

ENGINEERING AND MINING JOURNAL

Mule Haulage in Metal Mines

By W. F. Boericke

The Mineral Resources of Syria

By I. M. Toll

In reverberatory smelting of copper ores in this country everything is commonly charged through holes in the roof arch near the side walls. This practice, however, is patented, and the patents have been upheld in court. In this issue the development of the idea is traced and the principal patents are mentioned.

The proposed revision of the mining law has resulted in discussion both attacking and upholding the measure. It should be clearly understood that those interested in mining-law reform are merely seeking improvement over the old law. In this issue a series of editorials deal with a number of the objections.

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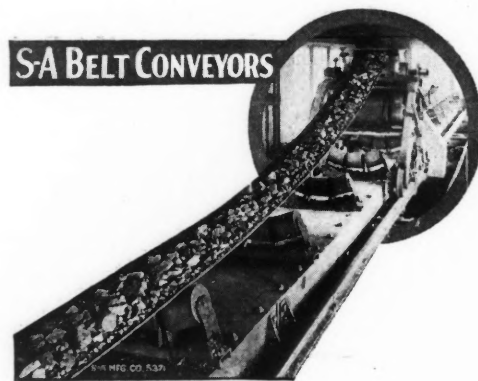
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The Reception of the Mine Law Revision

A BIRD'S-EYE VIEW of the various impressions reported from different parts of the country, as to the proposed revision of the mining law, indicates a general reaction against its enactment as it stands, a general drawing back from this and that provision, and in consequence a disinclination to accept the whole. Unmistakably, there is a feeling here and there that someone is trying to "put something over" on somebody else. That this is an absurd feeling is plain from a history of how and by whom and under what sponsorship the revision of the mining law came to be made; but bare facts avail little against a general impression. Certainly, the mining people will get nothing which they do not want: all who have the job of making or even suggesting laws are too wide-awake to their welfare and wishes.

The Specific Objections

ONE OF THE THINGS which has aroused much specific objection is the point which we ourselves have already objected to editorially—namely, the provision that makes it imperative for the locator to have the lines of his claim coincide with the ordinary areal subdivisions of existing land surveys, where these have been made. The objection to this provision is widespread. But we have it reliably that the committee which drew up the revised code, the Bureau of Mines, and the elements of Congress interested in mining-law reform are quite ready to drop this provision from the bill, or, indeed, to drop any other feature which shall not be desired, if by so doing something may be left of the proposed law which will mean a benefit and an improvement over the old law.

There will be found, upon examination and straw voting, some other features of the bill which are debatable. One such is the provision that a claim must go to patent in five years, or, if the prospector is unable or unwilling to pay \$50 per acre per year, it must be relinquished to the Government again. One competent observer has stated to us that in his opinion this injures the present rights and privileges of the prospector more than anything else in the bill. Under the existing law the prospector may hold an unpatented claim indefinitely so long as he performs his annual assessment work upon it; and there would appear to be really no valid objection to continuing this situation. It takes longer than five years sometimes to find enough on a claim to warrant patenting; and if the prospector is working away in the meantime on a hundred-to-one chance, it certainly is good business for the public to let him do it, and he should be given the privilege if he wants the gamble.

We Must Stand for Progress

THERE ARE A LOT of other objections, some valid, and some, in our opinion, not at all valid, which have been urged against various details of the bill. In

the original form, the indications are that the bill will not pass. Shall it be killed, and shall the work and progress it represents be scrapped? That would be a thousand pities. Let us see what advance is represented in it which we can all agree upon, and at least gain some one forward step by the present moment. The distinguished engineers who have drafted the bill would certainly welcome any solution which means any good advance whatever; and the great mining societies—the American Institute of Mining and Metallurgical Engineers, the American Mining Congress, the Mining and Metallurgical Society of America—which have long ago committed themselves to a revision of the mining law, would certainly support any restricted and generally beneficial program.

Abolish Extralateral Rights

ONE THING AT A TIME may be the necessary program under the existing circumstances. The principal feature of the proposed bill is one to which a great majority of mining men, whether they be prospectors or operators, will agree—the abolition of extralateral rights for claims located after the passage of the proposed law.

It is worth while that this point, and, if necessary, this point alone, be considered, and made into a law, or rejected, at the present moment. We have our opportunity to rectify, although very late, a stupid and ignorant piece of legislation—that which gave so-called extralateral rights to a claim.

The Origin of Apex Litigation

AS TO THE ORIGIN of this monster of legal provision, which makes havoc with the natural law, we quote from an article written by Horace V. Winchell in the scholarly Professor Peele's "Mining Engineers' Handbook":

"The right given by the mining laws of the United States to follow the vein beneath the surface of land owned by another was aptly termed the 'extralateral right' in an early discussion by Dr. R. W. Raymond (*Trans. A.I.M.E.*, Vol. 12, p. 387), and passed into current use in legal phraseology. This provision of the law has given rise to interminable litigation; and in its interpretation volumes of opinions have been furnished by the courts and writers of law books. The manner of its introduction into our system of laws does not seem to be clearly understood. It is at variance with the ordinary Spanish and Mexican codes, and is not to be found in the mining laws of any country but the United States. It was tried for a long period by the Germans in the sixteenth and seventeenth centuries, where a sort of inclined location was allowed, the miner having the right not only to follow the vein beneath the surface, but having also 7 lachter (about 25 or 30 ft.) on each side of the vein, parallel to its walls, within which to work (R. W. Raymond, "Mineral Resources," 1869, p. 195): but it was there abandoned because it gave rise to so much litigation. It was later tried for a short time in British Columbia, but promptly given up, for the same reason. (J. M. Clark, *Trans. A.I.M.E.*, Vol. 43, p. 617.) It may have arisen from the fact that our laws resulted from the local rules of the

miners, and that these rules were a product of the evolution and development of the western mines, starting with surface rights only, and at first solely with reference to placers, and being later extended to lodes. Each man located his vein and desired to work it regardless of its dip or inequalities and without interference with or from his neighbors. In many districts, moreover, there was a general theory, at least in early days, that the veins were all parallel to each other in dip and strike; and such complexities of structure and uncertainty in mining as afterward developed could not have been foreseen."

There you have it. You are properly called upon now to discard—after long trial—a fool law that the Germans tried and discarded in the sixteenth and seventeenth centuries A.D. And in Germany, and in British Columbia, as Horace V. Winchell writes, the valid reason why it was abandoned was that it gave rise to so much litigation. And it is causing, and has caused, too much litigation in this country; wherefore, then, should we be behind the efficient Germans—more than three centuries behind, we mean—in chucking it?

The Lawyers and the Geologists

THE LAWYERS will not advise putting an end to litigation. It is too much to expect of them. Would you put it to a farmer to abolish farming? Besides being their livelihood, litigation is the natural atmosphere they breathe; they regard it as natural and necessary in the scheme of life, and the more the better. But when they claim that the kinks of the law have all been worked out for extralateral rights, it is to laugh, to use a German idiom rendered perhaps admissible since we are discussing an old German-abandoned law. If we look over the records of the last apex case—an old case—we are forced to the conclusion that either they are very obtuse or they assume that the rest of us are. These apex cases are handled by lawyers and geologists, in cahoots; and it is very interesting to glean the general impression that the geologists are for the abolition of the extralateral rights which alone make these silly battles permissible, while the lawyers are not for it. Make a note on the advantage of scientific and engineering training, as against that of the law, in engendering clarity and equity of mental attitude, and vote for an engineer or geologist or technologist of any kind, for any position, and any time. The engineers, we have heard, stood highest in average psychological tests of all groups in the A. E. F.

Vertical Boundaries in British And Latin America

IF YOU DO NOT WANT to accept the German experience and conclusion—and perhaps we should not expect this in view of the developments since 1914—then we will put it this way: That most of the rest of the world were too wise ever to try this plan at all, based, as it is, entirely on a kindergarten idea of ore occurring only in straight fissure veins, like sheets of paper, going on forever laterally and in depth—only growing richer in depth—which is what they thought when they passed this law. This fairy-story idea of orebodies, and the resultant apex law, are equally matched as to practicable inapplicability. Not only did this legend never take root in Europe, except as stated, but nowhere in the New World than in this country. South of the Rio Grande, and north of the Great Lakes, they have flourished peaceably under a sensible law—

vertical boundaries and square claims. This applies to all Mexico and the countries as far as Cape Horn, and to all Canada as far as the North Pole.

Existing Vertical Boundary Regulations On American Soil

MOREOVER, the United States has provided similar vertical boundaries and square claims in mining laws framed for and enacted by Porto Rico and the Philippines. It is an old story that we do better by our dependent wards than we do by ourselves.

Furthermore, the vertical boundary and the abolition of extralateral rights has been enacted by private agreement, in many mining camps, such as Leadville, Tonopah in part, and many of the great camps of Arizona. Some of these, like Leadville, tasted or drunk deep of litigation before they found that the Federal law had nothing in particular to do with ore deposits. We are going to publish an article by D. A. Richardson, an authority on Mexican Mining Law, from which we quote in advance regarding the Spanish law:

"Under the early ordinances, as well as under the present law, there was an absolute right to work all veins or portions of veins within the located claim, regardless of the apex, and regardless of the dip or pitch. There was and is absolutely no right to follow a vein either on the strike or dip outside of the lines of the claim, unless the vein passes into vacant ground in which the locator must acquire rights prior to other locators, in order to protect himself in the possession of the extended vein. The contrast between this feature and the extralateral right accorded the locator under the laws of the United States is probably the more important of the entire mining system, and the superiority of the Mexican law, particularly in those cases where there are many adjacent locations in districts containing numerous cross lodes, broken veins, and covered apexes, is recognized in the United States in many such districts by the execution of agreements between the principal mine owners restricting the rights of locators and mine workers to the ore found within the space formed by extending their surface lines vertically downward."

Finally, the mining law of the State of Texas, covering the location of mining claims on state lands, provides for vertical boundary lines, although not for square claims. This excellent law is worthy of study on many points which we have not space to touch on here. But, concerning extralateral rights, it provides (Sec. 2) that "claims may be of unlimited depth, but shall be bounded by four vertical planes from the side and end lines." This law was enacted in July, 1919; it was originated, drafted, and sponsored by the Mining Circle of the El Paso University Club. A correspondent writes us that "this law has the approval and commendation of the mining fraternity in this region."

Criticism of Mining Schools

AS ENGINEERS, we look critically at the product of the various engineering schools. We see the different stages from the embryonic engineer to the consultant and operating engineer. Then we get busy and throw back various suggestions to the colleges and universities. We are not efficient diagnosticians nor are we good physicians, for we collect no fee for our gratuitous advice. We throw a bolt into the educator's camp and then go about getting our living without thought as to the possible damage we have done. We are perhaps conscious of having done "our best," but on the whole we feel our own shortcomings.

Let us see if it is possible to get a logical basis upon which to start. First, there is the "raw material," the entering students. This is not a standardized product.

You can't take each individual and put him through tension, compression, and torsion tests, and segregate the group into classes. We must not overlook the fact that students are human beings, and as a group represent a wide range in abilities, aspirations, and individual power. The intelligence tests are of some value, but are at best suggestive only, as we must not overlook the fact that they imperfectly reveal the moment position of a living, developing, and maturing individual. Thus the educator must receive a group of individuals representing a relatively wide range in individual capacity and earnestness. He can reject the most unlikely material on the basis of preparation, but he is powerless to discriminate further as the individual elects and would object to any other basis of discrimination.

Second, there is the objective of the educator. In respect to mining education, there are at least three objectives, which in the terms current are the vocational, the service, and the engineering courses. The vocational supplies the need of the working miner and foreman. The service course provides minor executives, assistants, and men of greater intelligence and a higher order of training. The engineering course represents a still higher level in ability and knowledge. Quantitatively, the mining industries require more workers, fewer service men, and of engineers, the least number.

It seems to us that this division would lead to greater clarity of thought and more intelligent attainment of objectives. Many schools do not discriminate between the service and the engineering objectives, but endeavor to make a given course serve both. Here is where considerable confusion has arisen. Engineers criticize the service course from the point of view of the engineering course and vice versa.

In the development of the five- and six-year courses, educators have endeavored to meet the needs of an engineering course, but we question whether some of them have not failed to discriminate closely between the objectives of the two courses. It looks to us as if the longer course represents the service course, with the addition of cultural and other courses. In our opinion, the engineering course should be an entity, consistently planned to meet the objective. If this were done, perhaps the time element, our third and last point, might be modified.

How much time should be given to mining education? Should it be one year for the miner, two years for the foreman, four years for the service man, and five or six years for the engineer? We do not attempt to say, for this question is one for educators in conference with mature engineers to decide. The variable nature of the raw product, the average rate of assimilation and the economic utilization of the time are the important factors. The time should be as short as possible, consistent with the objectives.

It is the function of the educator to plan his courses with as definite an objective as possible and to segregate his raw student material to correspond to the several courses. To the engineer who criticizes, it is essential for him first to study the practical limitations and then supply quite complete specifications covering the end-product of the particular kind of school. Two recent reports of committees of the Mining and Metallurgical Society, one on vocational and one of mining engineering education, represent a decided advance in thought upon the subject and should be followed up by further systematic attempts to resolve the problem on the part of engineers.

The Passing of the Burro

THERE WAS A PERSON of our acquaintance who had never been able to see the point of but one joke. That was when the automobile began to make itself prominent. "It's wonderful," said one citizen to another, "how the automobile is replacing the horse." "Indeed it is," was the reply, "I even found a bit of rubber tire in my sausage this morning."

The burro has been the chief reliance for the discovery of new mines. What with the burro that slips off the trail, the burro that wanders and must be found, and the burro that kicks the top off the outcrop, statistics of mining tradition will undoubtedly find that but for the burro new finds of ore would have been few and far between. Contributed popular evidence from time to time all accumulates in favor of the burro and weighs against the "expert." Wherefore, as we all love the old days, we grieve at the following dispatch:

"Yuba City, Cal., Nov. 5—Ted O'Connor, of San Francisco, is hailed here as the only autoist in the world who has found genuine pleasure in a blow-out. While on a motoring trip with his wife through the Yuba County hills a tire blew out and he dismounted to fix it, using appropriate language. While kicking and storming around the wheel he picked up a gold nugget that weighed in at \$18 value."

The horse and the burro have lost one of their last traditional offices in uncovering ore. The tire blow-out takes the place of the burro's kick. Romance is gone, and a new race of liars is scheduled to arise.

The Way of the Transgressor Is Hard

WE REPRODUCE HERewith an advertisement sent us by an Arizona subscriber with the comment "If you are a millionaire you can afford to buy something made of copper." Apparently, those who

make it at home do not necessarily escape from bootleg prices. On the other hand, we were much cheered by an advertisement which was recently sent us by the Rome Brass & Copper Co., which told of a "No-Profit Sale" by the hardware dealers of Rome, N. Y., in which nickel-plated copper dippers were sold at 35c.; two-quart copper coffee pots at 85c.; No. 8 nickel-plated copper tea kettles at \$1.15; and heavy sheet-copper wash boilers at \$3.34. The Rome Manufacturing Co., F. E. Bacon Co., E. Tyler, E. F. Rockwood Co., Rome Hardware & Imple-

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WHAT OTHERS THINK

"The Education of the Mining Engineer"

In the discussion following the report of the Committee on Technical Education, a summary of which appeared in your issue of Nov. 5, Mr. Graton regrets that only one side, that of the "producer" or educator, had been presented. However, Mr. Guess refers to the "product," presenting his ideal of the young engineer. The subject is one well worthy of discussion without, as well as within, the technical societies.

Mr. Guess expects rather too much in his "ideal young engineer," whether the deficiency lies with the technical educator who produced the engineer or with the individual engineer. A "self-starter with four cylinders; character, horse sense, energy, and technical knowledge," the average graduate starts—or is started—off with one cylinder functioning: the last, "technical education."

Naturally, he possesses inherent elements of "character," but individual character is built up with the up-building of the man, as his experience is gained. College training can do much toward the development of this cylinder and toward its ultimate efficiency, laying the foundation on which the permanent structure is erected in subsequent years.

Looking back over the years of varied associations, one is prone to view "horse sense," like art, music, or genius along other lines, as being inborn. A certain amount, as with the accomplishments mentioned, may be acquired, but real "horse sense" seems to be inherent. Perhaps this cylinder should "hit" now and then along with the fourth, from the beginning.

Technical training can and should have a great influence in the development of "energy," the third cylinder, in guiding its direction. But in this experience alone will, finally, develop and direct that energy to a degree of efficiency. I have noted a maximum of energy in the operation of the individual, but, unfortunately, with a minimum of result.

Analysis of the subject indicated lack of foundation and inability to co-ordinate effort to apply technical knowledge systematically to the problems in hand. The subject had had a more or less haphazard technical training which illustrates in the superlative degree the influence of technical training in the guidance of traits to be acquired and perfected under experience.

"Leadership," native in some and acquired by others, is largely latent in the college life; in the individual it develops mainly from the necessities of his surroundings. Much can be acquired by study of those with whom he is associated and those over whom he may have supervision. Thriving on opportunity it cannot develop in an isolated occupation.

"Culture," largely a matter of early training and environment, largely relative, in all more or less acquired, will be further influenced by the environment of the occupation under which experience is being won. The college atmosphere may set a standard; the young engineer "roughing it" must keep an ideal before him, an ideal set by college and social surroundings, for

inspiration. But, we must not forget that culture is a matter of environment; that it is relative; that its quality may be as sterling in the mountain wilds, of its kind, as in the social center.

The engineering college can but lay the foundation on which to erect the structure of experience. With "technical knowledge" acquired, a habit formed of thinking, of acting and of deciding along precise lines and with thoroughness (a habit which must be formed and founded in the college work), the graduate is, as far as is at present practical, prepared to acquire experience. He can build up his "character," bolster up any inherent lack of "horse sense," develop well-directed "energy," and supplement his "technical knowledge" by continued study, reading, travel, research, through any and all available channels.

The seven-cylinder motor may be a novelty, but, to carry on Mr. Guess' analogy, I should add another cylinder, "initiative." The college can do much toward creating and developing this qualification, so essential to his success, in the young engineer.

Too many young engineers have been seriously handicapped by being started off with but one cylinder, or, at best, two cylinders indifferently operative. They are started out along a line of work, lacking experience in the practical, operating side of that to which their duties are leading.

They lack, also, the details of practice which they should have acquired by experience under operating association. They have not learned "to think." Professor Wendell believes they do not "have time to think." But, "thinking" is a big part of the engineer's job; he must learn to think as well as *take* time to think. The result is that the young engineer so catapulted into the activities of operation of field examinations or other of the many spheres of activity to which he may be assigned, on his own resources, pursues a restricted course establishing an immature individuality and precedents which it may take years for him to overcome.

Another result lies in ineffective return to his employer, and, perchance, loss of faith by his employer in technical training. One cannot blame the young engineer, nor do I feel that he is open to criticism. He lacks experience and the development of the qualifications; the lack to which Mr. Guess objects. He is unfortunate, as well as his employer, in being thus sent, prematurely, to duties for which he has as yet not qualified.

I sometimes feel that the very general methods of imparting knowledge, in technical as well as public schools, particularly in the latter, tend to minimize the effort of thinking. Thinking is not a natural accomplishment but the development of certain mental faculties. Knowledge can be pumped into a student, developing the "memory" faculty, but to develop the "thinking faculty" the student must be so reached as to take in a considerable proportion of "knowledge" by "suction."

We meet a good many young engineers in the field who have jumped from college to experts. That they should be so thrown on their own resources is unfortu-

nate alike for them and their employer. Immature theories and views then formed shadow them all through their professional careers. They are untrained to think, have no precedent of their own experience to guide them, and fall back upon an effort to apply the memory of the lecture course.

Professor Warren's stressing "the need of securing men on the teaching staffs who have had actual and adequate experience in the field" cannot be too strongly emphasized. A "technical course as a 'short-cut to experience'" is hardly conceivable. Experience can be acquired only by actual work in the chosen field of endeavor, and this with the maturity of the mind that comes only in the years, after the average man has been graduated. Those of us who look back on our earliest efforts will fully appreciate this.

Helena, Mont.

L. S. ROPES.

Drilling Results and Dredging Returns

In the issues of *Engineering and Mining Journal* of Oct. 22 and 29, you publish a paper by Charles W. Gardner on "Drilling Results and Dredging Returns." The publication of this article is most timely, and you have opened up a fertile and interesting field for discussion. Mr. Gardner has given us a large amount of information that he has gathered during his many years of experience in this industry.

In your editorial of Oct. 22, you set forth the fact that Mr. Gardner has not analyzed the individual cases nor given any explanation of the underlying causes for all of the uncertainties and discrepancies that he enumerates. It is of little use for us to learn that our results are wrong if we cannot be told the why and wherefore or if we cannot be shown how to correct the errors of our ways. Mr. Gardner has cast a cloud of doubt over all placer prospecting work that may cause an investor to hesitate before putting much money into a gold-dredging project.

A dredging enterprise requires quite an investment today. One property that I now have in mind, having been recently equipped with a 10-ft. dredge, wherein the whole equipment included the power plant and necessary buildings, required nearly \$1,000,000 cash. The large equipment is more necessary today than heretofore, because most of the richer placer ground where a small dredge could be made to pay has already been equipped and exploited, and today we only find ground available containing comparatively low values and on which we must install large dredges or units, to obtain sufficiently low working costs to earn a profit. Not only must the capital investment be large, but it must all be risked or spent before it can be definitely known that the enterprise will prove a money maker. One cannot put up a small unit to handle fifty tons per day as can be done in a lode mine and then further extensions be made to this plant after it has been proved that one has a profitable operating business. The dredge must be completely installed, and in many instances together with its power plant, before a yard of gravel can be dug and the soundness of the enterprise be proved.

When one is called upon to consider an investment of say \$1,000,000 in a dredging project, probably one of the first questions that will arise in his mind is, "Are the drilling results reliable?" And if the investor should chance to read Mr. Gardner's article, he might be fully

justified in concluding that all drilling results are unreliable and that no one knows much about the drilling business.

In your editorial you state that "The method of depending on bore holes is not universally applicable to such deposits, and with this conclusion most engineers will agree. Just where to draw the line is a hard question. What deposits can be safely drilled? What deposits must be examined by other methods?"

Your conclusions are theoretically correct, but in actual experience the engineer usually has little choice in the matter, as it is generally necessary to resort to drilling because of the presence of water, the amount of time required for shaft sinking, the great difficulty, and the large expense of this work. I hold that shaft work is preferable where possible, but many an engineer will put down only a few shafts on a certain area, on account of the time, expense, and difficulties, whereas many more drill holes would be put down by him within this same area in little time and at small cost. Local conditions beyond the control of the engineer generally decide this matter for him and compel him to resort to drilling.

As to R. H. Smith's suggestion that the gold dredge was not doing its work, I think that there is very little room for any blame for poor gold recovery on a dredge of modern design, as ample screening capacity, large water supply, extensive table area, effective dump chutes, save-alls and clean dumping buckets all make for high efficiency today. Many shortcomings were found in one or all of these elements in the dredges built in the earlier days, but this is not true of the dredge of modern design.

In reading Mr. Gardner's article, one is almost forced to conclude that the larger part of the trouble as set forth by him lies in the personal element, and much benefit will be derived if we can hear from others giving their experiences in this field of operation.

New York.

A. C. LUDLUM.

Labor Turnover at Mines

In *Engineering and Mining Journal* of Oct. 15, on page 603, you refer to a short report of mine in the Bureau of Mines *Reports of Investigations* on a six-year accident record of the Anaconda Copper Mining Co., and you apparently would like to be informed as to the labor turnover in the Butte district. I am herewith forwarding *Technical Paper 229*, by myself, entitled "Accident Prevention in the Mines of Butte, Montana," and on page 49 you will find some data as to the labor turnover for the North Butte mine for the years 1916-1917. This tabulation was furnished to me by the officials of the North Butte mine, and though I have no definite figures as to the labor turnover for that period in the mines of the Anaconda Copper Mining Co., I am very much inclined to believe that the labor turnover for the Anaconda mines was even greater than that of the North Butte mine.

In the matter of labor turnover for Butte, however, it is not to be inferred that every time a new man is hired at a mine he is necessarily a new man to the district, inasmuch as a man may work at one mine today, another mine next week, and still another one for a number of weeks in succession, and in fact there are specific records showing that men have worked at as many as fifteen to twenty different mines in a year.

Denver, Col.

D. HARRINGTON.

The Mineral Resources of Syria*

Country Now Opened for Development—Geology and Mining Laws—Coal, Lignite, Petroleum, and Asphalt Found—Salt and Other Non-Metals—Iron Widely Distributed—Chrome, Copper, Lead, Gold-Silver, Nickel, and Tin

BY I. M. TOLL

Written for *Engineering and Mining Journal*

SINCE THE FIFTEENTH CENTURY Syria has been under the rule of the Ottoman Porte, although the Turkish burden lay very lightly upon the country until in the 80's the Asiatic policy of Abdul Hamid was initiated, stressing the importance of Mesopotamia, Arabia, Syria, and Egypt. In pursuance of this policy the construction of the Bagdad railway was pushed, and a modern railroad was built from Aleppo to Beersheba, connected by branch roads to five reconstructed Syrian ports. Damascus and Aleppo once more became great trade centers, and tramways and electric lighting were instituted.

The position of Syria as the keystone of this part of Asiatic Turkey necessitated jealous guarding and strict administration. Nowhere else in his dominions did Abdul Hamid so keenly resent foreign influence and the growth of Christian and Jewish institutions; yet these persisted, and the culture of Syria was the culture of France. Nationalistic sentiment flourished, and the Young Turk revolution in 1908 was followed by rebellious intrigue on the part of the Syrians that was exposed in 1914, in the early part of the war. Executions and massacres were the principal features of the reign of terror that followed, uniting Syria as she never before had been united.

After the Turkish army had been driven from the country by the united British and Syrian forces, relative quiet obtained until the British army was replaced by the French under General Gouraud, whose evident intention it was to occupy Syria as a French province rather than as the ally and advisor of a self-governing Syrian nation. The opposition of the natives was overcome by overwhelming superiority of arms and numbers, and the complete pacification of Syria is now claimed. On Dec. 23, 1920, an Anglo-French agreement determined the boundaries of the British and French Asiatic mandatories. The accompanying map shows those of French Syria.

REGION AWAITS DEVELOPMENT

This land, the resources of which have so long been withheld from the foreign investor, is now opened for development. Except for the railroads built by Abdul Hamid, the attempts to develop the country made by the Turks have been desultory and incomplete.

Syria's agricultural resources are her greatest asset, and much is expected of the northern part (Aleppo to the Beka'a) in cotton and cereals. At present, however, only one-fifth of the utilizable land is under cultivation, and only the most primitive methods are applied.

The information upon which this article is based has been derived entirely from the works cited in the appended bibliography. Because Blanckenhorn has done the most copious as well as the most recent work, his reports have been accepted as authoritative at points

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of dissension. His volume on Syria, Arabia, and Mesopotamia, in the *Handbuch der regionalen Geologie* series, contains by far the most complete treatment of the geology of those countries and has been largely drawn upon in the preparation of this article. Accurate locations of mineral deposits are difficult to find in Syria, and statements as to the kind, quality, and quantity of the ores are surprisingly rare in the literature.

The mineral resources of Syria have been the subject of many wildcat speculations in France, and the expectations of the public regarding them have been elevated far beyond their real value. So far as is known today, Syria's mineral deposits are but mediocre; yet much of the region is virtually unknown, and those parts which appear to be most rich in this respect, the vilayets (provinces) of Aleppo and Adana, have been the least prospected.

