jig and the overflow to a 50-ft. V-shaped settling-tank, which distributes a thickened product to the Wilfley tables. The overflow from the settling tank goes to a Dorr thickener.

The middling from the bull jigs is returned to the intermediate rolls, and the middling from jigs treating material between 6 and 12 mm. is returned to the fine rolls; the minus 6-mm. middling goes direct to the ball mill, to be re-ground for flotation. The discharge of the intermediate and fine rolls is delivered back to the head of the trommels.

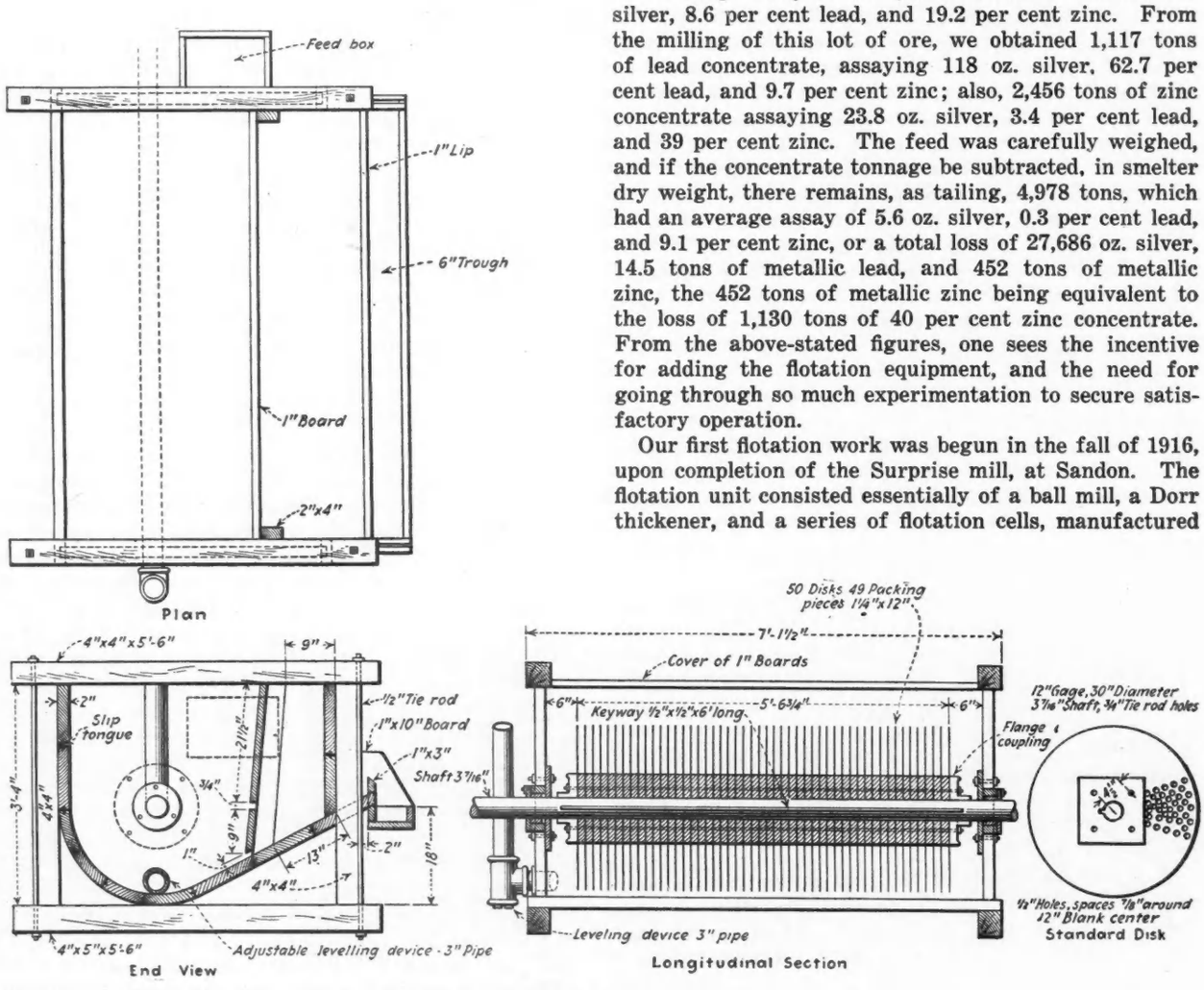
On all ore except that from the Bosun, lead and zinc concentrates are made on all the jigs, from both cups and hutches. The Bosun ore carries too much iron to permit a jig zinc concentrate to be made, and it is necessary to pass it direct to flotation.

Flotation Saves Zinc and Silver Loss

Our flotation work, both at the Surprise and Rosebery mills, was made necessary by the large amount of iron carbonate in the ore from the Surprise mine, and the pyrite in the ore from the Bosun mine, which resulted in a heavy zinc loss, coupled with a more serious silver loss. To this was added the incentive, during the war, of high prices obtainable for both silver and zinc.

As an illustration, I cite the results of the milling of 8,544 tons of Surprise ore in 1915, in what was then the Ivanhoe mill, which was fully equipped with the machinery necessary for gravity concentration only. The average assay of the 8,544 tons milled was 27.7 oz. silver, 8.6 per cent lead, and 19.2 per cent zinc. From the milling of this lot of ore, we obtained 1,117 tons of lead concentrate, assaying 118 oz. silver, 62.7 per cent lead, and 9.7 per cent zinc; also, 2,456 tons of zinc concentrate assaying 23.8 oz. silver, 3.4 per cent lead, and 39 per cent zinc. The feed was carefully weighed, and if the concentrate tonnage be subtracted, in smelter dry weight, there remains, as tailing, 4,978 tons, which had an average assay of 5.6 oz. silver, 0.3 per cent lead, and 9.1 per cent zinc, or a total loss of 27,686 oz. silver, 14.5 tons of metallic lead, and 452 tons of metallic zinc, the 452 tons of metallic zinc being equivalent to the loss of 1,130 tons of 40 per cent zinc concentrate. From the above-stated figures, one sees the incentive for adding the flotation equipment, and the need for going through so much experimentation to secure satisfactory operation.

Our first flotation work was begun in the fall of 1916, upon completion of the Surprise mill, at Sandon. The flotation unit consisted essentially of a ball mill, a Dorr thickener, and a series of flotation cells, manufactured



Detail of a 50-disk Hynes flotation machine

by the Minerals Separation Co. and sent to us in about 10,000 pieces, more or less. The Minerals Separation series of cells consisted of four Hebbard cells, for the selective flotation of lead, followed by a group of four standard cells, in series, with eight Hebbard cells for zinc.

The primary feed was sent to the first of the Hebbard lead cells, after being oiled with cresylic acid, for the selective floating of the lead. After passing through the four lead cells, from which a lead froth was taken, the pulp was discharged, and, after re-oiling for zinc, with water-gas tar, and hardwood creosote, was elevated for delivery to the first of the four standard cells, from which a finished zinc concentrate was taken. The pulp passed through the four standard cells in the usual manner, and then flowed, by gravity, through the eight Hebbard zinc cells, and thence to tailing. A middling froth was taken from the eight Hebbard cells, and returned to the standard cells for cleaning.

The flotation feed assayed 25 to 30 oz. silver, 1.5 to 2.5 per cent lead, and 10 to 15 per cent zinc, the high zinc content being due to the fact that no zinc concentrate was made at the gravity end of the mill. We were able to make, by selective oiling, a lead concentrate that assayed 40 to 45 per cent lead and 25 to 30 per cent zinc, and ranging in silver from 200 to 300 oz. per ton. We used about 0.1 lb. of cresylic acid per ton. The operation, however, was a delicate one, and required constant attention. The reduction in the lead content of the feed, through this process, was not remarkable, so the greater part of the lead in the flotation feed went on to be collected later in the zinc concentrate. The purpose that this operation did serve was to provide a not too zinky medium for collecting the silver that had been freed through sliming and was floating in its own compound free of the lead and zinc sulphides. The fact that a larger percentage of the lead was not removed in this operation was attributable not to the fact that lead is difficult to float but to the need for restraining the zinc.

Early Tailing Loss Excessive

Previous laboratory experiments had given us reason to expect better results in the flotation of zinc than we were able to obtain during the first few months of operation. No difficulty was experienced from the first in taking off a good grade of zinc concentrate from the standard cells, but the tailing results, through the early period of operating, were unmentionable. Weeks of experiment followed, and many kinds of oil were used in varying quantities. Various densities of pulp, combinations of cells for re-treatment, re-oiling at later stages in the flow of pulp, different degrees of fineness of feed, and any number of what one might call "stunts" were tried.

On the Minerals Separation unit as it stood we were not able to average better than a tailing assaying 6 oz. silver, a trace of lead, and 5 per cent zinc. The oil used consisted of 5 lb. of water-gas tar and 0.6 lb. of hardwood creosote per ton of ore treated. Before the war, and at present, such a tailing is bad enough, but when war prices were obtainable it was woeful.

Our next move was to add a Hynes machine, details of which I shall cover presently, to receive the tailing of the Minerals Separation machine, and give it further treatment for the lifting of the remaining zinc and silver. This machine was oiled with 0.3 lb. water-gas tar and 0.02 lb. Pensacola No. 350 pine oil. It delivered a light and voluminous froth of small bubbles; it lifted most of the remaining zinc from the pulp, and with it considerable gangue. The concentrate taken from this machine assayed about 10 per cent zinc, and was returned to the head of the standard cells for cleaning. The average of the tailing from this machine, over a period of thirty days, would be 2 oz. silver and 1.7 per cent zinc.

The Hynes machine consists, essentially, of a rotor, mounted horizontally, and its containing box or tank. The construction of the tank is similar to that of the K. & K. machine. A settling trough or spitzkasten is provided along the front of the tank for collecting and cleaning the concentrate. The dimensions of the tank of a medium-size machine are: length, 6 ft.; width, 5½ ft.; and depth, 4 ft.

The rotor consists of a 3 7/16-in. shaft, upon which are mounted perforated sheet-metal disks of 30-in. diameter, 1¼ in. apart. The disks are of 12 gage, with ½-in. perforations, spaced ⅝ in. between centers. An area 12 in. square is left blank in the center of the disk, and the center of this square is bored and notched to take the shaft and key. The interval between the disks is maintained by means of dry fir spacers 1¼ in. thick, conforming to the pattern of the blank square in the center of the disk.

The disks and spacers are slipped onto the shaft, the notch in the center of the disks fitting over the shaft key, which extends the full length of the disk line. The spacers and disks are drawn firmly together by means of four ¾-in. tie rods, running the full length of the disk line, and passing through the corners of the blank square in the central portion of the disk. The rotor shaft is supported by bearings mounted outside the tank. A rotor, operating in a tank of the size mentioned, mounts fifty disks. Our practice required a speed of 90 r.p.m. for the rotor shaft. The pulp enters one end of the machine, and passes out at the other, with the level maintained, approximately, at a point just below the shaft line, by a device on the discharge end. It is necessary, however, to vary the pulp level slightly from time to time in order to control the flow of froth. The chief virtue of this machine, I believe, lies in the excellent aëration of the pulp resulting from the air entrained by the rotating perforated disks.

Flotation Equipment of Rosebery Mill

The flow sheet of the gravity part of our Rosebery mill has already been described. The equipment of the flotation plant consists of a 4x6-ft. ball mill, one 28-ft. and one 18-ft. Dorr thickener, one small Callow pneumatic cell, four Hynes machines, and a 4x6-ft. Portland filter.

The Dorr duplex classifier, which is in circuit with the ball mill, is adjusted to deliver a pulp for flotation all of which will pass 60 mesh and 75 per cent pass 150 mesh. This pulp is elevated to a V-shaped thickener feeding the Wilfley tables, the thickened pulp being run over four Wilfley tables and one Deister slime table, where most of the remaining lead and part of the iron are removed. As no zinc is made on the tables, the table tailing includes all the blende present in the primary feed to the mill, except that removed on the jigs. This pulp goes to a 28-ft. Dorr thickener, before passing to the flotation machines. The thickener discharge is controlled so as to deliver a pulp carrying 30 to 35 per cent solid. The thickened pulp is then

elevated, by a centrifugal pump, to the head of the flotation unit.

The flotation unit consists of two 35-disk Hynes machines, one 50-disk, and one 100-disk machine arranged in cascade so that the feed, after entering the first of the 35-disk machines, flows by gravity through each of the four machines in succession. The second 35-disk machine takes the tailing of the first, the 50-disk takes the tailing of the second 35, and the 100-disk machine treats the tailing of the 50. A finished concentrate is made on the three smaller machines, and a middling concentrate on the large machine. The middling concentrate, assaying 10 to 12 per cent zinc, is returned to the head of the flotation unit for cleaning.

The first oil is added at the centrifugal pump, operating between the thickener discharge and the head of the flotation unit. Oil is added also at each of the machines as conditions demand.

A Forty Per Cent Zinc Concentrate Secured

We had no difficulty in making a 40 to 42 per cent zinc concentrate. The last thirty-day run on Bosun ore, with a flotation feed running 57.7 oz. silver, 0.9 per cent lead, and 12.6 per cent zinc, yielded a zinc concentrate assaying 95 oz. silver, 2.9 per cent lead, and 44 per cent zinc, and a final flotation tailing of 1.4 oz. silver, no lead, and 0.6 per cent zinc.

The last mill runs at Rosebery, on Surprise, Ivanhoe, and Canadian group ores, gave the following average results: Surprise ore, with a flotation feed of 22.3 oz. silver, 1.2 per cent lead, 11.7 per cent zinc, gave a zinc concentrate assaying 94.5 oz. silver, 5.0 per cent lead, and 42.6 per cent zinc, with tailing 3.7 oz. silver, no lead, and 3 per cent zinc. The Ivanhoe ore, with a flotation feed of 12 oz. silver, 1.1 per cent lead, and 9.8 per cent zinc, gave a zinc concentrate of 45 oz. silver, 3.3 per cent lead, and 45 per cent zinc, with a tailing running 0.6 oz. silver, no lead, and 0.8 per cent zinc. The Canadian ore, with a flotation feed of 12 oz. silver, 1 per cent lead, and 9.6 per cent zinc, gave a zinc concentrate of 53 oz. silver, 3.9 per cent lead, and 44.9 per cent zinc, with a tailing running 0.6 oz. silver, no lead, and 0.6 per cent zinc.

The samples of the feed, concentrate, and tailing of which I have just given the assay results are taken automatically every three minutes, and are not subject to the personal equation.

The oils used in the flotation of zinc, at Rosebery, are water-gas tar and Cleveland-Cliffs hardwood creosote, mixed for use with Surprise ore in the ratio of four of water-gas tar to one of creosote, and for use with Bosun, Ivanhoe, and Canadian ores in the ratio of three of water-gas tar to one of creosote. The oil consumption on the four different ores per ton of dry ore treated was as follows:

On Surprise ore, water-gas tar, 0.84 lb.; creosote, 0.21 lb.

On Bosun ore, water-gas tar, 0.75 lb.; creosote, 0.25 lb.

On Ivanhoe ore, water-gas tar, 1.50 lb.; creosote, 0.50 lb.

On Canadian group, water-gas tar, 1.65 lb.; creosote, 0.55 lb.

These oils were fed, hot, by feeders of the wheel and scraper type. Electric heaters were used to keep the oils at proper temperature. I attribute the difference in the consumption of oils at the Rosebery compared to the Sandon plant to the more perfect aëration of the pulp by the Hynes machine.

A flotation lead concentrate was made from Surprise ore by treating it first in a small Callow pneumatic cell before sending it to the Hynes zinc machines. Three-tenths of a pound of cresylic acid per ton treated was used in this operation. The amount of concentrate realized was not large; it assayed about 350 oz. silver, 23 per cent lead, and 22 per cent zinc. We were never successful in making a satisfactory lead concentrate in this machine from Bosun or Ivanhoe or Canadian ores. The product was very zinky, and the excess cresylic acid, which was carried through into the Hynes machine, caused an uncontrollable froth when used with the three ores mentioned. This froth, I think was occasioned by the action of the highly aërated pulp, in conjunction with the cresylic acid, upon the graphitic matter in the gangue, which was soft slate. This difficulty was not experienced with the Surprise ore when using similar amounts of cresylic acid under the same conditions. The gangue of the Surprise ore is a hard quartz-porphyry.

In order to make a satisfactory zinc concentrate on the Bosun, Ivanhoe, and Canadian ores, it was necessary to add a solution of copper sulphate to the pulp. This solution was introduced at the pump between the thickener and first flotation machine, the consumption being 0.75 lb. copper sulphate per ton of ore treated.

Copper Sulphate Coagulates Slime

Early in our practice, finding serious difficulty in making a satisfactory zinc concentrate on the Bosun ore, we tried copper sulphate, as we had heard of its use elsewhere. We obtained, almost immediately, satisfactory results. Later we did some experimenting to determine, if possible, the function of the copper sulphate. The work which we did went to show that its function was not in restraining the floating of the pyrite, nor in the decreasing of the zinc content of the tailing. A test was run over a period of ten days, during which copper sulphate was used every alternate day. The zinc and iron content of the flotation feed, concentrate, and tailing, with and without using the copper sulphate, was determined each day, and the results were tabulated. The average of the feed, in both cases, was the same in zinc and iron percentage—namely, 5.1 per cent zinc and 6.1 per cent iron—and it was observed that the average percentage of zinc and iron in the tailing was the same, being a little over 3 per cent in zinc and 6 per cent in iron in each case. The percentage of zinc in the concentrate, however, increased by ten points on an average when copper sulphate was used. Our deduction was that the copper sulphate had a coagulating effect upon the slime, or a restraining action upon the graphitic matter, causing at least part of it to pass into the tailing instead of rising with the froth. This theory is strengthened by the fact that no copper sulphate is necessary when treating Surprise ore, which does not slime readily and carries no graphitic matter.

Curves for determining the percentage of solid matter in the flotation feed, and for determining the tonnage going through the machines, were kept posted in the mill. I shall not go into the matter of the derivation of the formulas upon which these curves are based. For their use, the operator catches a sample of the pulp coming from the thickener in a container holding 750 c.c., and weighs this sample. Having the weight, he can find the percentage of solid by reference to one of the curves. He then turns the feed nozzle into a

box measuring 12x15x20⅓ in. and observes the time, in seconds, required to fill it. Knowing the percentage of solid and the time required to fill the box, reference to a second curve gives the tonnage per hour passing through the machines. This information is recorded every thirty minutes.

For such results as we have been able to obtain I wish to give credit to F. J. Murphy, who was with me as mill superintendent for three years, until he was transferred to Mexico to take charge of larger milling operations there. During the last year of milling operations, J. Reid, of Rosebery, was actively in charge of the Rosebery mill as foreman.

The Uses, Metallurgy, and Detection of Tellurium

The present uses for tellurium are limited, the demand being supplied by a few hundred pounds per year, says the U. S. Bureau of Mines in *Reports of Investigations*, No. 2,385. Efforts have been made by government agencies in co-operation with copper refiners to discover new uses for tellurium, but no important results have been reported. It has been used in a small way in high-resistance and other alloys, in organic dyes, for staining silver, in medicine, and as a reagent in chemical laboratories. As a coloring agent in glass or porcelain, blue, brown, and red colors may be produced by tellurium, some of the best ceramics being colored in this way. Tellurium dissolved in sodium-sulphide solution is used in toning baths for photographic prints. Tellurium dioxide at red heat is a powerful oxidizing agent, decomposing completely even lumps of steel or metal alloys. Its chemical similarity to sulphur suggests many possible uses. It might be used, for instance, as telluride in coloring lithopone, and the extension of the use of tellurium might well be studied in connection with the iron and steel industry. There is undoubted promise in experimentation with tellurium compounds in the fields of organic medicinals, while their physiological action in derivatives similar to those of sulphur and selenium has not yet been developed. In compounds similar to selenium oxychloride, tellurium may provide valuable laboratory reagents.

The use of two-tenths of 1 per cent diethyl telluride in gasoline as an anti-knock compound has been reliably reported. It is said to eliminate carbon deposits and to produce greatly increased efficiency when used in motors designed to operate on very high compression. A special type of engine is said to be required to produce these results, hence its general use in motors will not be feasible unless the motor industry should conform to the required type. This step in turn would be dependent on a supply of tellurium adequate to treat all the motor fuel. For this purpose, 1,500 tons of tellurium per year would be required, and as the possible annual supply of tellurium from the present best known sources of copper refineries is said to be only about 125,000 lb., a much larger supply must be developed; the discovery of new uses not dependent on so large a supply would result in wider utilization of present resources.

Tellurium is usually offered in the impure state, and no market standards have been developed. No ores are known that are rich enough in tellurium to permit mining and treatment for tellurium alone, even if the demand increased to large proportions. It is probable that the future supply will be derived as a byproduct from metallurgical processes, as in the past. The present practice for recovering tellurium from the residues in copper refining is well presented by Lawrence Addicks in a 1921 publication, "Copper Refining." Briefly, the hot, alkaline solution obtained by leaching slag from the doré furnace is acidified with sulphuric acid and agitated by air. Commercially pure tellurium is precipitated and recovered by filtration. Another method is described by Oberhelman and Browning, in the *American Journal of Science* (Vol. 36, p. 399).

Tellurium may be detected in a mineral by the following methods:

1. For native tellurium and tellurides, heat a little of the finely pulverized substance in a test tube with about 5 c.c. concentrated sulphuric acid, when the latter will assume a beautiful reddish-violet color if tellurium is present.

