

Engineering and Mining Journal

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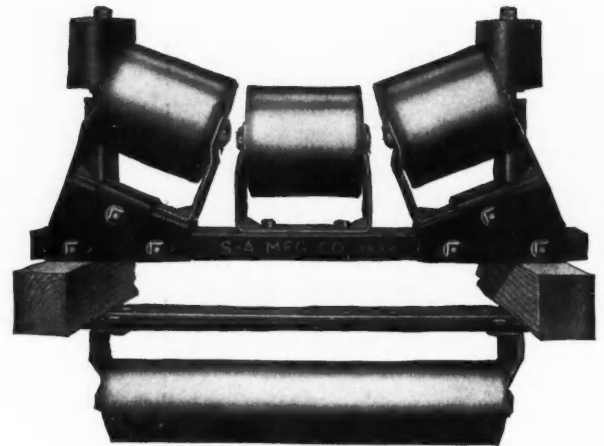
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Zinc Burning as a Metallurgical Process*

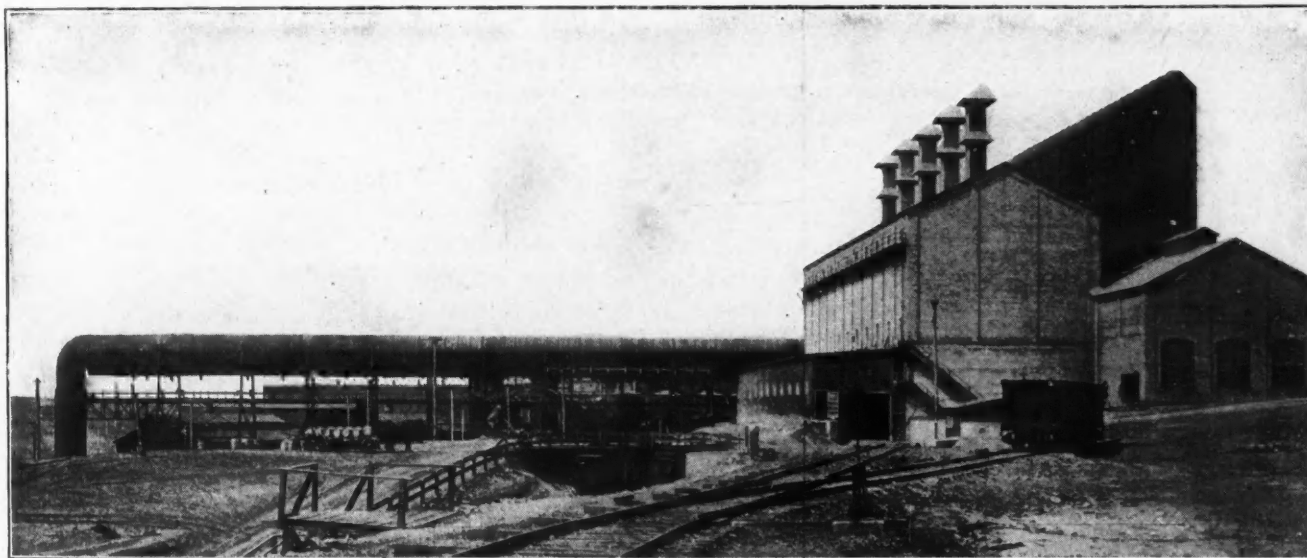
By W. R. INGALLS

Zinc burning is suggested as a designation of the practice of igneous concentration of zinc ores. This began with the development of the Wetherill process but seems destined to receive a wider application than the mere making of zinc-oxide pigment.

THE manufacture of zinc oxide directly from the ore is one of the most important contributions that America has made to the metallurgy of zinc. Heretofore, this has been done chiefly for the production of zinc and zinc-lead pigments, and the method has been known as the Wetherill process. While that term may properly be applied to the process for pigment manufacture, it must be recognized that the principles of the

of "zinc burning," which is convenient, readily understood and precise, for in all cases the zinc oxide is reduced to metallic form, is volatilized and is then burned to zinc oxide, the latter happening, however, after the zinc has been separated from the residue of the ore.

As previously indicated, zinc burning may be done either in blast or reverberatory smelting, the gangue of the ore being scorified and drawn off as slag, while other metallic minerals are reduced to matte or metal. Such processes have heretofore been practiced on fairly large scales. Thus, F. L. Bartlett smelted zinc ores at Canyon City, Colo., in specially designed blast furnaces, wherein the smelting column was only about 18 in. high. Such a limitation was necessary in order to prevent zinky accretions in the shaft of the furnace, which in course of time would have interfered with its operation.