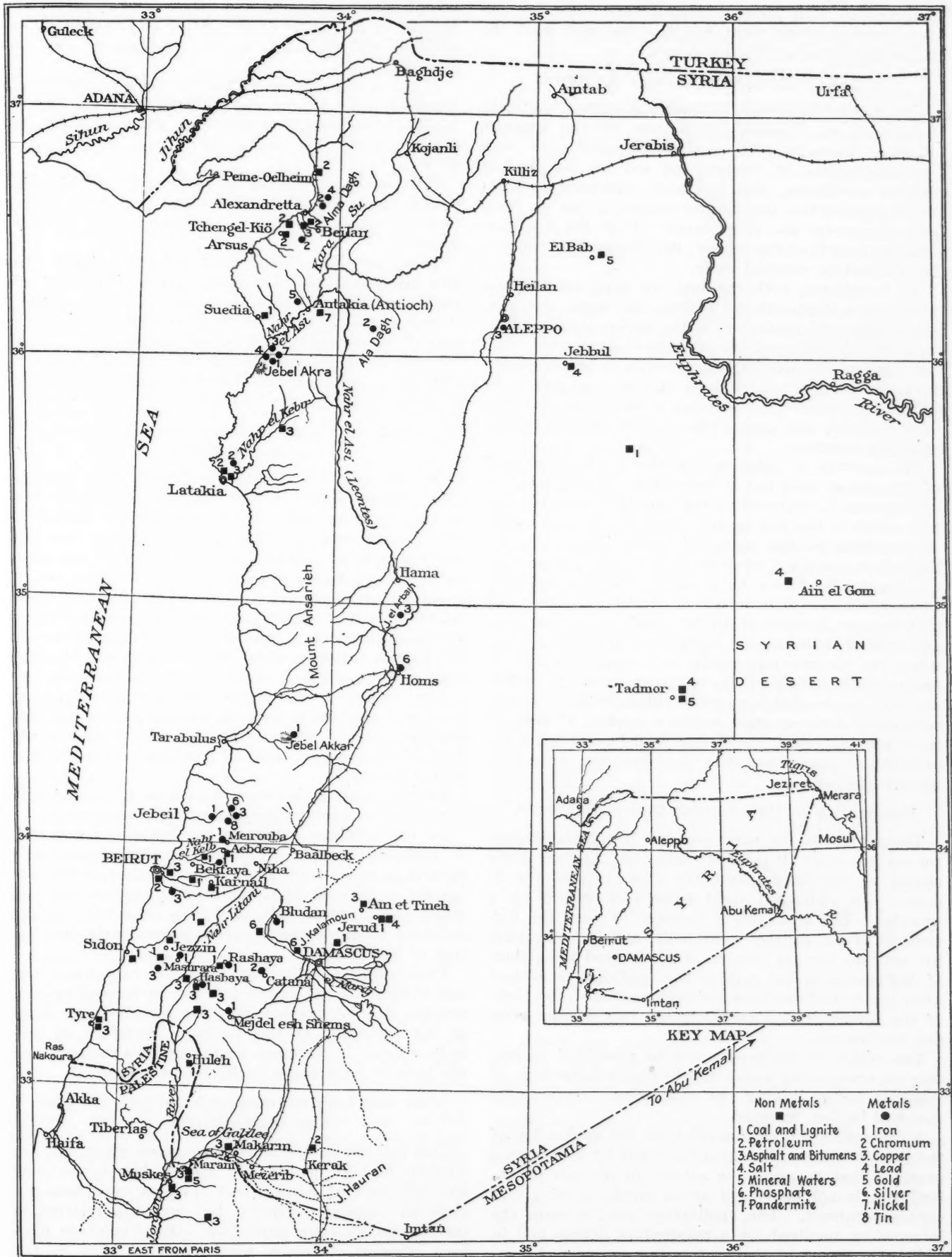
Of the mineral resources of Syria, the non-metals have in the past been of far greater importance than the metals. The latter have not, however, been adequately prospected, and their potential value cannot be estimated definitely until a thorough geological survey of the country has been made.

GEOLOGY

Structurally Syria is divided between two distinct provinces. North of a line along the Afrin River to Aintab the country has the folded structure of southern Europe and Asia. The flexures trend northeast-southwest and are approximately parallel to those of the Taurus. The Amanus and Kurd mountains may be said to belong to that system. South of the line the country is of the Indo-African type, only slightly folded and highly faulted. The faulting is subsequent to the folding, and is post-Cretaceous, probably late Tertiary.

The oldest rocks in Syria are Jurassic in age and very limited in extent, being exposed from the Sea of Galilee to Tarabulus. Cretaceous limestones, including the oil-bearing Senonian, cover the greater part of Palestine and occupy large areas northward to the Taurus and eastward into the Syrian Desert. Nummulitic limestones of the Eocene overlie the Cretaceous, and north of the Lebanon Eocene and Miocene formations cover most of the country. The Miocene of Syria west of the Euphrates is marine and predominantly calcareous. The upper Miocene oil-bearing salt and gypsum formation of Persia extends across Mesopotamia into Syria, and at the Euphrates includes intercalated fresh-water deposits. The Pliocene is not widely distributed, coarse marine deposits being found locally along the coast and in the valleys of the largest rivers and in fresh-water marls in the beds of old lakes in parts of middle and southern Syria.

Basalt flows are of widespread occurrence in Syria, the largest being that which caps the Hauran Mountains and forms the great lava plateaus north and east of the Sea of Galilee. In the far north these lavas are



MAP SHOWING MANDATORY OF FRENCH SYRIA

interbedded with Miocene deposits and must be contemporaneous with them, but for the most part the lavas appear to be Pliocene in age.

THE TURKISH MINING LAW OF 1906

Not until the European powers brought pressure to bear upon the Turkish government did the imperial irade of March 26, 1906, clear up the question of mining concessions in Turkey and put an end to the chaotic conditions that prevailed previously. Prospecting under this law became subject to the securing of a license (*permis de recherche*) from the Administrative Council of the vilayet, and concessions were to be obtained by imperial irade.

In accordance with the law, an application for a prospecting license should contain the name, domicile, nationality, and profession of the applicant; the situation and boundaries of the lands to be prospected, with the name of the district; the minerals to be prospected for; the category of the land and an engagement to indemnify owners; two sketches showing the situation of the mines; and papers showing the legality of the applicant company.

The petition is submitted to the governor general of the vilayet, who has it registered. A certificate of registration is delivered to the applicant, securing the first right to the license and hence to the concession. A committee is then delegated by the Administrative Council to ascertain whether there is any reason why the license should not be granted. Reasons sufficient for refusal are enumerated in Article 13: the fact that the area includes public buildings, places, gardens, and similar features, or extends to public domains; when the prospecting works will cause trouble or prejudice the needs of the natives; when the works are to be constructed in a city or village or in the neighborhood of forts or other military works. If none of these reasons exists, the license is delivered upon the payment of the government fee—five, ten, or fifteen pounds Turkish.

PERSISTENCE IN MAINTAINING RIGHTS ESSENTIAL

The permit is for one year and is renewable once for another year. It is transferable, but the formalities should be completed before the expiration of the license. An additional eight months is gained by a transfer. The applicant is expected to push the formalities of his petition continually, and if he neglects his petition for six months it is dropped altogether. If negligence on the part of the applicant is evident after the formalities have been consummated, the right of the petitioner will be abrogated two months after due notification.

The holder of the license will be permitted to execute all prospecting works and to export 2,000 tons of minerals before taking the concession. Government fees will be due, however.

A concession will be granted upon the application of the license holder. It may be secured by a foreigner provided that he agrees to submit to the law of the land and is not an official or an employee of a foreign government. The application must contain the information required for a prospecting license and in addition a report of the prospecting engineer, accompanied by samples.

If after inquiry the government is satisfied that the mine is exploitable and that its development will not injure any neighboring mine, the application will be

accepted and registered and notice thereof posted and printed in the public press. After two months no opposition will be heard to the granting of the concession.

If no acceptable opposition is made, a *cahier de charge* is prepared by the Ministry of Mines and referred to the Council of Ministers, who render a favorable decision. The concession is then granted by a firman.

The owner is required to begin work on his mine within two years, and if he neglects to do so within two and one-half years the concession will be withdrawn.

Taxes are of two kinds, fixed and proportional. The first amounts to 10 *piasters* per *djerib* (10,000 M) and the second amounts to 1 to 5 per cent of the product if the mining is done by galleries and 10 to 20 per cent if the minerals are found in masses.

Concessions are transferable by sale and transmissible by inheritance, and they are usually granted for a period of ninety-nine years.

FRENCH REGULATIONS RESTRICT OTTOMAN LAW SOMEWHAT

On Jan. 26, 1921, the Acting French High Commissioner issued a circular note (No. 119) regarding prospecting permits and mineral concessions under the new French régime. Although the Ottoman law still governs mineral affairs, certain restrictions are made as to the application of this law.

All concessions granted since Oct. 29, 1914, are cancelled. No new concessions can be granted without special authorization from the High Commissioner of the French Republic, which authorization will be given only exceptionally and in case of urgent necessity.

The control formerly held by the administrative council of the vilayet over the granting of prospecting permits (*permis de recherche*) is now vested in the High Commissioner, and all questions must be submitted to him.

Deposits already known will soon be listed and published and cannot be the subject of new licenses.

As the 1906 law grants to the holders of a *permis de recherche* a right of priority to the corresponding concession and a right to an indemnity in case the concession is refused him, the High Commissioner will grant one of these only to parties who will produce sufficient guarantee for assuring a reasonable exploitation of the properties.

Prospecting permits are valid for only one year; and if they are not renewed or the corresponding concessions are not granted, they are cancelled *ipso facto* at the expiration of this period. Therefore all permits granted by Ottoman authority have expired, and the holders must make application for renewal.

COAL AND LIGNITE DEPOSITS NUMEROUS BUT NOT OF HIGH QUALITY

Coal and lignite are found throughout Syria, but are nowhere of high quality. In Vilayet Aleppo, about 80 km. southeast of Aleppo, coal outcrops have been noticed by various explorers, but accounts relative to their importance are conflicting. Other outcrops have been reported at Suedia, north of Jebel Akra, on the Mediterranean coast. East of Sidon and extending along the western slope of Jebel Niha occurs a lignite bed 0.5 to 1.6 m. thick which is exposed for 1,200 m. and which certainly extends for a distance of at least

2,000 m. On the other side of Jebel Niha, between Niha and Mashrara, is a lignite exposure 500 m. long. At Haitoura, near Jezzín, is a lignite deposit whose extent is not definitely known, but which produces 500 tons annually. The Ainmade mine, near the village of Karnail, yields 1,000 tons a year. Both deposits are capable of larger outputs. Outcrops of coal have also been traced in the valley of the Nahr el Kelb; in Jebel Kalamun, a range of hills northeast of Damascus; in the village of Rashaya, at the foot of Mount Hermon; in Huleh, Province of Damascus; in Jerud; and in Birteh.

In the Nahr-Beirut region of Lebanon coal and lignite mines were formerly worked, and deposits also have been found at Falooga, near Hamana; Pambre; Aebdin, near Bekfaya; Mreyjaet, and Jezzín. Aebden is the seat of native exploitation undertaken on a small scale to supply silk factories of the district with fuel. The Lebanon coal measures are poor, however, and the seams are thin, being in places only a few centimeters thick, locally increasing to a meter and a half. It is pitch coal with numerous transitions to paper coal and bituminous coal, and pyrite is disseminated throughout. In spite of the wide distribution of coal in central and southern Lebanon, the presence of the pyrite and the high cost of transportation over difficult mountain ways make its development impracticable.

PETROLEUM AND ASPHALT OCCUR

The Syrian oil region is continuous with that of Palestine, where the petroleum appears to originate in either the Campanien or the Senonien group of the Upper Cretaceous. In northern Syria several oil springs of the Alexandretta region have been described, one 18 km. north of Alexandretta on the coast, another at Tchengel-Köi, between Arsus and Alexandretta. Oily films show on the surface of several streams flowing from Alma Dagh, where gas has been escaping for many years, toward Alexandretta; and Blanckenhorn mentions a spring southwest of these streams and close by the shore, called by the natives Kasod Jaghü. Asphalt is found also in the Alexandretta region. In Jebel Keferie, a hill 300 m. high in the region of the bend of the Nahr el Kebir, about 40 km. from the sea on the road from Latakia to Aleppo, is an important deposit of compact asphalt occurring over an area measuring about 1,500 x 1,400 m. Near by the asphalt oozes from vertical joints and impregnates the surrounding limestones and marls. There are oil springs on Jebel Musa, near Antakia, and on the coast. Three other localities in the neighborhood of Latakia are mentioned: Harbeh Vesolas, Kefrie, and Ghismum.

Near the city of Beirut both petroleum and asphalt are found. Blanckenhorn reports bituminous limestone at the springs of the Jordan. Asphalt is mined at Hasbaya and in the upper Jordan valley on the western slope of Mount Hermon. The pure asphalt occurs in beds up to 4 m. in thickness at the principal mine, that of Suk el Chan, or Bir el Hummar, located on the east slope of Jebel ed Dahr, a mountain separating the valley of the Hasbani from that of the Litani. Along the Damascus-Haifa railroad, in the valley of the Yarmuk, there are numerous exposures of bituminous limestone, as at Marani, and Schumacher discovered a petroleum spring between El Ekser and Makarin. At this spring, Tell el Dchamid, drilling was attempted in 1912, but was abandoned at the begin-

ning of the war. Asphalt occurs at El Hamm and at Muskes. In the Hauran Mountains, near Ain et Tineh, and at Sunuhre, in the Beka'a district, bituminous limestones are exposed, but their quality is not sufficiently high to make exploitation profitable.

ATTEMPTS TO EXPLOIT PETROLEUM FAIL

Several attempts have been made to exploit petroleum in Syria, but as yet none have been successful.

In the latter part of the 80's a company capitalized at 500,000 fr. was organized at Basel for the purpose of developing the Jebel Musa springs. In 1889, a concession of 8,000 hectares was given to Ahmed Nedshabi Effendi for seventy years at an annual rental of 10,000 fr. and 10 per cent royalty; but this lapsed after three years of unsuccessful prospecting.

During the years 1892-95 the Vereinigtes Deutschen Petroleumwerke A. G. drilled at Alexandretta without success. Director Bösche reported that expenses were so high that even with favorable drilling results it was extremely questionable if a profitable development of the undertaking could be obtained. For current expenses the sum of 150,000 marks was set, and when production should actually begin a further royalty of 8 per cent would have to be paid.

In 1913, Prince Jusuf Pascha Kemal undertook the development of petroleum and asphalt in Beirut Province, with the agreement (as reported) that in the event of a sale of the concession the Ottoman government was to retain 20 per cent of the price for itself and the owner of the property.

The Petroleum Gesellschaft Latakia was formed by Abdul Wahhab Effendi Harun, and by the purchase of older concessions obtained the privilege of exploiting asphalt and petroleum at Latakia.

A ninety-nine years' concession was secured in 1909 by the Société Minière Syrienne Haifa, composed of a number of local capitalists, for the exploitation of petroleum and asphalt in Vilayet Damascus. This included five prospecting and drilling permits on the east slope of the Jordan valley and in the Yarmuk valley about 88-152 km. from the Hejaz railway. The capitalization proved insufficient, and the aid of British capital was sought. After favorable examination by a petroleum expert, large investments were made, resulting in the formation of the Syrian Exploration Co., Ltd., capitalized at £100,000. This company is the same as that known as the Syrian Mining & Agricultural Syndicate, in Haifa as the Syndicate Agricole et Minière de Syrie. The concession is for 8,000 hectares of oil lands about 150 km. from Haifa, in the Yarmuk valley.

OPERATIONS NEAR MAKARIN ABANDONED

In 1912 two wells were sunk into a well-developed anticline near Makarin. In 1914 they had reached a depth of 500 ft. and found showings of oil, but no pay sands were reached. The rotary as well as the cable system was used, but the latter was more efficient, because of the hardness of the rocks. According to Dominican, limestone was first penetrated; then sandstone at 100 m., and finally hard shales. Hoberg gives the sequence as 10 m. of basalt-conglomerate and lava, then soft bituminous limestone, followed by 55 m. of Nubian sandstone. When the drilling machinery broke, the attempt was abandoned.

The large concessions obtained by the Standard Oil Co. of New York are supposedly limited to the Dead Sea region.

Of the mineral resources of Syria, asphalt and bituminous limestone have been considered by far the most important, and up to the present these alone have been profitably exploited.

ADVERSE CONDITIONS DETER DEVELOPMENT

Attempts have been made several times to work extensively the asphalt deposit at Latakia, estimated to contain over 2,000,000 tons. The primitive methods used gave 79 tons in 1906, valued at 17,790 *piasters*, and in the following year 20 tons, valued at 4,500 *piasters*. The concession passed from hand to hand until it was finally held by a Greek capitalist resident in Egypt who paid £50,000 for the rights on 1,590 sq.m. The difficulties of transportation to the coast and of shipping were great, and the construction of a narrow-gage railway and extensive harbor works was planned. This, however, would necessitate the aid of foreign capital, and the project was dropped. At Dahana and Sullas, near Latakia, deposits were being worked in 1904 by an Englishman, Gavin A. Gilchrist. During that year an initial shipment of 300 tons of asphalt was sent to England, but the mines do not appear in later reports.

The Alexandretta asphalts have their origin in partial evaporation of the petroleum. An analysis by Jacunski showed that this asphalt has the following composition: Carbon, 77.18 per cent; hydrogen, 9.07; sulphur, 9.40; nitrogen, 2.10, and ash, 0.50; total, 98.25.

In 1902, a total of 350 tons of asphalt was exported from Beirut. Most of the asphalt came from deposits near the port, and the larger part of the shipment was consigned to Trieste, where it brought 360 marks per ton. In Beirut the price varied between 50 and 57 fr. per ton.

The Hasbaya mines are very rich, and have been worked since the country was held by the Egyptians, in the sixteenth century B.C., with wells as deep as 60 m. They were taken over by the Ministry of the Civil List of the Sultan, in lieu of taxes, from the Schebab family, who had only worked the deposits at rare intervals. In 1856, a group of Damascus merchants received permission to mine bitumen, asphalt, and stone in Damascus, and the permit was renewed every three or four years on the payment of a rental, until in 1895 the Ministry decided to place the mines on the open market in order to draw from them a greater income. Brief leases were taken at 19½ per cent and even 65½ per cent, but after five years no lessee appeared. From 1890 to 1900 66,000 tons of asphalt was extracted.

HASBAYA ASPHALT HIGH IN BITUMEN

Hasbaya asphalt is of great purity. Hitchcock states that it contains 72.6 per cent of bitumen and volatile constituents, 14 per cent of carbon, and 13.4 per cent of earthy constituents. It is very slightly soluble in alcohol, more soluble in ether, and almost completely so in turpentine; softens in water at 24 deg. C., and melts at 121 deg. C.; burns with a yellow flame, leaving a gray residue.

The bituminous limestone of Hasbaya contains 77.36 per cent calcium carbonate and 10 per cent bitumen, according to an analysis by Dr. Anderson. Where the bitumen content is not present, the carbonate decreases and the silica increases to 78.60 per cent.

During the war the scarcity of lubricating oils in Syria became so serious that the directors of the Hejaz railway decided to attempt distillation of the abundant

bituminous limestone. The Makarin deposits in the Yarmuk valley seemed most promising because of the high bitumen percentage and because the six exposures extending over 10 km. could be easily worked from the surface. The limestone here contains 18 to 20 per cent bituminous material and has a heating power of 1,500 to 1,800 calories. The site chosen was that of the Syrian Exploration Co.'s abandoned plant, and the work was begun in the end of 1914. The first method used was extraction by gas ovens; but the method proved to be too complicated and expensive. The experiment was continued for ten months, however, and resulted in a daily production of 10 kg. a day at a cost of 70 *piasters* per kg.

In the second experiment, use was made of the materials left from the drilling outfit. The oven had a capacity of 15 cu.m., burning ten or twelve tons of rock in twenty-four hours. The stone, soft and of shaly nature, was broken by hand. The output was 500 to 600 kg. of crude oil, specific gravity 0.85 to 0.95, and about 1,000 kg. of ammoniacal water. The oil was sent to Damascus for distillation. In this way 20 to 25 per cent of the bitumen content of the rock was extracted at the following costs per ton: Extraction and transport, 25 *piasters*; breaking, 40; loading and unloading, 16; and general expenses and upkeep, 20; total, 101 *piasters*.

The yield was 45 kg. per ton and the cost per kg. 2.45 *piasters*. Taking into account the cost of the oven, the cost of building, general expenses and interest on capital (1,000,000 *piasters*), the cost price rises to 3.45 *piasters* per kg. With modern machinery the deposits could doubtless be exploited with less cost.

SALT INDUSTRY LITTLE DEVELOPED—MINERAL SPRINGS NUMEROUS—OTHER NON-METALS

The salt industry in Syria is old, but the maximum production has nowhere been reached. At Jebbul, on a salt lake 35 km. southeast of Aleppo, is one of the principal Turkish salt works. In winter the lake is 35 km. long and 20 km. wide, but in summer it becomes entirely desiccated, resulting in the formation of a pale rose-colored deposit of salt 1 to 5 cm. in thickness. The annual production, less than 10,000 tons, could be increased to 100,000 tons. Beyond the southern border of this lake are the unexploited salt lakes of Al Hamra, Haraidische Ajta, Serka, Ramle, Derehim, and Maragha.

Southeast of Palmyra, at Tadmor, is a small lake yielding salt of high quality. A bitter salt is obtained from the salt marshes of Jerud, northeast of Damascus, where the deposits are as thick as 10 cm. The total lack of fresh water and the location on the trail of Arab thieves make mining and transportation difficult. Nevertheless, a small quantity is produced each year. The natives also prepare salt at Ain el Gom (Kum), 90 km. south of Ragga, in the desert.

Mineral and thermal springs, for the most part sulphurous, are numerous in Syria, particularly in Aleppo. At Bab, 45 km. east of Aleppo, ruins of ancient Roman baths are found around sulphurous thermal springs. Similar sulphurous waters are present at Tadmor (Palmyra) and at Sabkha, in Zor Province. But the best-known springs are those at Hammi (ancient Gedara), in Damascus, where large streams gush forth from the ground. That the Romans recognized their therapeutic value is shown by the ruins surrounding them; and today Arabs come to these springs even from Persia

and Armenia. Dr. de Brun, of the Faculté de Médecine, at Beirut, testifies to the medicinal qualities of the water.

There is much fine marble in Syria and beautiful alabaster. In Aleppo both marble and gypsum are quarried; in Damascus, marble and porphyry; and in Beirut, gypsum and sandstone. Important deposits of red and yellow ochre are also worked in Beirut province.

Rock with a limited phosphate content is widely distributed throughout Syria and can easily be quarried. The best deposits are in the Barada valley.

A deposit of pandermite, a hydrous calcium borate, near Antioch, has never been worked, but is of potential value.

IRON WIDELY DISTRIBUTED

Iron occurs widespread throughout Syria. Deposits have been found in Jebel Akkar above Tarabulus; Mejd el Shems, 50 km. from Damascus; Bludan, 5 km. from the Beirut-Damascus railroad; Beirut; the slopes of Jebel Akra and of Mount Ansarieh, rich in various other metals; and Kufeir, 50 km. from Beirut. In Vilayet Damascus, the iron mines at Hasbaya have been abandoned, but those at Mashrara, in the Beka'a, and at Rashaya, north of Mount Hermon, are being operated. At the last-named locality coal from the same area is used.

The Lebanon possesses iron oxide ores in abundance, especially near Meirouba, at 1,200 m. altitude, in the valley of the Nah el Kelb. This deposit, like many others, is undeveloped, because of lack of means of communication. The ancient Phoenicians mined iron ore in the Lebanon, and central Syrian iron deposits have been worked intermittently ever since. The best known of these deposits is located in Wadi Sannin, the southern arm of the Nahr el Kelb, in Jurassic limestone. The ore occurs in a series of lenses extending parallel to the strike from northwest to southeast, and is mainly limonite and hematite, with some siderite. It is easily mined and yields a high-grade product, but the mining methods are very primitive. This may be the same locality as that described by D. A. Murr, of the American University at Beirut, as situated about ten miles distant from the coast near the mouth of the Dog River.

The deposits are in the neighborhood of Btaghrin village, and are known under the names of Biara Merjaba and Ein el Mur lands. Samples upon analysis gave from 42 to 60 per cent of iron, averaging 47 per cent for Biara and 50 per cent for Ein el Mur. The ore was worked by the natives and smelted in a primitive fashion until about fifty years ago, when the scarcity of wood for fuel and the low price of imported iron made it unprofitable to continue. The quality of the ore compares favorably with the average class of English ores. The gangue is chiefly lime.

Iron ore is found in the neighborhood of the village of Almat, about nine miles up the valley of the Fidar River from the coast near Jebeil. The rocks are limestone, with a few beds of shale and sandstone. Samples of the ore gave 51 per cent iron.

A license of research on iron deposits in the Yarmuk valley was issued to a group of men from Damascus and Haifa and was later transferred to a British firm. The license was not worked out, owing to the breaking out of the war.

The chrome-bearing area of southwestern Asia Minor extends down into Syria, where it includes deposits in

Aleppo, in the Ala Dah, the Beilan area, and the Amanus region of the Gaur Dag, northeast of Alexandretta. Chromium occurs at Catana, near Damascus, and in Beirut are deposits yielding 40 to 50 per cent chromium. These deposits were worked only for five years, but yielded during that time a minimum of 25,000 tons of ore. The concession was held by a Turk.

Copper deposits have not yet been developed in Syria, although they are found in every vilayet. Copper deposits occur in Vilayet Aleppo, 3 km. from Aleppo; in Beirut at Jebel Akra and in Beirut Sandjak; in Damascus at Djebel el Arbain, and in the Lebanon near Sidon and in the Kesserwan district.

The presence of lead ores in the Amanus massif has been confirmed, and silver-lead ores have several times been reported from Jebel Akra.

Auriferous sands are found in stream beds near Antakia. Silver occurs near Homs (ancient Emesa) and in the Kesserwan district of the Lebanon. A deposit is also mined at Toufail.

There is a nickel-bearing deposit at Jebel Akra, the minerals analyzed containing 72 per cent nickel.

Tin deposits in the Kesserwan district were examined and approved by Australian engineers, and licenses for the right of mining tin, copper, and silver were applied for by Murr in behalf of the Australian company which they represented. The work was discontinued, however, upon the outbreak of war.

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Tabling Sludges and Tailings

Investigative work on the mill sludges of the Wisconsin zinc-mining district is being directed by the Mississippi Valley station of the U. S. Bureau of Mines at Rolla, Mo. Work has been done on the tabling of sludges and fine tailings. The system of floating the sludge table concentrates has been simplified. The system of flotation has been changed so that the "oil rock" impurity can be more effectively removed than heretofore.

Controlling Rock Strata Gases In East Tintic District

The development of certain mines in the East Tintic mining district, Utah, has been hindered considerably by the presence in the rock strata of heavy irrespirable gases which at times flood the lowest working places, as well as by abnormally high rock temperatures in the lower horizons, according to Serial 2275 *Reports of Investigations*, by G. E. McElroy, mining engineer, U. S. Bureau of Mines. Local weather conditions are intimately associated with the gas inflows. The atmospheric low-pressure areas, or storm-centers, that affect the district, almost invariably pass to the north of the district and from west to east, and the local topography is such that winds are diverted to a southwest course that would otherwise assume the direction of a line joining the district and the center of the low-pressure area.