2. For the presence of tellurium in minerals in general, dissolve the pulverized substance in nitric acid or aqua regia and evaporate the solution to dryness with hydrochloric acid. Repeat this procedure and finally take up the residue with dilute hydrochloric acid; filter and pass SO_2 through the filtrate, when tellurium will be precipitated as a black metallic looking powder. This powder may be filtered off and treated as under paragraph 1.

The quantitative estimation of tellurium has been up to the present time of limited importance. The Committee on Selenium and Tellurium of the National Research Council, Washington, D. C., has been for some time studying the analytical chemistry of selenium and tellurium. The results of the investigation will be given to the public in the near future.

Why Interior Painting Should Be in Light Colors

Many years ago it was customary to paint machinery in bright colors, and workmen took pride in keeping everything clean and bright, says a writer in *The American Architect*. A stage of drabness succeeded the somewhat ornate, showy period, and machines were painted black or steel gray. Within quite recent years there has been another swing toward giving workmen pleasant rooms in which to work, and it has gone to the extent of using light-colored paints on all machinery and equipment. The result has been a marked reduction in accidents, for many accidents in shops occur because of lack of light. Men also take time now to clean their machines, where but a few years ago such time was considered to be wasted. The time spent in keeping the machines clean is paid for in the smaller amount of oil used for lubrication. Oil no longer flows too profusely over machines which are painted in a light color.

Paint performs three useful functions in that it is used to preserve surfaces to which it is applied, it is used to improve the appearance of surfaces and it is used to reduce the cost of artificial lighting. It is only indifference, or ignorance, which allows men to use paint for but one of the three useful functions it performs so well. When the maximum light is needed, the ceiling should be white, or a very light cream, ivory, buff, or green. The walls may be a somewhat darker tint to about four feet above the floor. For this height a darker color may be used which will not look too unsightly when touched with soiled hands or other objects which cause disfigurement.

Mining and Metallurgy at Yale University

Curricula Provide for the Selection of Fundamental Subjects—Teaching Ability Is a Faculty Requisite—Method of Presentation Given Particular Attention —Specialization Subordinated to Broad Study

BY GEORGE J. YOUNG

YALE UNIVERSITY is in an historic educational and civic environment. Yale College, named for Elihu Yale, who made substantial contributions to its support, was formally established in 1718. The title Yale University was authorized by the Connecticut Legislature in 1887. The school is situated in the bustling city of New Haven, a prosperous industrial and railroad center with a population of 162,537 (1920), founded by the Puritans in 1638. A few steps from the campus bring one into the quaint old streets of the city, in which one may roam with the certainty of finding interesting buildings and people. The New Haven Green, with its historic and picturesque old "Meeting Houses," recalls the days of the oldest Colonial period of the country.

The university's environment is one of thriving industrial development, manufactures of brass and alloys constituting an important factor of the business activities of New Haven and its immediately surrounding territory. No mining is done near the city, but, apparently with the purpose of making the curricula complete, a mining school was established at Yale and has been functioning for many years, both mining and metallurgy having been introduced in 1865. When I visited the university, late in 1921, it lacked at least one essential ingredient, a mining professor. The war had also played havoc with some of the classes, and upper-class students were extremely scarce. Since that time a well-known mining engineer has been induced to undertake the work of mining instruction. The present staff consists of B. Britton Gottsberger, professor of mining; C. H. Mathewson, professor of metallurgy and metallography; Arthur Phillips, assistant professor of metallurgy, and Robert K. Warner, instructor in mining. Alan M. Bateman is assistant professor of economic geology and Adolph Knopf is associate professor of physical geology and petrology. The last-named professors are in the department of geology and geography.

The Hammond mining laboratory

I have named only that part of the faculty which is directly associated with the subjects dealing with or closely related to mining. Mr. Gottsberger has had extensive and varied experience in mining and in executive responsibilities, and Mr. Mathewson has made a specialty of the metallurgy of metal and alloy fabrication. The essential elements in faculty personnel for specialization in mining, metallurgy, and other branches are available. The background afforded by other departments of engineering in a fair state of development is also present. In addition there are the traditions and glory of a great university. Lacking only is that mining environment which some consider so essential to the education of a mining engineer. To offset this, if it be necessary, one must give credit for a well-established and well-trained faculty, a university of moderate size, and excellent conditions that permit of concentration and efficient study.

A corner of the college campus

The Yale campus is a part of New Haven and conforms largely to the existing street lines. There is an interesting array of architecture, which culminates in the magnificent Harkness memorial quadrangle. In an artistic sense the buildings of this group are an inspiration in beauty of form as well as in color and texture of material. The old college campus is well worth a prolonged visit.

The curricula of the mining and metallurgy division is divided into two broad parts: the freshman year, completely organized as a separate school of instruction, and the remaining three years of the four-year course given in the Sheffield Scientific School. In the Sheffield Scientific School two broad options are available, mining and metallurgy. Geology is not offered as a separate course,

but doubtless a student may elect such extra work as he may desire or may continue his work as a post-graduate. Both the personnel and the laboratory equipment in geology and mineralogy are excellent.

Special emphasis is laid upon the fact that the freshman instruction is separately organized. Yale University takes the logical position that the freshman year is a critical period and that a good beginning is all-essential. The requirement for a faculty member in the freshman college is that he must be a good teacher. It is worthy of remark here that Yale University has not neglected the teaching factor in its educational program. First is the requirement of manifest teaching ability on the part of the faculty members, and second is the restriction of the size of class to twenty-six or less. Both are essential to efficient work. A system of student councilors, who are members of the freshman faculty, is provided and functions in a helpful capacity. Twenty freshmen are assigned to each councilor. Thus, both within and without the classroom, the freshman student is given the inspiration of fellowship with mature men.

The freshman curriculum is a simple one—English, mathematics, history, chemistry, and a foreign language. It is elastic and provides for deficiences in the preparation of the entrant. Probably some would criticize the range of subject matter in the freshman courses as reflecting an ancient or exceedingly conservative position, but if the subject matter is thoroughly taught, such criticism is not vital. The recitation method predominates.

The mining curriculum is given in the accompanying table, which includes an estimate of the time requirements in both freshman and advanced courses. In the accompanying figure I have given a chart of the time element from the viewpoints of subject matter and educational method.

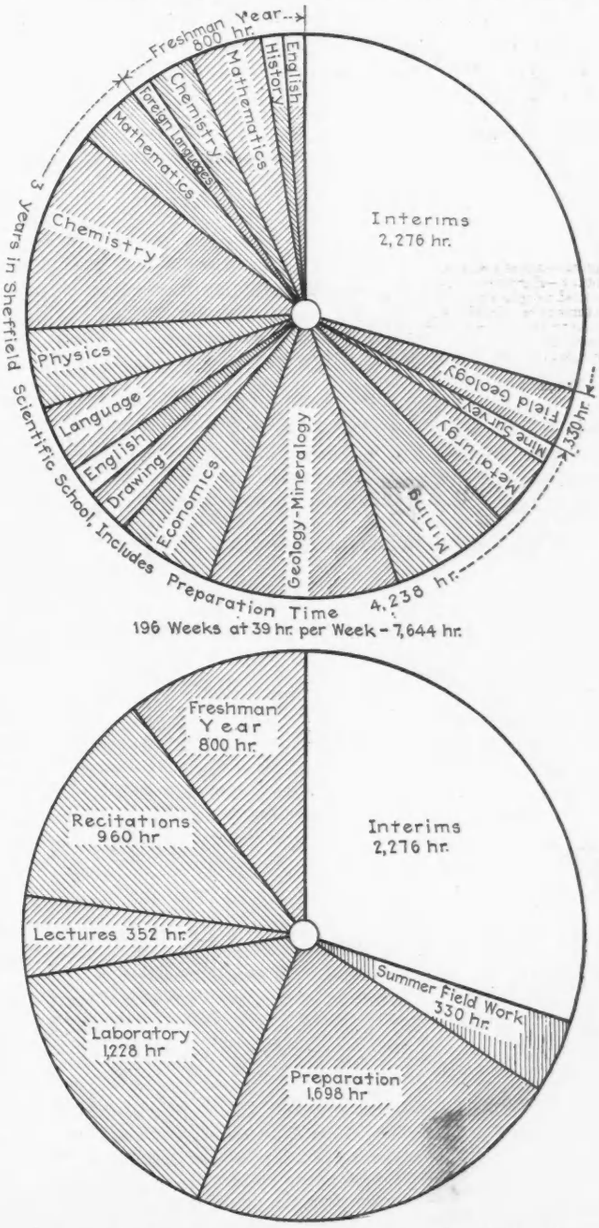
The mining curriculum lacks the mechanical and electrical as well as the engineering design element. It is strong on basic subjects, and the geological element is comprehensively developed. The curriculum as given in this table does not indicate other than the formal outline. Certain electives may be substituted; for example, elementary engineering mechanics (statics and kinetics) may be taken in place of quantitative and metallurgical analysis; stresses (theory), in place of assaying; mechanism and machine design may be taken by students who have had sufficient preparation. There is an evident attempt to give elasticity and to introduce the mechanical and engineering design element in at least as far as elementary principles are concerned.

The introduction of a course in principles of physical chemistry in the senior year is novel and has obvious advantages.

The curriculum is not top-heavy with courses; in fact, compared with some others, it might be considered scanty in technical subjects. In the catalog the curriculum is not called an engineering course. There is evidence here of a desire for accurate statement.

The analysis of methods of instruction is interesting. The lecture system is made secondary to recitation. The freshman year is largely handled by the recitation method. Only in the last two years in the mining course is the lecture system used to any considerable extent. Laboratory work is about equal in time to classroom work. An important point is the insistence upon adequate preparation. A specified time is allotted for each subject; the actual amount will vary with the individual student, some requiring more and some less.

In the metallurgy curriculum the second year is the same as in mining. The third year omits the courses in geology, but retains the course in elementary mineralogy. Physical chemistry is also given in this year. Options are allowed in mechanics, stresses, mechanism, and machine design. In the senior year, emphasis is placed upon the metallurgy which applies to the metal-manufacturing industry. Metallography and metal



Analysis of mining curriculum and methods of instruction.

technology, in addition to ore dressing, are given. The objectives of the metallurgy course aim at employment as a metallurgical chemist, as a metallurgist who may ultimately undertake the development and technical direction of ore-treatment processes, or as a physical metallurgist. The preparation is indicative of the fundamentals required for these objectives, leaving, however, the experience factor to be attained by the student after graduation.

The work of the mining and metallurgy courses is conducted in the Hammond laboratory, which houses the classrooms, departmental library, museum, and laboratories. Since I visited the Hammond laboratory in 1909 relatively few changes have been made in the ore-dressing equipment. New equipment for metallographic work has been added. The laboratory possesses possibilities of reorganization and improvement to accord with modern teaching requirements.

Yale University is worthy of study by technical schools chiefly because it has recognized the fundamental importance of good teaching and has not blindly followed the path of extreme specialization at the expense of fundamentals.

YALE FRESHMAN CURRICULUM (HOURS ESTIMATED)

	Recitation	Lectures	Laboratory	Total
English—a study of a few important books	96	..	..	96
History—European history, with emphasis on political, social, religious and economic movements	96	..	..	96
Mathematics—Solid geometry, trigonometry and introduction to analytic geometry and calculus	320	..	..	320
Chemistry	96	32	64	192
Foreign language	96	..	..	96
Totals	704	32	64	800

Alternatives are provided where entrants have had advanced work in mathematics and chemistry. Biology or drawing may be substituted for a foreign language.

MINING CURRICULUM IN SHEFFIELD SCIENTIFIC SCHOOL

	Recitation	Lectures	Laboratory	Preparatory	Total
Mathematics through calculus	96	.....	.....	192	288
Chemistry					
General	96	32	192	224	544
Determinative	37	16	240	64	352
Physics					
Mechanics, heat, light, sound	96	32	108	108	344
Language	96	.....	.....	192	288
English	64	.....	.....	64	128
Drawing	16	32	144	.....	192
Economics					
(Principles, business, finance, accounting)	192	.....	.....	240	432
Mine surveying (summer work)	...	.....	(a) 80)	.....	(80)
Geology—Mineralogy					
Mineralogy	48	.....	192	48	288
Physical and structural geology	64	.....	.....	102	166
Petrology—elementary	...	.....	16	.....	16
Historical geology	32	.....	.....	64	96
Economic geology	...	80	96	96	272
Field geology (summer work)	...	(a)(10)	(a)(240)	.....	(a)(250)
Mining	64	128	144	192	528
Metallurgy					
General	32	.....	.....	48	80
Ore dressing	32	32	96	64	224
Totals	960	352	1,228	1,698	4,238
Class room total		2,540			
Preparation total		1,698			
Summer work total		330			
Grand total		4,568			
Freshman total		(a) 800			
Total hours in four years		5,368			

(a) Estimated. Figures in parentheses are not included in total of table.

Angola Mineral Concessions Expiring

The concessions of several mining companies in Angola, a Portuguese dependency on the west coast of Africa, will expire early in 1923, according to *Commerce Reports*, and it is believed that these concessions will be given to the person or association guaranteeing to expend the largest sum annually in prospecting and exploitation. One of these concessions confers mineral rights in most of the Province of Angola north of the Benguela railroad, excepting diamonds and hydrocarbons. Mining engineers who have prospected in that territory believe the concession is valuable, although it has not been entirely prospected.

Another concession confers all mineral rights in a large portion of the southwestern part of the Province of Angola south and southeast of Mossamedes. Most of the alluvial gold deposits in this territory have been worked, so far as they are known to exist, but it is reported that auriferous quartz has been discovered in many parts of it. Engineers have reported that there are geological indications of other minerals, and that the territory has not been properly prospected.

Interested American firms may obtain the names of the companies now operating under the concessions, the names of the officials to whom to apply for such rights, and the names and addresses of engineers who can give detailed information as to the concessions by directing an inquiry to the Iron and Steel Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., and referring to file Nos. 66,585 and 66,586.

The Recovery of Gold on Corduroy Suggested in South Africa

Well-known objections to the use of mercury in the recovery of gold—such as theft of the amalgam, mercury poisoning, loss of mercury due to incomplete attachment of the mercury to the copper plates, flouring of the mercury, sand-scouring of the amalgamated plates, the expert labor required, and the fact that only gold and silver can be recovered by this means—have led South African metallurgists to the trial of substitutes. Corduroy cloth has been used for the collection of the valuable mineral, according to a writer in a recent issue of the *South African Mining and Engineering Journal*.

The method consists chiefly in the utilization of the ridges in the cloth as riffles for catching the heavy portions of the pulp as it issues from the mill. Its great function is to effect a separation of the valuable portion of the ore from the lighter and less productive pulp. The action of the cloth is therefore somewhat similar to that of a Frue vanner, except that in the former case there is no motion of the cloth itself; the pulp flows from the mortar boxes or from the tube mill over the cloth, which is spread over a table or frame, and the rush of pulp and water carries away the lighter material and a portion of the gold contents, but leaves behind in its path the coarser gold, black sand, and other heavy material. At intervals the cloth is removed and its contents are worked off into a suitable receiver from which the concentrate is removed and smelted for the recovery of the gold in the usual way.

The following important advantages are apparent by this method: The complete elimination of mercury as a factor in the recovery of the gold. The removal of the need for skilled labor in the treatment of the plates for amalgamation (the mechanical operation of removing and replacing the trays on the tables being done by Kafirs). The removal of temptation to purloin amalgam. The recovery not only of the gold but also that of the rare metals associated with it in the ore—ie., platinum, palladium, and iridium. Since the concentrates can be reduced to small proportions by the magnetic removal of the iron, the further recovery of the gold from the remaining concentrate leaves the residuum available for further treatment for the extraction of the metals of the platinum group.

CONSULTATION

The Crowe Process

"Is the Crowe precipitation process being used extensively? I would also like to know something about the theory of its operation."

The Crowe process is a patented method of vacuum precipitation used in conjunction with the cyaniding of gold and silver ores. It is, without doubt, a marked improvement in gold and silver hydrometallurgy and was patented by T. B. Crowe, mill superintendent of the Portland Gold Mining Co., of Cripple Creek, Colo., in 1916. The principle of the process is extremely simple and consists in the removal of oxygen from pregnant solutions before they are treated with zinc dust or shavings.

The process is essentially a physical one, although it is designed to prevent chemical action of the oxygen with the precious metals and zinc, which would affect precipitation. Owing to its simplicity and to the fact that the deleterious effect of oxygen on precipitatior was generally known many years ago, the patent was attacked by several engineers, but unsuccessfully. As in the case of other inventions, cause and effect were known, but it remained for Mr. Crowe to offer a practical solution to removing the cause. The process is now used in many cyanide plants in the United States and other gold- and silver-producing countries, where it is effecting economies in the consumption of zinc and cyanide. It is inexpensive in operation, as the only power necessary is that required to drive a small—generally a 1-hp.—motor operating a vacuum pump. The other apparatus required is a receiver in which the solution is subjected to the action of a vacuum, and the usual accompaniment of gages and valves. The flow of the solution is automatic.

In theory the process permits a greater amount of hydrogen to be evolved in the zinc boxes or other precipitating device than without its use. Hydrogen is assumed to be the active precipitant and is generated by the dissolution of the zinc in caustic alkali, a reaction which continues so long as fresh zinc is exposed to the solvent. Ordinarily, some of this hydrogen would be lost through combination with the dissolved oxygen in the pregnant solution and hence the precipitation affected.

The amount of the oxygen in solution depends upon the treatment to which it has been subjected and upon the temperature of the liquid. Agitation naturally is a powerful aërating agent, whereas the application of heat to a solution decreases its power of holding air. In fact, it is no new discovery that heating cyanide solutions in winter aids precipitation. However, it must not be forgotten that although the presence of oxygen is undesirable in the precipitation of gold and silver, oxygen is desirable in the dissolving of those precious metals in cyanide. The Crowe process removes the oxygen when it is not wanted, and only places the burden of precipitating the gold and silver upon the zinc, so that both weaker cyanide solutions and smaller amounts of zinc can be used.

Gallium

"We have found a mineral that we do not understand. It looks like gold, only it is redder than common gold and is softer. We can press it out into very thin sheets, which show great ductility. On putting it in an ordinary stove fire on an iron spoon it completely evaporates without even leaving a trace. We have been told that this is gallium and is highly valuable.

"Will you please let me know what you can about gallium, especially its market value and how to market the metal. Can I get any treatise on gallium ore? Where can I get it assayed for gallium?"

It is impossible from the description given to state whether the mineral you have found is gallium. It would be well for you to send your sample to a reliable assayer or chemist, requesting him to analyze it for gallium if you suspect that is present. The only occurrence of gallium known to us is as a constituent of zinc-blende, in which mineral it is found in minute amounts. Gallium is a fairly hard gray metal and may be hammered into thin sheets, which can be bent without injury to them. It has a specific gravity of 5.9 when solid and a low melting point, 86 deg. F. Its properties are similar to those of aluminum. Gallium was discovered in 1875, and it is interesting to note that its discovery was predicted much earlier by Mendeleef. According to Hillebrand and J. A. Scherrer, gallium will wet glass and porcelain and will remain liquid far below its melting temperature unless it is inoculated with solid gallium.

We do not know of any commercial application of gallium. Only small amounts have been produced at any time, and there is no regular market for the metal, hence we do not publish any quotations on it.

Flotation of Flue Dust from Copper Furnaces

"Will you be kind enough to advise me if there is any successful oil flotation process that will treat flue dust from a copper furnace?"

We do not think that flue dust could be economically recovered by any of the oil flotation processes so far developed. The chief difficulty would be in the oxidation of the sulphide particles. Owing to the heat and oxidizing atmosphere in the top of a blast furnace, all of the fine particles of ore that are blown out into the flue are at least superficially oxidized. Therefore, to float them would require surface reduction in a preliminary treatment, by the use of sodium sulphide or by other means. This, of course, is metallurgically possible, but we do not think it would be advisable. It is doubtful whether there would not be a good many particles of too large a size for flotation treatment. Moreover, the flue dust from a blast furnace contains a fairly large percentage of coke, and the value of this coke as a fuel in the subsequent smelting of the dust is not to be overlooked. It would probably be lost with the tailings if the dust were treated by flotation.

Possibly some of our readers can contribute further comment and information.

THE PETROLEUM INDUSTRY

Study of the Invasion of Oil into a Water-Wet Sand

THE RESULTS of an experimental study of the factors which are known or thought to exercise an influence on the segregation and accumulation of oil in porous strata were described by Orrin W. Skirvin in a paper presented by the Society of Economic Geologists at its Amherst meeting on Dec. 29, 1921. Various combinations of sands were used, together with three grades of oil.

"It has been shown experimentally that water invading an oil-saturated sand body containing a relatively coarse-grained and a relatively fine-grained sand will (within certain limits) displace the oil from the coarse sand and not from the fine sand," says Mr. Skirvin. "It has also been demonstrated that oil invading a similar sand body, but water-saturated, will displace the water from the coarse sand and not from the fine sand. There is no dispersion after the experiment in the latter case, nor in either case if the difference in grain size of the two sands—and therefore the difference in size of pores—is greater than a certain limiting value which has not been determined.