FLUE, COOLING PIPES AND BAGHOUSE OF THE ANACONDA COMPANY'S PLANT AT GREAT FALLS, MONT.

process are of far wider application; and that there is going to be wider application in the immediate future is more than an expectation. I have in mind the use of the process as a method of igneous concentration.

Igneous concentration is broader in its scope than the Wetherill process, for it may be done in the blast smelting furnace, or in the reverberatory, or by other means. Igneous concentration is a rather clumsy term, and I prefer to introduce the new generic expression

In running the Bartlett furnaces it was easy to bar them off, indeed, to poke right down into the smelting zone, and keep things going freely. Some iron blast furnaces in Virginia and the spiegeleisen furnaces of the New Jersey Zinc Co. afford other examples of zinc burning in blast-furnace smelting, although in their cases the happening is incidental rather than a primary purpose.

Just as zinc may be burned off in a blast furnace, so also may it be done in a reverberatory. Indeed, there is less trouble, in some respects, in a reverberatory, for therewith there is no shaft in which accretions

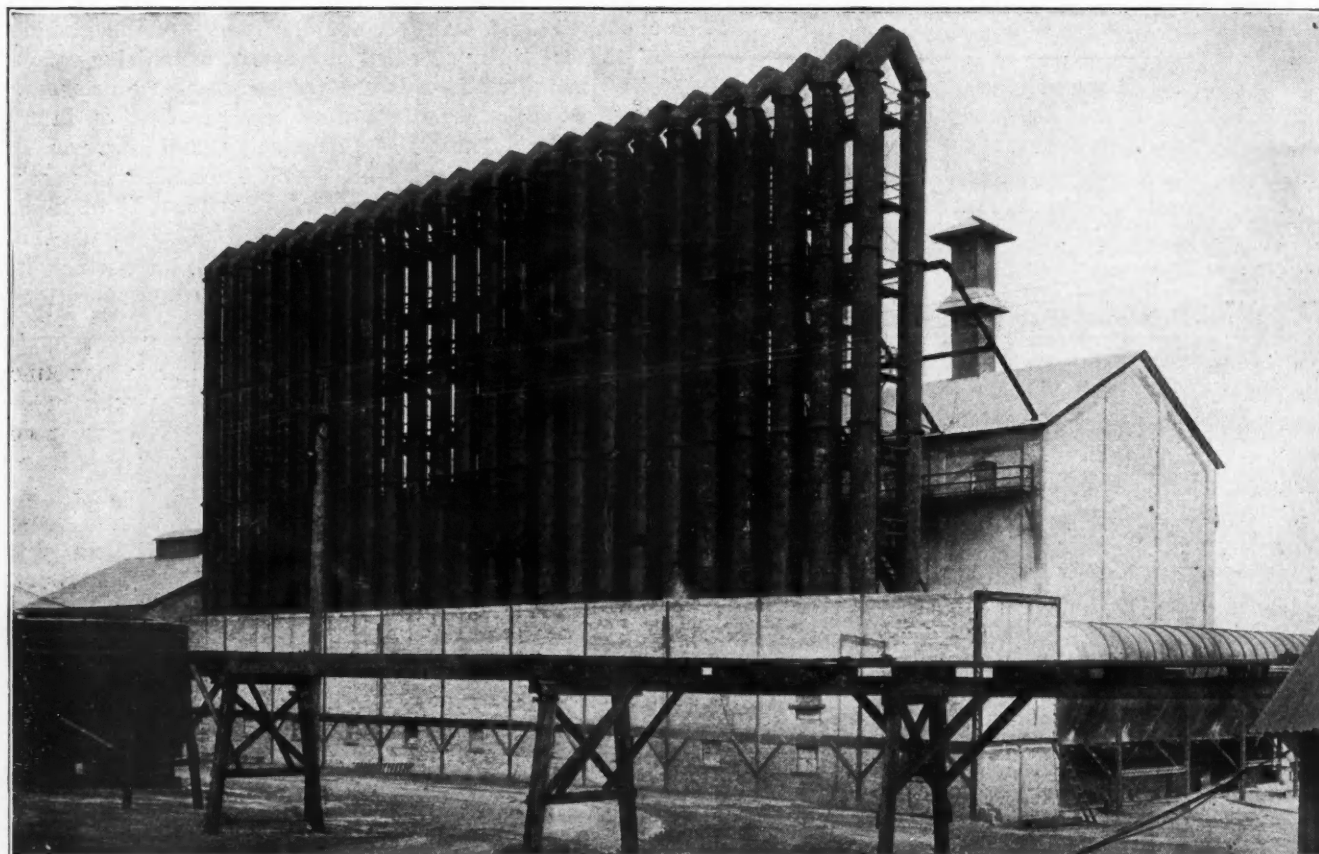
*This is a republication of a paper appearing in the *Bulletin of the American Institute of Mining Engineers* for September, 1917, to which the author has made some additions in both text and illustrations.