The following theory has been deduced to explain the mode of occurrence of gas inflows: A decrease in barometric pressure causes an increase in volume, according to the laws of gases, of a large body of gas contained in the quartzite and resting on water at an unknown depth. As the gas body is confined on the sides and bottom, the increase in volume tends to raise the level of the gas. However, as field observations show heavy inflows only from shattered and fissured zones, it is concluded that the rate of penetration of gas into the porous quartzite is so much slower than the rate of increase in volume that the excess is pushed up through the shattered more or less open zones that occur in the quartzite. Under certain conditions of rate and amount of decrease of barometric pressure, the gas rises to the levels of mine openings, and an inflow of gas results. The upward travel of the gas is limited by the practically impervious shale overlying the quartzite, except where local fissures in the shale provide access to connected fissure zones in the overlying limestones. As the barometric pressure rises, the increase in pressure causes a contraction of the gas body and the level of the gas in the shattered zones recedes.

Rock temperatures of 80 to 110 deg. in gas-producing horizons 900 to 1,600 ft. below the surface were obtained, and air temperatures in several dead ends indicated possible rock temperatures as high as 120 deg. Rock temperatures appear to be dependent mainly on locality, to a less extent on geologic formation, and practically independent of depth, which in other districts is usually the governing feature. Unfortunately, the highest rock temperatures are accompanied, as a rule, by the lowest relative humidities, but efficient mechanical ventilation of all working places is necessary to provide moderately comfortable and in some cases even bearable working conditions.

The necessity for good air motion at working places and the relatively slow rate of gas inflow indicate that the best remedy is dilution of the gas inflow with large volumes of air by mechanical ventilation. To make the remedy effective under all circumstances, both for efficiency and safety, two independent sources of power for ventilating apparatus should be used.

To Promote Use of American Graphite

A co-operative agreement between the U. S. Bureau of Mines and the Graphite Producers' Association for an investigation as to the possibilities of a more extended use of American graphite is being considered.

Mule Haulage in Metal Mines

Under Favorable Conditions the Use of Mules for Underground Tramming Has Proved Economical—Limitations Include Short Tramming Distances, Reasonable Grades, and Limited Life of the Mine—Treatment of Animals—Maintenance and Operating Costs

BY W. F. BOERICKE

Written for *Engineering and Mining Journal*

IN CONSIDERING the adoption of any underground tramming system, the following factors must be taken into account: Tonnage to be hoisted daily; distance from stopes or hoppers to shaft; grades and curves to be overcome, and life of the mine.

A system of haulage that may be suited for any one of these conditions may be totally unsuited for the others, and the system decided upon should be that which will show the least cost per ton of operation, taking into account the complete amortization of the capital expense involved when the mine is worked out. For instance, the stopes may be over 2,000 ft. from the shaft, the tonnage desired over 600 tons per day, the grades not heavy, and the track in fair order. These conditions call for mechanical haulage. If the life of the mine is limited, it will probably be better to operate under the higher cost that the use of mules entails, rather than to expend a large amount of money in an expensive locomotive, heavier rails, and an improved roadbed, with attendant disorganization of the mine while the changes are being made, all of which capital expenditure must be amortized before the ore is exhausted.

Hand tramming is suitable only for mines of small output, with tramming distances comparatively short—not over 400 ft. Small cars, of $\frac{1}{2}$ - or $\frac{3}{4}$ -ton capacity, are required, as a ton load is too heavy for one man to push unless favored by a grade. The advantage of hand tramming over any other system is the complete absence of any capital expense. With any attempt to increase tonnage, or an increase in tramming distance, the cost of hand tramming becomes prohibitive. Such methods may be used to advantage in cleaning up a small bunch of rich ore, or robbing pillars, where the handling expense is only a small percentage of the total value.

SOME DISADVANTAGES OF MECHANICAL HAULAGE

Mechanical haulage, where conditions are favorable, will show the minimum operating cost. But the tonnage handled must be a maximum and the distance from shaft to stopes must be long enough to show economy in time of hauling, after making all allowance for delay in making up the long trains at shaft and side tracks. Grades, wherever practicable, must be eliminated, or at least eased off as much as possible; curves must be cut out or widened. Unless the track and roadbed are in good condition, the locomotive will promptly search out every weak place and "jump" the track, necessitating vexatious delays in getting it back again, while the work of the mine is held up, and the millman enters on his report "No Dirt." Though it is true that a number of men can be eliminated from underground or put to other work when the change is made to mechanical haulage, the replacement of the engine driver, who may be incapacitated any time from accident or sickness, becomes a serious problem. It is usually an easy matter to put on an extra mule driver

or trammer, but a good motor man cannot be picked up on an hour's notice. It is not just a question of operating the engine, although that in itself requires the work of a skilled man. Because of his daily experience over the run, he knows where to put on speed for a grade, where to ease up for a curve, and a knowledge of these matters is most important in the operation of a long train. Furthermore, unless an extra engine is on hand, a breakdown in a vital part of the engine usually entails a shutdown in the mill, so that with a mine running on a close margin of profit, the loss of a day's time with all overhead expenses going on as usual will often completely eliminate the expected economy of the new haulage system for a considerable period.

LIMITATIONS OF MULE HAULAGE

Mule haulage is particularly adapted for mines having the following conditions to meet: Open stopes with mining conducted all on one level; tramming distance over 400 ft. and less than 2,000 ft.; many grades, neither very long nor very steep; many curves, some of very sharp radius, and limited life of orebody, but assured for a reasonable period. These conditions are common to many mines, particularly in the zinc mines of Wisconsin and Missouri.

Good mules can be purchased for from \$100 to \$150 per head. If the roof is high, and there is an incline down which the mules can be taken underground, large mules should be given preference, for the working capacity of a mule weighing 1,100 lb. or 1,200 lb. is far more than that of one weighing 800 lb. It may often happen, however, that there is no incline and the hoisting shaft is small and without means for installing a special mule cage, or that the tramming must be done in low drifts. Small mules can be taken down the shaft without much trouble by suspending them in a special harness and hooking them under the cage or directly to the cable in bucket hoisting. With a careful hoistman, there is not much danger of accident.

CHARACTERISTICS OF MAUD

The mule is a much maligned animal. It will do an extraordinary amount of work during a shift's time, patiently and willingly, if given decent treatment and care. It quickly learns the tracks underground, and knows its route in the dark. Reins can be dispensed with after a few days, and no guidance is necessary. A mule will feel its way along a shaky track with uncanny accuracy, and the only light needed is the cap light of the driver. Electric lights along the track are of course an excellent investment in every way, and by their aid a much better speed can be maintained and the track and roadbed kept in better condition. A mule is in no sense a stupid animal, despite frenzied testimony of the skimmers to the contrary. Unlike a horse, it is not nervous, and frequent blasting and boulder shooting do not disturb it in the least.

The number of mules required underground will de-

pend on the tonnage and the distance from the shaft. Cars must be taken away from the shovelers as fast as loaded, whether they work on contract or day's pay. If cars are trammed by hand from the stopes to the central gathering station and there made up in trains for the shaft, there must be a sufficient number of mules to get the loads to the shaft and the cars returned without anyone waiting for empties.

The time required by the average shoveler to fill a 16-cu.ft. car ($\frac{3}{4}$ ton) where there is plenty of dirt and not much time needed for breaking up boulders is from six to ten minutes. Trimming to the siding or layby and returning with the empty will take five minutes more. This is at the rate of from four to six cars per hour. Better records will be made by experienced shovelers.

If the shoveling time is fifteen minutes per car, this establishes a maximum for the tramping time. When the haul to the shaft is short, one mule can serve several shovelers without doubling up on the cars. As the distance increases more cars must be provided and two or more cars will be pulled at one time. With trams exceeding 1,500 ft. it is generally necessary to put in a relay station and an extra set of mules to pull to the shaft. The gathering mules will bring the cars singly or in pairs to the station, where they are made up into the longest trains possible and are then taken by heavier animals to the shaft. This means buying about one-third more cars for the mine.

Fifteen miles is the maximum distance that should be expected of a mule working every shift underground. As this is the total distance of the round trips, the mule will pull loads 7.5 miles. Considering a 1,000-ft. haul to the shaft, the number of trips will be about forty. As the distance increases the number of possible trips decreases unless the animal is run to exhaustion. It is therefore better to get the track into such condition that a number of cars can be taken per trip, and the mileage thus decreased.

GOOD TRACK CONDITIONS DESIRABLE

Mules should not travel faster than five miles per hour for good results, and if long trains of seven or eight cars are used a speed of three miles per hour is enough. Aside from the danger of accidents and derailments that may occur if greater speed is attained, a faster rate than this will wear out the animal quickly and cut down its vitality and tractive effort. It is better to get the track in good condition, improve the oiling of the cars, make an effort to cut down grades and curves, and then put one or two extra cars on the train and cut down the speed, than to make more trips with fewer cars. Mule drivers, especially the younger men, delight in taking chances by racing mules, and a kind Providence apparently protects them from low roof, weak track, and derailments; but it is poor practice and should be discouraged.

A mule needs a 6-ft. clearance between track and roof to work comfortably, and this should be exceeded if possible for large animals. Smaller mules can get along in lower headings, and in some mines, where the clearance was less, spaces have been hollowed out between the ties for them to walk in.

Wherever there is an incline to the mine it is usually advantageous to bring the mules out at the end of each shift. They quickly learn the routine, require little urging to go underground, and still less to come out. Where this is impossible or impracticable, underground

stables must be built. These in all cases must be dry. If possible they should be on an upper level or stope, with plenty of ventilation, but not exposed to draft. A sloping floor will aid drainage with individual stalls. The stable should be electrically lighted and kept as clean as possible. A mule tender, whose sole job is to look after the mules, curry, shoe, and feed them, watch their hoofs, and, in case of injury, do a little veterinary work, is worth his pay aside from any humanitarian reasons. If the job is left to the individual mule skinner the animals are likely to be neglected.

Mules should be well fed. Careful figures were kept at a large mine working fourteen mules, to determine the amount and cost of feed for the animals. These mules were all in constant service and averaged about eleven miles per shift, pulling two 16-cu.ft. cars for an average tram of 1,000 ft. The feed needed per month averaged as follows:

Feed	Amount	Per Mule
Hay, tons	3.1	0.22
Oats, bushels	69.0	5.00
Corn, bushels	28.5	2.00

The above figures are rather low in comparison with another mine where twenty-two mules were used on an average tram of 1,450 ft. with layby stations and numerous grades and curves. These were as follows:

Feed	Amount for Year	Per Mule per Month
Hay, tons	83.76	0.31
Oats, bushels	2,424	9.10
Corn, bushels	752	3.00

The cost of feeding will vary with the market price of produce. With hay at \$15 per ton, oats at 35c. per bushel, and corn at 60c. per bushel, the cost per mule per day will be about 26c. To this must be added the wages of the mule tender, or a fair allowance of time paid for the attendance, regardless of whether there is an extra man or not. Twenty-five cents per day per mule is not unreasonable for four or five mules, where each driver takes care of his own animal, but when more than eight mules are employed it is better to have one man take care of the entire stable. If the right man is selected he can take care of a large number of animals and the cost of feeding can then be cut to 10c. or 15c.

Rats cause considerable waste around a stable. No more feed should ever be taken underground than is necessary, as the dampness affects it and the rats raise havoc with the grain.

Not the least value of a mule is his ability to exceed his ordinary tractive effort greatly over a short distance. For a short pull, the mule can make some astonishingly steep grades. Regardless of his usefulness on a long haul, therefore, the mule has an undisputed place in gathering cars for the trains and in clean-up work where tracks are rough and only intended for temporary use, the curves sharp, and the grades steep. The following figures, from actual practice, show what can be done. The cars used were 16.5 cu.ft.

Length of Grade, Ft.	Per Cent of Grade	Number of Cars Pulled by One Mule
55	6.6	2
35	15.0	1
88	8.7	2
34	12.8	1
31	14.3	1
130	7.0	1 or 2

The ideal grade for haulage is usually taken as between 0.5 and 1 per cent, the gradient of equal traction, where the power needed to pull back the empties is just equal to that required to overcome the friction of the

loads coming down hill. In actual mine work, unless on long drifts that are carefully surveyed and driven on line, such an ideal condition is rarely encountered. Tracks will run up and down with variations in the floor of the orebody. Care in selecting the trackway and sometimes changing the line or cutting out a high spot will be amply repaid in added efficiency of the mules.

MULE HAULAGE EXPENSE

The cost of mule haulage is made up of the following items: Cost of feeding; cost of attendance; wages of mule drivers, and depreciation.

The cost of feeding has already been given as 25c. per day, but it varies somewhat with the market price of supplies, although it is nearly a constant charge, whether the mules are worked or not. The cost of attendance can be covered by 25c. per day, and this will also pay for such supplies as are needed, shoes, nails, harness, and other requirements. Wages of mule drivers are about \$3 per day on the present scale. They are generally employed on straight time, not contract.

A mule with good care and feed will thrive underground. Barring accidents, there is no reason why mules should not remain below six years or longer, and then, if in good health, they have a considerable value for farm work on the surface. If a mule costs \$150 and is worth \$50 when taken out, over a six-year period a depreciation figure of \$16 per year, or 5c. per day, is enough. The total expense of mule and driver per day is, therefore, \$3.55.

The ton mileage obtained will vary with the conditions in the mine, and I am quoting some typical instances. In all cases a 16.5-cu.ft. mine car, weighing 800 lb. empty, with solid body, loose wheels, plain bearings, lubricated with grease through slot holes bored in the hubs, was used. Track gage was 22 in., with 16-lb. rail.

At mine No. 1, the average tram was 1,450 ft. Two cars were hauled per mule. The grades were against the load, the worst pull being 300 ft. of 3 per cent grade. The curves were sharp. No brakes were used on empties; the drivers held back the cars by placing their hand on the mule's rump. The mules were worked hard on account of the long tram, and obliged to travel at a run on the return trip. Data were as follows:

Average tons trammed, per shift	180
Average tram distance, feet	1,450
Number of mules	4
Mineral tons per mule	45
Miles traveled per mule	12
Ton-miles per mule	12
Cost per ton, cents	7.9
Cost per ton-mile, cents	30

At mine No. 2 the average tram was 2,613 ft. This was covered by using a relay of big mules that picked up the loads at the layby station 1,000 ft. from the shaft and pulled them there in eight-car trains. The gathering mules pulled two cars over fair tracks with less than 1 per cent grade against the loads. On account of the long tram they were worked hard and were worn out soon. This mine was soon afterward changed over to gasoline haulage. The comparative figures are:

Average tons trammed, per shift	288
Average tram distance, feet	2,613
Number of mules	9
Mineral tons per mule	32
Miles covered per mule	15.8
Ton-miles per mule	15.8
Cost per ton, cents	10.9
Cost per ton-mile, cents	22.4

At mine No. 3 conditions were better. The average tram was 2,000 ft. over a level grade with curves well

proportioned. Large mules were used, taking trains of six cars to the shaft. These traveled at slow speed, about 3½ miles per hour. The figures follow:

Average tons trammed, per shift	400
Average tram distance, feet	2,006
Number of mules	3
Miles traveled per mule	8.5
Ton-miles per mule	26
Mineral tons per mule	64
Cost per ton, cents	5.2
Cost per ton-mile, cents	14.0

At mine No. 4 conditions were excellent for mule haulage. Cars were taken from the gathering point, 1,483 ft. from the shaft, by two mules per shift, in trains of four cars. The track from the layby station to the shaft dropped uniformly 1½ per cent in favor of the loads on a straightaway run. The track was in good condition and was electric lighted. The cars ran down the grade by their own weight after being started, and the mules went at an easy trot, about five miles per hour, which did not exhaust them. They could easily have taken down a much longer train, but four empties were their limit on the return trip. Brakes were not needed except at the end of the run, when a wheel of the last car was spragged. Comparative data follow:

Average tons trammed, per shift	256
Tram distance, feet	1,483
Number of mules	2
Mineral tons per mule	128
Miles traveled per mule	18.1
Ton-miles per mule	36.3
Cost per ton, cents	2.8
Cost per ton-mile, cents	10.1

The noteworthy mileage made by these mules was no doubt due to the down grade with the loads, which eliminated all hard pulling.

Practical points then seem to be as follows: Use the largest-size mule that can be worked in the drifts; keep track and roadbed in the best possible condition, with the grade, if any, in favor of the loads; load the mule to his capacity (if the grade is about 1 per cent this will be determined by the number of empties he can pull back), and maintain a constant, steady speed—frequent spurts may satisfy the sporting proclivities of the driver but they detract from the mule's efficiency.

It is frequently the case, as in mines No. 1 and No. 2, that the cost per ton may go up while the cost per ton-mile goes down. The same number of mules may take a less number of cars but cover a much longer distance, thus decreasing the latter but increasing the cost per ton, and, until both figures are known, criticism cannot be intelligently made. Knowing the time required for a round trip to the shaft from the stopes, plus delays in coupling and uncoupling cars at the stations, a close guess is possible at the number of mules needed to take care of any tonnage from any distance. For instance, in considering a tramping distance of 1,000 ft., with a tonnage of 300 required, four-car trains are possible, and the estimated time for a round trip, including delays, is seventeen minutes. Twenty-eight trips per eight-hour shift are then possible, mineral tons per mule will be 112, and three mules will be required. The cost per ton will be 3.1c., and the cost per ton-mile, 16.7c.

It is rare that the tramping problem can be handled by so simple a calculation as this. Conditions are constantly changing, and, in an effort to speed up production, a demand for more cars is made, or more speed by the trammers, and the ground boss has a new problem on his hands. A double track is always desirable, and an extra mule will earn his keep many times over in helping out in a pinch.

History of Side-Charging of Reverberatory Furnaces

Recent Patent Litigation in San Francisco Brings Up Interesting Points—Practice Now Used in All Large American Copper Smelters Was Developed in Operating Plants by Smeltersmen

EDITORIAL STUDY

RECENTLY LITIGATION has arisen over the method now commonly used for fettling and side-feeding reverberatory copper-smelting furnaces. We have made a more or less extended study of the art of reverberatory smelting of copper ores, and from various sources have summarized the following:

Fettling of the reverberatory smelting furnace is a necessity and has been accomplished in the smaller furnaces by claying the corrosion groove which forms at the matte and slag lines. This was formerly done by driving balls made from clay and siliceous material into the groove with a plugging iron. Peters, in his 1899 edition of "Modern Copper Smelting," on p. 453, gives, among other reasons for waste of time in reverberatory practice, the following: Slow charging through the side doors instead of hoppers—too frequent fettling. In his further comment, he states that the groove in the side lining should be rammed full of a mixture of 80 per cent quartz (hazel-nut size) and 20 per cent raw fireclay. "This should be thoroughly pugged together and made into large balls for use before the furnace doors are taken down. Two sets of men clay the furnace simultaneously from the two opposite sides—after this groove is once thoroughly filled, it can be kept from too rapid cutting by frequently throwing a heavy ridge of siliceous ore against it and all around the edges of the hearth."

In his "Principles of Copper Smelting" (1907), Peters said, "Modern practice has so amended this [frequent fettling] that the fettling is done only once a month or thereabouts. The practice of running the furnace with a more siliceous slag, 42 to 47 per cent silica . . . has little tendency to cut into the lining of the hearth and walls."

PETERS' RULE OF PRACTICE

In "Practice of Copper Smelting" (1911), Peters states (p. 323): "The chief agent in their elimination [undercutting of the side walls and hearth near their junction with the sand hearth] has been the practice of keeping the hearth full of matte so that it is completely protected from contact with the bases of the charge; further, the constructing and maintaining of a broad, heavy border of siliceous material, usually siliceous ores, which protects the contact-horizon completely from any attack of the slag." Peters shows a cross-section of the Cananea reverberatory, with side hoppers and openings in the arch contiguous to the side walls. He states that the feeding of fettling material through these openings intermittently was successful at Cananea, but that the same process tried experimentally at Garfield was not found advantageous, owing to the formation of extensive siliceous "floaters," which caused delay and the use of extra limestone to dissolve them.

In October, 1912, E. P. Mathewson presented a paper on the "Development of the Reverberatory Furnace for Smelting Copper Ores," before the American Institute of Mining Engineers (*Trans.*, Vol. 44, p. 781). In this

paper he states that charging hoppers above the reverberatory were in common use in 1848. Fettling was done once a month, but he does not mention side fettling. He shows a cross-section of the Cananea reverberatory with fettling openings in the arch contiguous to the side walls. On three other furnaces used at different plants no openings of this kind are shown. All of the reverberatories are shown with side doors.

THE ANACONDA METHOD

In the large copper-smelting reverberatories at Anaconda, according to H. O. Hofman, "Metallurgy of Copper" (1914, p. 284), the matte is first tapped out and "Two or three doors are opened on each side near the fire-bridge and about 20 tons of self-baking sand (SiO_2 , 95 per cent) thrown in during the operation" [fettling].

L. V. Bender presented a paper on Feb. 15, 1915, before the American Institute of Mining Engineers (*Trans.*, Vol. 51, p. 743) in which he described the coal-dust-fired reverberatories at the Washoe Reduction Works, Anaconda, Mont. In the furnace described, he states that there were no side doors to this furnace "as it was thought that with the arrangements for feeding, no 'fettling' or 'claying' would be required." The charging was done in either side of the furnace from longitudinal hoppers, extending a distance of 74 ft. from the back end of the furnace (124 x 21 ft.). Leading from the hoppers into the furnace were 6-in. pipes, spaced 19½ in. apart, through which the charge was intermittently dropped. The charge was kept well above the slag line at all times; in this way the side walls were protected and no fettling was required on this portion of the furnace, but it was necessary on the remaining portion. In a larger furnace at that time being planned he stated that the side feeding would be extended the full length of the furnace. A cross-section of this furnace is shown in the paper.

In February, 1915, David H. Browne described the furnaces of the Canadian Copper Co. (*Trans.*, A. I. M. E., Vol. 51, p. 752). He states that during 1913 the reverberatories were modified to make use of the Cananea system of side fettling. "Long and shallow pockets were provided along the side walls, and through holes in the roof, green-ore fines were fed to protect the sides."

DEVELOPMENT OF SIDE FEEDING IN ARIZONA

In September, 1916, F. N. Flynn presented a paper on "Smelting at the Arizona Copper Co.'s Works" before the Institute (*Trans.*, Vol. 55, p. 805). In this he states that the 100 x 22-ft. reverberatories were constructed with 6-in. holes, spaced at 24-in. centers, in the roof along the side walls and across the back, to allow the fettling material to be piped into the furnaces from trough-shaped bins. Seventy-five per cent of the total solid charge was introduced from hoppers at the end of the furnace and twenty-five per cent from the

side hoppers. For fettling purposes, ores and by-products were crushed to 2½-in. size. "Prior to July, 1914, the height of fettling was carried not to exceed 6 in. above the slag line. This height was gradually increased until October, 1914, when the practice of fettling to the holes in the roof was begun and later successfully adopted after the size of fettling material was increased from ¾ in. to the present 2½ in. size. The coarse size stands better. It reposes at an angle of 45 deg. above and 45 to 60 deg. below the slag line."

Under the same date (September, 1916) A. G. McGregor describes the International Smelting Co.'s reverberatories at Miami (*Trans.*, Vol. 55, p. 781). Mr. McGregor states: "The method of charging, instead of fettling only, along the side walls of reverberatory furnaces, now so successfully used by the Canadian Copper Co. and the Anaconda Copper Mining Co., was developed after the construction of this plant was well along. The plant was laid out for charge tracks running at right angles to the furnaces near the firing end. In order to distribute the charge along the sides of the furnaces, charge hoppers were located under the charge tracks directly over the side walls of the furnaces. Drag-chain conveyors were installed, one over each side of the furnace, which received the charge from the charge hoppers. Under these conveyors, approximately every 30 in., suitable down-spouts with gates were provided so that the charge may be distributed along the side walls of the furnaces throughout their length."

FETTLING ESSENTIALS

The two essentials for fettling are highly siliceous material and the depositing of this material along the walls at the corrosion groove. There has been no change in principle since Peters described the method in 1899. Side-wall protection from corrosion has always been accomplished by either the careful ramming of siliceous material, bonded by clay to enable it to hold together, or by simply shoveling enough siliceous material to fill the groove. Necessarily, the thrown material assumed an angle of repose, and a sufficient surplus was necessary to bring the top edge of the fettling material well above the top of the corrosion line.

The substitution of highly siliceous ore for highly siliceous material was a natural development, and necessity in some cases compelled metallurgists to use ore instead of barren material. The introduction of the siliceous material through holes in the reverberatory arch contiguous to the side walls was undoubtedly an improvement, as it enabled the banks of siliceous material along the side walls to be added to at any time without interfering to so great an extent with the operation of the furnace as by the method of shoveling through the side doors. Side doors became unnecessary, and coarse siliceous ore was substituted for the more efficient siliceous material because it was more economical to do so in most instances. Thus the novelty concerned itself with the manner of depositing the material for fettling, and not with the protection of the side walls. The change from feeding the charge in two parts, the greater part through the usual charge hoppers and the remainder on the sides, to feeding the entire charge through the side hoppers, was a gradual development in practice.

The first description of fettling through the arch of the reverberatory appeared in a paper by L. D. Ricketts, published in the *Transactions of the Institution of Mining and Metallurgy*, Vol. XIX, 1909-10, p. 160, in which

Mr. Ricketts states, "Fig. 5 illustrates the method of charging the furnace to protect the side walls from corrosion at the matte line. This method originated in Cananea, I think, and was suggested by Mr. Gmahling and installed by Mr. Shelby. The wide walls are built with a slight batter, as shown in the sketch, a 5 x 5-in. aperture is left in the arch close to the side walls on either side, and these apertures are 18 in. between centers for the entire length of the furnace. A hopper on either side of the furnace travels on a rail, so that the charge of fine siliceous ores, previously wetted down, may be brought over one of the holes in question." This paper was subsequently published in the *Engineering and Mining Journal*, Vol. 89, p. 317, and in the *Mining World*, Vol. 31, p. 1,116.

On March 14, 1914, the *Engineering and Mining Journal* (Vol. 97, p. 583) in an editorial, referred to fettling through the roof of the reverberatory. This elicited a letter from Henry L. Charles, who was then at La Fundicion, Peru. In this letter, published on Oct. 31, 1914, (written on Aug. 18, 1914,) (Vol. 98, p. 798), Mr. Charles claims to have been the first to discover the idea of side fettling with ore and calcines to prevent corrosion of the side walls of the reverberatory, and refers to his patent No. 871,477. In the *Engineering and Mining Journal* of Jan. 23, 1915, (Vol. 99, p. 206) L. D. Ricketts, in a letter under date of Nov. 13, 1914, said: "The first fettling through the roof of a reverberatory furnace of large size was planned and put in operation by Charles F. Shelby and William Gmahling, in the winter of 1906, at Cananea, Sonora, Mexico. Mr. Gmahling thrust holes along the side walls and the bridge, and experiments were tried in fettling the furnace through these holes. The device proved successful, and when the furnace was closed down in December, 1906, and given a general overhauling, fettling holes were made in the arch at about 2½-ft. intervals along both walls and over the bridge, and when the furnace was started immediately thereafter, and prior to March, 1907, the method of fettling was proved to be a success and has been followed ever since."