"From these considerations it would appear that whether oil is found in coarser- or finer-grained sands or strata than the adjacent strata—assuming the rocks to be water-'wet'—depends on whether the oil has accumulated by displacing water or whether the oil is the residual fraction retained in the finer-grained portion of the reservoir after the displacement or removal of that in the more open portion by invading water. Commercial deposits of oil usually occur in the more open portions of a water-wet sand—that is, in those portions of a reservoir in which the pore spaces are larger than the surrounding ones, provided there are irregularities in the sand body. We would infer, then, that such deposits are the result of oil displacing water from a more open part of a sand body. That this view is in accord with the anticlinal theory and its hydraulic modifications is attested by the carefully performed experiments of Mills[1] in which oil was made to displace water from the relatively coarse tops of domes and their analogies—but not from the fine-grained 'cap' sands above, by the action of relatively weak hydraulic currents.

"The relative viscosities of oil and water, oil, especially the heavier grades, being more viscous, tend to effect a segregation of oil in the larger pores whenever the motion of the two liquids is from larger to smaller pores. This is true because the resistance of small pores to viscous oil is much greater than that offered by the larger pores, while at the same time the resistance of small pores to water is much less than their resistance to the more viscous oil.

"Adhesion of oil to a sand particle is a function of the attraction of the molecules of the substance composing the grain for the molecules of oil. When this attraction is greater than the internal molecular attraction of the liquid, the substance is wet by the oil and adhesion becomes greater in proportion to the magnitude of excess attraction. Since all mineral oils wet the sand or reservoir material, we have assumed that the attraction between the molecules of the two substances at their surface of separation is greater than the molecular attraction within the oil. The rôle of adhesion is to retain as much oil as possible in contact with sand surfaces. When adhesion is relatively small, as with most light oils of low viscosity, the actual amount which a sand surface is able to retain when the liquid is subjected to a displacement force is small compared to the amount retained under similar conditions when the adhesion is great. Since viscosity is the result of internal molecular attraction or friction, while adhesion is the attraction or friction at the surface of contact with sand particles, it is seen that both work toward the same end to oppose any force which tends to remove the oil from contact with itself or with sand grains. This is why water-flooding methods for recovery of oil are much less effective with moderately viscous oils than with the light so-called non-viscous varieties. For since adhesion becomes more pronounced with higher viscosity we have both factors assuming important magnitudes as we pass from less viscous to more viscous oils.

"The theory has been brought forward by McCoy[2] that the accumulation of oil, especially the migration of oil from fine bituminous shales to adjacent reservoir rocks, is effected mainly by capillary forces. With this view the writer cannot agree, because experimental evidence seems to emphasize that any series of openings of capillary dimensions wet with only the thinnest film of oil have no preferential attraction for water. Since clays and shales are more compressible than sandstones, it is mainly through pressure and the resulting reduction in volume of pore space of the bituminous shales that oil is forced out of them and into the adjacent reservoir rocks."

The experimental study of the theory of invasion undertaken shows that the larger pores contain the invading fluid, whether this is oil that invades a water-wet sand or water that invades an oil-wet sand. This reduces the supposed rôle of differential capillarity in the distribution of oil and water in rocks, as related to their porosity.

Standard Subsidiary Will Build Refinery in Alberta, Canada

The citizens of Calgary, Alta., have ratified the agreement of the city with the Imperial Oil Co., subsidiary of the Standard, under which the company will build a $2,500,000 oil refinery in Calgary. The only concession granted the company is that the assessment is fixed at $250,000 for a term of twenty years.

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[1]Mills, R. A., "Experimental Studies of Subsurface Relationships in Oil and Gas Fields," *Economic Geology*, Vol. 15, No. 5, pp. 398-421, 1920.

[2]McCoy, A. W., "Notes on Principles of Oil Accumulation," *Journal of Geology*, Vol. 27, pp. 252-262, 1919.

New Books

Economic Geology Through German Spectacles

Abriss der Lehre von den Erzlagerstatten. By Richard Beck; condensed by Georg Berg. Berlin: Gebrüder Borntraeger. $3.60.

The original work on ore deposits by Beck, translated into English by Weed, was a valuable study in the science of ore deposits. The volume at our hand, published in 1922, and specified as to authorship Beck-Berg, with a preface by Dr. Georg Berg written in 1921, should, we expected, be an up-to-date and comprehensive book on ore deposits, as its title and preface convey. But certain tendencies were at once apparent to the reviewer, and he will try to express some of them statistically. It was apparent that not only was the language of the textbook German, but that the book was on ore deposits as seen through German spectacles. The reviewer took the first one hundred pages, and next opened the book at random and took one hundred pages from there on. This together represents half the book. The references for the two hundred pages were then roughly tabulated: references to *German* geologists, 178; American, 36; Russian, 11; Swedish, 8; English, 8; Norwegian, 6; Canadian, 4; Finnish, 4; Australian, 3; South African, 3; *French*, 2. Comment is unnecessary. The name of the great French economic geologist, De Launay, does not appear at all in the "Index to Authors" (Autorenregister) in the back of the book; though one of the two French references is to De Launay. Bear in mind that this is a universal textbook of ore deposits, covering the whole world and summarizing all the known science of economic geology.

Does this represent the pre-war German blind-spot to science which is not German; and may we hope that under the Republic the liberal scientist has appeared? Yet the book is published in 1922. The reviewer has again applied statistics to this problem. Going over the 263 references above mentioned to find the attention which had been paid to the latest literature, he finds the following references to publications since 1910: *German*, 61; American, 4; Russian, 2; Finnish, 1; Australian, 1; English, 1; Swedish, 1; Norwegian, 0; Canadian, 0; South African, 0; *French*, 0. In other words, out of 178 references to German authors, 61, or one-third, refer to publications since 1910; and (taking the next most numerous) out of 36 American references, only 4, or one-ninth, are to work since 1910. The two lone French references (out of 263) are dated 1886 and 1903!

The above demonstration could well be amplified; but it shows to American students that the book is to be used as a study of German thought in economic geology, and that it is very far from being reliable as a general textbook. The references to "American literature," in addition to their age, show a profound ignorance of the development of thought in American economic geology and of the literature of American ore deposits.

We should perhaps not be too hard on the Germans in this respect, for American writers of textbooks sin also in this particular, and have a very hazy idea of the literature of other countries. It is a universal failing, of which Americans and Englishmen and Frenchmen must own themselves separately guilty and provincial. But "they do those things better in Germany," when all is said; far better—or worse.

Having thus paid our respects to the new textbook, we hasten to express our regard for the late Dr. Richard Beck, of Freiburg, as an economic geologist. Those who study this work, or Weed's older translation, as an expression of the views of Dr. Beck as to deposits with which he was familiar (and they were many), will find themselves well repaid. But when the present volume describes the Comstock lode in Nevada as the most famous example of the "tellurium-gold veins" (p. 182), and on the next page (183) refers the free-gold ores of Farncomb Hill, in Breckenridge, Colo., to the same group, the sagacious reader must decide that the book is far from being a "reliable guide" (getreuer Führer) as Dr. Berg's preface optimistically hopes. Still, there is much pay-ore in the book if you dig for it—and if you know ore from waste when you see it.

J. E. SPURR.

A Monograph on Broken Hill

The Geology of the Broken Hill District. By E. C. Andrews. Geological Survey of New South Wales, Sidney. Memoirs, Geology No. 8. 1922. £2 2s.

This study of one of the most notable mines in the world is a credit to the Geological Survey of New South Wales and a monument to the industry and devotion of its author. The Broken Hill district, as the author states, is "as an individual producer of lead and zinc . . . perhaps the most important mining center known." The total yield from the district is over £111,500,000; and the dividends paid have exceeded £26,500,000. Most of this has been from one line of lode only, the Broken Hill lode, with a length of three and one-half miles. This has produced 32,000,000 tons of ore; and according to 1919 estimates the ore reserves are at least 13,000,000 tons. This, says the author (p. 285), "based on the output of 1918, say 1,250,000 tons, would give a life of exceeding ten years approximately . . . on the assumption that 7,000 men work three shifts of eight hours." But the author points out the "high expectation" of 7,000,000 tons over and above the 13,000,000.

Though the report is mainly on the geology of the district, as the title states, mining and milling methods receive some attention (Chapter VIII). The method of mining is the "square-set and fill" system so common in North America, the square-set system of timbering having been introduced by an American mining engineer from the Comstock lode in Nevada. Oregon pine was used.

The geology of the region occupies practically all of the report, and is sufficiently complex. Mr. Andrews supplies a wealth of material; it is possibly not carefully enough edited and compressed, but that is a common and natural characteristic of geological reports. The appendices are valuable, though they involve considerable repetition. Fortunately, Mr. Andrews himself has summarized the report in *Economic Geology* for September, 1922.

The age of the ore deposits is regarded as Archean. The schists and gneisses in which the lode lies are overlain by glacial till (tillite) of lower Cambrian or pre-Cambrian age. The original nature of the Archean country rocks (now schists and gneisses) is held to have been sedimentary shales; these were later intruded by many igneous sheets. Later came close folding and shearing and subsequently "igneous emanations." The order of deposition as interpreted by Mr. Andrews seems to be as follows: 1, Lodes and deposits of magnetite, garnet, apatite, and quartz; 2, pegmatite (with green feldspar); 3, main ore deposition—rhodonite, manganese garnet, apatite, fluorspar, quartz, calcite, gahnite (zinc spinel), zinc-blende, and galena.

At some distance from the main center of mineralization (away from the Broken Hill lode) come lodes carrying galena with iron carbonate and quartz, or with quartz alone, or with quartz and fluorspar. In some sections of the district, also, tin and tungsten minerals occur in connection with granite dikes, and elsewhere platinum in connection with very basic rocks.

As to the main Broken Hill lode, we may point out that it is unusual in the occurrence of manganese garnet and zinc spinel in a great lead-zinc deposit. To the reviewer some analogy is suggested with the zinc deposits of Franklin Furnace in New Jersey, and pre-Cambrian deposits in crystalline gneisses and sediments, where zinc spinel and manganese garnet likewise occur. Also, at Franklin Furnace, Spencer believes the ores to have been due to "magmatic emanations."

In form the Broken Hill lode is irregular, having formed largely by replacement of a large "drag fold" in the schists and gneisses; this drag fold is "a portion of a closely folded anticline which had suffered differential movement of the limbs through stretching by rock flowage." In this there also seems to the reviewer to be revealed a certain analogy to Franklin Furnace, where the main ore deposits occur in the apical areas of synclinal troughs, as the Broken Hill lode does in the apical areas of anticlinal saddles. Further analogies could be drawn between the two deposits.

J. E. SPURR.

SOCIETIES, ADDRESSES, AND REPORTS

A Jingoistic View of England's Opportunities in Russia

Sir E. Mackay Edgar Hopes for Mining Expansion and Monopolization Under British Control

IN a recent interview, Sir Edward Mackay Edgar, the British merchant-banker, waxed enthusiastic over the effects of the agreement which had just been reported as reached between the Soviet Government and Russo-Asiatic Consolidated, Ltd. Since Sir Edward's commentary, news has come that the Russian Government has finally declined to ratify the agreement. Concerning the reported concessions and convention, Sir Edward said:

"Its importance consists in this: while the world is running short of non-ferrous metals (copper, lead, and zinc) and while the present sources of supply are being rapidly depleted to meet a constantly rising demand, the inexhaustible reserves of Russia, thanks to this agreement and its consequences on the metal position of Russia, are again becoming available for the purposes of industry.

"The agreement arrived at between the Soviet Government and the Russo-Asiatic Consolidated has been welcomed and commented on from many points of view, political, personal, and commercial; it has been described, and quite rightly, as a remarkable tribute to the character and abilities of its chairman, Mr. Leslie Urquhart, and to his position in the public and economic life of Russia, but to my mind its most significant aspect is that it hastens the day when Russia, with her boundless mineral wealth, will come to the rescue of a world (if its demand of consumption remains normal), that must soon be starved of the non-ferrous metals (copper, lead, and zinc). From that standpoint I regard it as one of the most important arrangements that has happened to British industry in particular and to our international trade in general since the Armistice.

"Just look at the position—people hardly conceive it as possible that the world shall run so short of copper, lead, or zinc that the immense industries dependent on these non-ferrous metals should dwindle and collapse simply through flat inability to obtain these essential raw materials on a commercial basis. Yet it is possible—what is more, it is beginning to happen already under our very noses. Great forces are at work, which, as far as I can see, will make in the next generation a world-wide famine in non-ferrous metals inevitable, unless some new and prolific source of supply, such as Russia is, is proved and developed. I will go even further—I will say that the famine itself is inevitable and that Russia, at the present time, is our only hope of shortening its duration and lessening its severity. Take copper, for instance: in the past two generations the consumption of copper has quadrupled, and the known mines, generally speaking over that period, have been pushed to the maximum extent to meet this demand, which is self-evident in the rise of prices over that period of time. New industrial uses for it are being found every day and the uses for which no substitute will serve. The war was an immense drain on the world's reserves and practically put a stop to outside development work on a big scale.

"At present, the world draws a large majority of its supply of copper from the United States, but it is an acknowledged fact by those who know, that the copper mines in the United States will be approaching exhaustion if the present rate of production is maintained in about another twenty years. But to meet the world's demand, it will have to be not merely maintained, but increased. Directly trade begins to move again and the demand outstrips the supply, the price of copper will go up to its commercial possibilities. Lead and zinc are in very much the same case. The bulk of the world's supply of lead comes from less than twenty lead-mining positions. The United States produces about 40 per cent of the total output and consumes about 55 per cent. Here again, when demand rises, production is being outstripped and new sources must be found and worked if prices are not to become prohibitive, and the advance of industry to be haltered. Zinc is far more widely distributed than lead or copper, but very few large zinc deposits have been newly found in the last decade. But the zinc deposits that dominate the world supplies from their economic workings make it impossible for the numerous small zinc properties to be operated commercially unless prices are very much higher than rule today. Most of these are now lying idle.

"The same phenomena confronts one again. America produces some 45 per cent of the world's output and consumes about 50 per cent. As with lead, so with zinc: her deposits are not given a longer commercial life than some twenty years, and meanwhile the cry of the consumer grows yearly more clamorous and insistent. The crux of the matter is that the United States produces about 40 or 45 per cent of the world's supply of copper, lead, and zinc, and consumes herself over 50 per cent, that in another twenty years her principal known mines are expected to be pretty well worked out, that her wealth, her industrial energy, and her high standard of living will, in the meantime, have enormously stimulated her appetite for copper, lead, and zinc, and that in the absence of fresh sources of supply the rest of the world will either have to go short of these metals or pay through the nose. It is not a pleasant prospect, but it is true. For the next decade or so I see America lording it over the world of industry through her control of the non-ferrous metals, and forcing all the countries down to a lower scale of living, but I also see her abusing this as she has abused every other gift and advantage (look at oil and timber) which nature has given her. I see her squandering her heritage with rcekless prodigality until she herself falls a victim to the waste she has encouraged, and I see further how it may easily happen that just when America is reaching the end of her resources, Great Britain may be developing in Russia under British management and by the power of British capital, a position in the non-ferrous metal industry that will throw America's past ascendancy into the shade.

"That is where the Russo-Asiatic Consolidated company and the agreement with the Soviet authorities comes in. If it is allowed to develop the full extent of its capacity, and if its natural growth is not artificially restricted, it might easily be the greatest producer and purveyor of copper, lead and zinc to the world. It will free British industry from its servitude to these essential transatlantic raw materials and it will secure for us a sufficient supply of these metals that will be felt in every department of British commerce and manufacture, and it will result in the coming period of leanness and scarcity being followed by long years of plenty that will more than re-establish us in our old prosperity."

To Lessen the Fuel Shortage

The Chamber of Commerce of the United States urges coal users to keep the following points in mind:

First, confine purchases of coal under present conditions as closely to current needs as safety permits.

Second, suspend accumulation of advance stocks of coal until the present emergency pressure on production is relieved. This particularly applies to persons having low-price contracts and who are, therefore, under no price pressure to withhold immediate delivery.

Third, unload coal cars immediately and return them to service.

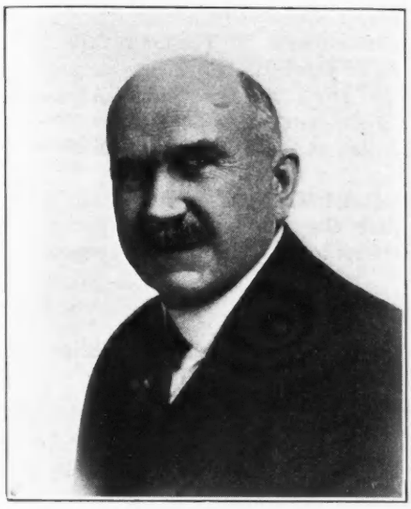
Fourth, promptly furnish material required for new railroad equipment.

The Chamber believes that if the business public will devote itself to these remedies and to others suggested by its own local conditions and by its own experience, a few weeks of favorable developments may provide correctives in this American way by co-operation, instead of increasing regulation, and this would be gratefully welcomed by the Federal Administration.

MEN YOU SHOULD KNOW ABOUT

E. P. Mathewson Is Choice for Next President of A.I.M.E.

It is rumored widely that Dr. E. P. Mathewson has been selected as the next president of the American Institute of Mining and Metallurgical Engineers, to succeed the present incumbent, **Colonel A. F. Dwight.** Like Colonel Dwight, Dr. Mathewson is a metallurgical engineer. His biography appears in *Engineering and Mining Journal*, Volume 109, p. 1312.



E. P. Mathewson

Born in Montreal, Canada, Mr. Mathewson was graduated from McGill University in 1885, and immediately thereafter started his metallurgical career in Colorado as assayer for the Pueblo Smelting & Refining Co. He soon became superintendent at that plant, and since has been superintendent or manager at nearly a dozen big smelters, including those at Perth Amboy, N. J., Monterey, Mexico, and Antofagasta, Chile. He was manager of the Washoe Reduction Works at Anaconda, and as manager of the International Smelting Co. built the Tooele and Chicago smelters. From 1916 to 1918 he was general manager for the British America Nickel Corp. During 1918 and 1919 he served as a director for the American Smelting & Refining Co. Since then he has been practicing as consulting metallurgist, making his home in New York City.

Mr. Mathewson has been a frequent contributor to the *Transactions* of the Institute. He is a member of the Mining and Metallurgical Society of America, the Institution of Mining & Metallurgy of London, and other similar organizations. Mr. Mathewson enjoys the highest regard and respect and is personally popular among the members of the profession, and his selection as president of the Institute will evoke general and cordial approval.

Ray J. Barber has returned to San Francisco from New York.

John G. Kirchen has returned to Tonopah, Nev., from San Francisco.

Albert Burch was a recent visitor to Virginia City, Nev., and the Comstock.

C. D. Kaeding has left Reno, Nev., on an Eastern trip of several weeks duration.

Oscar H. Hershey, consulting geologist of San Francisco, has been visiting Reno, Nev.

J. A. Burgess, of San Francisco, has been in Reno and Virginia City, Nev., on professional business.

L. E. Hanley, formerly secretary of the Hecla Mining Co., has been appointed general superintendent.

C. H. Fry has returned to San Francisco after spending three weeks at the Argonaut and Kennedy mines.

John V. N. Dorr has recently returned to New York from a six months' trip to England, France and Germany.

N. L. Stewart, of the Garfield Smelting Co., is in Helena, Mont., for a few months in charge of construction work there.

C. J. Adami, general manager of the St. Joseph Lead Co., of Bonne Terre, Mo., was in New York last week.

James P. Porteus, superintendent of the Bonney Mining Co., has returned to Lordsburg, N. M., from San Francisco., Calif.

Jesse T. Boyd has spent the last two months making a general reconnaissance of prospects in Yuma and Maricopa counties, Ariz.

A. D. Hughes, of the Yukon Gold Co., is in San Francisco for a short vacation. He is stationed at Ipoh, Federated Malay States.

J. Turner, formerly with the Moctezuma Copper Co., has been made mine superintendent of the Silver Dike Mining Co., at Neihart, Mont.

H. E. Meyer, chief clerk of the U. S. Bureau of Mines, who has been visiting the various stations of the Bureau, was in New York City last week.

C. N. Miller, of San Francisco, and **Charles Malone,** of New York, are examining copper properties in the Lordsburg district in New Mexico.

Charles M. Heron, engineer with the Lucky Tiger-Combination Gold Mining Co., has changed his headquarters from Los Angeles, Calif., to Douglas, Ariz.

E. M. Sawyer, general manager of the Burro Mountain Copper Co. at Tyrone, N. M., has returned from a visit to Bisbee, Ariz., and Los Angeles, Calif.

Frederick Burbidge, general manager of the Federal Mining & Smelting Co., has changed his residence from Spokane, Wash., to Wallace, Idaho, the latter being headquarters for the main western office of the company.

Milo S. Ketchum has been appointed dean of the College of Engineering and director of the Engineering Experiment Station of the University of Illinois, at Urbana.

M. C. Lake, chief geologist for the M. A. Hanna Co., has left Wilkes-Barre, Pa., to reside in Duluth, as a large part of his work is in the Lake Superior district.

H. W. Hardinge is returning from a three months' trip in Europe, on the "S. S. Berengaria," which sailed Oct. 3. His trip was for the purpose of studying mining and industrial conditions in Italy, Switzerland, France, and England.

Professor Ivan Alexiewich Korsookeen, a Russian mining engineer, visiting in San Francisco, was the guest of the Committee on International Relations of the University of California, Sept. 28, when members of the faculty heard him discourse on mining conditions in Siberia.

T. W. Quayle, formerly with the Burro Mountain Copper Co. at Tyrone, N. M., has gone to Nacozari, Mexico, as head geologist for the Phelps Dodge interests. Since the shutdown at Tyrone Mr. Quayle has held a professorship at the New Mexico School of Mines, at Socorro.

A. W. Ambrose, the assistant director of the U. S. Bureau of Mines, is en route to Hawaii to confer with officials there and to inspect the work under way on the Pearl Harbor oil storage. More than $6,000,000 is being expended on this Hawaiian project. The Bureau of Mines is supervising the work at the request of the Navy Department.

Edwin O. Daue has succeeded S. **Ford Eaton** as engineer in charge of the Dardanelles mine, at Chloride, Ariz. Mr. Daue is a graduate of the Michigan College of Mines, and has had over fifteen years of mining experience, both in this country and South America. Mr. Eaton has left mining work to engage in motor trucking in California.

Mining and metallurgical engineers visiting New York City last week included: **W. H. Staver,** of Idaho Springs, Colo.; **John E. Hodge,** of Minneapolis, Minn.; **Thornton Davis,** of Marblehead, Mass.; **G. H. Wigton,** of Eureka, Utah; **Benjamin L. Miller,** of Bethlehem, Pa.; **Charles H. White,** of San Francisco, Calif.; **Nelson Dickerman,** of San Francisco, Calif.; **Eugene McAuliffe,** of St. Louis, Mo.; and **B. C. Yates,** of Lead, S. D.

OBITUARY

Isaac Guggenheim, of Guggenheim Brothers, prominent in the mining and smelting industry in America and abroad, died suddenly at Southampton, England, on Oct. 10. An appreciation of Mr. Guggenheim and his work will appear in an early issue of the *Journal-Press.*

THE MINING NEWS

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

Leading Events

PREMIER GOLD MINE, in Portland Canal district, on Alaska-British Columbia boundary, pays another dividend of $750,000.

Forest fires in the mining districts of northern Ontario have swept several towns. Dead are estimated at sixty.

The Cleveland-Cliffs Iron Mining Co. will erect a large concrete dam, to assure steady supply of hydro-electric power on Marquette Range in Michigan.

Advanced prices for zinc and lead concentrate have stimulated operations in the Tri-State zinc-lead district centering at Picher, Okla.

Car shortage hinders distribution of coal—particularly anthracite.

Threatened strike of miners at Tonopah fails to materialize. New scale of wages is being considered.

Tax on diamonds in stock at the South African mines is upheld by higher courts.

Three miners were killed at the Tilden mine, in Michigan, on Oct. 3.

New York section of A.I.M.E. passes resolution expressing the belief that the time has come for the United States to participate in solving the economic problems of Europe.

Callahan Hopes To Reach Maximum Production Early in 1923

Labor Shortage Will Retard the Gathering of a Full Crew—Mill Improvements Will Be Made

Preparations are being made for resumption of production by the Callahan Zinc-Lead Co., one of the large producers of zinc in the Coeur d'Alene district, Idaho. The company also produces lead and silver. There will be little delay in getting started, as the manager, C. W. Newton, says that all that is necessary it to make some minor repairs in the mill and possibly some changes to increase its efficiency. This work is now being done, and it is expected that before the first of November the mine will be producing again. It is not to be expected, however, that production at full capacity will be reached for some months. Labor shortage is still serious in the Coeur d'Alenes, and though conditions in this respect will doubtless improve, Callahan will hardly be able to get its full quota of 350 miners and mill operators for some time.

With the exception of the Hunter, which normally employes 160 men and which is still inactive, the Callahan is the last of the big Coeur d'Alene mines to resume production. The Callahan closed down on Nov. 1, 1920, and has therefore been idle for two years. The suspension was due to the low price of zinc, coupled with excessive freight rates and other high mining costs. It is understood that the entire zinc output of the Callahan is contracted for shipment to the plants of the Grasselli Chemical Co.

Northern Ontario Silver District Swept by Fire

Several Towns Devastated—Sixty Lives Lost—Six Thousand Homeless

Haileybury, county seat of Temiskaming; North Cobalt; and a number of adjacent settlements in the Cobalt silver mining district of northern Ontario, are practically wiped out as a result of forest and bush fires that became serious on Oct. 4. Probably sixty persons lost their lives, and more than 6,000 are rendered homeless, 4,000 of these being residents of Haileybury. An estimate of the money loss is $8,000,000, which, besides buildings, includes farm crops.

The months of August and September were exceptionally dry, and numerous bush fires clouded the horizon with smoke. No apprehension was felt until on Wednesday, Oct. 4, a sixty-mile gale developed. A fire west of the tracks at Haileybury got out of control, and it soon appeared that the town was doomed. Cobalt itself was not seriously threatened.

None of the operating mines suffered damage, although some of the buildings of mines which were not working were burned. The transmission lines of the northern Ontario Power Co. between Cobalt and Matabichewan were partly destroyed, as was the Kirkland line north of Cobalt. All Kirkland mines are shut down, and unless there are steam pumping plants, the mines will flood. Cobalt mines and mills are also down, but there is plenty of power for pumping. A temporary line can probably be arranged for Cobalt within a week, but it will probably be two weeks before power will be available for Kirkland.

Advancing Prices Stimulate Operations in Tri-State Lead-Zinc Field

St. Joe Lead Co. and Chanute Spelter Co. Are Drilling—Railroad Embargo Has Cut Shipments

Several weeks of steadily advancing prices for both zinc and lead ores have created a renewed feeling of optimism in the Tri-State field, and resulted in unusual activity in starting up old properties or in development work to discover new ones.

Much drilling is being done west of Baxter Springs, Kan., by the Chanute Spelter Co., and other interests, and good results are being reported. The Weneeda Mining Co. has just started a new concentrator in the section north of Treece, Kan. The Bilharz Mining Co. is drilling in the hope of proving an extension of the rich run of ore that has been mined so successfully by the Blue Mound and Vinegar Hill Zinc companies, north of Picher, Okla. The Rakowsky interests and these of the St. Joe Lead Co. are continuing their extensive drilling operations to the north and east of Baxter.

Within the last week two different companies are reported to have taken leases and become interested in the field immediately around Joplin, where mining has not been carried on for two years and more. One of these, the Joplin Mines Co., is made up largely of Michigan mining men, and has taken a lease on a large part of the Rex 1,000 acres, just southeast of the city. The other company, one of the largest in the Picher field, is attempting to increase the acreage of its leases, a number of which it has recently ob-

tained on mining lands immediately west of Joplin.

It is also rumored that one of the largest companies in the field is contemplating taking a large lease acreage in the vicinity of Quapaw, Okla., where heavy water has long kept down operations.

Premier Mine Pays Another Dividend

The Premier Gold Mining Co., whose mine is near the International Boundary between Alaska and British Columbia, in the Portland Canal district, has declared its fourth dividend, amounting to $750,000, for distribution in October. The total distribution to date aggregates $2,400,000, or a return to shareholders of almost half their investment in nine months. Since the beginning of the year the Premier Mining company has been shipping each month about 3,000 tons of high-grade ore, running about $80 a ton; $3,000 tons of medium grade, running about $35 a ton; and it has been milling between 3,000 and 4,000 tons of lower-grade ore in its concentrating and cyanide plant. It is estimated that the mine has been turning out ore to the value of $400,000 each month, the high grade and concentrate going to A. S. & R. smelter, at Tacoma, and the medium to the Anyox plant, of the Granby Consolidated Co.

U. S. Gold Imports Decline

Gold imports into the United States declined from $84,901,554 in August, 1921, to $42,986,727 in July, and to $19,092,208 in August, 1922. Eight months' imports were $310,000,000 less than a year ago. The excess of imports over exports in 1921 was $667,587,405. Gold movement by months from January to August, 1922, inclusive, follow:

Month	Imports	Exports	Exc. Imports
January.....	$26,571,371	$862,983	$25,708,388
February....	28,738,920	1,731,794	27,007,126
March.....	33,488,256	962,413	32,524,843
April.....	12,243,555	1,578,867	10,664,688
May.....	8,993,957	3,406,658	5,587,299
June.....	12,976,636	1,600,754	11,375,882
July.....	42,986,727	645,114	42,341,613
August.....	19,092,208	955,853	18,136,353
Totals....	$185,091,630	$11,744,036	$173,347,598

Cleveland-Cliffs Co. Building New Dam for Electric Power Project

The Cleveland-Cliffs Iron Co. has started construction work on a new dam on the Dead River, at a point a few miles to the north of Negaunee, on the Marquette Iron Range of Michigan. It will be of concrete construction, half a mile long and 50 ft. in height at the center of the river bed. The amount of concrete to be poured will be about 335,000 cu.yd. This dam will cause a lake about ten miles long to be formed and will impound sufficient water to keep the two hydro-electric plants which the company now has on the river at capacity operation throughout the year. It is expected that nearly a year will be required to complete the work. The job will be done by the company's own engineers.

Ore Receipts at Trail 10,878 Tons

The following table shows the shipments of ore received at the smelter of the Consolidated Mining & Smelting Co., at Trail, B. C., for the period Sept. 22 to 30, inclusive:

Name of Mine	Locality	Tons
Alamo.....	Alamo, B. C.	91
Dublin Claim.....	Zwicky, B. C.	14
Northport Smelting & Refining Co.....	Northport, Wash.	51
Paradise.....	Invermere, B. C.	35
Quilp.....	Republic, Wash.	157
Queen Bess.....	Sandon, B. C.	35
Rambler Lease.....	Rambler, B. C.	77
Silver Bear.....	Kaslo, B. C.	10
Surprise.....	Republic, Wash.	50
Silve smith.....	Sandon, B. C.	269
Van Roi.....	Silverton, B. C.	49
Black Rock.....	Northport, Wash.	40
Roseberry Surprise....	Sandon, B. C.	49
Noble Five.....	Sandon, B. C.	132
Ruth.....	Sandon, B. C.	48
Company mines.....	.....	9,771
Total.....		10,878

State of Minnesota Seeks Supreme Court Decision on "Occupational Tax"

The State of Minnesota has asked the U. S. Supreme Court to advance for argument the seven cases brought by the Oliver Iron Mining Co. and other companies to test the constitutionality of the new Occupational Tax, which imposes a levy of 6 per cent upon the valuation of all ore mined after deducting the major cost of mining. The United States district court for Minnesota held the law valid, but enjoined its enforcement pending appeal. Practically all mining companies engaged in producing iron ore in the state sought to enjoin the collection of the tax. In support of its motion to expedite the final disposition of the cases, the state asserted that annually more than two-thirds of the iron produced in the United States was mined within her borders, and that consequently the mining business rightfully constituted a large source of revenue.

Reduced Rates on Nevada Ore Become Effective Oct. 22

Reduced rates on ores from Nevada over the Southern Pacific are expected to result in increased shipments to the Salt Lake valley (Utah) smelters. The reduction, though affecting all classes of ore, is of particular importance, as it affects ore of a value of $20 or less per ton, which under old conditions could not be marketed. The reduction of 35 to 40 per cent on these ores should greatly increase the activity of Nevada mines. The new rates go into effect on Oct. 22.

Mill Tailing Sold to Ceramists for Its Cobalt Content

The Nipissing silver mining company, of Cobalt, northern Ontario, Canada, recently shipped two carloads of residue to Berlin, Germany, consigned to a pottery firm which will use the cobalt contained in the residue for coloring purposes. The shipment was of an experimental character, the price received being about the same as that prevailing in the American market.

Argonaut Jury Recommends Connections Between Neighboring Properties

Coroner's Inquest Reveals Inadequacy of Equipment and No Inspection—Delay Followed Discovery of Fire

The coroner's jury investigating the Argonaut mine disaster of last August, in which forty-seven miners lost their lives on the Mother Lode of California, gave the following verdict on Sept. 26:

"Having been duly sworn according to law and having made such inquisition after inspecting the bodies and hearing the testimony abduced upon our oaths each and all do so: That the decedents came to death on the twenty-eighth day of August, 1922, in this county, by suffocation from poisonous gas fumes caused by a fire of unknown origin near the 3,000 level in the main shaft of the Argonaut mine, after they had bulkheaded themselves in on the 4,350 crosscut, having no means of escape, which were free from poison gas.

"We hereby recommend that in the future the Argonaut Mining Co. and the Kennedy Mining Co. be compelled to keep and maintain an opening with proper doors at one of the lower levels.

"We further recommend that in the future more precautions be taken to prevent fires and that better fire-fighting facilities be maintained at proper levels and stations as a safeguard against the repetition of such a disaster."

The hearing before the coroner's jury brought out some interesting information and differences in points of views.

Burt Turner, top man on duty at the shaft collar when the fire started on Aug. 27, testified that no warning had been sent to the men at the bottom; the skip was not sent down to them, nor was an effort made, as far as he knew, to telephone. There was no fire-fighting equipment for use below ground. The only fire extinguisher was in the carpenter shop on the surface. No fire drills were held. Half an hour after the alarm reached the surface, a skip was sent down with ten 5-gal. kegs of water and some 10-gal. cans. It came back in twenty to twenty-five minutes and descended with additional water.

E. C. Hutchinson, president and general manager of the Kennedy, testified that some years ago a drift in the Kennedy at 3,150 ft. was arranged with air pipe and rails available for an emergency connection with the 3,750 level of the Argonaut by knocking out 5 or 10 ft. of rock. It was allowed to fall in disrepair even before the fire of three years ago.

E. A. Stent, an official of the Argonaut company, testified that it was suggested a few years ago that the mines be connected, but he did not know if it had been accomplished. Operations, he said, were up to the local managers. Heavy expenditures would, however, have to be sanctioned by the company's directors. The Argonaut had only one shaft until 1913, when it acquired the Muldoon. This was regarded as ample protection for the men. He vaguely recollected, he said, that a

former Argonaut superintendent had reported the Kennedy management opposed to establishing an emergency connection from mine to mine. As to safety appliances, he assumed that the superintendent saw to their being on hand.

Testimony of E. W. Hopkins brought out the fact that there had been no "wire trouble" on the day of the fire. Respecting the patrol of the shaft, the witness stated that men came and went so often that there was no need of it, and even when ore was being hauled the shaft would be traversed by some workman at least in the course of three hours. Eight minutes is required for a trip from surface to bottom of shaft.

Michael Jogo, one of the three men who escaped from the mine, testified that he believed that all of the men could have been brought out of the shaft if the skip had been sent down immediately and that it could have made not only one trip but three or four trips down and back. V. S. Garbarini, general manager for the Argonaut, estimated that the time during which there was a possibility for the skip to go down after the fire was discovered by Bradshaw was an hour. He gave as his opinion that not a single trip could have been made, as buckling rails and falling timbers would have completely blocked the way. Garbarini said that the usual precautions against fire had been taken—"warning the fellows to be careful."

Garbarini stated that reversal of the fan would have blown out the doors at various levels and would have short-circuited the air without benefiting the trapped men. Three or four hours would have been lost in reversing the fan, and during this interval bad air would have been a menace. He said cold air would not have descended the Muldoon. Men trying to climb the Muldoon, if any had, would have been gassed. It would take an active man three hours to make the climb. There were no compressed-air pipes in the Muldoon, and the hoist had not been operated for a year. Garbarini said that he reached the mine at 12:15 a.m. Monday, Aug. 28, and the reversal of the fan was not suggested by anyone until a day or two later.

According to Garbarini, the Argonaut had tanks and hydrants and hose at the surface; at different levels were fire extinguishers. Extinguishers were inspected regularly and had been recharged within a few weeks. There were no piping facilities in the shaft, which was bone dry at 3,000 ft., but wet from seepage 600 or 700 ft. lower. At 2,000 ft. was an 18-in. valve in an old pumping pipe, but at the time of the fire this could not be opened, because of the rust.

Ben Sanguinetti testified that he reached the mine at 12:12 a.m. Monday. He said skips full of water were being taken down. He went to the 2,400 level and then by the manway to the fire, 600 ft. farther down. Skips were useless for rescue. Sanguinetti said that he inspected the Muldoon shaft in February, 1920, and found it sound, and he thought it was still in good condition. He stated that no fire drill had been held in a year.

According to evidence introduced, B. I. Hoxsie, superintendent of the Fremont mine, was the only one who had taken exception to the decision of advisors and officials, who were in agreement that the Muldoon fan should be used, as usual, to suck air from the mine, on the ground that if it had been reversed the result would have been to drive poisonous gases downward.

F. L. Lowell, mining engineer of the Industrial Accident Commission, said that he had inspected the Muldoon after its completion but that the shaft was out of his territory.

According to the hoist engineer, W. T. Brewer, an unnamed miner, one of the forty-seven victims, reported over the telephone that the men trapped below were aware of the fire. He was advised by the engineer that the flames were being fought from above.

Fall of Rock Kills Three Men in Michigan Iron Mine

At the Tilden mine, near Bessemer, Michigan, on Oct. 5 three men were killed and another workman was seriously injured by a fall of ground which broke through the timbering above them. The accident occurred on the top sublevel close under the capping rock, chunks of which caused the accident. The men were experienced miners. One had been in the mines thirty-five years, but apparently they had no warning; they were buried in front of the eyes of the shift boss, who was just coming to administer first aid to two of the men, who had received minor injuries. This is the worst accident that has occurred at the Gogebic Range mines of the Oliver Iron Mining Co. for the last ten years. The company employs normally from 2,000 to 2,500 men there, and has always been active in measures to promote safety.

New York Section of Institute Advocates Abandonment of Policy of International Aloofness

Sends Resolution to Secretary Hughes and New York Senators—Declares Conviction That America Must Interest Itself in Foreign Affairs—Speakers at Monthly Meeting

FOLLOWING interesting talks on Russia and on economic conditions in Europe generally, a resolution urging that the time had come for America to discard its policy of aloofness with respect to European affairs was adopted by the New York Section of the American Institute of Mining and Metallurgical Engineers at its first monthly meeting for the year, held following dinner at the Machinery Club on Oct. 14.

R. M. Raymond, presiding, introduced Edgar Rickard, who, after a brief sketch of the remarkable work of the American Relief Commission, of which he is executive head under H. C. Hoover, gave his view on the Russian situation in general. He questioned the likelihood of the Soviet Government reaching working agreements for the exploitation of Russia's resources by foreign interests for some time at least. The risk is so great that investors of outside capital would expect a chance for enormous profit. He said the Russian people must get to work, and concluded by expressing the opinion that Russia has a better chance under the present regime than under the Czars.

S. Redding Bertron, chairman of the American-Russian Chamber of Commerce, briefly and convincingly described the economic situation today as being no less critical than was the military situation when the United States finally went into the war. We, he said, were just in the nick of time to avert world disaster in 1917. Will we be in time in the economic crisis that the entire world faces today? Economists instead of politicians must shape events if collapse in Europe and consequently disaster here is to be prevented.

Boris Bakhmeteff, a Russian engineer whose consultation has been sought by both the Wilson and Harding administrations, first assured the meeting that the work of the American Relief Commission was more than appreciated by the people of Russia; and that America is the one country in the world to which Russia does not feel antagonistic today. He was optimistic as to the future. He declared that psychological and intellectual regeneration of the Russian people was at hand. He did not, however, consider the time ripe for American capital to attempt to finance Russian enterprise. The people of Russia must fight alone, he said, for a while.

The resolution, copies of which are to be sent Charles E. Hughes, Secretary of State, and to James W. Wadsworth, Jr., and William M. Calder, United States Senators from New York, follows:

Resolved, That it is the sense of the New York Section of the American Institute of Mining and Metallurgical Engineers that the time has arrived when the United States should discontinue its policy of isolation and aloofness from world affairs, and that it should participate in the economic rehabilitation of Europe by aid of counsel, deeds, and credits, not only on broad humanitarian grounds but because it seems evident that without this help Europe will continue to be unable to achieve economic stability and without this a sound prosperity in the United States cannot be hoped for.

News from Washington

By PAUL WOOTON
Special Correspondent

Outlook Favorable for Mexican Mining

Little New Capital Has Entered Country, However — Economies in Operation

A more favorable outlook for mining in Mexico is indicated in an exhaustive report which just has reached the Department of Commerce. The report points out that the Federal Government and most of the people of Mexico are particularly interested in encouraging metal mining in Mexico because it produces a healthy economic condition. It is regarded as being of basic importance to the welfare of the laboring element in that republic. The development of any mine provides for relatively large employment, and if the venture is a success it frequently results in the formation of new communities.

The Pittman law, says the report, has operated in the interest of Mexico. The fact that the United States Government pays a price in excess of the market price has diverted all American silver from the arts and trades and other markets of the world, leaving all such markets open to Mexican silver. Had it not been for this, mining authorities in Mexico are of the opinion that the silver industry would have collapsed during the depression. The depression has had the effect, the report points out, of causing the mining companies to reorganize their activities, which has resulted in the reduction of many expenses, particularly the items of overhead. The cost of machinery, chemicals and other materials has declined. As a result, most of the mines in the country are in a position to produce at lower costs than at any time since the war. The report contains a comparison of metal production in 1910 and in 1921. The former year is chosen because of its having been the last normal year before the beginning of the revolutions. The table follows:

	1910	1921
Silver, oz.	85,065,748	78,581,033
Gold, oz.	1,457,936	748,880
Copper, lb.	105,952,803	33,501,787
Lead, lb.	273,441,751	133,129,110

One of the indications of increased activity is the construction of a bullion refinery by the Real del Monte Co. at Pachuca. This refinery, which is just being completed, has a capacity of 1,500,000 oz. per month. In addition, the company is constructing new tramways and making general preparations for the handling of an increased tonnage, the report states.

It is admitted that all the increased activity is on the part of concerns with capital already invested. It is stated that little new foreign investment is being made in Mexican enterprises. There is a general lack of capital throughout the republic for development.