Henry L. Charles replied to Mr. Ricketts' letter in the *Engineering and Mining Journal* of Oct. 16, 1915 (Vol. 100, p. 648), by referring to his work in Butte and Salt Lake in 1905, 1906, and 1907. He stated that in the spring of 1905, at Butte, Mont., while in charge of the Montana Ore Purchasing Works, he drew his first plans of a reverberatory furnace with side hoppers to feed siliceous ore for fettling and smelting purposes. Subsequently, in the spring of 1906, he started to remodel the reverberatory furnace at the Bingham Consolidated plant at Salt Lake with the idea of incorporating his feeding and fettling scheme. He secured the services of W. N. Tanner at that time in preparing plans and working out the unfinished mechanical devices. Mr. Charles' statement, so far as we are aware, stands uncontroverted, and appears to be the last word in the rather meager history of this important improvement in copper reverberatory design and practice. Apparently Mr. Charles and Charles F. Shelby and William Gmahling were working at about the same time along similar lines. In point of time Mr. Charles, according to his statement, anticipated Cananea. All three of these men were practical smeltermen and developed their ideas in operating plants.

The recent lawsuit in San Francisco in which the claim was made that the use of fettling and ore feeding through the arch of the reverberatory at the side walls

of the furnace was an infringement of certain patent rights granted to George C. Carson brings about an interesting situation. Mr. Carson won his suit against the Afterthought Mining Co., and was awarded nominal damages of \$1. Application for patent was made by Mr. Carson on Jan. 15, 1907, and a patent was finally granted to him on Aug. 10, 1915, (No. 1,149,495), in which he claimed: "In a metallurgical furnace having receptacles arranged above the roof thereof, passages from said receptacles leading to said furnaces arranged in such a manner that the material in said receptacles passes out into said furnace by gravity and forms the lining thereof." The drawing in the patent specification shows an arrangement similar, in principle at least, to the ordinary fettling arrangement, but also indicates that the inventor intended the bottom or hearth of the reverberatory to be renewed by the accession of material from the side hoppers. Under date of April 29, 1919, (No. 1,302,307, applied for June 26, 1915), Mr. Carson was allowed three claims as follows:

"1. In a furnace roof for open-hearth and reverberatory furnaces, having charging ports around the outer edges thereof; said ports being made of metal cooling blocks that serve the purposes of protecting said roofs from the scorification of materials fed through said ports, and stresses caused by varying temperatures within said furnaces.

"2. The method of protecting the walls of an open-hearth or reverberatory furnace which consists in feeding the ores or fettling materials into the furnace chamber near the upper part thereof, and in causing the same to form a sloping embankment resting upon the floor of the furnace chamber and along the walls within the chamber between the bath and walls.

"3. In an open-hearth or reverberatory furnace, a floor, walls extending upwardly from the floor, and feeding ports leading into the upper part of the furnace chamber and being so located that the ores or fettling materials entering therethrough may have unrestricted vertical movement downwardly to the said floor near the walls and may form sloping embankments against the walls to protect the latter from the heat and corrosive action of the metal bath."

On Nov. 29, 1907, (patent No. 871,477, applied for March 26, 1907), Henry L. Charles was granted a patent which covered substantially fettling through the arch adjacent to the side walls. This patent, we are informed, was sold to the American Smelting & Refining Co. On Aug. 2, 1910, (No. 966,285), a patent was granted to F. W. Winkler, which describes, as a part of reverberatory furnace construction, side feeding of ore through the arch adjacent to the side walls, with the object of protecting side walls.

BRITISH PATENT OF 1867 MAY ALSO APPLY

An additional element of interest is afforded by the fact that Charles William Siemens was granted a British patent on March 20, 1867, (A.D. 1866, Sept. 20, No. 2,413, provisional specification), that involves the idea of feeding ore through the arch of a reverberatory furnace in close proximity to the side walls. Quoting from the specification: "My invention further consists in the construction of furnaces by which the above-described process may be carried into effect, the same being modification of the regenerative gas furnaces described in the Specification to certain Letters Patent granted to myself, in conjunction with Frederick Siemens, on the 22d of January, 1861, No. 167, which improved form of furnace may also be used with advantage for the fusion and reduction of copper and other metallic ores. The arrangement of furnace which I prefer to employ for this purpose consists of an oblong

or polygonal firebrick chamber, two or more sides of which are formed as inclined surfaces, which chamber is closed in at top by means of a firebrick arch having openings, which may be provided with slides through which the ore is introduced on to the inclined surfaces."

Although the Siemens invention was primarily intended for steel furnaces of the open-hearth type, Siemens' statement shows that he believed that it was not restricted to steel making but might be used for the reduction of copper and other ores. A United States patent was taken out by Mr. Siemens on April 11, 1871 (No. 113,584).

The patent situation, involving as it does four American patents, excluding the older Siemens patent, is intricate. Although Mr. Carson's application for patent was first in point of time, Mr. Charles' patent was the first granted. Unless an applicant reveals to the art in a substantial manner the idea involved, there is no way by which this information can be obtained. Thus the copper smelters knew about the Charles patent in November, 1907, whereas the first Carson patent was revealed on Aug. 10, 1915, and the second on April 29, 1919. Before either of these dates, practice had advanced by slow stages until the side feeding of both charge and fettling material had become established.

George C. Carson, the patentee, had worked in refineries and subsequently became an assayer and reported on mines. According to his testimony at the trial he evolved the conception of the principle of his patent in 1902, but made no practical application of it, nor was it used by anyone. After applying for patent he tried to have the practice adopted by the Montana Ore Purchasing Co., but was unsuccessful. His efforts to interest other companies and individuals also failed.

The first patent was under consideration in the Patent Office from Jan. 15, 1907, to Aug. 10, 1915, or over eight years. According to our San Francisco correspondent's report in the *Engineering and Mining Journal*, Sept. 10, 1921, p. 247, the Carson application of Jan. 15, 1907, was referred back to Carson, as it covered three separate and distinct inventions. Mr. Carson cancelled his claims covering specific hearth structures and specific roof structures, and a patent was issued on Aug. 10, 1915. On June 26, 1915, Carson filed a second application in which he disclosed a furnace having two rows of holes arranged along the sides of the arch but without any hoppers being provided. A broad patent was issued on this application in 1919. Judge Van Fleet ruled during the trial that the application for the second patent was not a proper divisional application, and that, therefore, the date of such application could not be carried back to Jan. 15, 1907, but must be deemed to be June 26, 1915. If this ruling is sustained in subsequent suits, it would appear to invalidate the broader patent if it is not invalidated for other reasons.

The Afterthought case did not clear the situation, and it appears to us that only further action at law can establish the validity and scope of the patents involved. As far as can be ascertained from the testimony of Mr. Carson, he conceived the idea first, but was not able to get any one to try it in practice. Mr. Charles seemingly was the first to try the method on a practical scale, this being done at the plant of the Montana Ore Purchasing Co. at Butte. Some months later, apparently, Gmahling and Shelby, working independently of Charles, established the practice at the Cananea smelter, which seems to have been the first plant at which the method of feeding was made the permanent practice.

BY THE WAY

A Copper Shop

My attention was directed to a tiny advertisement in the paper I held. It said Ye Copper Shop—The Romance of Copper—East 44th St. The "romance of copper"! What could it be, I speculated. Then I picked up hat and coat and started out for an explanation. I turned off Fifth Avenue and soon found a modest shop. My attention was first attracted to the polished copper trim upon the plate-glass front and then to a bronze figure of a gnome that upheld a copper lantern bearing upon its translucent glass sides the sign "Ye Copper Shop." I entered the attractive room, mentally noting the bronze door handle and elaborate plate, my eye catching sight of the bronze hinges at the same time. The room was like a drawing room. Red-brown rugs, mahogany tables, and comfortable brown wicker chairs were tastefully distributed about. On the right was a beaten-copper jardinière, out of which grew an exuberant fern. On the left was the bronze statue of a miner. Just beyond was a copper-bound glass showcase, in which I noted many extraordinary specimens of copper minerals, native copper, azurite, malachite, chrysocolla, and others. Then my eye caught sight of the walls of the room. Some artist of more than ordinary ability had spread the story of the copper mining districts in a series of drawings which made the room appear to stretch out in all directions. Here was the ocatilla of Arizona in the foreground and a great smelting plant in the background; next a bit of sage brush, and beyond that the slashed and terraced hills representing a great open-pit copper mine. Other well-known copper mining centers were depicted and then a splendid series showing the different stages in the reducing of the ores.

I was entranced. I retraced my steps and thoughtfully looked each picture over again. Here was an industrial epic in colors, I said half aloud. Then I stepped past a portière draped with copper-colored hangings and into an alcove. On the one hand was a slim pedestal of wrought copper, and surmounting it a tiny bronze, the "Flower Girl." Its outstretched hands appealed to me. Suddenly over me came the desire to possess. I wanted that statuette. An attendant had noiselessly appeared at my side. Without taking my eyes from the little bronze, I laconically and perhaps pessimistically said, How much? Ten, he said. Mine, I said, reaching for my purse. Then he left and reappeared in an instant, handing me a package in exchange for the bill. At the same time, he said: "The Copper Shop is the idea of a skilled artist who delighted to work in copper. He believed that if quantity production could be applied to the more highly artistic work of gifted sculptors, the selling cost could be made low enough to be within reach of many who appreciated art but whose desire for possession was repressed by their inability to purchase. The little bronze you purchased under ordinary conditions would have cost you at least six times the price you paid."

With a great feeling of satisfaction I clasped the package in both hands. I turned. My eyes were delighted by a ruby red copper bowl which reposed in

gorgeous splendor upon a small table. How much? I asked again. Two-fifty, he said. Mine, I said. With my purchasing power for the moment satisfied, I went from alcove to alcove. In each there was some rare object of art made from copper or bronze. I wanted them all, but, I reflected, I can come again. In the last alcove was an exhibit of brass, bronze, and copper building hardware and opposite many other architectural and decorative uses of copper and brass. I was looking them over carefully reflecting: So this is the romance of copper—when suddenly everything faded away and I found myself looking at the metal price page of *Engineering and Mining Journal*. "Some dream," I said to myself as I noted the copper price, 13c. per lb. "Well, I must have paid a royal per pound cost for that copper junk I bought," as I shook myself and rubbed my eyes.

The Renaming Contest

Replies are beginning to pour in from contestants for the prize offered for making the best suggestion as to a more suitable name for Mrs. H. P. Whitney's creation which she has named "The Engineer." The figure referred to, that of a man crouching over a shovel, is shown on page 777 of the issue of Nov. 12. L. P. Kerruish, of Sullivan, Mo., says that it looks more like a prospector, and states that he has done a great deal of prospecting. P. Kelly, of Butte, thinks they mixed the babies at the christening, so to speak, and that the figure represents a mule skinner clearing the track after a spill, cussing profanely the while. Izzy Solowski, a dealer in secondary metals, of Pearl St., New York, thinks that it's all a fake—that it isn't an engineer at all. "Take it from me," said Izzy, when he called, "more should it be a statue of this here feller, Henry Ford, digging the boys out of the trenches by Christmas." Izzy's opinion will not be considered, however, for we know he is prejudiced against Mr. Ford.

In the near future we shall run a photograph of the prize, a box of Chiclets, to arouse a keener interest in the contest. Eleven weeks more to go! It is urged that answers be sent in as early as possible, so that the mails may not be congested around the holidays.

Introducing Charles Sharp

The days of the burro are gone, but Charles Sharp, of Hanford, Cal., is now with us, so let gloom chase itself and joy be unconfined. The orthodox way of discovering bonanzas formerly was to take a donkey out and let him kick a few chunks off the landscape. Then, hopefully examining the freshly exposed rock surface, one was almost sure to find evidence that he was standing over a great storehouse of untold mineral wealth. But Charlie works differently. "For over forty-one years I have watched with interest the success and achievement of my old friend and co-worker, Luther Burbank, in the study, investigation, and mastery of the vegetable kingdom," says Mr. Sharp, "and for a like time my attention and study have been directed toward the mastering of the mineral kingdom." He has succeeded, and, apparently ruling with divine right, uses a divining rod of sorts as scepter. Germany is the only country that will patent mineral instruments, he says; hence he does not sell them. In this he is wrong, for a glance at the *Patent Gazette* shows that one can patent anything, no matter how sensible the idea. All success to Mr. Sharp! May he bring back the days of '49 to California.

Preparation of Fuller's Earth in Florida

Open-Pit Mining Is Followed by Crushing, Drying, and Grading Of the Mineral, Which Is Used Chiefly in Clarifying Vegetable And Mineral Oils—Finely Ground Grades Are the Most Expensive

BY STRAUSS L. LLOYD

Written for *Engineering and Mining Journal*

CLAYS having the properties of fuller's earth are widely distributed in the United States and are confined to no particular geological horizon, although the largest known deposits belong to the Cenozoic Age. By far the greater part of fuller's earth occurs as a distinctly stratified sedimentary deposit, from which an overburden must be removed in mining. In Arkansas, however, some fuller's earth is known which is of exceptional occurrence in that it is residual, having been formed in place from the disintegration of basaltic dikes.

The fuller's earth of southern Georgia, which is worked at Attapulgus, near the Florida line, represents a northward extension of Florida deposits. In central Georgia near Macon, however, is found a different type of fuller's earth, which, according to the Georgia Geological Survey, is the Claiborne formation of the Eocene. This mineral differs in some important respects from that of Florida, being used chiefly for the clarification of vegetable oils, whereas the Florida grade finds its chief application at present in the clarification of mineral oils. The fuller's earth of Arkansas is also used chiefly in clarifying vegetable oils. The fuller's earth of Colorado is said to be used in bleaching cottonseed oil, and that of Massachusetts is used in fulling woolen goods. The fuller's earth of California is used, according to the state mineralogist, as a clarifying agent in the refining of crude oil.

Florida is practically the chief producer of fuller's earth in the United States. The deposits being worked are those of Gadsden County, in northern Florida, and of Manatee County, in the southern part of the state, the mineral being found at both localities in the Alum Bluff formation of the Upper Oligocene.

All the sedimentary deposits of fuller's earth are mined by the open-pit method, the overburden being removed by steam shovel in the larger mines and by mule team and scraper or pick and shovel in the smaller ones. The depth of overburden that can profitably be removed is variable, depending, as it does, upon the thickness and quality of the fuller's earth stratum beneath and upon the character of the overburden itself. In the Florida mines the maximum overburden removed is from 12 to 14 ft. thick. This consists of sand, clay, and in some cases marl. The fuller's earth in these mines includes two strata, each from 6 to 10 ft. thick, and separated by a thin stratum of sandy or calcareous material. As a rule only the first stratum is worked. The fuller's earth itself is dug with pick and shovel, and loaded on to cars to be drawn to a plant, where it is broken up by passing through a crusher, thus facilitating both handling and drying. Although the material is usually taken directly to the crusher, in some instances it is placed in storage bins and air dried before being crushed.

The driers employed are for the most part rotary cylinders. Those in use in Florida are 40 to 60 ft. long and about 6 ft. in diameter. When in operation they rotate slowly, the mineral being moved along by

means of flanges attached to the inside of the cylinder. These cylinders are heated to a moderate temperature by petroleum burners, the heat being applied either at the end where the wet earth enters, or at the opposite end, from which the dry earth escapes. No precautions are necessary to prevent overheating in these plants, as the earth is used for filtering mineral oils, but when fuller's earth is to be used for edible oils precautions are taken to avoid overheating, as driving off the combined water is supposed to be injurious. To guard against overheating, especially constructed rotary cylinders are used, or the mineral is run into brick form and dried in tunnel driers through which hot air is forced. Although the English fuller's earth is injured by driving off the combined water, it has been found that some of the American earths bleach fully as well after the combined water is removed. It is probable that precautions against overheating for the use of edible oils are sometimes unnecessary.

In grinding, a variety of mills are in use. After grinding, the fuller's earth is bolted. That intended for refining petroleum is bolted to a definite size and placed on the market graded as 15 to 30 mesh, 30 to 60 mesh, and 60 to 80 mesh. The coarser sizes are in most demand, but as a rule no market exists for material passing a 90 mesh, which is not infrequently a total loss, being thrown into the dump. For edible oils it is said that fuller's earth should be ground to pass 100 mesh, but that there should not be an excess of exceedingly fine material, which would clog the pores of the coarser material and prevent successful filtering. The grades differ in the degree of fineness to which they can be successfully ground. Whereas English fuller's earth is ground to 120 mesh without having an excess of very fine particles, much of the American mineral cannot be ground finer than 100 mesh, for edible oils. It is true also that the mill employed must be adapted to the particular fuller's earth for which it is to be used.

Most fuller's earth imparts more or less taste to the edible oils, and formerly American grades were rejected by refiners of edible oils on this account, but methods are now known for removing taste and odor from the oil by blowing dry steam through the refined oil heated to a temperature above the boiling point of water. A serious difficulty in its use is the rapid oxidizing action which some fuller's earths have on edible oils. In milling practice, air is blown through the filter press to force out the oil remaining in the fuller's earth after treatment. With some of it, the oxidizing action is so rapid that the oil remaining in the mineral takes fire, or is liable to take fire. It is hoped that this difficulty will be overcome.

Fuller's earth used in clarifying mineral oils, which includes by far the greater part of that produced in America, is sold at the mine, ground, bolted and sacked for shipment. That used for refining vegetable oils brings a somewhat higher price, as more expense is incurred in handling the material, as it must be ground finer for vegetable than for mineral oils.

HANDY KNOWLEDGE

Neighborly Chats With the Foreman Tool Waste

BY DUNCAN MACGREGOR

Written for *Engineering and Mining Journal*

Yesterday, Jim, I went over our small-tool account with the storeroom clerk. He was telling me that the number of small tools served out to the mine had increased greatly over some of our good records of past years. You say that you have a pretty poor crew on the whole. Possibly, Jim, you haven't put your mind on this detail. I know that you are hard put to get tonnage and keep it moving, but perhaps some improvement is possible. Let me suggest that you get your notebook busy and first set down under each unit, muckers, stopermen, raise men, shaft men, timber men on drift and crosscut work, drillers on drift and crosscuts, pipe men, pump men, trammers, electricians and underground mechanics, the tool kit each is required to have for the efficient performance of his respective tasks. Take several trips through the mine at the end of the shift and note where tools are mostly placed. Then decide the best places for them and make each man or one in each gang responsible for placing the tools in these places. When you go your rounds get a report from each unit or responsible head as to whether the tool kit was complete and in its customary place. You will quickly spot the careless men, and by discussing the trouble with them in your tactful way, you can get them to come through in the course of a couple of shifts. No, I wouldn't post rules and regulations about this. Just let your shift bosses and your men know what you want. Make up your mind, however, on what you want first.

For tools that are most used, pick out places close to the working places, as you can't waste a man's time in going long distances to get his tools. The two important time losses, you know, are making ready and preparing to quit. Tools that are rarely required but that are needed on a level should be placed in a locker at the station, and tools that are needed for special jobs, as by electricians and mechanics, should go to and from the job with the worker. A tool room in the surface plant near the shaft is best for them, and the respective workers should be made responsible for their safe return. Give them also a proper bag in which to carry the necessary tools. A plumber or a carpenter seldom loses his own tools, for he will have his own box or a bag.

Have your tool nipper keep a close account of the drill steel required for each shift, and of the sizes and kinds for each level. Have a rack made at the station for all the sizes and kinds and have one-half or a full shift's supply always on hand. Have a special car designed for receiving the used steel and place one of these cars on each level where much steel is used. This will avoid rehandling of used steel at the station. After the men are hoisted, the steel car can be returned to the shop and reloaded with an equivalent amount and kind and returned to the level. Have a number of extra tools of the kind most used in stock at the station. Unfit and broken tools should be returned to the shaft station and replaced from this stock.

Have plenty of tools. It isn't the number that you have in stock or in circulation that counts, it's the waste of them that brings us nearer to the red. Tools dropped into waste fills or hidden back of timbers or dropped into chutes count on the cost sheets. A worn-out tool is the best evidence that its cost has been earned in service.

Air-Lift Calculations

BY GEORGE J. YOUNG

Written for *Engineering and Mining Journal*

S. F. Shaw, in his article on "Air Lifts for Mine Drainage," in *Engineering and Mining Journal* of June 5, 1920, p. 1,263, gives data for the computation of the proportions of air lifts. An approximate calculation can be more readily made by use of the following figures:

Air Pres- sure Lb. in Cu.Ft. per Sq.In. for 1Hp.(a)	Free Air per Min.	Gallons Water per Minute Lifted 100 Ft.; 1 Hp.:			
		Assumed Efficiency, Per Cent			
		40	35	30	25
110	6.19	15.82 (0.391)	13.85 (0.447)	11.86 (0.521)	9.89 (0.625)
100	6.48	15.82 (0.409)	13.85 (0.467)	11.86 (0.546)	9.89 (0.655)
90	6.82	15.82 (0.431)	13.85 (0.492)	11.86 (0.575)	9.89 (0.689)
80	7.26	15.82 (0.459)	13.85 (0.524)	11.86 (0.612)	9.89 (0.733)

(a) Theoretical amount of air for two-stage compression. Figures in parentheses are cubic feet free air per gallon per minute lifted 100 ft.

As efficiency increases with an increase in per cent of submergence, the lowest efficiency may be assumed for a submergence of 20 to 25 per cent; 30 per cent efficiency for 25 to 30 per cent submergence, and 35 per cent efficiency for 40 per cent submergence. It should be noted that for a given position of the air lift the submergence grows smaller as the level of the water falls. As a consequence, either the amount of compressed air must be increased or the capacity falls. A constant capacity cannot therefore be looked for under such conditions unless increased air is available or submergence is maintained at a constant figure by lowering the air lift as the water recedes. In this situation, the lift is also increasing, and this would lower capacity. By assuming a velocity of from 500 to 1,000 ft. per minute for the air-water mixture at the foot piece (volume of free air reduced to volume at working pressure), the cross-section of the lift pipe can be calculated. The first velocity may be used where the column is to be of uniform diameter and the second where the upper 20 per cent of the lift pipe is made of larger diameter than the lower. By calculating the expansion of the air as it rises in the lift column it will be observed that the relative expansion is greatest in the last 20 per cent of the lift. Hence the lift pipe may be made of uniform diameter for about 80 per cent of its length (including the submerged portion), and then increased within reasonable limits from this point to the point of discharge. The discharge velocities of air-water mixture noted by S. F. Shaw range from 2,300 ft. per minute at a maximum efficiency to over 5,000 ft. per minute when operating at maximum capacity.

The conditions attending the operation of the air lift for mine drainage are unlike those pertaining in air-lift pumping from wells, and as a consequence exact

methods for calculating portions of the air lift are not of special value. These conditions are: Submergence limited by obstructions in the shaft; a decreasing submergence and increasing lift as the water is lowered; the necessity for periodical lowering of the air lift as the water level recedes.

The maximum pressure upon the lift column is at the water level, as below this level the column is surrounded by water which exceeds in hydrostatic head the hydrostatic head of the air-water mixture in the column. The strength of the column, therefore, need be no greater than necessary to meet the internal pressure of the air-water mixture at lift height and water level corresponding to least submergence. A pipe calculated to withstand the maximum air pressure used will be more than sufficient to meet this condition. Where the lift column is suspended, the cross section of the metal and the connections should be calculated to withstand the weight of the pipe.

The Size of the Stick of Powder

Written for *Engineering and Mining Journal*

Miners get into the habit of using a certain number of sticks of powder for a hole of given depth. Sometimes more but seldom less is used, depending upon the miners' judgment. If the hole breaks well the miner is satisfied, although an excess of powder may be used. As the miners' operations are distributed over many working places, it is a difficult matter to effect economy in the use of explosives. By counting the sticks of powder, some miners have secured increased efficiency. This is a method to which the careful miner responds.

Nevertheless, a stick of powder is a stick of powder, whether it is "extra" dynamite or a 35 per cent powder. There are, however, about 100 $1\frac{1}{4}$ x 8 in. sticks or cartridges of extra dynamite and about 135 sticks of certain brands of ammonia dynamite to a 50-lb. box. The higher-grade explosive is much more expensive, and there are fewer sticks to the box, so that the cost per stick is relatively much greater.

Here is where the foreman can secure more economical use of powder. By using the lower-grade explosive where the nature of the rock or ore is such as not to require the higher-grade explosive, the same number of lower-priced sticks of powder will serve the purpose. It is possible by counting the sticks and using the lower-grade powder to affect a saving of 35 per cent in the weight of explosives used. In a year's time this economy results in a considerable sum.

Lower-grade powders averaging 150 sticks per 50-lb. box are also manufactured, and experimentation is worth while with these powders. If they will do the work, a still greater economy is possible.

Increasing Shaft Capacity

Written for *Engineering and Mining Journal*

In small mines with cage hoisting, a limit is speedily reached with respect to maximum hoisting capacity. The most effective way of increasing capacity is to increase the load hoisted at one time rather than to increase the speed of hoisting. This can be done by adding another deck to the cage.

Rope diameters must be suitable for the added load, and where the hoist is motor driven, it is necessary to change the motor to a larger one if the first motor was closely proportioned to the single-deck load and the

speed of hoisting. By the use of skips instead of cage hoisting, a still greater increase in capacity can be obtained without special changes in the hoisting engine.

Treatment Rates on Gold Ores

Rates recently charged by the Golden Cycle Mining & Reduction Co., of Colorado Springs, Col., for treating gold ores are given in the following table:

To and including \$4.50 per ton value,	\$2.00 per ton plus \$1 freight.
Over \$4.50 and including \$8 per ton value,	\$2.25 per ton plus \$1 freight.
Over 8.00 and including 10 per ton value,	4.00 per ton f.o.b. mill.
Over 10.00 and including 15 per ton value,	5.25 per ton f.o.b. mill.
Over 15.00 and including 20 per ton value,	6.25 per ton f.o.b. mill.
Over 20.00 and including 25 per ton value,	6.60 per ton f.o.b. mill.
Over 25.00 and including 30 per ton value,	6.90 per ton f.o.b. mill.
Over 30.00 and including 40 per ton value,	7.50 per ton f.o.b. mill.
Over 40.00 and including 100 per ton value,	8.60 per ton f.o.b. mill.
Over 100.00 value per ton.	5.50 plus freight (graduated).

A Problem

Did Columbus discover America, or was it some darker-hued explorer from Africa? This is a question propounded by the Copper and Brass Research Association. Bulletin No. 3, issued by the organization on Nov. 10, prints the following:

"Did African slaves roam the soil of West Virginia two centuries before Columbus discovered America?"

"That is a question puzzling coin collectors and ethnologists of that state.

"A Sparksburg boy has just dug a copper coin, approximately 600 years old, from a virgin vein of coal at a small mine near his home, finding it firmly embedded in the seam while helping his father at the mine.

"On one side of the coin is a crude picture of a human head and skull. On the other side is the date 1330, while there also appears a unique design similar to that found on a rare specimen of African postage stamp, thus indicating that the coins may have been of African origin.

"Now, this being the case, could African slaves have roamed what is now West Virginia six centuries ago? If so, how did they get here? Furthermore, could the seam of coal be formed geologically within that time?"

This is a problem to stagger the wits of Sherlock Holmes. What a large number of questions rolled into one, and each a baffling one at that! That copper should have lasted six hundred years is nothing. Roman coins of copper or bronze are common enough. We direct the attention of the research scientists of the Copper and Brass Association to the Book of Mormon, which may shed some light on the subject. In this volume is an account of an American civilization that antedated Columbus' time.

As to whether a seam of coal can be formed in 600 years, briquets can be made in ten minutes!