Alaska's Mineral Output for 1922 Low, but Future Bright, Says Brooks

The mineral output of Alaska probably will be smaller this year than last, according to Alfred H. Brooks, who has just returned to Washington from a brief inspection trip in the territory. However, Mr. Brooks is optimistic as to the future. Dredging operations are improving and there is more systematic prospecting for gold, both at Nome and at Fairbanks, than at any time since 1915. The construction of the railroad has been an important factor in stimulating development.

Mr. Brooks anticipates increased prospecting for oil. The development of Alaskan oil has been retarded somewhat owing to the fact that many claims were staked by men who lacked not only experience but the money to carry on the necessary work. This condition has been remedied, and a number of well-equipped outfits are on the way to the territory now.

War Minerals Relief Claimant Profited, Instead of Lost, Thinks Commissioner

Subject to the approval of the Secretary of the Interior, the War Minerals Relief Commissioner has recommended the following awards:

Dodge and Doeblin, Carrville, Calif., $488; Charles Abrell, Redding, Calif., $311; Luddy and Neilson, Yreka, Calif., $570.10; Upton and Sparhawk, Buffalo, Wyo., $693.70; S. C. Stone, Heisson, Wash., $212.77; Dixon, Dixon, Hunt and Allen, Yreka, Calif., $1,259.70; W. C. Dack, Hazel Creek, Calif., $451; E. K. Carey, Canyon City, Ore., $764; J. R. Allison, Yreka, Calif., $525.70; Williams and Facey Brothers, Callahan, Calif., $731.50. The claim of J. G. Murphy, of Seattle, was disallowed because the commissioner found on reviewing the case that he could not recommend any award in addition to that paid under an order from the former commissioner. A review of the claim of J. R. Whitman, of Atlanta, Ga., has convinced the War Minerals Relief Commissioner that his operations resulted in a profit, rather than a loss. As a result, he has recommended that the claim be disallowed.

More Time for Tax Payments in Mexico

A further extension of time in which the owners of Mexican mining properties may pay their taxes has been granted in a presidential decree. According to this decree, which was signed Sept. 30, properties may be retained provided the full tax for 1921 and for 1922 is paid prior to Jan. 1, 1923. Arrangements can be made for the payment of those taxes in installments.

Car Shortage Hinders Distribution of Coal From Eastern Mines

Substitution for Anthracite by Householders Should Be Encouraged—Federal Fuel Distributor Is Active

Developments of the first week in October have caused the officials concerned with coal to take a much less encouraging view of the situation than at any time since the strike was settled. There is a general belief that the peak of production has been reached and that a decline in output may be expected.

The public believes that the shopmen's strike is over. As a matter of fact it is continuing on a number of roads, and some of those roads are very vital in securing the maximum coal production. Even on those railroads where the strike is settled, unusual difficulty is being experienced, apparently, in securing an equitable distribution of the available cars. Car supply is spotty and uncertain. The non-union districts are suffering particularly. Their cars were sent broadcast all over the country during the strike, and great delay in their return has resulted. Incidentally, as a result of this situation, the western mines have a proportionately better car supply. The fact that the surplus of empties has been exhausted, and the increasing pressure of other freight, along with the difficulties in securing compliance with service orders, and car rules and regulations, make for increasing difficulties in supplying mines with coal cars even where the output could easily be increased.

It is clear that the more critical part of the situation is to secure the distribution of household fuel. Every effort is being made at the office of the Federal Fuel Distributor to meet that situation. It is known that there has been no extensive substitution for anthracite, and is recognized that that situation is one in which the operator can do little. It is entirely a problem of inducing the retailer to exert his influence with the consumer to induce him to lay in a supply of bituminous coal or coke, and thereby decrease the need for anthracite.

Radio for Mine-Rescue Cars of Bureau of Mines

Experiments with a radio receiving set are being conducted on one of the mine-rescue cars of the Bureau of Mines. The results thus far show that messages can be received just as clearly when the car is in motion as when it is at rest. An effort is being made to ascertain whether the radio has a practical application on mine-rescue cars. Owing to the fact that these cars are almost always out of immediate touch by telephone and telegraph, it is believed that information as to mine accidents could be sent them more quickly by radio.

News by Mining Districts

London Letter

Dolcoath Tin Mine Receives Government Aid—South Roskear Lodes Will Be Developed

BY W. A. DOMAN

London, Sept. 29.—More than twelve months ago the directors of the Dolcoath Mine (Cornwall) applied to the Trade Facilities Board for an advance of cash in order to permit of the property being reopened, mainly with a view to the relief of unemployment. Since then, the East Pool mine and the Levant mine have received financial assistance from the government, and within the last few days a satisfactory reply has been made to the application of the Dolcoath management. What the government will do will be to guarantee principal and interest of a £50,000 loan. Before this comes into actual operation, however, the Dolcoath company must clear off all its indebtedness, and the shareholders must subscribe a similar sum. It is expected that a scheme will be put before the shareholders within the next few days. I understand that the funds now to be provided will not be to open up the original property, but to sink a new shaft at Roskear. R. Arthur Thomas has put forward a plan of development, and the central shaft, which will be situated between North and South Roskear, will prove beneficial in the working of both sections later. According to some experts, the old Dolcoath mine is virtually worked out, and future tin production depends upon the exploitation of the South Roskear group of lodes. It has been suggested that if the government had assisted the mine at an earlier date, the necessity of sinking a new central shaft might not have arisen, but the unwatering of the Williams shaft would now prove unduly expensive.

As usual with the mines belonging to the Rand Mines group, the report and accounts of the New Modderfontein Gold Mining Co. are fairly informative. From 947,000 tons milled during the twelve months to June 30 last, there was a working profit at standard price of gold of £807,682. Revenue from the price above standard was £359,583, making the total £1,167,265. The number of ounces of gold recovered was 449,768, and as costs, including strike expenditure, were £1,080,454, each ounce was won at the low figure of £2.4

The "premium" varied considerably. From 111s. 3d. per fine oz. in July, 1921, the net value declined to 90s. 3d. in May of this year, and 90s. 9d. in June, the average (including premium) being 99s. 4d. For the previous financial year the average was 112s. 7d. Development, owing to the strike, was about 2,500 ft. less, at 17,677 ft., of which 11,168 developed ore. Of this figure, 9,705 ft. were in reef formation, and 74 per cent. of it, all on the Main Reef leader, gave an average value of 45.7 dwt. over 19 in., the new tonnage brought in being 975,700 tons of a value of 10.7 dwt.

The reserves at 8,577,600 tons are lower by 307,000 tons, due mainly to curtailed development and partly to a reduction in the estimated stoping width from 68 in. to 66 in. The reduction, however, raised the value by 0.2 dwt. to 8.6 dwt. Preceding the strike, working costs were 21s. 9d. per ton; in June, when work was again normal, they were only 18s. 6d. Eleven per cent of waste was sorted out, of a value of 0.647 dwt. The theoretical extraction was 96.8 per cent and the actual 98.6 per cent. The upper levels of the northeastern section of the mine are being filled with sands. The deep level area of the mine is to be opened up by sinking a new circular shaft in the southwest of the property.

Johannesburg Letter

Tax of Diamonds in Stock Is Upheld—Swaziland Will Be Prospected

BY JOHN WATSON

Johannesburg, Sept. 5—There is likelihood of Swaziland being thrown open for prospecting, the Union Government having decided to impose by proclamation a tax upon unworked mineral areas. The mineral concessionaires have protested against such a tax, but the feeling among the general public is in favor of it. Between 1885 and 1889 prospecting was active along the western border. At that time Forbes Reef, Pigg's Peak, and the Horo were producers of gold. Despite those activities, 75 to 80 per cent of Swaziland has never been properly examined.

Justice Gregorowski delivered judgment on Aug. 31 in the Rand Division of the Supreme Court in the case in which De Beers Consolidated Mines, Ltd., appealed against the Commissioner for Inland Revenue re the taxing of diamonds in stock on June 30, 1920. The taxing by the commissioner was upheld.

Reference was made recently to the find of a 33-carat diamond worth £800. A correspondent, H. Ward, writing to the evening paper, says a diamond of 119½ carats was recently found at Wedberg, near Windsorton, which realized £5,000—a record sum for a single stone from alluvial diggings. He says that the name of finder and purchaser can be disclosed, if necessary, as authentic proof. The building of the new mint at Pretoria is being delayed, at present, owing to a strike or lock-out. A builder is said to have employed unskilled men in his brick yard. This led to the withdrawal of artisans from the brick yard and later from the mint and other works. The master builders have requested the men to return to work by tomorrow, failing which a lock-out will be declared.

AUSTRALIA

Queensland

Large Investment in Cobalt Reduction Works, in Cloncurry District—Market Questionable

Special Correspondence.

Brisbane—A crushing and concentrating plant, costing about £40,000, has been installed at the cobalt mine at Mount Cobalt, Cloncurry district, and is now successfully at work. Though several shipments of high-grade ore from this mine have been sent to England from time to time, a large quantity of a lower value has been mined and awaits treatment by the new plant. Between sixty and seventy men are employed at the mine, and ore is being got down to the 112 level, to which a second shaft (the southern) is being sunk. There can be no question as to the high quality and extent of the cobalt ore obtainable if the market can be assured. That the owners have confidence in the ultimate success of their enterprise is shown by the installation of a treatment plant at the mine and by the fact that vigorous development is proceeding. The Mount Cobalt Co., Ltd., which was registered in Queensland two or three months ago, has a capital of £100,000 in £1 shares. It is understood that the shares are largely held by persons concerned in Mount Elliott, Ltd., near whose headquarters in the Cloncurry district the cobalt mine is situated. Up to the end of last year 500 tons of ore had been shipped to England since the mine was opened in 1920, and in July last 120 tons of picked ore and hand-jigged concentrate was shipped.

An old Queensland gold field known as the Normanby, that had for many years lain dormant, has of late experienced quite a revival, and bids fair to attain considerable prominence. It is situated about sixty miles by a rough road south of Bowen, one of Queensland's northern ports. Discovered in 1872, it was soon eclipsed by the more sensational field of Chartes Towers, which came to light about the same time. After many vicissitudes, the Normanby became totally idle until 1920, when gold in payable quantities was reported as being found in an area outside that previously worked. At least four new reefs were located, all of which offered good promise with further prospecting.

BRITISH COLUMBIA

Silversmith Paid $25,000 Dividend Oct. 1—Jack Paul Mine Resumes

Sandon—The Silversmith Mining Co. distributed its third dividend of $25,000 on Oct. 1. Production on this property has been proceeding at the rate of 500 tons of crude and concentrated lead ore and 300 tons of zinc concentrates per month since Jan. 1.

Hudson Hope—Extensive iron-ore deposits in this district may determine the location here of the plants of the Coast Range Steel Co., Ltd., a recent organization formed by Victoria, Van-

couver, and London interests. It is claimed that high-grade iron-ore beds are known to exist over sixty miles of territory, and that the ore contains as high as 60 per cent iron. Abundance of coking coal and large water-power possibilities make the location practical, it is said.

Greenwood—An orebody encountered in the Jack Paul mine, at Rock Creek, near here, is showing promise of profitable development, according to a report of Frederick Keffer. A general sample of the high-grade ore contains $2 in gold and 123 oz. of silver per ton, and 6 per cent lead. The lower-grade streak contains 19 oz. of silver and $3.60 in gold per ton. There are five veins traversing the property, and a depth of 500 ft. can be attained from the lower lever just being started.

Telka—Operations have been resumed on the Cassiar Crown property, near here. Development was suspended in November, 1920, but substantial increase in metal prices warrants resumption of development, according to J. V. Pohlman. Work will be concentrated in the lower tunnel at 250 ft. depth on the Ruby oreshoot.

MEXICO

Labor Laws in Chihuahua May Strangle Mining Industry

City of Mexico—The new labor laws of the State of Chihuahua have had a decided dampening effect on the mining industry. New mining enterprise is discouraged, and though the larger companies now operating will probably continue, the owners are not optimistic. The new laws increase the cost of production. Representations are now being made to the federal authorities here in hope that the central government may take a hand in the matter. A high official stated to a representative of the *Journal-Press* that the federal officials would probably be inclined to give the new legislation a thorough try-out before attempting to bring pressure for a change.

In response to the solicitation of a large number of petitioners, the Secretary of the Treasury has suspended the decree limiting time of payment of mining taxes to the end of September and has extended the time limit to the end of the year. More than 18,000 pertenencias were in arrears for taxes on Oct. 1. The secretary expresses his desire to assist the mine owners in every reasonable way.

The present year promises to be one of the biggest years in silver production since the beginning of mining in this country. With one exception, 1912, the annual output will probably exceed all records. For the first half of this year the output has already reached 1,195,355 kg. and there is every reason to assume that the last half of the year will show even a larger production. The output by months for the first six months is: January, 190,212; February, 188,193; March, 209,345; April, 175,513; May, 221,232; June, 210,857.

NEVADA

Threatened Strike at Tonopah Fails to Develop—Negotiations May Lead to Wage Increase

Tonopah—The more radically inclined miners attempted to start a strike in this district on Oct. 1, but failed, owing to the refusal of the more conservative element to join in the movement. The latter held a meeting on the evening of Sept. 30 and arranged for a representative committee to meet the operators and discuss possibilities for a wage increase. About 15 per cent of the mine crews were off on the following day, but it is believed in Tonopah they will gradually return to work.

The West End has reported that the new vein cut on the 400 level from the Ohio shaft shows a width of 10 ft. of ore of commercial grade. Drifting east and west has been started. The Tonopah Extension has completed installation of its pumping equipment to such an extent that the 1,880-level workings from the Victor shaft can be unwatered.

It is reported here that the Tonopah Mining Co. has taken an option on a group of claims adjoining the famous Ophir Hill Consolidated Mining Co.'s property in Ophir, Utah. It is said that the faulted segment of the rich orebody of the Ophir Hill Co. has been located in these adjoining claims by core drilling, at a depth of 1,200 ft.

Candelaria—The 300-ton cyanide mill of the Candelaria Mines Co. is practically completed, and the electric power has been turned on. The mill will be given the preliminary try-out early in October. Mine conditions are good, and ore is to be drawn first from the stope fills on the Northern Belle, and the blocked areas in the Lucky Hill mines.

WASHINGTON

Boundary Red Mountain Mine Is Earning Profit—George Wingfield Interested

Spokane—The Boundary Red Mountain Mining Co., which owns a producing mine in Whatcom County, has rerecently been listed on the Spokane Stock Exchange. Reports of the company show that the mine has been opened by three crosscut tunnels and an oreshoot developed for over 500 ft. The vein, varying from 1 to 7 ft. wide, is reported as carrying average values of $21, mainly in gold. A fifty-ton stamp mill is reported to be earning $10,000 per month above expenses. George Wingfield, formerly of Goldfield, Nev., is the chief stockholder.

Bossburg—The Minorca Homestake mine has recently been taken over by Spokane men and a new company organized to develop the mine. Samuel Glascow is president. One lode on the property is 6 ft. wide and carries average values of $20 per ton in gold, silver, and copper, and another, 4 ft. wide, is richer. About $100,000 was spent in development by the former owners. The ores and general formation are reported to be similar to the Rossland mines, a few miles north.

IDAHO

Good Concentrate Goes to Bunker Hill Smelter from Idaho Continental

Port Hill—The Idaho Continental mine, twenty-six miles west of here, on the Canadian boundary, is operating to capacity, according to A. Klockman, manager. Changes in the mill delayed starting. Monthly accumulations of concentrates are 600 tons, which average 68 per cent of lead and 23 oz. of silver. Of this, 500 tons has already been shipped to the Bunker Hill smelter and 1,000 tons has accumulated in the bins. Transportation to Port Hill is by means of caterpillars and trailers. Development work has been kept two years in advance of production. The company employs 130 men. Wages will be raised soon to $5 for miners and $4.50 for muckers, it is said.

CALIFORNIA

Mines' Production Shows Increase

Grass Valley — The Grass Valley Boundary Mines Co., which owns the New Idea, Scadden Flat, Clinch Hill, Gamblers', and other claims to the west of the town, is installing an electrically driven plant to cope with the large amount of water encountered in the lower levels. A power line is being constructed to tap the Pacific Gas & Electric Co.'s main line. The company expects soon to resume active operations.

The new hoist at the Brunswick mine is now erected, and the work of unwatering is to be started at once. It is expected that the bottom of the shaft will be reached in a month.

Minersville—Following the acquisition of 610 acres of placer ground on the east fork of Stuart Fork, a group of Oakland capitalists has incorporated the Nugget Bar Placers Co. and has begun operations on the property, which is situated about two miles from the old Van Matre station.

The drill prospecting of the Bragdon and Fogg & Lawrence tracts along the Trinity River has been completed under the direction of Lawrence Gardella, who has a bond on the properties.

Shasta—A prospector recently returned from the mountains with evidence of having discovered platinum. No information is available as yet as to the location of the alleged find.

San Francisco—A compilation by the State Mining Bureau of the final returns from producers shows that fifty-one mineral substances were produced in California during 1921, exclusive of a segregation of the various stones grouped under "gems." All the fifty-eight counties of the state contributed to the total, which amounted in value to $268,157,472—an increase of $20,057,805 over the previous year's production. As revealed by an analysis, the salient features of the year's output comprised an increase in the value of petroleum, gold, silver, cement, crushed rock, and natural gas. The notable decreases in output were in copper, quicksilver, and lead.

UTAH

Sioux Con. Will Be Restarted—Salt Lake Favors Southern Pacific in Railroad Controversy

Eureka—Control of the Sioux Consolidated mine has been acquired by Provo men, headed by E. F. Birch, formerly manager of the Knight Investment Co. The Sioux has produced over $750,000 in dividends. It has been opened through a shaft 600 ft. deep, from which there are extensive lateral workings connecting with an adit. It is planned by the new management to start work from the 1,700 level of the Iron Blossom, from which the Sioux ground can be reached with 300 to 400 ft. of drifting. The officers of the new company will be: E. F. Birch, president; George Finch, vice-president and E. E. Prickett, secretary and treasurer.

The Dragon Consolidated has started shipping 100 tons of iron ore daily to the smelters. A considerable number of lessees are working in the mine and shipping some ore to the smelters. The Tintic Milling Co. is taking low-grade ore.

At the Iron Blossom, there has been some trouble in holding old stopes, but this has been overcome, and increased shipments are expected. However, despite this drawback, production has been continued, and the regular quarterly dividend of 2½c. a share is expected.

Bingham—Shipments for the week ended Sept. 30 amounted to seventy-five cars. Shippers (not including Utah Copper or Utah Consolidated) were: United States Mining, 41 cars; Utah Apex, 21; Montana-Bingham, 5; Bingham Mines, 8.

Park City—Shipments for the week ended Sept. 30 amounted to 4,371 tons, compared with 3,965 tons the week preceding. Shippers were: Park-Utah, 1,262 tons; Ontario, 1,165; Judge and Park City Mining & Smelting, 1,010; Silver King Coalition, 934.

Salt Lake City—Plans for the building of a steel plant in Utah—probably in Utah County—to exploit iron and coal deposits of southern Utah were discussed at a meeting and banquet of business men held in Provo on Sept. 30. L. F. Rains, president of the Carbon Fuel Co., addressed those present, and expressed the hope that plant-site problems would be worked out satisfactorily, so that the people of this district might confidently expect that steel will be manufactured here soon.

In the matter of the control of the Central Pacific railroad by either the Union Pacific or Southern Pacific companies, there has been considerable discussion among Utah business men, since the issue of an order by the Supreme Court several months ago that the Central Pacific be separated from the Southern Pacific. The action had been pending in the Supreme Court for years, and the decision is rendered under the Sherman Act. The Salt Lake City Commercial Club and Chamber of Commerce, after a thorough investigation, including conferences with representatives of both the Union and Southern Pacific railroads, has gone on record as favoring Southern Pacific control. The chief ground taken was that it did not appear advisable for one road to control all of the outlets to the Pacific Coast, and that competition in Utah markets between the East and West was desirable.

Business men were reluctant to take part in the controversy over the control of the Central Pacific, in view of the long-continued service of the Union Pacific, but felt that the issue was forced. Action by the Interstate Commerce Commission in the matter is awaited with interest.

COLORADO

New May Day Oreshoot Promises Well —Cripple Creek Production Increases

Cripple Creek—The total output of ore from the Cripple Creek district for the month of September was approximately 24,500 tons, of a bullion value of $367,500, a slight increase over the production for August. The Golden Cycle mill during the month treated 692 carloads of ore, an increase of sixty-nine cars over August.

The Portland mill, which was closed down early in the year, resumed operations on Oct. 2, and is treating from 300 to 400 tons of low-grade ore daily. The output of the Portland during August was the heaviest for years.

Durango—The strike recently made on the May Day claim of the Cumberland Mines Co. gives promise of being the most important discovery made in the state for several years. The property is in the La Plata Mountains about fifteen miles west of here. The search for the lost vein has been going on intermittently for many years. The May Day was a heavy producer in early days, but the oreshoot suddenly terminated at a fault, and all efforts to locate the continuation were unsuccessful until recently. Eighteen inches of the vein sampled by an official of the American Smelting & Refining Co. gave values of approximately 5 oz. in gold. Officials of the Cumberland company claim that they have traced the extension several hundred feet.

Alma—The London Mines Leasing Co. has been organized to operate a lease including all of the North London and part of the South London mines. The new company will control 4,000 ft. along the strike of the vein. Development work, under the direction of B. G. Essig, will comprise the driving of a 1,000 ft. of drifts and crosscuts. It is possible that a new mill will be erected either at the South London or at the mouth of the new lower tunnel of the London Gold Mines Co. L. L. Davis is overhauling his equipment at Montgomery, preparatory to mining and milling a large body of gold ore which has been developed during the last year in the Magnolia mine.

MONTANA

Huffman Property, at Philipsburg, Will Be Reopened—R. M. Atwater, Jr., Talks of B. & M. Development Co.

Butte—With a slight increase in the number of miners arriving in Butte, plans are under way for getting additional tonnage from the mines in the Butte district during the winter. The Davis-Daly, which cut down to one shift during the summer owing to the shortage of men, plans to put on a night shift and will probably be able to add about 200 tons daily to the output going to the East Butte smelter. At present about 500 tons is the daily report.

Philipsburg—Barton Mitchell, of Stockton, Calif., a former Butte mining man, who represents Pittsburgh interests, has made the first payment of $20,000 on the Huffman Brothers' group at Maxwell near here. Mitchell put a crew to work repairing roads in the vicinity of the property and building bunkhouses. The Huffman property consists of four quartz claims, containing silver and copper, about a mile and a quarter from the power plant of the Granite County Power Co. With ample power available, Mitchell plans the installation of electrical equipment.

Neihart—Three miles of transmission line are being built by the Montana Power Co. to supply the demands of the Silver Dyke group at Neihart operated by the American Zinc, Lead & Smelting Co. One thousand horsepower will be used. The Silver Dyke will be the second important user of electric power in the Neihart district, the Hartley group of the Neihart Consolidated being already equipped. The mill to be built by the Silver Dyke will be of 650 tons' capacity, and construction will start immediately. Several hundred thousand tons of ore is said to be blocked out.

Marysville—On the 400 level of the old Bald Butte mine, a property that was supposed to have been worked out nearly twenty years ago, a lead has been struck that is running $16 in gold and $5 in silver. The property is owned by men in Helena, Mont., and Duluth, Minn., represented at the mine by George W. Padbury. There is more activity around the old workings in the Marysville district now than for many years.

Walkerville—The Crystal Copper Co., which owns the Goldsmith mine, north of Walkerville, has taken over the operations of the mine on the expiration of the lessees' contracts.

Elkhorn—R. M. Atwater, Jr., of New York, has completed an examination of the mines of the Boston & Montana Development Co., at Elkhorn. Mr. Atwater said that the mine would now be able to mill about a thousand tons of ore daily running from $2.50 to $5. "This tonnage can be maintained for years," Mr. Atwater is quoted as saying in an interview in Butte.

WISCONSIN

Higher Prices for Zinc Concentrate Stimulate Mining

Platteville—The prevailing rate of wages in the Wisconsin zinc district is as follows on the basis of a nine-hour shift: underground drill men, $4; grizzly men, $3; hookers, $3.50; shovelers, 8c. per can, with a guarantee of $3.50 per shift. The rise in the price of 60 per cent zinc concentrate from $22 per ton to $44 per ton has stimulated operations and has resulted in the opening of many new mines in the district.

The Vinegar Hill Zinc Co. will open the Monmouth and the Fields mines before long. Rumors are that the Mineral Point Zinc Co. will also start operations at the Penna Benton mine in New Diggings. This company is to ship 7,500 tons of ore to its works at Depue, Ill.

The Rodham & McQuiety mines, at Shullsburg, are making arrangements to resume operations after a shutdown of two years.

At the Blockhouse mine, the Kistler Stephens Co. is sinking a shaft. Only 25 ft. more remains to be sunk, when production will be started.

The Snow and Loveland mines, in New Diggings, are making fifty tons of 45 per cent zinc ore per week.

MICHIGAN

The Copper Country

September Shipments by Boat Establish New Record for Year

BY M. W. YOUNGS

Houghton—From the several smelters in the Michigan copper district, 11,540,000 lb. of copper was shipped by boat in September, breaking all previous monthly records for the year. The previous high was 10,728,000 in August. In addition, fully 1,000,000 lb. was shipped by rail to inland points. Of the Lake shipments, 8,128,000 lb. was delivered by the Calumet & Hecla and subsidiaries; 3,088,000 lb. was Copper Range, Mohawk and Wolverine metal; and 324,000 lb. was Quincy copper.

Coal shipments showed a large increase in September, 80,812 tons being received, as compared with only 19,562 tons in August. Receipts continue satisfactory, and fear of a coal shortage at the mines, mills and smelters the coming winter has largerly passed. It is now believed all companies will get sufficient fuel before navigation closes to last until Lake shipping reopens in the spring.

A small gain in underground forces is reported by the Copper Range company for September, and it is expected this improvement will continue. Physically, all three mines are in good condition, with new openings well up to the average. Sinking has been under way intermittently in all four shafts of Champion, and there is no change in the high average yield with depth. As men are added, the opening program will be increased. No. 4 shaft, Baltic, is hoisting from the top levels, but repair work through the crushed area in the lower part of the shaft is still under way. The only construction work being done is at Trimountain No. 2 shaft, where preparations are being made to erect a steel shafthouse. The steel is expected soon.

Wages have been readjusted at the Calumet & Hecla mines and subsidiaries and at the Wolverine and Mohawk mines. Underground men and skilled surface men receive the largest increases, the average increase for all classes of work being 11 per cent.

Not only are the backs of stopes, arches, and pillars furnishing a rich grade of rock in mining operations in the conglomerate department of Calumet & Hecla, but new openings at great depth are highly encouraging in mineral content. Rock from the clean-up of stopes and pillars in No. 4, Calumet and from No. 2 is averaging high in copper, and the upper levels in the conglomerate shafts will continue to furnish high-grade rock for some years. It takes approximately fifteen years to mine out the upper workings in a conglomerate shaft, and several shafts have been barely touched as yet.

Though Arcadian Consolidated is devoting all attention to development of territory contiguous to the New Baltic shaft, it eventually will reopen the New Arcadian shaft, where an encouraging showing was revealed. It is toward this shaft that the 942 level south drift from the New Baltic shaft is proceding. When work is resumed in the New Arcadian branch some attention will be given to the Allouez conglomerate vein which was reached by a crosscut from the 800 level. In the limited opening into this formation some good-looking rock was encountered, and the samples show considerable copper. The showing warrants further investigation.

Marquette Range

Ishpeming—Preparations are being made to crush 175,000 tons of hard ore in stock at the Cleveland-Cliffs Iron Co.'s Cliffs Shaft mine. This is the finer grade which is separated from the lump when brought from underground and which has not found a ready market, whereas the lump is easily sold. About one-third of the ore coming from the mine will also be treated instead of merely being put through a revolving screen. The present crushing equipment, which has not been in use in recent months; a magnetic separator, and a Symons 48-in. disk crusher will be used. The ore from stock will be loaded by steam shovel into large hoppers and drawn off onto a conveyor belt for transporting to the crusher plant. Ore from stock will be crushed only when required for shipment, which is during the period of navigation. The foundations for the new machinery are now being prepared. The equipment will be able to handle 1,200 tons on the two shifts. The ore will be crushed to ¾ in.

Menominee Range

Iron Mountain—The Peninsular Power Co. has purchased 700 acres of land at Sturgeon Falls, on the Sturgeon River, in Dickinson County, and is to erect another hydro-electric plant. This plant will develop about 1,000 h.p. The company already has four water and steam plants and is supplying about 25,000 h.p. to mining companies operating on the Menominee Range.

MINNESOTA

Cuyuna Range

Wood Used as Boiler Fuel Is Found Cheaper Than Coal

Ironton—The Hillcrest Mining Co., of the Coates & Tweed interests, has completed the season's shipment of 125,000 tons of iron and manganiferous iron ore from its Hillcrest open pit. Stripping limits are being extended to the south with one steam shovel.

Ten cars of ore are being shipped daily from the Huntington mine, operated by George H. Crosby. The Huntington is a new property, worked by underground methods. Slicing work on the top "subs" was begun this summer.

At the Bonnie Belle mine, the Liberty Mining Co. is burning tamarack wood in its boilers. The tamarack, originally cut for mining timber, is purchased from some of the manganese mines now idle in the vicinity. The operators claim more economical power with the wood fuel than they can secure with coal at present high prices.

It is reported that negotiations are under way for reopening the Arko mine, a manganiferous iron-ore property which has been idle since the war. The property recently reverted to the fee owners upon default in royalty payments by the Arko Mining Co.

Trommald—The Marquette Ore Co. has completed hydraulic stripping for the season at its Maroco mine. During the season stripping has been extended over the southeastern lobe of the ore deposit.

Hibbing—Ore shipments from the docks at the head of the Lakes for the season up to Oct. 1 amounted to 33,111,236 tons, an increase of 14,440,041 tons over the 18,671,195 tons shipped during the 1921 season up to Oct. 1.

Shipments for last month amounted to 6,801,296 tons, a gain of 2,888,173 tons over the 3,913,123-ton shipment for September, 1921. Ore shipments for last month, however, were not as heavy as shipments in August. In August, 9,015,982 tons was sent down from these docks, showing a decrease in September shipments as compared with August.

As the end of the shipping season draws near, the gross tonnage of ore shipped from these ports will apparently be one of the biggest in recent years. The strike of seamen on the boats of the Great Lakes which took effect Oct. 1 has not at this early date assumed any really serious aspects.

THE MARKET REPORT

Daily Prices of Metals

Oct.	Copper, N. Y., net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
5	13 70@13.75	32.50	32 875	6.35@6.50	6.25	6.70@6.75
6	13.70@13.75	32 50	32 875	6.50	6.25@6.30	6.65
7	13.70@13.75	32.625	33 00	6.50	6.30	6.60@6.65
9	13.70@13.75	32 625	33 25	6.50	6.30	6.60@6.65
10	13.70@13.75	32.75	33 50	6.50	6.30	6.60@6.65
11	13.70@13.75	33.25	33 75	6.50	6.30	6.625

*These prices correspond to the following quotations for copper delivered: Oct. 5 to Oct. 11 inc., 13.95@14c.

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.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Federal bureaus in Washington which are interested in the mining industries.

London

Oct.	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3M	Lead Spot	Lead 3M	Zinc Spot	Zinc 3M
5	63	63½	71½	163½	164½	25⅛	24⅜	33	32⅜
6	62½	63⅛	71¼	163¾	164⅝	25	24¼	33	32⅜
9	63⅛	63⅝	71	163⅞	165⅛	25⅛	24⅜	33	32⅜
10	63	63⅝	71	165¼	166¼	25¼	24¼	32⅞	32¼
11	62⅝	63¼	70¾	165⅞	167⅛	25⅛	24	32¾	32

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

Oct.	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London	Oct.	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London
5	4.42¼	99¼	69⅜	35¼	9	4.41¼	99¼	69⅛	35 3/16
6	4.40½	99¼	69⅛	35 3/16	10	4.41⅜	99½	69⅛	35⅛
7	4.41¾	99¼	69¼	35¼	11	4.43¼	99¼	69	34 15/16

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 one-quarter of a cent premium.

Metal Markets

New York, Oct. 11, 1922

Copper and zinc have been more quiet than usual during the last week; lead has been in the normal good demand; and tin has been active at advancing prices. The market for the minor metals, minerals, and ores cannot be said to be established as yet, from the dislocation caused by the tariff. Many importers have fairly large stocks on hand that were brought into the country with the expectation of a tariff advance, and these are being released at prices which represent all the way from a fair profit on the purchase price to a figure which takes full advantage of the tariff advance. Fundamental business conditions in the country continue good, and the next few months should see an improvement in the fuel supply and transportation conditions, facts which should have a favorable effect on the metal markets. Many mining companies are seriously affected by a labor shortage which will tend to cut down production, but at the same time, by restricting the supply, will increase the price of metals.

Copper

Copper is distinctly weaker. Sales have been very unsatisfactory during the last few days, though consumers of the metal are, in general, working to capacity, and it is felt that the present lull can therefore be no more than a temporary one. As most producers are well sold up, there has been no great pressure of metal on the market, but a slight tendency to a price recession can be observed. Most of the large producers, if not all, are holding at 14c. delivered, and in the last week have sold possibly 25 per cent of their normal business. They seem willing to book business somewhat further ahead than usual. There are persistent rumors to the effect that large consumers have had plenty of copper offered to them at 13¾c. delivered, even to Connecticut valley points, but we have been unable to find a producer who will acknowledge to have partaken in this business except to points near New York where the freight rate is around 15c. per 100 lb. Several orders of this nature have been placed, however, which we are compelled to reflect in our quotations, this being the first quotational break in the 13.75c. refinery figure since Sept. 1.

Export demand has fallen away, as well as the domestic, though some satisfactory orders have been received in the last two or three days, German buying of a substantial quantity giving added encouragement.

Lead

The official contract price of the American Smelting & Refining Co. was advanced from 6.35c., New York, to 6.50c. on Friday, Oct. 6.

Many producers remain practically out of the market and are selling only small quantities to regular customers. The custom continues of refraining from selling for far forward delivery, and it is difficult to obtain lead for shipment later than November. Those producers who have any lead to sell have done an excellent business. Prices are much steadier, and there is less tendency to make bizarre quotations than has been evident for the last two or three weeks. Lead for prompt delivery has been obtainable from more than one source for 6.50c., and the supply seems sufficient to take care of the needs of all reputable consumers. The St. Louis market was rather firmly established at 6.25c. before the advance on Friday, but since then, 6.30c. has been the general settlement basis, with quotations of 6.325c. frequently made. Corroding lead seems somewhat scarce in the Middle West, and 6.45c. St. Louis, or 6.55c. Chicago, has been quoted.

Zinc

Although the market declined during the week, no adequate reason for the decrease in price has been forthcoming. The statistical position of zinc is excellent, and stocks today are probably

lower than they have been at any time this year. It is probable that the freight embargo is largely responsible for the behavior of the market. Last Thursday, 6.70c. East St. Louis was generally obtained; Friday the market dropped to 6.65c., and the lowest sales of which we have any record were made yesterday at 6.60c. Today the market seems somewhat stronger at 6.625c. High-grade business is exceedingly satisfactory, the demand at present being larger than the supply. The price of high-grade is unchanged at 7.75c., with a freight allowance of 30c. per 100 lb. On Prime Western, the customary freight differential of 35c. per 100 lb. between the New York and St. Louis price continues.

Tin

The tin market had been more active than for some time, and the price has shown a daily advance. Consumers bought freely up to the 33c. level, but above that they seem to have quieted down somewhat. Far Eastern stocks continue large, but they seem to be strongly held, and the likelihood is that the governments concerned will not release them until prices are substantially higher. Visible supplies have increased recently, but it seems probable that invisible supplies have decreased more than an equal amount. Experts in the market look for gradually increasing tin prices. Tin for forward delivery has varied from the same prices as have been asked for spot, up to ¼c. premium.

Arrivals of tin, in long tons: Oct. 2, Straits, 75; Oct. 3, Liverpool, 195; Oct. 5, Straits, 25; China, 100. Total this month to date, 3,445.

Gold

Gold in London: Oct. 5th, 93s. 1d.; 6th, 93s. 4d.; 9th, 93s. 1d.; 10th, 93s. 4d.; 11th, 93s.

Foreign Exchange

On Tuesday, Oct. 10, francs were 7.55c.; lire, 4.27c.; marks, 0.03⅝c.; and Canadian dollars, ⅛ per cent premium.

Silver

Silver prices in London held fairly steady until the middle of the week, when a slight decline occurred. This decline, however, has hardly been reflected in the New York price, on account of the improvement in sterling exchange. The weakness in London has been caused by selling from the Continent, but there is no pronounced tendency, and the market closes quiet.

Mexican Dollars—Oct. 5th, 53; 6th, 53; 7th, 53; 9th, 52⅞; 10th, 52⅞; 11th, 52⅞c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—Importers are not anxious sellers, preferring to wait for better prices. General market for 99 per cent grade, about 20@21c. per lb.

Antimony—Chinese and Japanese brands, 6¾@7c.; W. C. C., 7.25@7.50c. Cookson's "C" grade, spot, 9c. Dull.

Bismuth—Price has advanced to $2.35@$2.45 per lb. London price still 10s., but domestic sellers are taking advantage of full tariff differential.

Cadmium—Quiet at $1.15 per lb.

Iridium—$275@$300 per oz. Nominal.

Nickel—Standard market, ingot and shot, 36c.; electrolytic, 39c. Outside market, 32@34c. per lb.

Palladium—$55 per oz.

Platinum—$112 per oz. Easier.

Quicksilver—$73 per 75-lb. flask. Market firm. San Francisco wires $69.50.

Selenium—$1.80@$1.90 per lb.

Tellurium—$1.75 per lb.

Tungsten—Powder, 75c.@$1.05 per lb.

The prices of Cobalt, Magnesium, Molybdenum, Monel Metal, Osmium, Rhodium, and Thallium are unchanged from prices given Oct. 7.

Metallic Ores

Chrome Ore—Indian chrome ore, $18 per ton, c.i.f. Atlantic ports. Rhodesian and New Caledonian, $23 and $25 per ton. Market quiet.

Manganese Ore—30c. per long ton unit, seaport, plus duty; equivalent to about 45c. Chemical ore, $70@$75 per gross ton.

Molybdenum Ore—55@60c. per lb. of MoS_2 for 85 per cent MoS_2 concentrates, plus duty; equivalent to 80@85c. per lb.

Tungsten Ore—Chinese ore, $8 per long ton unit of WO_3.

Iron Ore, Magnetite, Tantalum, Titanium, Uranium, Vanadium, and Zircon ore are unchanged from the quotations published Oct. 7.

Zinc and Lead Ore Markets

Joplin, Mo., Oct. 7.—Zinc blende, per ton, high, $43; basis 60 per cent zinc, premium, $42; Prime Western, $40; fines and slimes, $38@$36; average settling price, all grades of blende, $39.09; calamine, basis 40 per cent zinc, $22.50.

Lead, high, $86.20; basis 80 per cent lead, $85; average settling price, all grades of lead, $83.14 per ton.

Shipments for the week: Blende, 7,590; calamine, 34; lead, 1,275 tons. Value, all ores the week, $403,540.

An unexpected drop in zinc metal reacted on the ore market, buyers offering $1 to $1.50 per ton less for ore than last week. Until today sellers declined to accept the lower offerings, but they finally decided to sell a limited tonnage on the reduced offerings, and 8,410 tons was sold.

Lead has continued firm, and buyers are competing actively for the limited production. The car situation affected the lead shipments more this week than the zinc, a large portion of the tonnage delivered being trucked to smelters. One smelter had but two cars for loading lead.

Platteville, Wis., Oct. 7.—Blende, basis 60 per cent zinc, $44 per ton. Lead, basis 80 per cent lead, $85 per ton. Shipments for the week: Blende, 851 tons; lead ore, none. Shipments for the year: Blende, 15,104 tons; lead, 1,284 tons. Shipped during the week to separating plants, 1,345 tons blende.

Non-Metallic Minerals

Borax—5¾@6c. per lb.

Asbestos, Barytes, Bauxite, Chalk, China Clay, Emery, Feldspar, Fluorspar, Fuller's Earth, Graphite, Gypsum, Limestone, Magnesite, Mica, Monazite, Phosphate, Pumice, Pyrites, Silica, Sulphur, and Talc are unchanged from the prices published Oct. 7.

Mineral Products

Arsenious Oxide (white arsenic)—firm at 10c. per lb.

Copper Sulphate—Large crystals, 5.85c. per lb.; small, 5.75c.

Sodium Nitrate—$2.25@$2.65 per 100 lb., ex vessel Atlantic ports.

Potassium Sulphate and Sodium Sulphate are unchanged from quotations of Oct. 7.

Ferro-Alloys

Ferromanganese—Domestic, 78@82 per cent, $69@$75 per gross ton, f.o.b., furnace. Spiegeleisen, 19@21 per cent, $39, f.o.b. furnace; 16@19 per cent, $38.

Ferrotungsten—Domestic, 70@80 per cent W, 75c.@$1 per lb. of contained W, f.o.b. works.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferro-uranium, and Ferrovanadium are unchanged from the prices published Oct. 7.

Metal Products

Zinc Sheets—$8.50 per 100 lb., f.o.b. works.

Copper Sheets, Lead Sheets, Nickel Silver, and Yellow Metal are unchanged from the prices published Oct. 7.

Refractories

Chrome Brick, Bauxite Brick, Chrome Cement, Magnesite Brick, Magnesite Cement, Silica Brick and Zirkite are unchanged from the prices published Oct. 7.

The Iron Trade

Pittsburgh, Oct. 10.—Steel production is now 70 per cent of capacity.

Basic prices for steel products, for shipment at mill convenience, no longer show an advancing tendency. Delivery premiums are tending to narrow and may disappear almost entirely within a few weeks. Orders for rails, joints, spikes, and tie plates, brought under cover in anticipation of the rail price advance from $40 to $43, now in force, total about 1,500,000 tons and will help winter and spring rollings materially.

Pig Iron—Cherry Valley furnace is scheduled to blow in within a week. The market remains stagnant. Cambria seems to be making the market, quoting $33 for bessemer, $31 for basic and $32.50 for foundry, f.o.b. Johnstown, with $1.77 freight to Pittsburgh, the same as from the Valleys.

Connellsville Coke.—Production is greater, but market offerings remain limited. Prices are practically unchanged, at $12 to $12.50 for furnace and $13.50 to $14 for foundry.