A Bad Name Lived Down

The reputation that smelters have "enjoyed" among their customers needs no telling. Whether it is justified is another matter. Likewise the custom assayer is often tarred with the same stick, in the minds of some, who hold that he throws their samples away without running them, but charges for them just the same. It is interesting to note that in parts of Latin America the proper Spanish equivalent of "custom mill" is *molino de trasquila*, by which no reflection on the millman's honesty is intended, though literally it means a mill where "shearing" is done, in the Wall Street sense. Years ago the term was undoubtedly used with its implication of dishonesty, but time has made it commonplace.

THE PETROLEUM INDUSTRY

Oil Prospects in Australia of Little Consequence

SPECIAL CORRESPONDENCE

The discovery of oil would be an event of great importance in the development of Australia, but apart from the oil shales being worked in a perfunctory fashion, it cannot truthfully be said that the prospects of discovering petroleum are alluring. There is quite a boom in the organization of oil companies, and a great deal of money is being spent in putting down bores, but there is no geologist of standing who will risk his reputation by recommending such work. One recent prospectus may be quoted as showing how little justification there is for the expenditure of money in this direction:

"This company is being formed to prospect for oil on Block 16 on the Roper River, Northern Territory, containing about 1,000 square miles, on information supplied to our Darwin agent who writes as follows:

"The information I received was that this man camped at a certain spot for about a week some four or five years ago, in a large swamp, and on pulling up some roots to put on the fire the roots blazed up as if they had been soaked in oil, and smelt of kerosene. He also said that the water about the swamp had an oily coating on the surface; also that when lying on the ground at night he could hear rumbling sounds underneath, similar to what might be heard in coal country or where there was gas escaping. He has marked the place out on the plan for me."

Considerable excitement was occasioned in Western Australia recently by sensational reports as to the discovery of oil sands at Bremer Bay, in the southwest of Western Australia. The government promptly sent a geologist to the locality. He took samples for analysis, with the result that no trace of petroleum was detected nor any trace of ozokerite or asphalt such as form surface indications of the existence of oil seepages. Oil has been found in the territory of Papua and also in New Zealand, but not in payable quantities.

The Commonwealth Oil Refineries, Ltd.,—in which the Anglo-Persian Oil Co. and the Commonwealth government are associated—is proceeding with the erection of reservoirs for the storage of crude oil in Sydney and Melbourne, and refineries probably will be installed next year. The crude oil will be imported from Persia until local sources are developed.

The Elk Hills Oil Field

At present there are two limited areas of development in the Elk Hills oil field of California, according to R. E. Collom, in *California Oil Fields*, one within and one not within Naval Petroleum Reserve No. 1. At the end of May, 1921, the area inside of Naval Petroleum Reserve No. 1 had produced 1,846,178 bbl. of oil and 3,228 bbl. of water since January, 1919. The area outside of Naval Petroleum Reserve No. 1 had produced 14,487,930 bbl. of oil and 3,713 bbl. of water since February, 1920.

The most notable observation from this record is the exceptionally small quantity of water produced in the

Elk Hills oil field. This is due principally to careful drilling and close co-operation between the responsible representatives of operating concerns and the Department of Petroleum and Gas.

The Elk Hills oil field was dormant for a period of ten years prior to January, 1919. The petroleum land withdrawals of 1909 and the subsequent creation of Naval Petroleum Reserve No. 1, along with litigation between the Federal Government and private concerns as to titles passed from the Government, prevented rapid development of the Elk Hills field such as that which took place in the Midway-Sunset area, and, to the public at large, its value as an oil field was indeterminate because of the conflicting claims advanced by contending litigants.

It is probable that the boundaries of Naval Petroleum Reserve No. 1 were originally laid out to cover, and therefore indicate, the estimated areal extent of the "geologic structure" of the Elk Hills field. The Naval Reserve covers an area of slightly over 38,000 acres. Recent developments have emphasized the hazard of attempting broadly to delineate the outer confines of a subterranean reservoir almost solely upon the evidence of surface geology.

The development by the Standard Oil Co. on the Hay lease¹ in Section 36, Township 30 south, Range 23 east, M. D. B. and M., in the years 1918 and 1919, showed that in addition to being an oil field of promise, the Elk Hills also contained highly productive gas reservoirs. The first well drilled by the Standard Oil Co. on the Hay lease was not an exceptional oil producer, yielding an initial production in January, 1919, of 255 bbl. of oil per day. The Hay lease is practically in the center of Naval Petroleum Reserve No. 1.

In February, 1920, the Standard Oil Co. brought in well No. "Tupman" 1 on Section 36, Township 30 south, Range 24 east, M. D. B. and M. This extended the area previously recognized as probably productive. The Tupman lease is just outside the easterly limits of Naval Petroleum Reserve No. 1.

During February, 1920, the discovery well produced at the rate of 5,200 bbl. of oil per day. Rapid development by the Pacific Oil Co., and the Standard Oil Co., of their holdings along the eastern boundary of Naval Petroleum Reserve No. 1, soon made the newer portion of the Elk Hills oil field the key factor in the relations between production and consumption of oil in California. Early in 1921, twenty-five wells in the easterly portion of the Elk Hills oil field were contributing 50,000 bbl. daily to the production of the state.

Americans Diligent in Quest for Oil In Foreign Fields

WASHINGTON CORRESPONDENCE

An intimation that American interests have not a keen appreciation of the need for securing foreign petroleum rights brought from H. C. Hoover, Secretary of Com-

¹McLaughlin, R. P.—"Natural Gas Development in the Elk Hills, Kern County, California," California State Mining Bureau, Fourth Annual Report, Chapter for May, 1919, pp. 4-8.

merce, recently a statement that American companies are showing commendable enterprise in their search for petroleum in foreign countries. He declared that throughout that vast expanse of territory from Colombia to Chile, on each side of the Andes, which gives some promise of the occurrence of petroleum in great quantities, American geologists and other types of petroleum specialists are engaged in systematic search for new sources of oil supply. He pointed out that an American company is very active in the exploration work being conducted in northern Canada.

Mr. Hoover's information with regard to the petroleum situation in the Russian field is that production has receded until it is less than 10 per cent of the pre-war output. It is his opinion that the entire production is coming from flowing wells. He thinks this oil is being handled and that no waste is resulting from the demoralization of the Russian petroleum industry under present conditions.

Improvement in Rumanian Petroleum Trade

The American Minister to Bucharest reports that the situation of the oil companies in Rumania is more satisfactory at present than it has been since the war, according to *Commerce Reports*. The government has apparently abandoned the project of an export monopoly of petroleum products. On Aug. 25 it reduced the high export tariff on petroleum products to a level which will increase exportation. The new tariff is valid for only three months, but will possibly be continued thereafter. It is expected that the lower export tariff on petroleum products will decrease the cost of the fuel oil purchased by the Rumanian railroads.

A decree published on June 16, 1920, requires the consent of the Council of Ministers to every petroleum con-

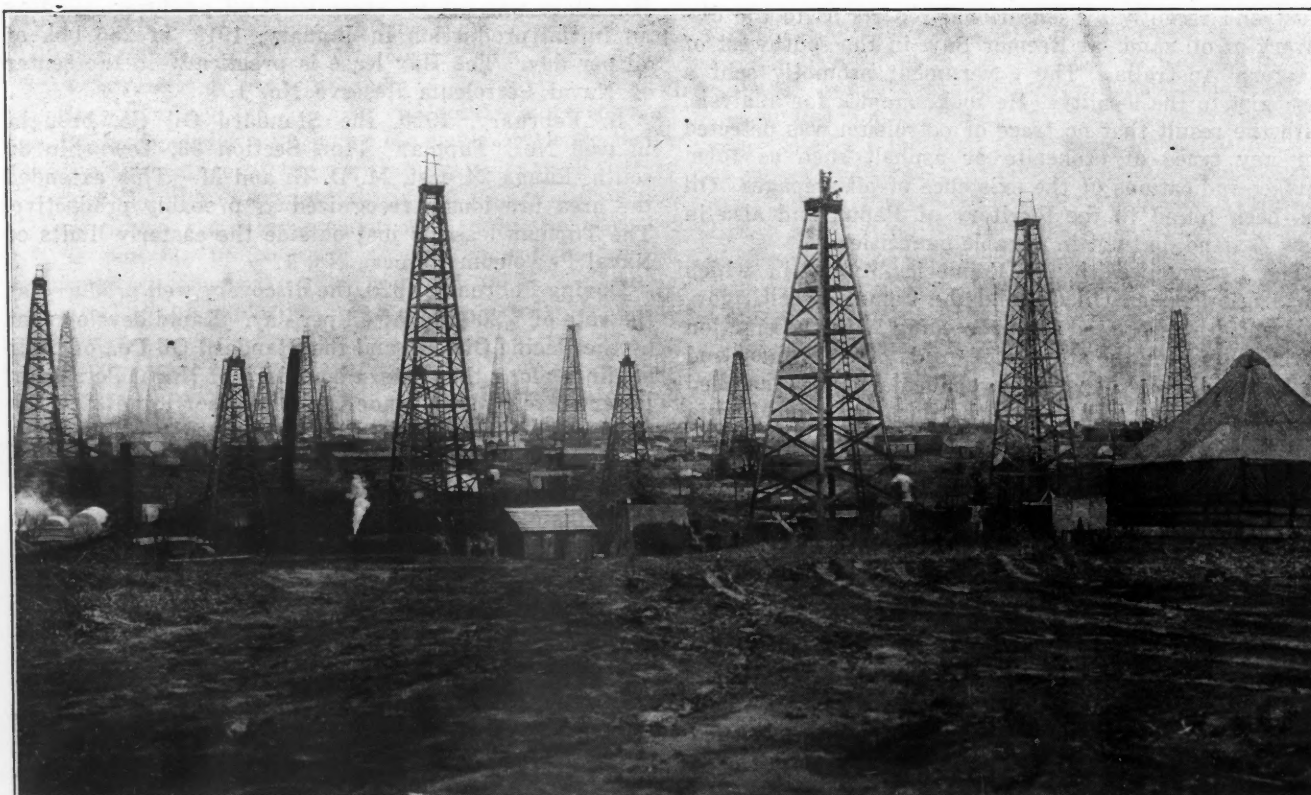
cession or lease acquired by private companies. For a time this decree hindered the acquisition of new petroleum lands; but lately no difficulty has been encountered by the companies in securing such permits, other than the delay which is always involved. This delay may occasion losses, several parties paying for the same lease before registration (which depends upon the approval of the lease by the Council of Ministers) can be made in the courts.

The law of April 18, 1919, covers the procedure by which all state lands may be given for exploitation. This law provides that all state petroleum lands shall be divided into four parts. One of these parts shall be reserved to the state, and this cannot be leased except by special law; a second part can be leased to companies having only Rumanian shareholders; a third part can be leased by auction to existing petroleum companies; and the remainder may be leased by auction to anyone wishing to bid for it. Although this law is in force, the present government decreed by a ministerial decree, published in the Monitor Official of Sept. 5, 1920, that 80 hectares (about 198 acres) of the choicest state lands be leased to the I. R. D. P.—a Rumanian company. This transaction was later approved by parliament, and an additional 80 hectares were leased to another Rumanian company, called the Credit Minier.

Gulf Coast Crude Price Increased

The price of Gulf Coast crude oil was advanced 25c. on Nov. 9 by the Texas Co., making the price \$1.25 per bbl. except for Pierce Junction oil, where the price is \$1.05. This raise will undoubtedly be met by the other pipe line companies in the near future.

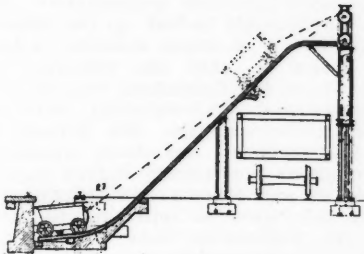
On this same day the Magnolia Co. posted an advance of 2c. per gal. on on gasoline and 1c. on kerosene, making the price 23c. and 13c. respectively.



NORTHWEST EXTENSION, BURKBURNETT FIELD, TEXAS, THREE MONTHS AFTER DISCOVERY

Recent Patents

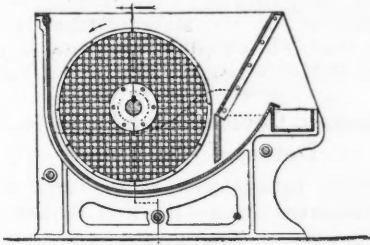
Hoisting Cylinder—No. 1,378,901. William Robertson, Chicago, Ill. A vertical cylinder containing a piston, the latter supported by a hollow rod.



On admission of fluid under pressure into the hollow rod, the cylinder descends and a pull is exerted on a cable to which the cylinder is attached.

Flotation Machine—No. 1,389,674. L. D. Lyons and C. F. Hoff, Butte, Mont. The invention consists chiefly in means to remove the froth from a mechanically agitated flotation machine. The device operates regardless of the pulp level.

Flotation Machine—No. 1,394,306. D. P. Hynes, Evanston, Ill. A flotation machine in which the air is beaten into

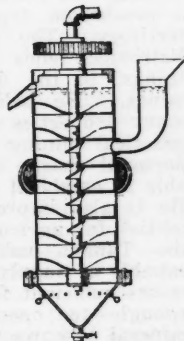


the pulp by means of perforated disks partially submerged in the pulp revolving in a vertical plane.

Ball-Mill Feeder—No. 1,395,089. H. H. Burhans, Newark, N. J. This patent covers a device for automatically feeding a ball mill. The ball mill is driven by an individual motor, as is the apron conveyor which feeds it. As the current consumption of the motor driving the ball mill rises, the circuit of the motor driving the conveyor is opened, thus cutting off the feed for a time.

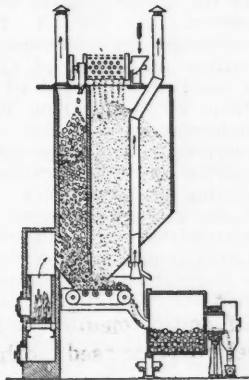
Flotation—No. 1,394,958. A. Schwarz, Joplin, Mo., assignor to Metals Recovery Co., New York. The use of selective agents preliminary to flotation.

Ore Washer—No. 1,392,413. A. M. Gow, Duluth, Minn. An ore washer for separating magnetic from non-magnetic particles of different degrees of permeability. A vertical tank is used with means for drawing magnetic particles to the inner surface. A rotating shaft causes these to descend and a supply of water washes the gangue upward where it is discharged.



Flotation—The *Journal of Chemical Industry* describes a British patent recently issued to Minerals Separation, Ltd. (E. P. 154,870, 9.6.20) Oxidized metallic ores, e.g. those containing carbonates, silicates, or oxides of copper or lead, are ground wet to 80 mesh, during which process a small quantity of oleic or similar fatty acid (say, 3 lb. or less per ton of ore) is added. The pulp containing one part of ore to four or five parts of water is then treated with a small quantity (say, 2 lb. per ton of contained ore) of sodium silicate, carbonate, hydroxide, or other suitable alkali, and the mixture subjected to agitation and aeration by known processes. The first froths may be re-treated without further addition of the frothing agent, but with a further small quantity of alkali, if necessary.

Dry Grinding Moist Material—No. 1,394,294. J. S. Fasting, Frederiksberg, near Copenhagen, Denmark, assignor to F. L. Smidth & Co., New York. A trommel separates the large from the small material which is to be ground, the large material going to a separate bin, where it may be subjected to heat, after which it is mixed with the fine material and charged to a ball mill. The large hot particles are supposed to dry the fine material and keep it from packing in the mill.



Jig—No. 1,395,716. H. D. Kostenbauder, Aristes, Pa. A design for a jig for separating coal or mineral from waste rock.

Hydrometallurgy of Copper—No. 1,395,755. G. A. Bragg, Thomson, Nev., assignor of Metals Research Co. The copper-bearing material is leached to obtain a copper sulphate solution which is then heated and treated with sulphur dioxide.

Book Reviews

A Manual of Determinative Mineralogy. By Charles H. Warren. Limp binding; 7½x5½; pp 163. First edition. McGraw-Hill Book Co., 1921. Price, \$2.

This manual was prepared for use in the beginner's course in mineralogy, at the Massachusetts Institute of Technology, in response to a demand for a relatively inexpensive but satisfactory determinative text. Even a casual perusal of the book will show that it is admirably arranged and much of the superfluous matter appearing in the larger textbooks has been left out. Chapters cover the use of the blowpipe, simple tests for the elements, tabulative lists of reactions and like related matter. Useful in determinative mineralogy and the determination of minerals.

D. E. A. C.

Technical Papers

Wolfram, Bismuth, Molybdenite—The treatment of wolfram, bismuth, and molybdenite ores at the Burma Queensland Corporation's mill at Wolfram, N. Q., is described in a twelve-page paper in the *Proceedings of the Australasian Institute of Mining and Metallurgy* No. 40, Melbourne. The ore is essentially quartz, the chief minerals being molybdenite, wolfram, metallic bismuth, bismuth sulphide, bismuth carbonate, and rarely a little scheelite. It is crushed by 1,250-lb. stamps, run at 100 drops per minute with from 6 to 7 in. drop. The stamp duty varies from 5.5 to 5.8 tons per twenty-four hours. Following the crushing, the flow sheet is somewhat complicated, as would be expected from the nature of the ore. Wilfley, Buss, and Krupp tables are used, from which bismuth-wolfram concentrates are obtained. These are sized and then separated in magnetic separators of the Dalbouse bracket type. The products are a clean wolfram concentrate and a bismuth concentrate containing a little wolfram. The tailings from the tables already mentioned are treated on other apparatus, including buddles, Isabel vanners, Lührig vanners, and slime frames, and then subjected to flotation in machines of the cone type, producing concentrates running from 80 to 94 per cent MoS₂. The methods used in the chemical laboratory are also given, including an acid method for estimating WO₃ in concentrates and ores; the colorimetric estimation of bismuth and molybdenite; the estimation of bismuth in bismuth-wolfram concentrates; and the volumetric estimation of molybdenite.

Mica—The mica deposits of Alabama are described in a 115-page book recently issued by the Geological Survey of Alabama, University, Ala. The book contains forty pages of general data on mica, which includes production, stocks, consumption, value, imports and exports, occurrence, properties and characteristics, uses, commercial grades and specifications, associations, and distribution of deposits. This information is all of general interest to mica producers in other parts of the country. The rest of the book is confined to a detailed description of the various Alabama deposits, together with a short chapter on Alabama kaolin.

Mineral Resources—Recent publications of the U. S. Geological Survey in the "Mineral Resources of the United States" series (obtainable on request) include: "Gold and Silver in 1919," forty-four pages; "Abrasive Materials in 1920," four pages; "Sand and Gravel in 1920," nine pages; "Lime in 1920," twelve pages; "Feldspar in 1920," two pages; "Mineral Waters in 1920," six pages; "Slate in 1920," nine pages; and "Gold, Silver, Copper, and Lead in South Dakota and Wyoming in 1920," nine pages.

New Jersey Iron Ores—Two articles which appear in the Nov. 10 and Nov. 17 issues respectively of *Iron Trade Review*, entitled "Developing North Jersey Iron Ores," by E. C. Kreutzberg, outline the mining and milling methods used on magnetic iron ore at the Beach Glen mine, controlled by the North Jersey Steel Co., near Rockaway, N. J.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Federated American Engineering Societies Have Rendered Constructive Service

Activities Cover a Number of Accomplishments, and Show Increasing Range of Federation's Influence

In a statement summarizing general conditions in the Federated American Engineering Societies, the executive secretary, L. W. Wallace, expresses the belief that the federation has made substantial progress. At the annual meeting of the American Engineering Council to be held in Washington Jan. 5 and 6, this progress will be shown by reports covering activities in many fields.

"Unquestionably," says Mr. Wallace, "the federation has made favorable and permanent contacts in Washington. Through the activities of Congress and of the new Federal administration, we have had the opportunity of rendering some really constructive service. We feel, however, that the great body of engineers are not adequately informed of the organization of the federation, of its aims and purposes and of its activities.

"This lack of information is serious, and until engineers in general are more fully informed, we shall not hope to function to the best advantage. The Executive Board should, therefore, give serious consideration to methods of informing engineers as to the aims, policies, and activities of the federation. Some member societies have been and are now, perhaps, rather indifferent to a continuation of their affiliation. As far as we have been able to ascertain, this condition is due to the officials and the members of such organizations not being fully informed.

"While it may be true that during the first year, the federation has not been able to accomplish all that was expected on the part of some, and that it has not fully found itself, so to speak, yet the progress has been such as to justify optimism rather than pessimism as to the future usefulness of the federation. The federation has been fairly well established in the minds of the public and in Government circles. This is evidenced by the character and quantity of publicity that the federation has received.

"The report of the publicity committee to the executive board clearly shows that the activities of the federation have attracted attention and notice in all of the leading cities and many of the towns and villages of this country. Constant reference is being made to the federation in the technical, daily, and periodical press. It is also being referred to in the official proceedings and publications of many commercial and trade associations. This alone is one reason for encouragement."

The general activities of the federation during the year have embraced the following: Assistance in organizing a conference of engineers to con-

sider the advisability of fall letting of highway construction contracts; co-operation in arranging for the Unemployment Conference; action to prevent a miscarriage of justice which would result from reopening the cases disposed of by the War Minerals Relief Commission; promoting the movement for a National Department of Public Works; representation through Colonel Arthur S. Dwight on the deputation of engineers that visited England and France; appointment of a committee to frame a plan for a permanent employment service; adoption of a policy to avoid confusion and antagonism on the question of licensing of engineers; co-operation in reforming conditions in the United States Patent Office; approval of certain recommendations contained in the report of the Committee on Types of Government Contracts; appointment of a committee to form an engineering education policy; indorsement of the classification of engineers as proposed by the Committee on Classification and Compensation of Engineers of Engineering Council; appointment of a special Committee on Length of Shifts in Continuous Industry; conferences with a committee of the American Association of Engineers; investigation by Committee on Elimination of Waste in Industry; co-operation through a committee in New York State Government Reorganization; appointment of a Committee on Co-operation with the American Institute of Architects; establishment of a Federation Bulletin and Digest Service; and preparation of a Digest of State Laws covering the registration of engineers.

This list of federation activities, though incomplete, serves to show the increasing range of the federation's influence and its potentialities. The leading activity of the federation was the work of the Waste Committee, whose findings have just been published in book form.

The federation has now more than 43,000 members. Despite the financial depression and the ordinary difficulties of organization, the membership is growing. The Engineers' Club of Kansas City, Mo., is considering the question of applying for membership. The president of the Engineers' Club of Philadelphia has appointed a committee to investigate and to report upon the advisability of that society joining the federation. The American Society of Testing Materials considered joining the federation, finally deciding it was financially unable to accept the invitation to become a charter member.

Recent societies admitted to membership in the federation are the Vermont Engineering Society and the Associated Engineers of Spokane. The Vermont Engineering Society has named George A. Reed, of Montpelier, as its representative on the American Engineering Council.

Dean Mortimer E. Cooley and Mr. Wallace are now carrying out plans

for more intensive organization, aiming particularly to link up the member societies in a more cohesive scheme of action so that the influence and benefits of the federation may be more directly and systematically communicated to the societies. Mr. Wallace for several months has been appearing throughout the country before member societies and other organizations. Mr. Wallace's speeches outlining the aims of the federation have been widely noticed in the public press. He plans to continue these visits to the member societies so far as his executive duties, which are constantly growing, will permit.

Many matters not the subjects of committee action are occupying the attention of the headquarters staff in Washington. Not the least among the influences which the federation has developed is a growing function of its place in the political life of the nation as evidenced by requests of Government departments and bureaus for aid and advice. The reports to be submitted at the January meeting in Washington will, it is stated, show the federation to be in a healthful condition, with every prospect that its usefulness, measured by its accomplishments of the year, will continue to expand in the way contemplated by its founders.

Alaska's Development To Be Slow, Dorsey Lyon Thinks

Definite Information as to Territory's Resources Scant—Work at Berkeley Successful

Good judgment was used in selecting the Seward-Fairbanks route for initial railroad development in Alaska, in the opinion of Dorsey A. Lyon, chief metallurgist of the U. S. Bureau of Mines, who has just returned to Washington after having spent the field season in Alaska and in the mining districts of the Western states. In his opinion, it is going to be many a year before the Government's railroad in Alaska will be self-sustaining. He believes, however, that its construction is a necessary step in the development of that territory and that the investment will be amply justified by results. It is Mr. Lyon's belief that the development of Alaska will be gradual. He is firmly convinced that no good can come from holding out hope that there is to be a mushroom type of growth in the territory. The country tributary to Fairbanks lends itself particularly, he thinks, to the development of small mines. He believes that there are many properties in that section where practical mining men, willing to take personal charge of operations, will be able to establish themselves profitably. He is also impressed with the possibilities for agricultural development in the Tanana valley. This valley is capable of supplying the food requirements sufficient for a population large enough to operate every available mineral resource in the region.

Although there is no lack of definite pronouncements as to the possibilities of Alaska, Mr. Lyon was impressed on his visit with the lack of definite information available as to the resources of the territory. This applies even to those limited areas where there has been some development, but Alaska, as a whole, he regards as a great unknown. He thinks the Government has great responsibility toward Alaska and should see to it that the people who go there are reasonably encouraged to stay.

Mr. Lyon is pleased with the success of his plan in placing technical control of the non-ferrous work at the experiment stations under the immediate direction of O. C. Ralston, at Berkeley. This makes a sort of service station at Berkeley to which all other experiment stations can refer their most difficult problems and where the fundamental physical chemical work can be done. That more expert attention may be brought to apply to the chemical side of these non-ferrous problems, L. E. Roberts, a physical chemist who has distinguished himself in colloidal chemistry, has been added to the staff of that station. He obtained his doctor's degree at the University of Chicago and for two years was an instructor in chemistry at the University of Pittsburgh. For the last eighteen months, he has been in charge of the research laboratory of the American Writing Paper Co., at Holyoke, Mass.

Mining Councils To Be Formed In Spain

Royal Decree Orders Organization in Various Districts—To Act in Advisory Capacity

In an effort to stimulate the mining industry in Spain, the King by royal decree has made obligatory the formation of mining councils in the various mining centers of the kingdom. The councils are to be regarded as advisory bodies to the ministry of public works. They are given the right of hearing in customs modifications, taxes, and in all administrative matters which effect the mining industry. It is the prescribed duty of these councils to initiate proposals to the government which will lead to the greater development of the mining industry. They are to compile statistics which are to be available to the government. They are to aid in the extension of mining education, prescribe sanitary codes for mines, and are to assist in the compilation of labor statistics. With the previous authorization of the Minister of Public Works, they may contract loans to provide for the expenses of carrying out the decree. When called upon by the Minister of Public Works, the separate councils are to unite in assemblies for the general discussion of the problems affecting the industry.

The Minister of Public Works is to designate the number of members which is to make up each council. He is to take into account the number of mines in the district, the capital employed, the number of operators, and the number of laborers. No council may have less than ten members nor more than forty. The Minister of Public Works must promulgate prior to Dec. 23 complete regulations for carrying the decree establishing the mining councils into effect.

Board of Northwest Mining Association to Continue

No election having been held, the board of the Northwest Mining Association of Spokane will serve for another year. The board consists of G. B. Dennis, Frank M. Smith, Frank A. Ross, F. C. Bailey, Leigh Nicholls, Oscar Cain, and W. H. Linney. Mr. Dennis has been elected by the board to succeed Mr. Cain, who has resigned as president.