Movements of Ores and Metals for August

Imports and exports of metals and ores during August, as shown by the returns to the Department of Commerce and the revised figures for August, 1921, are as follows:

IMPORTS, AUGUST 1921 AND 1922
In pounds, unless otherwise stated

	August, 1921	August, 1922
Antimony ore, contents	.....	.....
Antimony matte, regulus or metal	2,718,285	2,288,528
Copper		
Ore, contents	6,834,291	6,588,207
Concentrates, contents	2,300,197	4,277,267
Matte and regulus	1,753,938	935,682
Imported from in part		
Spain	457,428	710,952
Canada	61,674	10,033
Mexico	723,209	.....
Cuba	2,726,241	5,734,671
Chile	5,828,650	3,011,212
Peru	110,554	118,098
Venezuela	.....	713,793
Unrefined, black, blister	12,574,740	28,504,557
Refined, in bars and plates	271,916	7,118,756
Old, for remanufacture	3,662	9,620,785
Composition metal, copper chief value	385,307	11,870
Lead		
Ore, contents	5,151,595	1,787,945
Bullion, contents	7,819,123	11,395,203
Imported from in part:		
Canada	4,432,747	1,085,074
Mexico	8,301,796	11,174,321
Chile	.....	594,617
Pigs, bars and old	3,254,013	1,345,397
Manganese ore, long tons	28,939	62,121
Tungsten ore, long tons	286	499
Pyrites, long tons	10,892	12,868
Imported from		
Spain, long tons	10,892	12,868
Canada, long tons	.....	.....
Tin ore, long tons	3,201	114
Bars, blocks and pigs	5,200,504	8,218,837
Imported from in part		
United Kingdom	2,138,972	556,862
British Straits Settlements	2,836,434	5,653,364
Dutch East Indies	.....	913,051
Hongkong	225,098	990,280
Zinc		
Ore, contents	26,228	730,009
Blocks, or pigs, and old	.....	4,289

EXPORTS COPPER, LEAD, AND ZINC
In pounds

	August, 1921	August, 1922
Copper		
Ore, concentrates, matte and regulus (copper content)	.....	4,020
Copper and manufactures of	.....	63,384,150
Unrefined, black and blister	43,705	.....
Refined, in ingots and bars	41,249,258	54,471,463

EXPORTS—Continued

Copper		
Exported to		
Belgium	1,345,313	4,633,478
France	6,091,425	6,536,642
Germany	16,428,127	17,913,116
Italy	.....	8,294,436
Netherlands	1,127,258	3,608,393
Spain	471,082	1,726,280
Sweden	560,578	1,693,216
United Kingdom	1,234,428	6,838,443
Canada	16,715	196,747
China	.....	1,998,080
Japan	7,699,880	.....
Other countries	6,274,452	1,032,632
Old and scrap	.....	150,080
Composition metal, copper chief value	4,549	7,720
Pipes and tubes	75,602	198,233
Plates and sheets	164,406	469,841
Rods	1,136,766	6,748,853
Wire, except insulated	216,111	566,087
Insulated wire and cable	.....	511,256
Lead		
Pigs and bars		
From domestic ore	90,804	689,351
From foreign ore	6,086,575	2,152,548
Exported to		
France	.....	560,268
United Kingdom	4,815,967	1,488,256
Argentina	.....	29,618
Brazil	224,202	648,590
Japan	448,000	.....
Other countries	689,210	115,167
Zinc		
Dross	132	1,581,269
Spelter		
From domestic ore	949,712	1,993,320
From foreign ore	588,002	71,019
Total zinc slabs and blocks	1,537,714	2,064,339
Exported to:		
France	.....	1,265,699
United Kingdom	.....	56,000
Canada	260,000	106,128
Japan	1,008,014	447,993
Other countries	269,700	188,519
In sheets and strips	96,806	483,928
Zinc dust	.....	215,900
Other zinc manufactures	.....	104,202

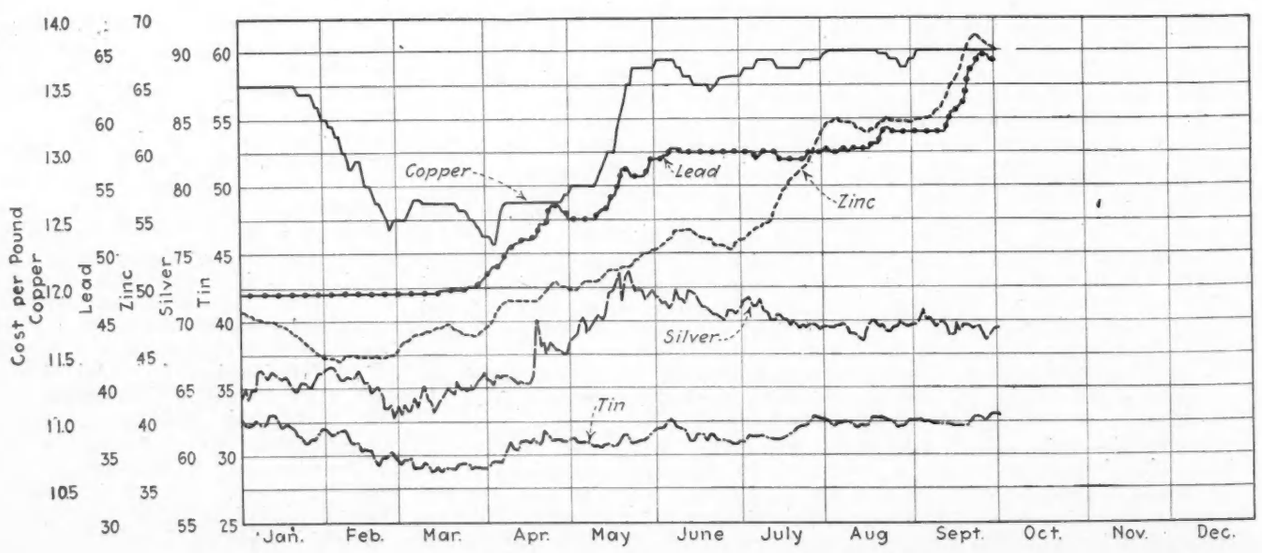
Transvaal Gold Production

The following table summarizes Transvaal gold production since 1917, according to the report of the Transvaal Chamber of Mines:

RAND GOLD OUTPUT 1917–1922, IN FINE OUNCES

	1922	1921	1920	1919	1918	1917
January	639,728	651,593	670,503	676,059	714,183	782,631
February		558,137	625,330	636,728	659,759	721,324
March		671,123	707,036	712,379	696,281	787,091
April	511,338	681,382	686,979	694,944	717,099	742,774
May	629,786	687,776	699,041	724,995	741,217	729,388
June	675,697	678,490	715,957	702,379	727,696	759,725
July	730,635	689,555	736,099	725,497	736,199	757,894
August	.....	711,526	702,083	706,669	740,210	756,650
September	.....	691,026	682,173	698,558	708,206	732,238
October	.....	707,000	662,472	723,722	679,764	751,290
November	.....	704,236	633,737	677,970	658,701	722,839
December	.....	681,847	632,215	650,191	641,245	722,419

Prices of New York Copper, Silver, and Lead, and of St. Louis Zinc January to September, 1922



MINING STOCKS

Week Ended Oct. 7, 1922

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	63	61	63	Aug. '22, Q	$1.00
Alaska-Br. Col.	N. Y. Curb	2 7/16	2 1/4	2 3/8		
Allouez	Boston	23 7/8	23	23	Mar. '19	1.00
Anaconda	New York	53 1/2	52	52	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2 3/8	2 1/4	2 1/4		
Ariz. Com'l	Boston	8	8	8	Oct. '18, Q	0.50
Big Ledge	N. Y. Curb	*11	*8	*9		
Bingham Mines	Boston	18	18	18	Sept. '19, Q	0.25
Calumet & Arizona	Boston	60 1/2	59	59 1/2	Sept. '22, Q	0.50
Calumet & Hecla	Boston	290	280	289	Aug. '22, Q	5.00
Canada Copper	N. Y. Curb	*3	*1	*2		
Centennial	Boston	9 1/2	9 1/2	9	Dec. '18, SA	1.00
Cerro de Pasco	New York	40 3/8	38 1/2	39 1/8	Mar. '21, Q	0.50
Chile Copper	New York	27	25 1/2	26 1/2		
Chino	New York	31	28 3/8	29	Sept. '20, Q	0.37
Copper Range	Boston	40	39 1/2	40	Mar. '22, Q	1.00
Crystal Copper	Boston Curb	1 1/2	1 3/8	1 1/2		
Davis-Daly	Boston	4 1/2	4 1/2	4 1/2	Mar. '20, Q	0.25
East Butte	Boston	10	9 1/2	10	Dec. '19, A	0.50
First National	Boston Curb	*50	*50	*50	Feb. '19, SA	0.15
Franklin	Boston	2 1/16	1 7/8	2		
Gadsden Copper	Boston Curb	*75	*75	*75		
Granby Consol.	New York	31 1/4	30	31 1/8	May '19, Q	1.25
Greene-Cananea	New York	31 1/2	30 3/8	30 3/8	Nov. '20, Q	0.50
Hancock	Boston	†2 1/4	†2 1/4	2		
Howe Sound	N. Y. Curb	3 1/2	3	3 1/8	Jan. '21, Q	0.05
Inspiration Consol.	New York	40 1/4	38 1/4	38 1/4	Oct. '20, Q	1.00
Iron Cap	Boston Curb	†8	†6 1/2	8 1/2	Sep. '20, K	0.25
Isle Royale	Boston	23 1/2	23	23	Aug. 22,	0.50
Kennecott	New York	35 1/2	34	35	Dec. '20, Q	0.50
Keweenaw	Boston	2 1/2	1 7/8	2 1/2		
Lake Copper	Boston	4	3 1/2	4		
Magma Copper	N. Y. Curb			34	Jan. '19, Q	0.50
Mason Valley	N. Y. Curb	1 3/8	1 1/4	1 3/8		
Mass Consolidated	Boston	3	2 1/2	3	Nov. '17, Q	1.00
Miami Copper	New York	29	27 5/8	29	Aug. '22 Q	0.50
Michigan	Boston	2 3/4	2	2 1/2		
Mohawk	Boston	61	59 1/2	59 1/2	July '22, Q	1.00
Mother Lode Coa.	N. Y. Curb			11	June '22, I	0.50
Nevada Consol.	New York	16 7/8	15 3/8	16 1/2	Sept. '20, Q	0.25
New Cornelia	Boston	18 1/2	17 1/4	18 1/2	Aug. '22, K	0.25
North Butte	Boston	11 1/4	10 3/8	11	Oct. '18, Q	0.25
Ohio Copper	N. Y. Curb	*30	*23	*29		
Old Dominion	Boston	23 1/4	23	23 1/8	Dec. '18, Q	1.00
Osceola	Boston	34	33	34	Aug. '22, Q	1.00
Phelps Dodge	Open Mar.	†175	†165		Oct. '22, Q	1.00
Quincy	Boston	40	39	39 1/2	Mar. '20, Q	1.00
Ray Consolidated	New York	15 5/8	14 1/2	15 1/2	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb	1 1/2	1 3/8	1 1/2		
St. Mary's Min. Ld.	Boston	45	44	45	Apr. '22, K	2.00
Seneca Copper	Boston	10	10	10		
Shannon	Boston	*80	*72	*75	Nov. '17, Q	0.25
Shattuck Arizona	New York	9 1/4	9 1/8	9 1/8	Jan. '20, Q	0.25
South Lake	Boston	†1	†*50	*35		
Superior & Boston	Boston	1 1/8	1	1 1/8		
Tenn. C. & C. cfs.	New York	10 1/4	9 1/4	9 1/2	May '18, I	1.00
Tuolumne	Boston	*52	*50	*52	May '13,	0.10
United Verde Ex.	Boston Curb	29 1/4	28	29	Aug. '22, Q	0.25
Utah Consol	Boston	2 1/2	2 1/4	2 1/2	Sept. '18,	0.25
Utah Copper	New York	68 3/4	65 3/4	66 1/2	Sept. '22, Q	0.50
Utah Metal & T.	Boston	1 1/4	1 1/8	1 1/8	Dec. '17,	0.30
Victoria	Boston	†1 1/2	†1 1/4	1 1/4		
Winona	Boston	1 1/2	1 1/4	1 1/2		
Wolverine	Boston	10	9 1/2	9 1/2		
NICKEL-COPPER						
Internat. Nickel	New York	17 1/2	16 3/4	17	Mar. '19,	0.50
Internat. Nickel, pfd	New York	83 1/2	82 1/2	83 1/4	Aug. '22, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	6 1/2	5 1/2	6 1/2		
National Lead	New York	109 1/2	103	108 1/2	Sept. '22, Q	1.50
National Lead, pfd	New York	117	116	117	Sept. '22 Q	1.75
St. Joseph Lead	New York	18 7/8	18 1/2	18 3/4	Sept. '22 Q	0.25
QUICKSILVER						
New Idria	Boston	*40	*40	*40		
ZINC						
Am. Z. L. & S.	New York	20 1/2	18 3/4	19 1/2	May '20,	1.00
Am. Z. L. & S. pfd.	New York	56	55	56	Nov. '20, Q	1.50
Butte C. & Z.	New York	7 3/8	7	7 1/8	June '18,	0.50
Butte & Superior	New York	35 1/8	32	34	Sept. '20,	1.25
Callahan Zn-Ld	New York	9 3/8	9 1/4	9 1/4	Dec. '20, Q	0.50
New Jersey Zn.	N. Y. Curb	167	154	166	Aug. '22, Q	2.00
Yellow Pine	Los Angeles	*64	*58	*61	Sept. '20, Q	0.03
SILVER						
Batopilas Mining	New York	1/8	1/8	1/8	Dec. '07, I	0.12½
Beaver Consol.	Toronto	*35	*32 1/2	*33	May '20, K	0.03
Coniagas	Toronto	1.70	1.45	1.60	May '21, Q	0.12½
Crown Reserve	Toronto	*28	*26	*26	Jan. '17,	0.05
Kerr Lake	N. Y. Curb	3 1/2	3 3/8	3 1/2	July '22, Q	0.12½
La Rose	Toronto	*26	*25 1/4	*25 1/2	Apr. '22,	0.10
McKinley-Dar.-Sav.	Toronto	*26	*26	*26	Oct. '20, Q	0.03
Mining Corp. Can.	Toronto	1.95	1.95	1.95	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	6 1/4	5 3/4	5 1/2	July '22, Q, X	0.30
Ontario Silver	New York	†8	†7	7 1/2	Jan. '19, Q	0.50
Temiskaming	Toronto	*40	*35	*38	Jan. '20, K	0.04
Trethewey	Toronto	*5 1/2	*4 1/2	*5	Jan. '19,	0.05

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	3/8	1/4	3/8		
Alaska Juneau	New York	1 3/8	1 1/8	1 3/8		
Atlas	Toronto	*30	*26 1/2	*27		
Carson Hill	Boston	8 3/4	8 1/4	8 1/2		
Cresson Consol. G.	N. Y. Curb	2 5/8	2 3/8	2 1/2	July '22, Q, X	$0.10
Dome Mines	New York	38 1/2	36 1/2	37 1/2	July '22, Q	.50
Golden Cycle	Colo. Springs			*92 1/2	June '21, Q	0.02
Goldfield Consol.	N. Y. Curb			*7	Dec. '19,	0.05
Hollinger Consol.	Toronto	13.40	12.60	12.75	Oct. '22,	0.05
Homestake Mining	New York	72 1/2	71 1/2	72 1/2	Sept. '22, M	0.25
Keora	Toronto	*12	*10	*11 1/2		
Kirkland Lake	Toronto	*46 1/4	*41 1/2	*44		
Lake Shore	Toronto	2.88	2.70	2.70	Aug. '22, Q	0.02
McIntyre-Porcupine	Toronto	18.35	17.00	18.00	Sept. '22, K	0.25
Porcupine Crown	Toronto	*24 1/2	*23	*23 1/2	July '17,	0.03
Portland	Colo. Springs	†*40	†*37 1/2	*40	Oct. '20, Q	0.01
Schumacher	Toronto	*57	*55	*55		
Teck Hughes	Toronto	*89 1/2	*78 1/2	*79		
Tom Reed	Los Angeles	*89	*84	*80	Dec. '19,	0.02
United Eastern	N. Y. Curb	1 1/32	1 1/16	1 1/8	July '22, Q	0.15
Vindicator Consol.	Colo. Springs	†*5	†*3	*4	Jan. '20, Q	0.01
Vipond Cons.	Toronto	*70	*63	*64 1/2		
White Caps Mining	N. Y. Curb	*17	*15	*15		
Wright-Hargreaves	Toronto	3.40	3.05	3.15	Oct. '22,	0.05
Yukon Gold	N. Y. Curb	*95	*90	*90	June '18,	0.02½
GOLD AND SILVER						
Boston & Montana	N. Y. Curb	*12	*8	*12		
Cons. Virginia	San Francisco	*18 1/2	*16 1/2	*16 1/2		
Dolores Esperanza	N. Y. Curb	2	1 7/8	2	July '22,	2.50
El Salvador	N. Y. Curb	*9	*9	*9		
MacNamara M.&M.	N. Y. Curb	*9	*9	*9	May '10,	0.02½
Tonopah Belmont	N. Y. Curb	1 1/16	1 1/16	1 1/16	July '22, Q	0.05
Tonopah Divide	N. Y. Curb	*85	*78	*80		
Tonopah Extension	N. Y. Curb	3 1/16	2 3/8	3 1/8	Oct. '22, Q	0.05
Tonopah Mining	N. Y. Curb	2 1/4	2 1/8	2 1/4	Apr. '22, SA, X	0.07½
West End Consol.	N. Y. Curb	1 1/4	1 1/8	1 1/8	Sept. '22, SA	0.05
SILVER-LEAD						
Caledonia	N. Y. Curb			*8	Jan. '21, M	0.01
Cardiff M. & M.	Salt Lake	†*53	†*45	*60	Dec. '20,	0.15
Chief Consol.	Boston Curb	5 3/8	5 3/8	5 3/8	Aug. '22, Q	0.10
Columbus Rexall	Salt Lake	†*2	†*21	*19	Aug. '22,	0.03
Consol. M. & S.	Montreal	2 1/8	26 1/2	26 1/2	Oct. '20, Q	0.62½
Eagle & Blue Bell	Boston Curb	3 1/8	*3 1/2	*3 1/2	Apr. '21, K	0.05
Electric Point	Spokane	*4 1/2	*2	*3	May '20, SA	0.03
Federal M. & S.	New York	15	15	15	Jan. '09,	1.50
Federal M. & S. pfd.	New York	61	58 1/4	60	Sept. '22, Q	1.25
Florence Silver	Spokane	*39	*36 1/2	*36 1/2	Apr. '19,	0.01½
Grand Central	Salt Lake	†*55	†*60	*61	Jan. '21, K	0.01
Hecla Mining	N. Y. Curb	7 3/8	7 1/4	7 1/4	Sept. '22, Q	0.15
Iron Blossom Con.	N. Y. Curb			*27	Apr. '22, Q	0.02½
Judge M. & S.	Salt Lake	3.95	3.95	3.95	Sept. '20, Q	0.12½
Marsh Mines	N. Y. Curb	*14	*12	*14	June '21, I	0.02
Prince Consol.	Salt Lake	*9 1/2	*9 1/2	*9 1/2	Nov. '17,	0.02½
Rambler-Cariboo	Spokane	*4	*4	*4	Feb. '19,	0.01
Stewart Mines	N. Y. Curb	*7	*6	*7	Dec. '15,	0.05
Tamarack-Custer	Spokane	3.32	3.25	3.32	Jan. '21, K	0.04
Tintic Standard	Salt Lake	3.42 1/2	2.80	3.40	Sept. '22, K	0.05
Utah Apex	Boston	2 1/2	2 3/8	2 3/8	Nov. '20, K	0.25
IRON						
Bethlehem Steel "B"	New York	75 3/4	71	75	Oct. '22	1.25
Colorado Fuel & Iron	New York	34	33 1/4	33 1/2	May '21	0.75
Col. Fuel & Iron, pfd.	New York			106	Aug. '22	2.00
Gt. North'n Iron Ore	New York	40 1/2	39	39 7/8	Nov. '20	1.50
Inland Steel	N. Y. Curb			48 1/2	Sept. '22	1.00
Mesabi Iron	N. Y. Curb	11 1/2	10 1/2	10 3/4		
Republic I. & Steel	New York	36 1/2	32 3/8	35 1/4		
Republic I. & Steel	New York	59 3/8	53 1/2	57 1/2	May '21	1.50
Rep. Iron & St., pfd	New York	87 1/2	86	86 1/4	Jan. '22	1.75
Sloss-Sheffield S. & I.	New York	50	49 1/2	50	Feb. '21	1.50
U. S. Steel	New York	106 1/8	101 1/2	105 3/8	Sept. '22	1.25
U. S. Steel, pfd.	New York	122 1/4	122	122 1/8	Aug. '22	1.75
Virginia I. C. & C.	New York	54	53	53	Jan. '22	1.50
Virginia I.C.&C.,pfd.	New York			82	July '22	2.50
VANADIUM						
Vanadium Corp.	New York	48	44 1/4	46 1/2	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	69	68 1/2	69	July '22, Q	1.50
Asbestos Corp. pfd.	Montreal			85	July '22, Q	1.75
SULPHUR						
Freeport Texas	New York	24 1/2	21 1/2	23 1/2	Nov. '19, Q	1.00
Texas Gulf	New York	61 1/8	55 5/8	60	Sept. '22, QX	1.00
MINING, SMELTING AND REFINING						
Amer. Metal	New York	48 3/4	47	48 3/8	Sept. '22,	0.75
Amer. Metal pfd.	New York	111	107 1/2	111	Sept. '22, Q	1.75
Amer. Sm. & Ref.	New York	63 1/2	59 3/4	62	Mar. '21, Q	1.00
Amer. Sm.& Ref. pfd	New York	101 1/2	100 3/4	101 1/4	Sept. '22 Q	1.75
Am. Sm. Sec. pfd. A.	New York	98 1/2	97 1/2	97 1/2	Oct. '22, Q	1.50
U. S. Sm. R. & M.	New York	43 1/2	42 1/2	43	Jan. '21, Q	0.50
U.S. Sm.R.& M. pfd.	New York	48 1/2	48 1/2	48 1/2	July '22, Q	.87½

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

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

Current Prices of Mine Materials and Supplies

RISE AND FALL OF THE MARKET

Advances—Standard rails up $3 per ton, f.o.b. Pittsburgh, effective Oct. 1. Light rails, spikes and track bolts also higher at mill. Structural steel, $2@$2.25, f.o.b. Pittsburgh, for indefinite deliveries; plates quoted as high as $2.50 per 100 lb. Lower discounts on wrought-iron pipe and wire rope. Cast-iron pipe up $2.50 per ton at Birmingham; $2 higher in Chicago. General advance on machine bolts and nuts. Hollow tile higher in New York. Red and white lead up ¼c. per lb. Linseed oil advanced 2c. in New York and dropped 2c. per gal. in Chicago, during month. Rawhide lacing discounts slightly lower.