British Protest Sale of Scrap

The inclination on the part of the British Disposals Board to sell its remaining surplus of scrap brass and gun metal for £4,000,000 to the British Metals Corporation, Ltd., is bringing forth protests from metals brokers, who insist that there should be competing bids for this material.

MEN YOU SHOULD KNOW ABOUT

G. M. Colvocoresses is in New York. Frank J. Nagel was recently in Guadalajara, Mexico.

George Huntington Clark has been examining bauxite deposits in Alabama.

Herbert C. Jussen is in the Presbyterian Hospital in Chicago in a serious condition.

Paul Kern has joined the forces of the Great Eagle Fluorspar mine, at Lordsburg, N. M.

Colonel J. C. Greenway is visiting the property of the Erupcion Mining Co. in Chihuahua, Mexico.

Wilber Judson is on an extended business trip through some of the central and southern European countries.

K. Hasegawa, metallurgical engineer of the Imperial Steel Works, Yawata, Japan, recently visited Lehigh University.

D. C. Jackling has been in Salt Lake City and in Bingham and Garfield, visiting the properties of the Utah Copper Co.

J. Ward Williams, formerly connected with the American Metal Co.'s Mexican division, has opened offices at 405 Lexington Ave., New York City.

G. Herbert Jones, vice-president of the Inland Steel Co., Chicago, has tendered his resignation and will devote his time to personal interests.

Frank Estes returned to New York recently from Salvador, where he has spent the last few months investigating mining property of the Salvador Silver Mines Co.

P. G. Beckett, general manager of the Phelps Dodge Corporation, and Thomas H. O'Brien, general manager of the Inspiration Copper Co., recently returned from a trip to England, France, Belgium and Germany.

George T. Harley, formerly efficiency engineer for the Burro Mountain Copper Co., at Tyrone, who later went to River Mines, Mo., with the St. Joe Lead Co., has been forced, on account of ill health, to move to Pueblo, Col.

A. C. Dinkey, president of the Midvale Steel & Ordnance Co., accompanied by J. C. Agnew, assistant to the president, recently visited the company's

properties on the Mesabi and Vermilion ranges; also the plant of the Mesabi Iron Co. at Babbitt, Minn.

R. B. Moore, chief chemist of the Bureau of Mines, addressed the New Jersey Chemical Society at Newark on Nov. 14. He discussed the chemical work of the U. S. Bureau of Mines and reviewed the investigation and research which have been done on helium.

R. T. Stull, superintendent of the U. S. Bureau of Mines Ceramic Station at Columbus, Ohio, conferred last week in Chattanooga with officials of the Central of Georgia R.R. concerning the co-operative work being done on Georgia kaolins.

K. Yoshizawa, chief engineer of the Mitsui Mining Co. of Tokio, recently visited the Michigan College of Mines at Houghton. Mr. Yoshizawa is a lecturer in the mining school of the Japanese Imperial University. Gaichi Yamada, assistant professor of metallurgy at the Kyoto Imperial University at Kyoto, Japan, has also been visiting the mills and smelters of the Lake district. He is concluding a year's tour of the United States.

Mining and metallurgical engineers visiting New York City last week included: E. H. Hicks, Golden, Col.; F. Winslow, Washington, D. C.; N. H. Emmons, 2d, Framingham, Mass.; Harold C. E. Spence, New Glasgow, N. S.; H. M. La Follette, La Follette, Tenn.; J. Lorenz Kalb and Gardner Gantz, Rapid City, S. D.; Allan Gibb, London; F. Crabtree, Pittsburgh, Pa.; and Francis Nicholson, Charlotte Court House, Va.

SOCIETY MEETINGS ANNOUNCED

The ninth annual meeting of the Colorado Metal Mining Association and the fifth annual meeting of the Colorado Chapter of the American Mining Congress will meet in joint session at the State Capitol Building in Denver during the week of Jan. 16, 1922. The chief questions for consideration this year will be freight-rate adjustments, particularly in reference to a change in the basis of rate making from gross to realized value, after smelting charges have been deducted. Plans will be considered for co-operative action to secure lower costs for powder, steel, and other supplies and equipment. The smelter situation as affected by the closing down of various plants in Colorado, and the resulting abnormal high cost of smelting, will also be discussed, with the purpose of devising some form of relief.

OBITUARY

E. G. Bush, for ten years active in the development of a number of copper mines near Tucson, Ariz., died on Nov. 7.

George D. Sherman died suddenly on Nov. 15 of heart disease at his home in Port Henry, N. Y. Mr. Sherman was one of the stockholders of the Witherbee-Sherman Co. and the Port Henry Iron Ore Co.

THE MINING NEWS

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

Leading Events

Signs of improvements are to be noted in the week's news from many sections. The upward trend continues in the Birmingham iron district. Some mines are reported to have resumed or to be about to resume in the Lake Superior iron country, though it is possible that this is partly owing to a desire to ease the unemployment situation. The New York & Honduras Rosario Mining Co. has resumed operations in Honduras, owing to the improvement in the price of silver.

The American Smelting & Refining Co. has decided to complete the 50-ton test mill at the mouth of the Yak tunnel, in Leadville, Col. Tests on a commercial scale will be made to determine the possibility of concentrating the low-grade complex ores of the district, of which there is a large tonnage.

Arizona Commercial's side line suit, involving the Iron Cap company, will be heard at Tucson, Ariz., Dec. 12.

Union Sulphur's suit against the Texas Gulf company, for alleged illegal removal of sulphur, has been settled out of court and the case dismissed.

The Star and the Federal Mining & Smelting companies will be heard in court on Nov. 28 on the question of the proper compensation due the former for ore illegally removed.

Reuter's Agency reports that the labor dispute at the gold mines on the Rand has been compromised.

The East Butte and the Davis Daly copper companies have shut down.

A suit faces the Northwest Magnesite Co., a farmer charging that magnesite from the company's calcining plant has ruined his crops.

Senator Nicholson has decided to prepare a campaign to push his bill for a Federal Department of Mines. The War Minerals Relief Bill has been passed by the House.

A. S. & R. To Complete Test Mill At Portal of Yak Tunnel

Will Attempt To Treat Low-Grade Complex Ores of Leadville District on Commercial Scale

As a result of laboratory tests and experiments conducted for a year or more, E. L. Hartwell, local manager of the American Smelting & Refining Co.'s property at Leadville, Col., has been authorized to complete a fifty-ton mill at the portal of the Yak tunnel in California gulch. If as satisfactory results can be obtained in a commercial way as from laboratory tests, plans will be made at once for enlarging the plant to handle the enormous tonnage of low-grade complex ore available from the Yak tunnel.

The low-grade ores of the Yak are principally sulphides in which zinc, lead, or copper predominate, with a certain percentage of both gold and silver. The process will be a combination of jigging, concentration, and flotation, and the laboratory tests indicate that by this method about 80 per cent of the values can be recovered, instead of only 40 or 50 per cent by present methods.

The management hopes to have the mill in operation by April 1, 1922. The successful working of the mill will greatly stimulate production in this district, as there is practically unlimited reserves of this lower-grade material which cannot be profitably moved under present conditions.

Broken Hill Conference Fails

By Cable From Reuters to "Engineering and Mining Journal"

Broken Hill, N. S. W., Nov. 18—The conference between representatives of the mining companies and the men's unions, when proposals aiming at full resumption of operations at the mines were discussed, proved abortive.

Union Sulphur-Texas Gulf Suit Settled Out of Court

The suit of the Union Sulphur Co. vs. Texas Gulf Sulphur Co., in which the plaintiff asked \$6,768,000 damages for sulphur removed from its land by the defendant, has been settled out of court and has been dismissed by the Federal court at Houston.

French Interests To Exploit Mexican Mines

By Cable From Reuters to "Engineering and Mining Journal"

Paris, Nov. 17—A company has been incorporated here with a capital of 15,000,000 francs, with headquarters in this city, to exploit mines in Mexico.

Rand Labor Dispute Compromised

By Cable From Reuters to "Engineering and Mining Journal"

Johannesburg, Nov. 17—An important compromise has been effected with regard to the conditions of labor in the gold mining industry of the Rand, the men having expressed their approval of various alterations which practically insure eight hours' work by natives under white supervision.

According to an earlier dispatch, Sir Evelyn Wallers, former president of the Transvaal Chamber of Mines, in a statement outlining the attitude of the mining industry toward the proposed government amendment covering mining regulations, said that even with the present substantial premium the Randfontein and East Rand Proprietary companies were unable to pay the standing charges for October. He had considered that the suggested amendment would improve efficiency but it did not go far enough.

The Chamber maintained that the management must be free to allocate the available force of mine workers.

Magnesite Plant Damaged Crops, It Is Claimed

Northwest Magnesite Co. Sued by Farmer—Company Retains Agricultural Specialists

John Ehorn, a farmer of Chewelah, Wash., has brought suit against the Northwest Magnesite Co., in which he alleges that the dust and smoke particles from the stacks of the company's calcining plant has destroyed vegetation on his land and that livestock which has eaten the vegetation had died. He seeks damages for \$56,427 for alleged destruction of crop, death of four cattle, and damage to 185 acres of land. Also, he asks that the magnesite company be prohibited from again operating its plant as it has been previously operated.

Until recently the Northwest company has been operating four rotary calcining kilns for dead-burning its magnesite. Ehorn's farm is closely adjacent to the plant, and it is his contention that the dust coming out through the stack has settled on his land to form a crust and seriously hamper the growth of crops.

Roy N. Bishop, general manager for the company, has employed Dr. E. M. Ledyard, a specialist in agriculture, and his staff, consisting of Charles B. Weeks, horticultural specialist, Fred C. Mathews, soil specialist, and Dr. F. C. Connelly, veterinary surgeon, to investigate crop conditions surrounding the calcining plant at Chewelah.

New York & Honduras Rosario Resumes

The New York & Honduras Rosario Mining Co. has resumed operations at its mines owing to the improvement in the price of silver. The conditions prevailing in the industry forced the cessation of production last June.

Compensation Hearing in Star Case To Be Held Nov. 28

Opposing Sides Disagree Greatly as to Value of Ore Wrongfully Extracted

In the spring of 1917 the Star Mining Co. started an action against the Federal Mining & Smelting Co. alleging trespass upon Star ground through the operation of the Morning mine. The subsequent trial resulted in a decision by Judge Dietrich, of the U. S. District Court, in favor of the Federal, from which the Star appealed to the appellate court, which reversed the lower court. Thereupon the Federal company applied to the U. S. Supreme Court to review the case, which application was denied. This disposed of all questions except the very essential one of compensation due the Star for ore removed.

For many months engineers and accountants for each company have been engaged on the problem. The claims of both have now been filed with the court, and the hearing has been set for Nov. 28 at Coeur d'Alene. Considering the difficulties in making underground measurements to determine the amount of ore removed and the differences in method of the opposing engineers, the results so far as tonnage is concerned are not so far apart as might be expected. The Federal engineers found that 456,327 tons had been removed, whereas the Star engineers placed the figure at 470,035. But when it came to fixing the value of the ore and the amount the Federal should pay, they were about as far apart as possible. The total net smelter returns for the ore shipped as given by the Federal was \$1,230,075.59 and the net profit, the amount for which it was liable, is placed at \$71,786.14. In making the report, however, Federal claims that despite the decision, it is the rightful owner of the ore in dispute, reserves the right to correct the decision, and makes its showing under protest.

The contention of the Star is that the net smelter returns amounted to or should have amounted to \$2,404,110.56, that the net profit was \$1,615,902.74 and that the interest was \$861,168.39, making the total due to the Star, in the event that the court holds that the trespass was innocent, \$2,477,071.13. If the court finds that the trespass was wilful, the claim for principal is \$2,404,110.56, for interest, \$1,317,686.41, and the total, \$3,721,796.97. The Star objects to making the computation based upon sales of ore to the American Smelting & Refining Co. on the ground that the returns were not as great as would have been received if the ore had been sold in the open market.

Texas Sulphur Co. in Hands of Receiver

The Texas Sulphur Co. has been placed in the hands of a receiver following the petition of a group of stockholders and the vice-president of the company. T. B. Doty, president of the First National Bank of Beaumont, Texas, is receiver. This company is a corporation of Arizona, with headquarters in Orange, Texas, and mining lands in Culberson County, Texas, and should not be confused with the Texas Gulf Sulphur Co. of Matagorda County.

East Butte and Davis Daly Shut Down

The East Butte and the Davis-Daly copper companies suspended production on Nov. 14. Adverse metal-market conditions are unofficially stated to be the reason. It is admitted that negotiations are under way looking to the consolidation of the properties on a basis of exchange of stock. East Butte is reported to have offered one of its shares for two of Davis-Daly, to which the latter is said to have refused to consent.

East Butte, it is said, cannot continue without Davis-Daly's ore and the latter, according to one explanation, does not care to ship ores at present copper prices and pay war-time smelting costs. Davis-Daly has dismissed 300 men. East Butte employed in its mines, smelter and mill upwards of 1,000. Davis-Daly's shutdown comes as a surprise to some, at a time when the copper market is strengthening.

Bunker Hill & Sullivan To Start Second Lead Furnace

A second lead furnace is to be blown in at the Bunker Hill & Sullivan smelter at Kellogg, Idaho, soon, to treat increasing tonnage of custom ores.

Zinc Used in New Building

Zinc is to be used at every available opportunity in the building being constructed by the University of Missouri to house the experiment station of the United States Bureau of Mines. As much of the work of this experiment station will be on zinc problems, it was decided to make the building itself something of an experiment in demonstrating the extent to which zinc can be used in construction.

Lower Rates on Ore Sought in Nevada

The Chamber of Commerce of Reno, Nev., in conjunction with the State Public Service Commission, is endeavoring to collect data which will be instrumental in effecting a reduction in rates on ore from Nevada points to smelters in Utah and California. Such a reduction would undoubtedly be a stimulus to the mining industry in this state. A hearing with representatives of the railroads was held on Nov. 18.

Hill Top Suit Dismissed

The suit pending in the superior court of Maricopa County, Ariz., concerning the transfer of a block of stock in the Hill Top Metal Mines Co. has been dismissed. It was brought against the company about three years ago by Chicago stockholders, who claimed an interest in the stock transferred, and has been terminated by the withdrawal of the suit by the plaintiffs. The Hill Top company began mining operations on its property in the Chiricahua Mountains, Cochise County, Ariz., eight years ago, and has been working a large force steadily ever since. Altogether \$700,000 has been expended upon the property to date, and the orebody has been opened to the 1,700 level by a number of tunnels, one of which extends entirely through the mountain, a distance of 3,000 ft. The ores are silver-lead, but only a few test cars have been shipped.

Minnesota Advertising for Bids For Prospecting Permits

Action Is in Accordance With New Law Affecting State Lands

The auditor of the State of Minnesota is advertising for sealed bids for permits to prospect for iron ore on state lands in which the state has an interest, except lands situated under the waters of any public lake or river. The bids are to be opened publicly on the morning of Jan. 9, 1922, and permits will be awarded to the highest bidder.

The advertisement appears in accordance with a bill passed at the last session of the Legislature which places the leasing of the state lands on a competitive bidding plan. Each applicant must set forth in his bid the amount of royalty per gross ton of ore based upon the iron content of such ore when dried at 212 deg. F. The state reserves the right to reject any or all bids, and no bid shall be accepted which does not equal or exceed the minimum royalty per ton which is based on a revenue to the state of \$1,250 for the first year and \$5,000 for the second year.

The lands that have been listed for leasing purposes are divided into the following four classes: Class 1, lands containing iron ore, the larger part of which may be shipped without beneficiation; Class 2, lands likely to contain iron ore capable of being beneficiated by washing, drying, or screening; Class 3, lands likely to contain iron ore or iron-bearing material requiring magnetic-separation methods; and Class 4, lands containing iron ore or iron-bearing material where a combination of two or more of the foregoing processes of beneficiation may be necessary. The mining units upon which bids are to be submitted are not to exceed in the aggregate two contiguous forty-acre tracts for lands in classes 1 and 2 and three contiguous forties for classes 3 and 4.

Boom Reported at Royston, Nev.

Interest in the Royston or San Antonio district, in Nevada, continues, and the town of Royston now contains over 100 people, all living in tents or light frame houses hauled from Tonopah. The deepest working in camp is 200 ft. vertical, or 300 ft. on the dip of the vein, with several hundred feet of lateral drifts and winzes and considerable stopping. The vein is narrow, rarely exceeding 2 ft., but contains high-grade ore. These are old workings.

On the Betts lease, which operation is new work, the shaft has reached a depth of 35 ft. in ore varying from 10 in. to 4 ft. in width, all of which is high grade. A 10-ton trial shipment ran \$715 per ton. A second shipment of over thirty tons is ready, and this ore is said to be higher in grade. Several others have favorable surface showings over narrow widths.

Manganese Ore From Storage at Russian Ports

Appearance of considerable tonnages of manganese at Russian ports is not to be taken as an indication that the Russian mines have resumed operation, it is pointed out at the Department of Commerce. The ore which has just made its appearance at the seaboard apparently has been taken from storage, it is stated.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

To Push Mines Department Bill More Actively

Nicholson Preparing Campaign in Behalf of Measure—Want Public Familiar With It First

Senator Nicholson, of Colorado, is completing plans for an active campaign in the interest of his bill providing for the creation of a Federal Department of Mines. Although he introduced the bill early in the extra session, he has confined his activities since that time in circulating printed copies of it, so as to give those most concerned an opportunity to study the plan. He feels that a bill of that character had no place in a session of Congress intended principally for the consideration of tax and tariff legislation. With the beginning of the regular session of Congress in December, he expects to keep actively behind this measure, although it is not his purpose to call it up for passage until ample opportunity has been given for the public to become acquainted with its purport.

In January, it is expected that hearings will be had on this bill before the Senate Committee on Mines and Mining. A concise record will be made at that time setting forth the advantages of a separate department devoted to the mining industry and to the advantages that will come from having a representative of that industry at the Cabinet table. An opportunity also will be afforded those who are opposed to this legislation to set forth their objections. This testimony will be assembled in a single volume and will be circulated widely, thereby giving the public an opportunity to acquaint itself with each side of the question.

A favorable report on the bill by the Committee on Mines and Mining is practically assured. This will have the effect of securing a place for the bill on the Senate calendar. After an ample

opportunity has been given for the public to familiarize itself with the purposes of the bill, it is the intention of Senator Nicholson to call it up and press it for final passage.

House Passes War Minerals Relief Bill

Amendment Stands Requiring Reappropriation of Funds To Meet Awards

By a vote of 177 to 137, the House of Representatives has passed the bill liberalizing the War Minerals Relief Act. It amended the measure, however, so as to require the reappropriation of funds to be used in paying additional awards. The Senate conferees, Messrs. Poindexter, Sutherland and Walsh, have agreed to a change of language which is expected to meet the objection of the House to the action of its Mines and Mining Committee, held to be usurpative of the exclusive right possessed by the Committee on Appropriations.

If the two houses accept the changes which have been agreed upon by the Senate conferees and Representative Rhodes, the chairman of the House Committee on Mines and Mining, and should the President approve the measure, it will mean that practically all of the claims filed with the War Minerals Relief Commission will be reopened. This new legislation will apply to more than the 610 claims, which were disallowed on the ground of there having been no specific request or demand, as many of the other claimants can now establish an earlier date of Government stimulation. In addition, the fifty-two claims that were mailed within the time limit set by the original act, but which did not reach the War Minerals Relief Commission until after the expiration of the time limit, will be entitled to full consideration.

Stimulation of Mineral Exports Discussed With Hoover

Metal, Coal, and Oil Representatives Meet Secretary—Joint Committee Named

In an effort to stimulate export trade in minerals, a full discussion of the subject was had on Nov. 15 with Secretary Hoover by committees representing the metals, petroleum, and coal industries. As a result of the conference with Secretary Hoover a joint committee was named to join with representatives of exporters of grain, cotton, and other American products to initiate plans which will permit of an enlarged export movement. Those selected to serve on that committee are T. H. Watkins, of the Foreign Trade Committee of the National Coal Association; George S. Davidson, of the Gulf Refining Co.; Bulkeley Wells, former president of the American Mining Congress, and B. B. Thayer, representing the copper producers. The conference with Secretary Hoover was arranged by the Mining Congress.

Army To Sell Metal as Scrap

A lot of 13,500,000 lb. of motor forgings and castings is to be sold by the Air Service of the Army. Informal bids will be received until Dec. 10. The material is to be sold on a scrap-metal basis. Quantities are as follows: Steel, 11,534,937 lb.; cast iron, 1,041,249 lb.; bronze, 750,000 lb.; aluminum, 189,022 lb.; brass, 12,407 lb. The materials are open for inspection at the Long Island Air Reserve Depot, Long Island City, N. Y.

Government Silver Purchases

Purchases of silver by the Bureau of the Mint during the week ended Nov. 19 totaled 2,654,000 fine ounces. This brings the total purchases under the Pittman Act to 82,762,863 fine ounces.

NEWS BY MINING DISTRICTS

London Letter

Gaika Gold's Position — Attempts To Revivify Cornish Tin Mining — Mexican Shares More Active

By W. A. DOMAN

London, Nov. 11—Attempts are being made to revivify Cornish tin mining. Much distress prevails among the miners in the duchy, and the government has again been approached for financial assistance. A comprehensive amalgamation scheme of various companies, including Tehidy Minerals, is under consideration, and a new shaft is being sunk to estimates by Berwick,

Moreing & Co. in the Wheal Agar section of the East Pool & Agar mine. The work is expected to occupy almost two years and to cost £60,000.

The Transvaal gold mining companies are more moderate in their estimates of the price to be received in respect of the past month's production, a figure of 103/— per fine oz. being taken as against 110/— for September.

Mexican mining shares are being given a twist. Esperanza, which has provided so much sensation in the past, is moving up again to the accompaniment of rumors of favorable developments. These rumors have been in circulation for some days.

San Francisco Mines also are being bid for in the expectation that the new plant will soon be in operation.

In the last fiscal year the Gaika Gold Mining Co. treated a rather larger quantity of ore than in the preceding year. As the grade was a little lower, the value, including premium, was only £2,400 higher. There was, however, a set-off in the matter of working expenses, which were 2/1 per ton less, at 25/3, the outcome being an increase of about £3,700 in the net profit. Shareholders receive the benefit of this improved position, for the dividends and bonus at 12½ per cent compare with 7½ per cent in 1920. This

year's payments slightly exceed the amount of net profit, the result being that the carry forward is reduced. The position as at the end of the two years is as follows:

	June 30, 1920	June 30, 1921
Tons crushed.....	36,724	40,127
Oz. recovered.....	15,095	14,980
Value, including pre- mium.....	£80,173	£82,580
Working costs per ton.	27/4	25/3
Net profit.....	£28,996	£32,613
Dividend, per cent.....	5	10
Bonus, per cent.....	2½	2½
Carry forward.....	£9,865	£6,921
Ore reserves, tons.....	64,000	73,000
Average value, dwt.....	15.7	13.2

During the last year the new tonnage brought into the reserves was 49,127, and as will be gathered from the table, the additional ore was of lower value. The recovery last year was 7.4 dwt. from a feed of 8.25 dwt. The extraction was a little in excess of the 1920 figure of 88 per cent.

Of the reserves, 10 per cent is represented by pillars which will not be mined until all other sections are depleted. Apparently the mine position is none too comfortable, for C. E. Parsons, the consulting engineer, specially points out the difficulties that would attend treating ore only of the estimated value of the reserves, that is, 13.2 dwt. Nearly 14 per cent of the ore is represented by one block in the Rubble area, valued at 20 dwt., which so far is yielding ore of a grade below this estimate. The various ore-bodies have no defined walls. As regards the future, the extent in length and depth of recent discoveries is proved, and unless new ore can be found the reserves "are bound to show a considerable shrinkage at June 30 next." At present there are practically no new and promising developments to report.

CANADA

British Columbia

Work Resumed at North Star—Ottawa Mill Ships Concentrates

By H. W. POWER

Revelstoke—A number of prairie and coast residents interested in the Multiple mine, Camborne, visited the property recently, and inspected the development accomplished during the season.

Kimberley—Operations have been resumed at the North Star mine, which has been idle for about a year. A small crew has been put on, and the operators, Thompson & McKinney, plan to make occasional shipments from the old workings during the winter.

Kaslo—Lessees of the Utica mine, on 12-Mile, have uncovered two substantial showings of the characteristic high-grade silver ore in the old workings of the mine. The long tunnel is being continued to intercept the two main veins, and it is expected that the easterly one will be reached soon. Sixteen men are employed.

Slocan City—The first shipment of concentrates from the Ottawa Mining & Smelting Co., which has a lease on the Ottawa mine, on Springer Creek, near here, has been sent to Trail. The mill is small and was completed this fall. Material treated was mostly from old dumps.

Nelson—Improvement in inquiry with regard to possibilities for mining investment of the Kootenays is noted by local Board of Trade officials. A Kootenay branch of the British Columbia Mining Association, whose headquarters are in Vancouver, is in process of organization. E. W. Widdowson, who has been engaged in assaying in Nelson for a number of years, has again enlarged his ore testing plant in anticipation of an increase in business.

Edgewood—A new crosscut tunnel, which will be about 1,000 ft. in length, has been started on the Rampolla group, in the Lightning Peak section of the Arrow Lakes.

Victoria—J. J. Warren, president of the Consolidated M. & S. Co.; S. S. Fowler, of the Blue Bell mine, Riondel; Valentine Quinn, comptroller of the Granby Consolidated; Randolph Bruce, of the Paradise mine, Windermere; Gomer P. Jones, general manager of the Hedley Gold Mining Co., and T. W. Bingay, comptroller of the Consolidated M. & S. Co., constituted a deputation of provincial mining men that appeared before Premier Oliver and William Sloan, the Minister of Mines, recently, with a request for further reduction in assessments on mining property because of development, depreciation and depletion. The matter is under consideration by the provincial authorities.

Trail—Ore shipments received at the Consolidated smelter Nov. 8-14 inclusive totaled 8,642 tons, coming from the following shippers: Gem, Sandon, 10 tons; Horn Silver, Similkameen, 51; J. Osborne, Tulameen, 1; Queen Bess, Alamo, 35; Surprise (Rosebery), Rosebery, 97; Standard, Silverton, 109; Van Roi, Silverton, 92; Whitewater, Retallack, 42; and company mines, 8,205.

ALASKA

Alaska Juneau's Operating Profit in October Best Yet Made

Juneau—The following data refer to the operations of the Alaska Juneau in October:

A total of 143,200 tons was trammed; 91,630 tons fine milled; gold assay of mill fine feed, \$1.47; gold recovered, \$1.14; milling cost, \$46,000; milling and tramping cost, \$27,000; general cost, \$4,000; total operating expense, \$77,000; and operating profit, \$27,500. This is the best profit showing made yet, it is stated.

ARKANSAS

American Manganese Co. Building Washing Plant at Polk-Southard Mine

Batesville—The American Manganese Co. is installing a washing and concentrating plant at the Polk-Southard mine, one of their properties near Cushman, Ark. The plant will have a capacity of approximately 200 tons a day, and they expect to make about 25 tons of concentrates daily. The same company will also install a large stone products plant at Penters Bluff. At this plant they will manufacture lime, ground limestone, cement and ground phosphate. The company lately took over the Independence Mining Co. They own several thousand acres of manganese land in the Batesville field, which also contains commercial deposits of limestone, phosphate, marble and shale.

JOPLIN-MIAMI DISTRICT

King Brand Co. Leases Land Near Treece—Preparations To Be Made Against Smallpox—1,081 Injuries This Year

By P. R. COLDREN

Joplin—Production of zinc ore in this field is approximately unchanged from what it has been for several months, and there seems no reason to expect notable change either in the way of reduced output or increased production in the near future. The ore in bins, though estimated by different persons at anywhere from 90,000 to 115,000 tons, is still held in strong hands and appears not to be a bear influence on ore prices. One company alone has about 35,000 tons of concentrates, 1,000 of which are reported to be held in storage in the bins at one mine in the district.

The King-Brand Mining Co., which is owned by Jefferson City, Mo., investors, during the week ended Nov. 19 took over a lease known as the Longacre tract, immediately adjoining its mine near Treece, Kan., northwest of Picher, Okla., a short distance. The lease comprised twenty-two acres, which has been drilled thoroughly, and on which a shaft has been sunk 130 ft. The King-Brand Co. will finish sinking the shaft to about 230 ft. and connect it with its own mill by tram. W. T. Landrum is manager for the King-Brand company.

The Huttig Lead & Zinc Co. reports good drill strikes on its tract near Crestline, Kan., some distance north of Baxter Springs and in a part of the field comparatively undeveloped. It expects to proceed with development soon.

Accident statistics for the Tri-State field have been furnished to the Tri-State branch of the American Zinc Institute by Dr. D. L. Connell, physician and surgeon in charge of the Picher hospital, which is operated by the Institute. He reports that during the year 1921, up until November, a total of 1,018 injuries had been reported, 10 per cent being major injuries and 90 per cent of a minor nature. Of the total, 41 per cent were injuries received by miners from falling boulders, slabs, rocks, and similar causes; 34 per cent were eye injuries, of which the big majority were from flying rock, and only a few from flying steel; 10 per cent were injuries affecting the back, and 15 per cent were of other kinds.

Doctor Connell further reported that for the most part the change houses of the Tri-State camp are in fine condition, well provided with shower baths, lockers and heating equipment. He also reported that the sanitary condition of the town of Picher has been improved during the year by the acquisition of a sewer system, and that typhoid fever has been reduced at least one-half thereby.

Upon this suggestion, A. M. Gaines, president of the Tri-State branch of the Zinc Institute, and head of the hospital committee, promised to see if it would not be possible to prepare for smallpox, an epidemic of which is reported at Kansas City, Mo., by obtaining a suitable house to use for a detention hospital. Four years ago when smallpox developed it was difficult to secure such a place, and patients lacked proper care and attention for several days.

MICHIGAN

The Copper Country

Bureau of Mines Studying Underground Loading Devices—Seneca Repairing Gratiot Shaft—Winona Sells Its Standing Timber

BY M. W. YOUNGS

Houghton—It is estimated that there are 12,000,000 tons of sand in the Tamarack conglomerate tailings in Torch Lake, assaying 12½ lb. of copper to the ton. Calumet & Hecla plans to complete the reclamation plant there next summer, and the recovery of this metal will then begin. Though the deposit is not as extensive or as rich as that of the Calumet & Hecla proper, the copper can be recovered at low cost and the plant investment will yield a large return.

The Calumet & Hecla deposit originally contained 40,000,000 tons, running as high as 14½ lb. of copper to the ton. In 1920, the Calumet & Hecla tailings assayed 13.1 lb. to the ton, and of this amount 10½ lb. was recovered. A total of 14,138,240 lb. was produced, at a cost of 6.6c. per lb., exclusive of smelting and selling expense. This cost was high, on account of the abnormal price of coal and high cost of labor and supplies. It compares with a normal cost of 4½ to 5c. per lb. In the few years the Calumet & Hecla reclamation plant has operated it has recovered 48,537,488 lb. of copper. It is estimated the remaining sands carry over 450,000,000 lb. of the metal.

A study is being made by the Bureau of Mines of power shovels, stope and level scrapers, and other similar devices. A representative of the Bureau is now in the Lake district to continue the investigations. He has already visited other mining sections in the west, southwest and northwest. The findings will be incorporated in a report soon to be issued.

At the Gratiot shaft of the Seneca property extensive repairs are under way, preparatory to the resumption of sinking. The old shaft collar is being removed, and a new collar will be constructed. Steel sets will be used, and the collar will be concreted through the overburden, a depth of 95 ft. from surface. The present depth of the shaft is 1,420 ft. It will be sunk 1,800 ft. deeper, at which point it will be connected with the 3d level drift, north, from the Seneca shaft. The present hoist will be replaced with one having a capacity of 3,500 ft., purchased recently from the East Norrie mine, at Ironwood. The distance between Seneca's 3d level and the Gratiot shaft is approximately 4,000 ft. The 3d level drift is now about 1,900 ft. long. Seneca's forces have been somewhat increased to provide for the new work at the Gratiot shaft. It probably will be several months before sinking is resumed. All five drifts from the Seneca shaft, proceeding northward toward Gratiot, have been in good milling ground practically all the way. The showing in the 3d level drift, the longest, and in the 7th, the deepest, is important, inasmuch as these openings prove that values extend in the direction of Gratiot and also persist with depth.

The Winona Mining Co. has just concluded an important deal, having sold all of its standing sawlog timber to the Pampa Land Co., recently organ-

ized, which will establish a sawmill and tiemill at Winona. The transfer involves 20,000,000 ft. of timber, the greater part of which was owned by the Winona and the remainder by several small holders. The Winona company has arranged to sell power to the new concern and also will allow it to use its electric railway, houses, and other equipment in its work. The arrangement does not affect the mining rights of Winona, the company retaining all of its lands and other mining assets.

Gogebic Range

Operations Resumed at Newport and Palms-Anvil Mine

Ironwood—The Steel & Tube Co. of America has announced resumption of mining operations at its Newport and Palms-Anvil mines on Nov. 21. About 160 men have been employed at these mines, keeping them in repair and ready for operation. About 100 more will be taken on at the Newport and 150 at the Palms-Anvil. This will bring their forces up to about a quarter of normal strength.

The Newport will work three days per week and stock its ore, and the Palms-Anvil will work six days, but with no night shift, and will ship its ore to the company's furnaces at Mayville, Wis. The Eureka mine at Ramsay has taken on a few more men who were badly in need of work.

The Oliver Iron Mining Co. is preparing to sink "G" shaft of the Pabst mine another 120 ft. from the 23d to the 24th level. The latter level has been opened up from a transfer shaft and from "H" shaft.

Menominee Range

Carpenter and Monongahela Mines To Reopen Dec. 1

Crystal Falls—The M. A. Hanna Co. has given orders to reopen the Carpenter and Monongahela mines on Dec. 1. About 300 men will be given employment on full time. The mines have been idle since early in the summer. All ore mined will be stocked for shipment next summer. Prospects for the winter are far brighter than they were a few weeks ago, because of the Hanna announcement and the fact that the Steel & Tube Co. added 250 men to the forces at the Newport and Palms-Anvil mines on the Gogebic Range. It is expected that the Oliver Iron Mining Co. will soon issue a statement regarding winter operations.

Iron River—The Spies was the last mine to ship ore by water this year. An order was received recently to forward 28,000 tons to Escanaba, and this was soon loaded. Present indications are that Pickands, Mather & Co. will reopen some of their mines on Dec. 1. All of their properties are now idle.

Marquette Range

Kloman Mine Being Examined With View to Leasing

Ishpeming—The Holmes was the last property to move ore from stock this year. Twenty thousand tons was shipped by water this month. No announcements have been made regarding resumption of work at Marquette Range mines. A number of properties are being worked on a half-time basis and will probably continue to do

so throughout the winter. Very little ore was sent out during the period of navigation and the stockpiles are well filled.

Republic—Engineers in the employ of R. W. Hunt & Co., of Chicago, recently inspected the Kloman mine for a Chicago concern which may take a lease. The mine has been idle for years, but it is known that it contains some low-grade ores. There is a possibility that a concentration of high-grade ore exists, such as found on the Republic, which adjoins on the east.

MINNESOTA

Mesabi Range

About 40 Per Cent of Men on Range Have at Least Part-Time Work

Hibbing—To reduce the rapidly rising number of unemployed in the Lake Superior iron district, the local managers of many of the independent operators have submitted plans to their eastern headquarters for the reopening of many of the mines after Dec. 1. The increase of the number of unemployed men is due to curtailment or temporary abandonment of road work and other construction activities. About 40 per cent of the 30,000 men employed normally in this district are now at work either full time, or part time, with married men given the preference.

Eveleth—The Oliver company's Leonidas mine has laid off most of its men, and only a few crews are now busy cleaning up. This is incidental to the closing of the shipping season. Stripping at the Spruce mine, operated by the same company, is being continued. The company plans to keep as many of the men employed as is possible.

Marble—To facilitate the handling and grading of ore next season at the Hill-Annex mine, the Interstate company has started to stockpile some of the cretaceous ore taken out, which it plans to treat at its washing plant next season.

Nashwauk—The Hanna Ore Mining Co. has started three diamond drills to work at its La Rue property to prove up the deposit lying south and east of the present pit limits.

Vermillion Range

Shift Added at Oliver Company's Pioneer Mine

Ely—Another shift of miners has been put to work at the Oliver's Pioneer mine. Recently a day shift of 100 men has been working steadily, but with the additional shift added it is estimated that the total number employed will be 250.

ALABAMA

Upward Trend Continues—Employment Conditions Much Improved in Birmingham District

BY GEORGE HUNTINGTON CLARK

Birmingham—Predictions as to iron making for the closing months of the year in the Birmingham district, based upon an expectancy of a steady although gradual upward trend toward normal, seem to have been reasonably well founded on fact. Authoritative figures for October production, now officially known, show that the pig-iron output has been actually 100,261 tons, or as premised.

Contributory, and in large measure auxiliary, to this pig-iron output, Octo-

ber coal production reached the highest mark since last February, being approximately estimated at 1,005,038 tons. The largest production for any week, or 266,000 tons, seems well advanced toward normal, which would be in excess of 300,000 tons. It is probable, however, that in some degree this output was measurably increased by anticipation of the threatened railroad strike.

Coke production, under the prevailing price basis, reached a total figure of 199,123 tons.

According to official figures, Alabama pig-iron production for the year steadily declined from the January output of 144,426 tons to the minimum of 66,573 tons reached in July. The upward trend, beginning Aug. 1, has been gradual but steady, culminating in the October output above stated, with an accredited total for the year, thus far, of 973,043 tons.

The output of steel realized was 65,000 tons, reflecting a recent order received from the Southern Pacific R.R. and now confirmed, for 44,600 tons of standard-steel rail, which represents the output of the Ensley plant of the Tennessee Coal Iron & Railroad Co. during a seven-weeks' period of normal operation.

Conditional rail orders from other southern and southeastern railroads, if confirmed, will bring the total steel rail business anticipated up to a total of about 130,000 tons already for 1922 delivery.

In view of the above encouraging upward trend of affairs generally, conditions of unemployment are naturally much improved, with no labor troubles or difficulties either under adjustment or expected.

CALIFORNIA

Central Consolidated and Norambagua Mines Merged—Engels Copper Increases Output

San Francisco—Consolidation of the Central Consolidated Mines, Inc., and the Norambagua Mines, Inc., both properties in the Grass Valley district, has been announced. Neither property has been in operation for some time. The Central Consolidated Mines, northeast of Grass Valley, was organized by John M. Nicol, a mining engineer of San Francisco. Mr. Nicol found it difficult to interest sufficient capital, and therefore made no attempt to work the property. The Norambagua is south of Grass Valley, and is an old property. After being closed down for a number of years it was reopened in 1916 by T. R. Pell and his associates, and the plant was modernized. The work was suspended during the war. The officers of the company are: President, N. J. Webster; vice-presidents, Theodore Roosevelt Pell, New York, John M. Nicol, San Francisco; vice-president and secretary H. B. Walmsley; treasurer, Leland Lyon; directors, Ernest Du Pont, A. De W. Foote, Parmeley W. Herrick, John Erickson and William H. Finley. Apparently, John M. Nicol is to be in charge of operations and F. A. Beauchamp is said to be retained as consulting metallurgist. No operating plans have been announced.

The organization of this company indicates the marked tendency toward the merging of small mining companies into larger groups that has characterized gold mining during the past ten years in this state.

An encouraging report is given by W. J. Loring upon the condition of the Plymouth Consolidated Mines. Because of the low grade of the ore and a large amount of development work the monthly returns have been unsatisfactory. Rich ore has been found in the small west vein on the 3,235 level, and this is expected to sweeten the bullion returns sufficiently to bring the property back to a paying basis.

The Engels Copper Co. is reported to have produced 1,100,000 lb. of copper and 17,000 oz. silver in October. This company has kept its properties steadily in operation during the period of the copper slump.

NEVADA

Tonopah Belmont and Extension Companies Providing Permanent Quarters for Men—Spanish Belt Mill Makes First Shipment

Tonopah—The Tonopah Belmont company recently shipped bullion valued at \$153,000, representing the clean-up for the last fifteen days' operations in October. Since the strike of last April the Tonopah Extension and the Belmont have provided accommodations for their men, and both companies are now preparing permanent quarters suitable for winter. This is the first time in the history of the district that boarding and rooming houses have been provided by any company for its men.

The Cash Boy is sinking a winze from the 1,650 to the 1,770 level and is doing lateral drifting and stoping. About four cars of ore of milling grade are being shipped per month to the MacNamara mill. About twenty men are employed at present, part on development work in connection with apex litigation with the Tonopah Extension.

Divide—The Tonopah Divide shaft has nearly reached the 1,200-ft. point without striking the water level, and no change is reported. Development work, consisting of drifting and raising on the vein, on the 1st, 2d, 3d and 8th levels, progressed normally. Regular daily fifty-ton shipments are being made to the Belmont mill at Tonopah.

Spanish Belt—The Spanish Belt Consolidated Silver Mining Co., operating fifty miles north of Tonopah, made its first shipment of concentrates on Nov. 15. Tonnage was about thirty, and values approximately \$200 per ton. With normal operations the company expects to ship two cars per month in the future.

ARIZONA

Old Dominion Said To Have Broken Diesel Records—Iron Cap Suit Up at Tucson Dec. 12

BY JAMES H. McCLINTOCK

Phoenix—On a stormy night last July, a daring thief stole the platinum tips from the ends of eight copper lightning rods that projected high above the coping of the new 275-ft. smokestack of the International smelter at Miami. The tips have just been replaced.

From the Old Dominion power plant comes report that one of the company's 1,250-hp. Diesel engines has broken all Diesel records by continuous operation for 66 days. It is furnishing all power now consumed by the Old Dominion and Arizona Commercial properties.

The side line and apex dispute between the Iron Cap and Arizona Commercial companies will be heard in Globe, in the Gila County Superior Court, Dec. 12, before Judge Samuel L. Pattee, of Tucson.

A contract has been awarded for leveling the site of the new United Verde crushing plant, which is to be on one of the low hills on the edge of the Verde Valley, west of Clarkdale. There will be 35,000 cu.yd. of excavation and 18,000 cu.yd. of fill. More than three months will be required for the work. The buildings of the company's Cottrell smoke treatment plant at Clarkdale are completed and the stack is being erected.

James Douglas, president of the United Verde Extension, states that negotiations are in progress with the railroads in the hope of securing a freight rate of \$5 a ton on copper bullion from this section to San Pedro harbor, on the Pacific coast, with expectation of shipping thence by water to New Jersey refineries. The pre-war rail rate to New York on bullion loaded at Douglas was less than \$9 a ton. This has been raised to about \$16, constituting a serious barrier for the southwestern copper industry to surmount.

NEW MEXICO

Possible Freight Reduction Encouraging—Gold Strike in San Mateo Mountains Causes Activity There

BY JAMES P. PORTEUS

Lordsburg—Mining men generally are encouraged at the promised freight reductions on mine necessities. New rates on coal from the mines in northern New Mexico and southern Colorado will re-establish the old relationship of 15c. per ton higher for coke than on coal, and rates on slack coal, which has never had a rate before, will be established on a basis of 80 per cent of the lump rate.

The new gold strike in the San Mateo mountains, thirty miles north of Palomas Hot Springs, is still attracting attention. Many locations are being made and additional pits are being sunk. It is claimed that the quartz ledges, which are in rhyolite, have been traced for six miles. Picked samples brought out show free milling quartz, and assays of from \$10 to \$40 are not unusual. The arroyos and gulches are being panned for gold, with fair results, the gold being fine but of good quality.

The 85 mine has cut the station on the 1,350 level, this point being 1,600 ft. below the apex of the vein. The shaft will be carried 50 ft. deeper to make room for ore pockets. A drift will be run to cut the vein, estimated to be 110 ft. distant.

The Co-operative mine continues to work, having shipped a car of high-grade silver ore to the El Paso smelter last week. Fluorspar continues to move, with three cars from the Great Eagle mine here and several from Las Cruces, all to Chicago territory.

A compressor and gas engine have been moved onto the Norman King ground in the Steeple Rock district. Development work will start at an early date under the lease and option held by the Calumet & Arizona company.

Chloride—John McCutcheon has almost completed the fifty-ton flotation mill on the Silver Monument property.

The Midnight company also has men working on the construction of a fifty-ton mill. All machinery has been purchased, but some heavy pieces are still at the railroad. Bad roads have been a serious handicap.

Silver ores are being shipped to the El Paso smelter by Stauber and Wright from Lake Valley, by Stauber, Wright, Bell and Anderson from Chloride Flat, near Silver City, and by the Lady Franklin mine, at Kingston.

Under date of Oct. 26, 1921, Judge Colin Neblet, of the U. S. District Court for New Mexico, entered a decree in the case of Fleming et al vs. the Monte Rico Mining Co., Lawrence R. Boyd et al, which put an end to litigation which has tied up the affairs of the company named for more than four years. The judge directed in the decree that the bill of complaint be dismissed at the plaintiff's cost and that the defendants recover from the plaintiff their costs expended in the case.

siderable promising ground for deeper exploration.

Rich ore has been found on the 20th level of the Ajax, where the development work is on company account. An 18-in. vein of \$60 ore has been opened for a distance of 40 ft. on the Phillips lease.

The Le Brun Co. is developing the South Burns mine under lease, and extensive prospecting with diamond drills is progressing. Holes will be drilled from the 12th level of the South Burns to the Pharmacist, from the 3d level to the Findlay, and from the bottom level to the Pauper. The 11th level has been advanced 260 ft. north of the shaft, to cut the ore shoot mined above the 10th level, and a recent strike on the 13th level is developing favorably.

The Bull Raven Mining and Development Co. will undertake extensive prospecting by diamond drill, under the direction of E. P. Arthur, consulting

IDAHO

Coeur d'Alene District

Gold Hunter Planning To Resume Production—Day Mines May Reopen About Jan. 1—Paragon Consolidated To Use Electric Power in Mine and Mill.

By A. J. DUNN

Wallace—The Gold Hunter Mining & Smelting Co., operating at Mullan, is planning to resume production soon after Jan. 1, according to a statement recently made by C. L. Herrick, general manager. The company has been inactive during the last year, the chief cause of suspension being the excessive freight rates on smelter products to the east. A substantial reduction was made several months ago, but in the meantime the price of lead had declined to a point that made it impracticable to resume operations. The



TAMARACK & CUSTER CONSOLIDATED MINING CO.'S PLANT, SUNSET, IDAHO, THREE MILES FROM WALLACE

COLORADO

Diamond Drills Active in Cripple Creek District—Scotia Mill Being Remodeled

Silverton—Development work has been resumed at the Kittimac property, and drifting is in progress on both north and south veins.

Recent development work in the Gladstone tunnel opened a 4-ft. vein of silver lead ore. A mill test resulted in making concentrates assaying about 30 oz. silver and 25 per cent lead.

Cripple Creek—The work of advancing the Roosevelt deep drainage tunnel a distance of about 2,500 ft. from the Portland to the Vindicator mine is now under way. Work on the extension will also be done from the Vindicator end. The new connection will greatly reduce the cost of pumping at the Vindicator, and make available con-

engineer. The company will also unwater the Maude Helena shaft.

The Sangre de Cristo property is being reopened by Samuel MacDonald and associates. Compressed-air power is being installed preparatory to a campaign of development.

Telluride—During October the shipments of concentrates were as follows: Smuggler-Union, 90 cars; Tomboy, 56; Liberty Bell, 6 cars from clean-up around mill; total, 152 cars, compared with 109 cars for October last year.

Idaho Springs—Many properties that have been closed down for some time are being reopened, and there is a general revival of mining activity. The Little Mattie company will install a new wood-stave pipe line for power purposes, unwater the mine, and overhaul the mill, preparatory to resumption of active operations early next year.

more recent advance in the price of lead and favorable outlook for the metal now justify the company in preparing for an early resumption. The Gold Hunter employs normally about 160 men.

The belief also prevails that the Hercules and the Tamarack & Custer, commonly referred to as the Day mines, will also become active about Jan. 1, but of this there is no authoritative information. It is known that a large amount of coal has been delivered at the Hercules during the last few weeks to be used for heating surface buildings; that a carload of powder has recently been delivered at the mine, and that a large order has been placed for mine timbers. At present probably not more than twenty-five men are employed at the Hercules, and naturally the delivery of these large orders is taken to mean that a

large force is soon to be put to work. At the Tamarack probably not more than a dozen men are employed, the mine being in excellent condition for production. The mill has been undergoing repairs. These movements in connection with the Day mines, taken with the favorable metal situation, are responsible for the prevailing belief that they will soon be active.

The directors of the Paragon Consolidated Mining Co. have placed an order with the Washington Water Power Co. for the immediate installation of electric power for both mine and mill. It is thought that this may mean the placing of that company in position for uninterrupted development and production, but it is also expected to have a direct bearing upon the reconstruction of the Prichard Creek branch of the O.-W. R. & N. Ry. from Prichard to Paragon, a distance of about fourteen miles. This branch was washed out four years ago. War conditions prevented reconstruction at the time, and unfavorable mining conditions subsequently discouraged the enterprise. The Paragon has a mill of 100 tons' capacity and tonnage available with which to supply it. With this company using motor trucks for the delivery of its product to the railroad, and several other properties in position to ship, it is believed that the reconstruction of the railroad will be amply justified. In fact, a company has been organized for the purpose, and it is expected that the action of the Paragon company in preparing for production will materially assist in financing the enterprise.

Clarks Fork.—Operations at the Lawrence mine have been resumed under the management of Joe Reed. A crew was started Nov. 5 stoping ore from above the level of the main tunnel. Milling operations will be resumed as soon as enough ore is in the bins.

By a suit filed in the district court, Helen F. Thibadeau, secretary and treasurer of the Copper Giant Mining Co., seeks to recover \$58,500 from John G. Lake and associates as damages caused by the sale of treasury stock, which, it is claimed, rendered her holdings valueless.

The Clarinda Mining Co. has awarded Oscar Nordquist, of Murray, the contract for completing tunnel No. 5 to the Lone Pine vein. The tunnel has been driven 1,190 ft. and will cut the vein within the next 205 ft., it is estimated. Some promising mineralized stringers carrying chalcopryrite have been cut in driving this tunnel.

MONTANA

Helena Smelter Still Looking for Suitable Ore—Anaconda To Resume at Bonner Lumber Works

By A. B. KEITH

Butte.—In view of the high silver content of the concentrates of the Butte & Superior Mining Co., it will occasion no surprise if production is resumed within thirty days. In fact, an eastern officer of the company is credited with the expression of an opinion to this effect. Development of copper ore on the 2,200 level continues.

Damages of \$11,900,000 have been named by the Minerals Separation North American Corporation as due it from Butte & Superior, this according to the estimate placed before the mas-

ter who has been taking testimony in New York in the accounting resulting from the flotation litigation. This sum is given as the measure of damage as representing the difference between water concentration and flotation.

Anaconda is continuing development work to the extent necessary as a measure to help relieve the unemployment situation. At its phosphate deposit, near Soda Springs, Idaho, development work is apparently going ahead.

It is officially announced that Anaconda will resume operations at its Bonner lumber works on Dec. 1. This plant is situated west of Butte, near Missoula, and will afford employment for about 700 men. Anaconda has been building a new logging line, and with the men which it will put in the timber or has there already considerable relief will be given the unemployed.

The Tuolumne Copper Co. is finding the eastern territory on the 1,600 level encouraging. There is a possibility that development of other veins besides the Spread Delight on this level will be undertaken, particularly the Sinbad fissure, after which the original shaft on the Tuolumne's Main Range mine was named. This vein on the upper levels produced a good grade of copper ore, with the copper content running up to from 5 to 6 per cent. This showing was had on the 500 level and was the development which prompted the entry of the Tuolumne into the Main Range property.

The Barnes-King Development Co. is building a road to its recently acquired gold prospect near Waterloo, Mont. This property is promising on the surface.

Superior.—Rich copper ore is reported to have been found near Cedar Creek, about four miles from Superior.

Montana City.—The dredging possibilities of a tract of ground situated about ten miles from Helena below the early-day placer camp of Montana City, is attracting attention. Placer tracts in Alder Gulch and the Ruby Valley, where dredging has been in progress for years, are slowly becoming exhausted.

Helena.—The following statement has been made by an official of the East Helena plant of the American Smelting & Refining Co.: "It has been rumored that the American Smelting & Refining Co. has withdrawn from the custom ore business in the Butte district. While it is true that we have found it necessary to place an embargo on the very low-grade highly siliceous ores from Butte, we still are in the market for such Butte ores which will stand the necessary treatment charges."

WASHINGTON

Springdale.—Drifting on Cleveland mine property is nearing ore discovered by diamond drilling last summer. The mill is being put in condition for operation, in the hope of early production.

UTAH

Pittsburg Tramway To Be Completed Next Month—Prospecting Active in Big Cottonwood Section

American Fork.—The Pittsburg mine, which was productive of high-grade carbonate silver-lead ore in the early days, will have its tramway completed by the middle of December. Shipments are promised from sulphide ore carrying silver, lead, and zinc said to be left

in the mine. There is also considerable unprospected ground. Silver-lead ore of milling grade that has proven for 300 ft. and ranges from 2 to 4 in. in width, is reported to have been found at the Pacific mine. There is a mill on the property, which has not been operating for some time.

Ophir.—Directors just elected for the Ophir Silver Mines are: Guy La Coste, president and general manager; H. W. Lane; L. F. Adamson; W. G. Goodart, and Ira Tichenor.

Park City.—Shipments for the week ended Nov. 11 amount to 1,962 tons, as compared with 1,979 tons the week preceding. Shippers were: Judge allied companies, 934 tons; Silver King Coalition, 603; Ontario, 425. A station has been started at the top of the contact raise from the Spiro tunnel at a point just under the black limestone. Prospecting from here will be done along the contact. The second car from the new find at the Quincy mine will bring about \$66 smelter net. The ore runs well in silver.

Salt Lake City.—Owing to the opening of a new producer, the Alta Tunnel & Transportation, in addition to the Cardiff, which has been a successful shipper for a number of years, activity has been stimulated in the Big Cottonwood section. Prospecting is being carried on at the Howell, Tar Baby, Price, Reed's Peak, and other properties. The Alta Tunnel & Transportation has made its fifth shipment from the new find, although it is being hampered by lack of hauling facilities. Considerable ore is accumulated in the workings.

Eureka.—Ore shipments from the Tintic district for the week ended Nov. 11 totaled 177 cars. Shippers were: Tintic Standard, 69 cars; Chief Consolidated, 38; Victoria, 12; Dragon, 12; Centennial-Eureka, 7; Eagle & Blue Bell, 6; Iron Blossom, 5; Colorado, 5; Swansea, 5; Bullion Beck, 2; Empire Mines, 2; Gemini, 2; Showers, 1; and Sunbeam, 1. Shipments are considerably less than those for the week preceding, owing to an order for curtailment of shipments of dry silver ores by the smelters, effecting a number of shippers, among them the Chief Consolidated and the Tintic Standard. The restrictions upon dry silver ores are felt to be temporary, as the smelters have made special arrangements for this class of material.