Declines.—Slight increase in steam hose and rubber belting discounts, since last month. Dynamite, 40@60 per cent gelatin, about 2c. per lb. cheaper 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 No. 10	$2.50@$2.75	$4.10	$4.00	$4.35	$4.19
Black No. 28	3.35@ 3.50	4.85	4.85	5.90	4.90
Galvanized No. 28	4.35@ 4.75	5.85	5.95	6.75	5.90

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

	Pittsburgh Current	Pittsburgh One Year Ago	Birmingham	Chicago
Standard bessemer rails	$43.00	$45.00	.....	$43.00
Standard openhearth rails	43.00	47.00	$43.00	43.00

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	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅝-in. and larger	$2.75@2.85	$3.00	$2.55	$2.85	$4.45	$3.29
Track bolts	3.75@4.50	4.00	3.65	3.85	5.45	4.29
Standard section angle bars	2.40	2.75	2.40	2.75	4.10	2.94

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.	$2.00@$2.25	$2.40	$3.14	$4.20	$3.00	$3.02½	$3.25
Channel, 3 to 15 in.	2.00@ 2.25	2.40	3.14	4.20	3.00	3.02½	3.25
Angles, 3 to 6 in., ¼ in. thick	2.00@ 2.25	2.40	3.14	4.20	3.00	3.02½	3.25
Tees, 3 in. and larger	2.00@ 2.25	2.40	3.14	4.20	3.05	3.02½	3.25
Plates	2.00@ 2.25	2.40	3.14	4.20	3.00	3.02½	3.40

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	25%
Cast steel round strand rope	27½%
Galvanized steel rigging and guy rope	12½%
Round strand iron and iron tiller	10%
Plow steel round strand rope	40%
Special steel round strand rope	35%

	New York	Cleveland	Chicago
Drill Rod (from list)	55@60%	40%	50%

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

	Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
BUTT WELD—	..1 to 3	68	56½	⅜ to 1½	34	19
LAP WELD—	2½ to 6	65	33½	2½ to 6	32½	19

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

	Black New York	Black Chicago	Black St. Louis
2½ to 6 in. lap welded	57%	59½%	58½%

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

	New York Current	New York One Year Ago	Birmingham	Chicago	St. Louis	San Francisco
6 in. and over	$55.30	$45.30	$40.50	$48.70	$49.00	$51.00

	New York	Cleveland	Chicago
Nuts, hot pressed, sq., per 100 lb. Off list	$1.00	$3.00	$4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00

MACHINE BOLTS	New York	Cleveland	Chicago
1½ and 1½x3 in. up to 12 in.	20 %	50%	50%
Button head bolts, with hex. nuts	15 %	$3.90 net	.....

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

	New York Current on Trucks	New York One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory
4x12x12	$0.1230	$0.1137	$0.0808	$0.15	$0.092	$0.108	.....
6x12x12	.1844	.1516	.1112	.....	.115	.156	.....
8x12x12	.2305	.2021	.1516	.18	.160	.244	$0.2147

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 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$30.00	$33.00	$33.00	$35.00
3x6 and 8	30.00	33.00	33.00	36.00
4x4-6 and 8	30.00	33.00	34.00	37.00

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 20 Ft. and Under	New York 22-24 Ft.	Chicago 20 Ft. and Under	Chicago 22-24 Ft.
3x4 to 8x8	$47.00	$48.00	$45.00	$47.00
3x10 to 10x10	50.00	51.00	48.00	50.00
3x12 to 12x12	54.00	55.00	51.00	53.00

Other Cities	8 x8-In. x 20 Ft. and Under Pine	Fir	Hemlock	Spruce	12 x 12-In. 20 Ft. and Under Pine	Fir
Boston	.....	.....	.....	.....	.....	.....
Cincinnati	$40.00	$50.00	.....	.....	$45.00	$64.00
Montreal	50.00	50.00	$35.00	$38.00	78.00	50.00
Denver	.....	38.75	38.75	38.75	.....	39.75
Minneapolis	47.00	39.75	42.00	.....	49.00	39.75
Kansas City	47.00	47.00	47.00	49.50	49.00	.....
Birmingham	28.00	.....	.....	.....	36.00	.....

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.60@$2.75	$3.10	$4.00	$5.00	$3.60	$4.95
Cut	.....	5.50	5.65	7.75	6.00	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
NewYork, del. by truck	$2.60	$2.60	$2.50
Chicago, f.o.b.	2.20	2.20	1.97
Cleveland, f.o.b.	2.46	2.46	2.28

LIME—Warehouse prices:

	Hydrated, per Ton Finishing	Hydrated, per Ton Common	Lump, per Barrel 280-lb. net Finishing	Lump, per Barrel 280-lb. net Common
New York	$15.80@$16.17	$13.10	$3.63½	$2.75@$3.14½
San Francisco	22.00	16.00	....	(180-lb net) 1.75

LINSEED OIL—These prices are per gallon:

	New York Current	New York One Year Ago	Chicago Current	Chicago One Year Ago
Raw in barrel (5 bbl. lots)	$0.93	$0.76	$0.97	$0.87

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

	Red Current Dry	Red Current In Oil	Red 1 Year Ago Dry	Red 1 Year Ago In Oil	White Current Yr. Ago Dry or In Oil	White Current Yr. Ago Dry or In Oil
100-lb. keg	12.75	14.25	12.25	13.75	12.75	12.25
25 and 50-lb. kegs	13.00	14.50	12.50	14.00	13.00	12.50

HOSE—

Fire	50-Ft. Lengths
Underwriters' 2½-in. coupled	49½c per ft.

Air	First Grade	Second Grade
¾-in., 3 ply per ft.	$0.31	$0.22½

Steam—Discounts from List

First grade..... 50-5% Second grade....50-10% Third grade 60%

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

Competition..... 65–10% Best grade..... 60–5%

LEATHER BELTING—List price per ply, 12-in. wide, per lin. ft. $2.88.

Grade	Discount from list
Medium	40—5%
Heavy	30—5%

RAWHIDE LACING—For cut, best grade, 40%, 2nd grade, 50%. For laces in sides, best, 48c. per sq.ft.; 2nd, 43c. Semi-tanned: cut, 40%; sides, 48c. per sq.ft.

PACKING—Prices per pound:

Rubber and duck for low-pressure steam, ⅛ in.	$0.90
Rubber sheet	.45
Rubber sheet. wire insertion	.70

MANILA ROPE—Per lb., ¼-in. and larger, 1,200-ft. coils.

Atlanta	$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	9.00@11.50	12.00	11.25
Mixed	6.50@10.00	9.00	8.00

EXPLOSIVES—Prices per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.2700	$0.3000
Minneapolis	.2092	.2295
Denver	.2025	.2325
Seattle	.1750	.1950
Cincinnati	.2300	.2500
New Orleans	.2350	.2650
San Francisco	.1950	.2350

FLOTATION OILS—All prices are per gal., 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.	35

NEW MACHINERY AND INVENTIONS

A Double-Drum, Compressed-Air Hoist

A portable hoist, designed primarily for more convenient, economical, and effective use in hauling ore scrapers or "slushing" than can be secured with the single-drum hoist of this type, is announced by the Sullivan Machinery Co., Chicago, Ill., and is known as type "HDA." In the double-drum hoist, the "Turbinair" motor, in its casing, is supported on a central standard with a broad frame or foot, and supplies power to the two hoisting drums, each 10¾ in. in diameter by 5½-in. face, which inclose the motor. A driving pinion at each end of the motor casing engages an internal gear in each drum shell.

Air is admitted at a central inlet port. The two drums are controlled independently by friction clutches and band brakes, corresponding in operation to those used on the single-drum hoist. The clutches are at the outer ends of the drum and the brake bands and handles at the inner ends. By this method either drum may be operated separately or both may be thrown into gear at the same time. In "slushing" work the live or hauling rope is attached to one drum and the tail rope or return rope to the other drum. By means of a suitably placed snatch-block or arrangement of sheaves, the tail rope is paid off the second drum as the load comes in on the first, and when the scraper has been dumped the process is reversed, the clutch being thrown out on the live rope drum and in on the tail rope drum to haul the scraper back to the loading point.

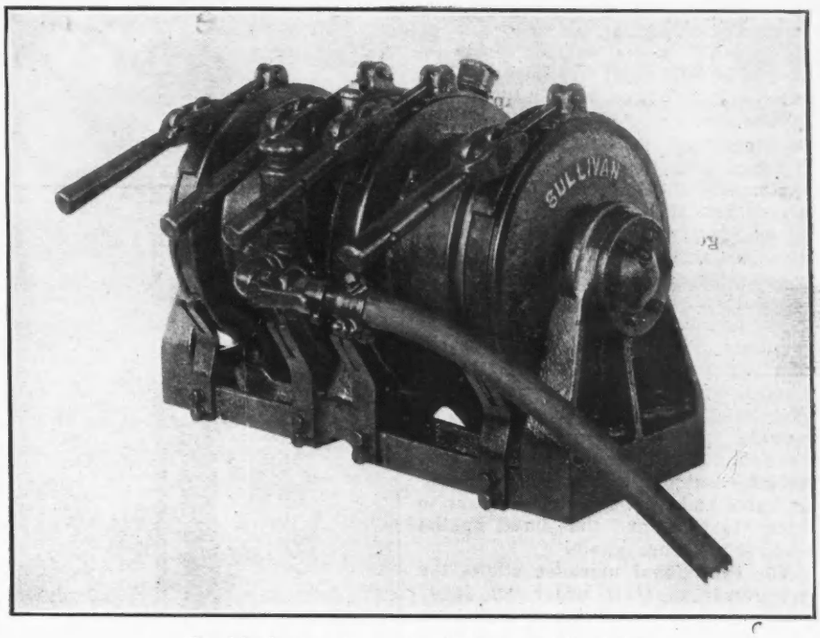
The double-drum hoist is exceptionally compact and light, rendering it convenient for use in mine sublevels and other relatively inaccessible working places. It weighs only 555 lb., or about 85 lb. per hp., is 29 in. long by 15 in. wide, and stands 18½ in. high. Each drum holds 225 ft. of ⅜-in. wire rope.

In "slusher" work the brakes are not used and the handles may be thrown up out of the way, or the brakes and bands may be removed altogether if desired.

The capacity of this hoist is the same as that of the single-drum type. Either drum is capable of lifting 2,000 lb. dead weight vertically, with 76 lb. of air pressure at a speed of 110 ft. per minute. This hoist has the same economy of air consumption as the single-drum machine. Sufficient air can be supplied the machine through a ¾-in. hose line to develop the machine's rating of 6½ hp.

Ball bearings are used throughout to reduce friction, and there are no jaw clutches, valves, or pistons to give trouble or get out of order. Automatic lubricators have been provided wherever possible, and the design and construction are such as to permit long-continued operation under the severe service found in mining conditions, without delay for repairs or other operating troubles.

The double-drum hoist may be used for other work within the capacity of the machine, as, for example, on boom derricks, where one drum is used for hoisting the load and the other for operating the boom. The fact that it takes no larger air connections than the single-drum type, (¾ in.) will appeal to mine operators, as they can employ the hoist without changing or laying new air mains to the breasts or other working places.



Double-drum, compressed-air portable hoist

Lubrication System Is Feature of Small Vertical Air Compressors

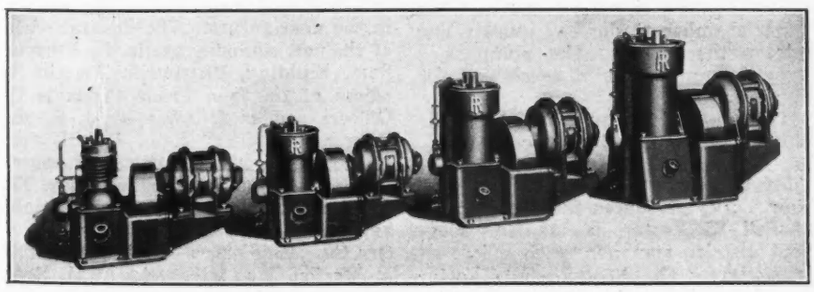
A new line of small vertical belt-driven air compressors known as Type 15 has been announced by the Ingersoll-Rand Co., 11 Broadway, New York. In addition to the plain belt-drive design each size is built as a self-contained electric motor outfit, driven through pinion and internal gears as shown in the accompanying illustration, or by employing the short belt-drive arrangement. The compressing end and electric motor of both gear and short belt-drive units are furnished mounted on a common sub-base, so that they are in no way dependent upon the foundation for correct alignment.

Several noteworthy features of construction have been incorporated, of which the "Constant-Level" lubrication system is the most important. Others include the constant speed unloader for plain belt-drive machines; the centrifugal unloader for start- and stop-control machines; and the increased size of the water-reservoir cooling pot.

The lubrication of small vertical compressors employing the inclosed crank case and splash system has often been a source of concern wherever oil in the air is a serious menace. The tendency of the old system has been to feed too much, resulting in discharged air containing excess oil, or too little, causing scored cylinders, excess loads, and burned-out bearings.

The "Constant-Level" system used in Type 15 compressors automatically maintains a constant-level of oil, which insures the right amount being distributed to all parts.

As with the ordinary splash system, the base of the compressor forms an oil reservoir for the "Constant-Level" system. However, with this system, petcocks determine the maximum and minimum amount of oil in the reservoir.



Small vertical electrically driven compressors

Above this reservoir and directly underneath the connecting rod is a constant-level pan. Oil is pumped from the reservoir into this constant-level pan through a unique oil pump. Regardless of the amount of oil in the reservoir, so long as it is somewhere between the high and low level pet-cocks, this system will function perfectly, insuring a constant-level of oil in the pan. A projecting stem on the connecting rod dips into this pan and distributes just a sufficient quantity of oil for proper lubrication.

The constant speed unloader controls the unloading of the compressor by automatically opening the inlet valve when the receiver pressure rises above that at which the unloader is set to operate. When the receiver pressure has fallen a predetermined amount, the unloader automatically releases the inlet valve and allows the compressor to return to work and thus build up the receiver pressure again.

The centrifugal unloader allows the compressor to start under "no load" such as is essential when automatic start and stop control is used, and permits the electric driving motor to come up to full speed before the load is thrown on automatically. This unloader accomplishes its purpose by holding the inlet valve open until the motor has reached full speed.

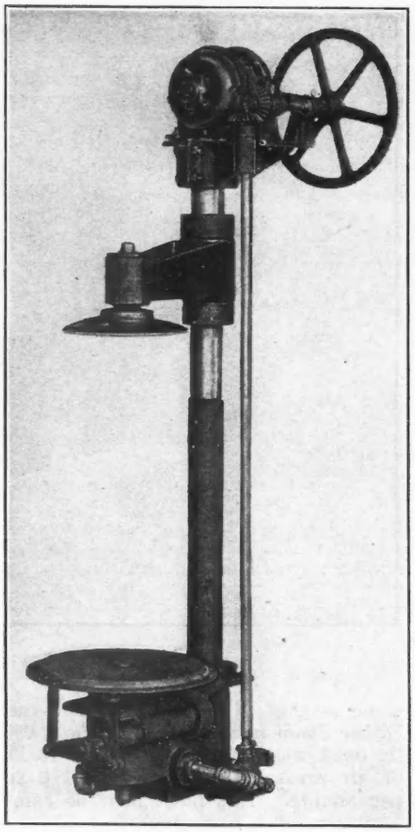
The smallest size is built with either ribbed cylinder for air cooling, where the service is intermittent, or a water-jacketed cylinder of the reservoir type for constant service. All other sizes are only built with the water jacket of the reservoir type. The size of these reservoir pots is generous, and one filling will be found sufficient for long periods of operation.

A Self-Contained Machine for Heading Barrels

A machine which will be of interest to mining companies packing ore in barrels for rail or water shipment has been developed by a Florida manufacturer. The machine comprises one main base casting with a table attached and which is really a part of the hydraulic plungers. A steel upright at the back of this main casting carries the overhead heading piece which presses the head into the barrel. This overhead casting revolves out of the way so that it is easy to place the barrel on the press.

The pedals in front and slightly to the right of the press table are operated by the foot and cause the table to rise and fall. Pressing the left-hand pedal causes the table to rise; removing the pressure from this pedal stops the rising of the table and does not allow it to fall, so that the barrel will be held in any position desired. Pressing the right-hand pedal causes the table to fall, releasing the barrel after the head is attached.

The machine has been designed with all the valves built into the base casting as a safety device to prevent any possible damage to the press through carelessness of the operator. Leaky joints have been avoided by placing the pump close to the base casting and attaching it to it. The pump is driven by belt drive or electric motor. The valve in the main base casting is a rotary valve similar to rotary valves used on steam pumps and the oil reservoir is cast into the main base casting.



Self-contained barrel-heading machine

When no barrel is on the press and when the press is not in operation the pump is running idle, circulating the oil into the oil reservoir and through the pump and then into the reservoir again. When the barrel is placed on the table and the left-hand pedal depressed, the valves change so that the oil discharges from the pump, is pumped into the plunger chamber, and causes the table to rise. As the pressure on the contents increases, the pressure of the oil increases.

When the pedals are thrown to neutral position, the oil is again circulated through the reservoir and the pump runs idle. When the right-hand pedal is depressed, the pump sucks oil out of the pump chamber, causing the pump chamber to descend quickly and release the barrel. The pump is a rotary pump capable of developing 200 lb. pressure.

This press is manufactured by the Skinner Machinery Co., Dunedin, Fla.

Power Specialty Co., 111 Broadway, New York, announces the appointment of Pell W. Foster, Jr., as New England district manager, with offices at 50 Congress St., Boston. Mr. Foster was formerly in the New York sales office.

INDUSTRIAL NOTES

Herbert C. Follinger, manager of the Chicago office of the Chain Belt Co., died of pneumonia at his home in Chicago on Sept. 27. Mr. Follinger was thirty-eight years old, and was born at Fort Wayne, Ind. He became associated with the Chain Belt Co. in 1914, and in 1916 was appointed district manager for the Chicago territory.

Harry C. Collins, formerly of the firm of Collins & Webb, has been appointed sales manager for Rosenburg Co., of Los Angeles, Calif., who represent in that territory Fate-Root-Heath Co., Northern Engineering Works, Central Frog & Switch Co., N. P. Nelson Iron Works, and Gruendler Patent Crusher & Pulverizer Co.

The Brown Hoisting Machinery Co., of Cleveland, Ohio, announces that its conveyor sales are now in charge of E. P. Sawhill, who has had nearly thirty years' engineering and selling experience on this type of equipment. The Brownhoist elevator and conveyor equipment includes a complete line of belt conveyors, chain conveyors, coal crushers, screens, apron conveyors, picking tables, and similar machinery.

The Prescott Co., Menominee, Mich., has recently closed contracts with the Sinclair Pipe Line Co., of Tulsa, Okla., for six big pipe-line station pumps, each having a capacity of 26,000 bbl. per day against a line pressure of 900 lb. per sq.in. These pumps are similar to those the company furnished the Oliver Iron Mining Co., in that they have solid forged-steel fluid ends, but are bigger machines. They will be used on the new line running from the Mid-Continent field to Chicago and will be driven by 440 hp. Nordberg Diesel engines.

The Iron Trade Products Co., with offices in Pittsburgh, Philadelphia, and New York, supplying raw materials to the steel trade, has organized under a Delaware charter, the Big Four Fluorspar & Ore Co., which has absorbed some well-known Crittendon County, Ky., fluorspar properties, including the well-known Big Four, Love, Deer Creek and Crittendon Springs mines. Work is being pushed on the further development of these properties, and it is expected that machinery for milling the ores will be installed in the near future. The general offices of the new company are in the Farmers Bank Building, Pittsburgh, Pa., in the offices of the Iron Trade Products Co. Officers are as follows: W. J. Strassburger, president; J. L. Hukill, vice-president; Louis J. Adler, treasurer, and Huntington Downer, secretary. The company will act as exclusive sales agent for the Big Four Fluorspar & Ore Co. Mine offices will be maintained at Marion, Ky., where Avery H. Reed, as vice-president and general manager, will be in charge.