The Iron Blossom will pay a dividend of 2½c. a share, or \$25,000, on Dec. 20. This will bring dividends to date to \$3,300,000. The last payment was made Jan. 26, 1920.

The Tintic Standard has installed two new roasters at its mill near Goshen. This will make a total of nine roasters, and the mill's capacity will be increased to approximately 200 tons daily. The new roasters are expected to be ready for operation early in December. At the Water Lily shaft of the Chief Consolidated the work of installing the new air line has been completed, and other improvements preparatory to resuming sinking have been made. The air pipe is 2 ft. in diameter, and the ventilating system is working satisfactorily, and will effectively remove any gas encountered in sinking. New guides have been placed in both compartments of the shaft, and a new headframe has been built.

At the Zuma the shaft is down 950 ft., and is being sunk at the rate of 4 ft. daily. The projected length of the shaft is 1,200 ft.

THE MARKET REPORT

Daily Prices of Metals

Nov.	Copper, N. Y., net refinery*		Tin		Lead		Zinc
	Electrolytic		99 Per Cent	Straits	N. Y.	St. L.	St. L.
17	13.00		28.75	29.125	4.65@4.70	4.35	4.65@4.70
18	13.00@13.125		28.75	29.125	4.65@4.70	4.35	4.65@4.70
19	13.00@13.125		28.75	29.125	4.65@4.70	4.35	4.65@4.70
21	13.125		29.00	29.625	4.65@4.70	4.35	4.65
22	13.125@13.25		29.25	29.625	4.65@4.70	4.35	4.65
23	13.25		29.50	29.625	4.65@4.70	4.35	4.65

*These prices correspond to the following quotations for copper delivered: Nov. 17th, 13.25c.; 18th and 19th, 13.25@13.375c.; 21st, 13.375c.; 22d, 13.375@13.50c.; 23d, 13.50c.

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

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

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

London

Nov.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3 M	Spot	3 M	Spot	3 M
	Spot	3 M							
17	66	67	74½	159½	161½	24½	23½	25½	26½
18	66½	67½	74½	158½	160½	24½	23½	25½	26½
19
21	66½	67½	74½	160½	162½	24½	24	25½	26½
22	66½	67½	74½	161½	163½	24½	24½	25½	26½
23	66½	67½	75	160½	162½	25½	24½	25½	26½

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

Nov.	Sterling Exchange "Checks"	Silver			Nov.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
17	399½	99½	68½	38½	21	399½	99½	69½	39½
18	399	99½	69	39	22	398	99½	67½	38
19	399½	99½	69½	39½	23	399	99½	68½	38½

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-half cent premium.

Metal Markets

New York, Nov. 23, 1921

The metal markets have not moved in unison. Copper has been the feature of the price movement through the week, advancing regularly and continuing to exhibit the strength it has shown for the last few weeks. The zinc market has eased off and shown a slight decline, and lead shows no change in price. Tin has continued its advance. On the whole, the metal markets had a satisfactory week.

Copper

All sorts of prices have been quoted and received in the copper market during the week, copper being sold last Thursday for 13½c. delivered, prices ranging upward to 13½c., the price received by one producer yesterday for

forward copper. The strength of the market and the upward tendency that were noted in the columns of the market report for last week are still characteristic of it. The demand continues to be for forward copper, very little metal for prompt shipment being sold. Some large-sized tonnages were sold as far ahead as next June, and at prices that were being quoted for first-quarter delivery, 13½@13½c. delivered. One producer expressed himself as being willing to consider sales for the entire year 1922. Several consumers have availed themselves of this opportunity to procure copper at the present attractive prices. No doubt the gradual advance in copper prices which began a few weeks ago has induced many manufacturers to come into the market now to fill requirements rather than

to risk a possibility of being unable to obtain satisfactory tonnages at some future date. Prompt copper was obtainable yesterday at 13½c. delivered, but the amounts of metal offered today at this price are not heavy. The larger producers have kept consistently above the market, but have seemingly had no difficulty in transacting business. They are generally quoting 13½c. delivered for delivery up to the end of February. Sales of copper have been so large for the first three weeks of this month that already it begins to appear that the 140,000,000 lb. sold in October will be handily eclipsed in November. The improvement in the copper market brings the date of resumption in production much closer. The subject is being talked of, but it is much too early to take such a step.

Export trade has been good, the metal having been sold both to Europe and the Orient by the Copper Export Association. It is reported that the European business has been booked on a 13.75c. c.i.f. basis.

Lead

The official contract price of the American Smelting & Refining Co. continues at 4.70c., at which level it has remained for about two months. The market was fairly active during the week, and New York transactions were made on a 4.70c. and a 4.65c. level, which is our range for the week. The St. Louis market has shown no change from the last report, and continues at 4.35c. One consumer expressed himself as being able to obtain the metal below this price, but we have heard of no sales to indicate that better than this has been done. Owing to the prospective reduction in freight rates from Missouri, producers in that state have been able to compete in the New York market. Several sales were made at the New York level quoted above for delivery after the reduction takes place, on Dec. 10. Competition from the West with New York will not be felt at such interior points as Pittsburgh and Cincinnati, for the freight decrease does not affect traffic to cities between St. Louis and New York.

Mexican lead is still going to Europe, where a much better market awaits it. Today's London price is the equivalent of about 4.53c. New York. The Spanish and Australian lead positions are none too good, which, coupled with the insistent demand from Europe and small stocks available, has led to an improvement in the London market.

Zinc

The market has been exceptionally quiet. Of the largest producers but one has been active in disposing of ordinary Prime Western metal. The lull has continued for almost two weeks, and has now found a reflection in the price, as zinc has been sold down to 4.65c. East St. Louis, for which it is readily obtainable today. Producers in a good financial position are generally unwilling to meet this price, and again it is the smaller operators who are setting the market.

The galvanizing trade has been interested more in high-grade than in other varieties of zinc. One producer reports that he is experiencing the best month of the year in high-grade metal, which is being sold at prices corresponding to those of the last few weeks, 6c., with freight allowed.

Tin

The market has risen, and prices are close to 30c. Large tinplate interests have been active in the buying of the week, the rise in the market evidently having induced prospective purchasers to fill their needs at the present time before the market has an opportunity to get away from them.

Tin for February delivery: Nov. 17th, 29.375c.; 18th, 29.375c.; 19th, 29.375c.; 21st, 29.625c.; 22d, 29.625c.; 23d, 29.625c.

Arrivals of tin in long tons: Nov. 17th, China, 100; 21st, London, 25, Straits, 375.

Gold

Gold in London: Nov. 17th, 102s. 8d; 18th, 103s.; 21st, 102s. 11d.; 22d, 103s. 3d.; 23d, 102s. 11d.

Foreign Exchange

Sterling has been the feature of the market, quotations crossing \$4 during the week, but failing to hold the advance. Other exchanges have been quiet. On Tuesday Nov. 22, francs were 7.13c.; lire, 4.123c.; and marks, 0.36c. New York funds in Montreal, 9½ per cent premium.

Silver

Silver has fluctuated violently the last week. During the first few days China banks were keen buyers, both in New York and abroad, but toward the close of the week speculators sold in London, and China became a reluctant buyer in the local market. Rupee exchange continues weak, with no buying by the Indian bazaars. At the close the market appears steady, with China again a buyer. On Nov. 18, the New York quotation for bar silver of "domestic origin" was raised from 99¼c. to 99½c. per ounce .999 fine. This advance in price was caused by the decreased cost of transportation, owing to the fact that the U. S. Government is now accepting delivery of silver purchased under the Pittman Act at the Philadelphia Mint only. Previously, when the quotation was 99¼c., the Government had required deliveries to be made at Denver or San Francisco Mints.

Mexican Dollars—Nov. 17th, 52½; 18th, 52½; 19th, 53½; 21st, 53½; 22d, 51½; 23d, 52.

Other Metals

Quotations cover wholesale lots unless otherwise specified.

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 17.50@18c., with practically no sales.

Antimony—Chinese and Japanese brands, 4.60c.; W. C. C. brand, 5.25@5.75c. per lb. Cookson's "C" grade, spot, 9c. per lb. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 5.25c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb₂O₃, wholesale lots, 6½@7c.

Bismuth—\$1.50@1.55 per lb.

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

Cobalt—Metal, \$3@3.25 per lb.; black oxide, \$2@2.10 per lb. in bbls.

Iridium—Nominal, \$150@170 per oz.
Molybdenum Metal—In rod or wire form, 99.9 per cent pure, \$32@40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; spot, 41c.; electrolytic, 44c. Small tonnage, spot, 35@38c. Market dead.

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

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

Palladium—Nominal, \$55@60 per oz.
Platinum—\$80 per oz.

Quicksilver—\$39@41 per flask. San Francisco wires \$41. Market dull.

The prices of the following metals remain unchanged from the figures published in these columns on Nov. 5: Rhodium, Selenium, Thallium, and Tungsten.

Metallic Ores

Manganese Ore—\$23@24 per unit, seaport; chemical ore, \$55@60 per gross ton, lump; \$75 per net ton, powdered. Nominal.

The market is generally exceedingly quiet, and prices on the following ores remain unchanged from the figures published in the Market Report in the Nov. 5 issue: Chrome, Iron, Magnetite, Molybdenum, Tantalum, Titanium, Tungsten, Uranium, Vanadium, Zircon, and Zirkite ores.

Zinc and Lead Ore Markets

Joplin, Mo., Nov. 19—Zinc blende, per ton, high, \$27.70; basis 60 per cent zinc, premium, \$26; Prime Western, \$26@25; fines and slimes, \$23@22; average settling price, all grades of blende, \$24.74.

Lead, high, \$63.40; basis 80 per cent lead, \$55@52.50; average settling price, all grades of lead, \$60.50 per ton.

Shipments for the week: Blende, 7,750; lead, 1,180 tons. Value, all ores the week, \$292,980.

Almost 9,000 tons was purchased this week, for next week's delivery, on \$26 basis, advancing the market \$1 over last week. The high school-tax assessed against bins of ore in the Picher and Cardin school districts in Oklahoma has caused the sale of some reserve ore, and a few other bins may be offered for shipment at an early date. Ore on hand at the year-end will be subject to tax, said to amount to \$2 to \$3 per ton. The matter was fought out in the Oklahoma courts last year, with all decisions against producers of zinc ore.

Platteville, Wis., Nov. 19—Blende, basis 60 per cent zinc, \$29. Lead ore basis 80 per cent lead, \$55 per ton. Shipments for the week: Blende, 535; lead ore, 80 tons. Shipments for the year: Blende, 10,719; lead ore, 1,763 tons. Shipped during the week to separating plants, 461 tons blende.

Non-Metallic Minerals

Asbestos—Crude No. 1, \$1,000@1,500; No. 2, \$600@850; spinning fibres, \$225@400; magnesia and compressed sheet fibres, \$150@250; shingle stock, \$80@150; paper stock, \$45@65; cement stock, \$15@25; floats, \$7@10, all per short ton, f.o.b. Thetford, Broughton and Black Lake mines, Quebec, Canada.

Generally dull markets also exist for the non-metallic minerals, and there is no quotable change in the following from the prices published in our Nov. 5

issue: Barytes, Bauxite, Borax, Chalk, China Clay, Emery, Fluorspar, Fuller's Earth, Graphite, Gypsum, Kaolin, Limestone, Magnesite, Mica, Monazite, Phosphate Rock, Pumice Stone, Pyrites, Silica, Sulphur, Feldspar, and Talc.

Mineral Products

Arsenic—6½c. per lb., f.o.b. New York. Price has risen and the market is firm. Importations have been small and the insecticide business has improved, agricultural buying for next Spring being a feature of the market. Forward deliveries command a premium.

Potassium Sulphate—Powder, domestic, \$1@1.10 per unit, basis 90 per cent, f.o.b. New York.

The prices of Sodium Nitrate and Sodium Sulphate are unchanged from the quotations published in these columns Nov. 5.

Ferro-Alloys

No quotable changes have taken place in the following ferro-alloys from the prices quoted in the Nov. 5 issue: Ferrotitanium, Ferrocerium, Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotungsten, Ferro-Uranium, and Ferrovanadium.

Metal Products

Zinc Sheets—\$9 per 100 lb., less 8 per cent on carload lots, f.o.b. works.

Copper Sheets—Current New York list price, 21c. per lb.; wire, 14.75@15c. Lead Sheets, Nickel Silver, and Yellow Metal unchanged from Nov. 5th quotations.

Refractories

Prices on the following are unchanged from the figures published in the Nov. 5 issue: Bauxite Brick, Chrome Cement, Chrome Brick, Fire Brick, Magnesite Brick, and Silica Brick.

The Iron Trade

Pittsburgh, Nov. 22, 1921.

Though the finished-steel market in general is commonly reported as being distinctly dull, there is a fair degree of activity, making a favorable comparison with conditions in July and August but an unfavorable comparison with the latter part of September and the forepart of October.

There is important improvement in one respect, in that railroad buying on a scale of importance has been resumed. Orders for more than 5,000 freight cars have just been placed, and inquiries total more than 10,000 cars.

Steel production is ranging between 40 and 45 per cent of capacity, against a rate of 44 per cent in October, the highest rate since February.

Steel prices continue to show a slight sagging tendency. In the past fortnight there has been much shading of 3c. for black sheets and 4c. for galvanized sheets, but in the last two or three days many low prices have been withdrawn. The Steel Corporation is likely to announce first-quarter sheet prices within a week or so. Bars, shapes and plates are sometimes done at 1.50c., but the general run of the market is a shade above that figure.

Pig Iron—The market continues dull. Foundry iron has yielded 50c., to \$20.50, Valley. Bessemer remains at \$20, Valley. Though basic is still quoted at \$19, Valley, by producers, resale iron is available at less.

Coke

Connellsville—Furnace, \$3.35@3.50; foundry, \$4.25@4.75 per ton.

Disarmament and the Metals

Producers Undisturbed Over Cut in Naval Construction—Iron and Steel Trade Hardest Hit—Copper, Zinc, and Lead Producers' Prosperity Built Upon Sound, Peaceful, Industrial Applications

EDITORIAL MARKET STUDY

WAR IS WAGED WITH METALS. Therefore metal producers have a natural interest in war and anything that affects its conduct or regulates armament. Fortunately, this interest is not vital to the prosperity of any metal producer, as normal industrial applications greatly outweigh the uses of the metals in the prosecution of war. At the height of an active campaign or in preparation of a great offensive the effect of armament demand is felt most; during periods of peace it is at a minimum.

The Disarmament Conference at Washington, acting on the initiative of Secretary Hughes, has taken a sudden and bold step in adopting a plan of limiting naval armaments and scrapping some costly existing men-of-war. The curtailment of naval building comes just at a time when the three largest naval powers are preparing to enter on an extensive period of naval construction. The first reaction of everyone engaged in industrial pursuits to the Washington decisions is, "How will they affect me or the industry I am engaged in?" The answer is necessarily of especial interest to the metal-mining industry.

The most important metals used in war from the standpoint of quantity are iron, copper, lead, zinc, and nickel. Iron is by far the most important, particularly in naval armament, with which the Washington Conference is chiefly concerned, yet none of the leaders in the iron and steel trade seem particularly disturbed over the prospect of a severely curtailed or entirely abandoned naval-construction program. Comments have been decidedly optimistic and cheering. Judge Gary sums up the subject by saying, "Disarmament is a good thing—steel included." The recent convocation of the American Iron and Steel Institute found an echo of this expression in the speeches of Charles M. Schwab and others sharply affected by the turn of affairs.

Although statistics are not available to indicate exactly what proportion of the entire steel consumption of the United States enters into naval armament, it is estimated that the scrapping of fifteen capital ships now under construction would involve about 420,000 tons of steel. The further elimination of fifteen other war vessels would bring the total close to 600,000 tons, a small figure compared with the total rolled-steel output of the United States in 1920 of about 32,350,000 tons. However, the figures cannot readily be compared, as the building of so many ships would be spread over a period of possibly eight or ten years. The amount of steel required for a year's building would be only a fraction of 1 per cent of the entire country's tonnage. Even this small fraction will, nevertheless, cause a readjustment among employers and employees engaged in naval construction. It will be a wholesome readjustment. The world can still find use for many plows, railroads, steam engines, and other equipment and devices. This readjustment will be nothing compared with the great change that was made directly after the armistice, or with other great industrial alterations.

Copper producers are not at all perturbed over naval disarmament. Copper is more handmaiden to that wonderful servant of the twentieth century, electricity, rather than to the god Mars. The modern battleship uses relatively small amounts of copper; brass fixtures, electrical machines, copper in the ship's magazine, copper in various other manufactured forms account for the most of it. Copper and brass are most important in munitions manufacture—land and naval. Inasmuch as little prospect exists for a reduction of land armament, copper consumption normally entering into that channel may not be greatly affected.

Prior to 1914 the war demand for copper was an important market factor. Germany imported large amounts of copper for use in the manufacture of ammunition, and

it is generally admitted that the war chest built by Germany accounted in a great measure for the heavy purchases of American copper, the question may readily be asked whether, in view of Germany's disarmament, her future purchases of copper will be greatly reduced. The record for 1921 would answer strongly in the negative, as Germany has consistently been the heaviest buyer of American copper ever since the first of the year. The fact that a huge export trade will have to be built up by Germany in order to pay reparations presupposes that much copper will have to be imported for manufactures, such importations replacing to an unknown extent the copper imported for munitions. At the same time other European countries which remain on a war footing or one closely approaching it add to the demand for copper.

Estimates of normal copper consumption in the United States in munitions and armaments are unavailable. A guess would place the figure at not more than 20,000,000 lb. Of course, there are a great many uses for copper in electrical machines, instruments, or devices that are requisite in war, which may be considered to be affected by disarmament, but this is an unimportant consideration, as practically all these machines can be used for some peaceful pursuit.

Lead and zinc are important in war. Lead is used in making shot, shrapnel, and other ammunition, and zinc, as an important constituent of brass, is used in cartridge cases and other important applications. Here again no accurate statistics are available indicating what amounts of these metals are normally used in armament. The War Industries Board, however, has made an estimate for the war years 1917 and 1918 which would show that 2.6 per cent of domestic lead production for that period entered into shrapnel manufacture, 1.77 per cent into shot, 1.46 per cent into military small arms, and 1.39 per cent into sporting ammunition. For the first ten months of 1918, the ratios were still higher, 5.37 per cent for shrapnel, 1.38 per cent for shot, 3.10 per cent in military small arms, and 1.43 per cent in sporting ammunition.

The present demand for lead is not built upon consumption in most of these channels. The uses of lead in cable, pipe, sheets, storage batteries, foil, paints, and sporting ammunition are the healthy normal pillars of the lead-mining industry. Disarmament will not shake them.

Although the war demand for zinc raised that metal to unheard-of prices, prosperity among zinc producers is happily not predicated on war uses. Hence producers are untroubled over the proposed cut in naval armaments.

Perhaps the metal to feel the change most keenly is nickel. Large amounts of nickel are used in the manufacture of nickel steel, an especially tough and valuable armor. The peace uses of nickel have not been developed to the extent that other metals have, principally because of its higher price—from 30 to 40c. per lb. Nickel producers will undoubtedly feel the decreased naval building, both in the United States and abroad. Of the other metals, antimony, quicksilver, platinum, little need be said, as the United States is a small producer of them.

Even were the entire mining industry of the United States to stand a heavy loss by the cut in arms, the sacrifice would, we can rest assured, be gladly made for the advancement of civilization. The minor readjustments to be made consequent upon the Washington conclave will be concluded without great difficulty. The non-ferrous metal-mining industry will not be disturbed to the extent that the iron and steel trade will be affected.

The many industrial applications for all the metals which aid in promoting industrial development and in making life more comfortable offer a large enough field for the outlet of those normally consumed for war purposes.

COMPANY REPORTS

Hollinger Consolidated Gold Mines, Ltd.

A report of Hollinger Consolidated Gold Mines, Ltd., for 1920 states that profits amounted to \$3,792,341.59. Nine dividends of 1 per cent each were paid, or \$2,214,000. There was 650,205 tons of ore milled, the average value of which was \$9.93 per ton. The net value recovered was \$6,219,664.80. Bullion shipped in 1920 amounted to \$6,634,129.80. Profit and loss account follows:

PROFIT AND LOSS STATEMENT

Sources of 1920 income from:			
Gold and silver produced.....	\$6,939,628.43		
Interest on investments and other income.....	222,982.70		
		\$7,162,611.13	
Disposal of 1920 income:			
General charges.....	\$342,133.67		
Mining charges.....	1,851,046.92		
Milling charges.....	951,148.14	3,144,328.73	
Operating profit.....			\$4,018,282.40
Deduct:			
Taxes, Province of Ontario.....	\$66,927.26		
Municipal taxes (includes \$35,000 royalty to Town of Timmins).....	46,356.72		
Reserve for Dominion of Canada 1920 taxes.....	112,656.83	\$225,940.81	
Depreciation:			
Plant.....	445,985.08		
Investments in Hollinger Stores, Ltd., etc., written down.....	260,872.27		
Development written off.....	408,250.00		
Donations.....	1,959.31	1,343,007.47	
Net profit.....	\$2,675,274.93		\$2,214,000.00
Paid out in dividends.....	2,214,000.00		
Added to surplus.....			\$461,274.93
Surplus:			
Balance of account from 1919.....	\$2,670,577.08		
Profits from Jan. 1 to Dec. 31, 1920.....	3,792,341.59		
			\$6,462,918.67
Less dividends.....	\$2,214,000.00		
Plant depreciation.....	445,985.08		
Capital development written off.....	408,250.00		
Donations.....	1,959.31		
Investments in other companies and properties written down.....	260,872.27		
Net surplus carried forward.....		3,331,065.66	
			\$3,131,852.01

The company is capitalized at \$25,000,000, of which \$24,600,000 in stock is outstanding. General charges per ton of ore were \$0.5262; mining charges, \$2.847; milling charges, \$1.4628; a total of \$4.836.

Wallaroo & Moonta Mining & Smelting Co.

Copper; Australia

A report of operations of the Wallaroo & Moonta Mining & Smelting Co., Ltd., for the year ended June 30, 1921, shows a loss for the year of £71,863 18s. A total of 3,206 tons of refined copper, 1,600 oz. of gold, and 1,400 oz. of silver was produced. Working expenses were £342,590 19s. 1d., and office expenses and other charges brought this total up to £354,952 11s. 4d. The deficit of the company on June 30, 1921, was £87,747 3s. 4d. Capitalization, 200,000 shares of £2 each, of which 160,000 have been issued.

Broken Hill South, Ltd.

A report of operations of Broken Hill South, Ltd., for the year ending June 30, 1921, discloses that a loss of £56,701 17s. 11d. was incurred by the year's operations before depreciation and debenture redemption had been considered. There was produced a total of 14,307 tons of concentrates having a metal content of 7,801 tons of lead, 510,560 oz. of silver, and 1,730 tons of zinc.

Broken Hill South has large interests in other companies, among them being the Broken Hill Associated Smelters

Proprietary, Ltd., of which it has 200,000 shares of £1 each; the Electrolytic Zinc Co. of Australia, Ltd., 150,000 shares of £1; the Globe Proprietary Co., Ltd., 11,250 shares of £1; the Barrier Roaster Co. Proprietary, Ltd., £10,000 of £1 each; the Zinc Producers Association Proprietary, Ltd., 720 of £1; and the Australian Ore & Metal Co. Pty., Ltd., 300 of £1.

Operations of the company have been beset with many difficulties, mainly labor troubles.

Caledonia Mining Co.

Lead, Silver; Idaho

A review of operations of the Caledonia Mining Co. for the nine months ending Sept. 30, 1921, with financial report of Sept. 30, 1921, states that production during the above period is from the shipment of a small amount of ore, but comes mainly from reclaiming of material in stope fillings and dumps left from the early operations of the property and on which a profit is now possible because of improved working facilities, the good silver market, and the excellent marketing arrangements at the local smelter. It is estimated that it will require upward of a year to reclaim the material which still remains in old stopes and dumps. The standing ore in the mine is practically all gone, and development work done since the last report, which is being continued, so far fails to disclose new ore, and there is no substantial reason for expecting new disclosures. All of the company's ground will be thoroughly tested and prospected, however, before development work is finally terminated.

A statement of production and operating costs and a report of the financial condition of the company follow:

PRODUCTION AND OPERATING COSTS

	Quantity	Avg. Price	Avg. Assay	Amount
Total dry tons.....	6,963.39			
Pounds lead.....	994,094.00	4.4805	7.138	\$44,541.56
Ounces silver.....	148,051.02	0.989	21.260	146,349.15
Pounds copper.....	4,757.33			411.92
Gross value.....				\$191,302.57
Less smelter deductions.....				84,423.00
Net value of bullion.....				\$106,879.57
Mining, 6,963 tons @ \$7.48.....			\$52,105.26	
Shipping, 6,963 tons @ \$0.1335.....			929.35	\$53,034.61
Profit.....				\$53,844.96

FINANCIAL STATEMENT

Sept. 30, 1921		
Cash in banks.....		\$71,005.93
Liberty bonds.....		325,000.00
Treasury saving certificate.....		846.00
Due from smelter.....		12,860.54
Total.....		\$409,712.47
Current accounts payable.....		\$2,021.35
Reserve for taxes.....		6,333.09
Surplus.....		401,358.03
Total.....		\$409,712.47

Transvaal Gold Production

The following table summarizes Transvaal gold production since 1917:

RAND GOLD OUTPUT 1917-1921, IN FINE OUNCES

	1921	1920	1919	1918	1917
January.....	681,382	670,503	676,059	714,183	782,634
February.....	671,123	625,330	636,728	659,759	721,321
March.....	588,137	707,036	712,379	696,281	787,094
April.....	651,593	686,979	694,944	717,099	742,778
May.....	687,776	699,041	724,995	741,217	729,385
June.....	678,490	715,957	702,379	727,696	759,724
July.....	689,555	736,099	725,497	736,199	757,890
August.....	711,526	702,083	706,669	740,210	756,658
September.....	691,026	682,173	698,558	708,206	738,231
October.....		662,472	723,722	679,764	751,290
November.....		633,737	677,970	658,701	722,839
December.....		632,215	650,191	641,245	722,419

MINING STOCKS
Week Ended November 19, 1921

Table listing mining stocks with columns: Stock, Exch., High, Low, Last, Last Div. Includes sections for COPPER, NICKEL-COPPER, LEAD, QUICKSILVER, and ZINC.

Table listing mining stocks with columns: Stock, Exch., High, Low, Last, Last Div. Includes sections for GOLD, SILVER, GOLD AND SILVER, SILVER-LEAD, and VANADIUM.

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.

MINING, SMELTING AND REFINING
Amer. Sm. & Ref., New York 41 3/4 39 1/2 41 1/2 Mar. '21, Q 1.00
Amer. Sm. & Ref. pf, New York 82 1/2 81 1/2 82 Sept. '21, Q 1.75
Am. Sm. pf. A., New York 85 1/2 81 1/2 85 1/2 Oct. '21, Q 1.50
U. S. Sm. R. & M., New York 33 1/2 32 1/2 33 1/2 Jan. '21, Q .50
U.S.Sm.R. & M. pf., New York 42 1/2 39 1/2 42 1/2 Oct. '21, Q .87 1/2