may form and hang. The first attempt to burn off zinc in a reverberatory furnace on a large scale whereof I know was made with the Fry process, first in a works at Swansea and later in a large plant on the Manchester Ship Canal. Trial of the process was also made by the Anhaltische Blei und Silberwerke in Germany. In this process the roasted ore was first smelted with about 25% of salt cake in a blast furnace, yielding silver-lead and a zinkiferous slag. The slag mixed with 10 to 20% of coal was then smelted in a reverberatory furnace, wherein the zinc was reduced and burned off. Although something like 25,000 tons of Broken Hill ore was treated by this method, the process did not prove a commercial success. About the same time Ellershausen was working on similar ideas at Angoulême, in France. He began by burning off zinc in a reverberatory, but he abandoned it in favor of a blast furnace.

About the same time, also, three European metallurgists—Pape, Witter and Babe—were working to-

at Anaconda, Mont., to make zinc burning in the reverberatory furnace a successful large-scale process. This was done early in 1917 for the extraction of the zinc remaining in the residues of the leaching for electrolytic zinc extraction.

The blast furnace and the reverberatory furnace are both smelting furnaces. A smelting furnace may be defined as one in which reduction, fusion and scorification are performed. The Wetherill-grate furnace is a blast furnace in which reduction is performed but no fusion and no scorification, or to but a slight degree. There is no run of slag, but merely enough formation of it to clinker the residuum. Anything more would clog the grate and the furnace could not be worked. We have here a combination of conditions that exist in the retort for zinc distillation and in the blast smelting furnace. The zinc is distilled and the residue remains in somewhat the same physical condition as in the former. The product can not be metallic zinc, however, for just as the carbon dioxide and excess of



CLOSER VIEW OF COOLING PIPES OF THE ANACONDA ZINC-BURNING PLANT, GREAT FALLS, MONT.

gether on the same problem and took out certain patents in common, but subsequently they separated. Pape developed a method of burning zinc out of the Oker slags, developing a special furnace of the blast-furnace order, and made a great commercial success of it, his zinc fume being a large source of zinc supply to the smeltery near Hamburg. Babe did further experimental work with apparatus conforming to the principles of the Bessemer converter. Witter took up the idea of reverberatory smelting and about 1908 carried on some rather extensive experiments at a works in Germany. However, neither Babe nor Witter developed a commercial method. It remained for Frederick Laist,

air act oxidizingly in the blast furnace, they act more intensively in the Wetherill furnace. That the reduction of zinc oxide to zinc takes place is well known for the beautiful bluish-green flames of burning zinc may be observed immediately above the charge but it is quickly converted into zinc oxide by the carbon dioxide and excess of oxygen that are present and what leaves the furnace is gas laden with zinc oxide (and lead oxide and sulphate if lead be present in the ore).

Heretofore the process of zinc burning on Wetherill grates has been confined to the manufacture of pigment. In that are involved problems in collecting a product of the requisite physical properties, especially

purity of color. It is necessary to effect a perfect combustion of coal dust mechanically carried over, a perfect separation of all mechanical impurities, and the ore that is treated must be free from certain impurities, such as cadmium, which affect adversely the color of the zinc oxide. In accomplishing these things much skill, that can be gained only from practice, is necessary. As a means of concentrating zinc, however, no great skill is required, the color of the product being no consideration, and the process then becoming so simple that attention is being increasingly directed to it. There are several directions for its application, the most important of which seem to be as follows:

POSSIBILITIES OF ZINC BURNING

1. As a simple means of concentrating low-grade ore, especially calamine, to save freight and treatment charges on worthless gangue. Thus, the calamine of Leadville might be taken to Canyon City, Colo., the zinc might there be burned off and the zinc oxide shipped to distillers or to electrolytic refiners. This is in fact being done on a small scale.

2. The residues from lixiviation in electrolytic zinc works, containing a large quantity of zinc owing to the formation of insoluble zinc ferrite in roasting may be burned on Wetherill grates for the extraction of that zinc. This is going to be done. An ore containing 48% of zinc and yielding 83% of it to sulphuric acid may have a residue assaying 20% zinc, the proportion of residue to original ore (roasted) being about one-third, and that 20% of zinc is well worth extraction.

3. It is possible that it may be found most economical in the electrolytic process to roast the ore, burn it on Wetherill grates and leach the fume.

4. The production of zinc fume in this way affords an excellent supply of zinc for the manufacture of lithopone and other chemical purposes.

All of the above are important opportunities for the process of zinc burning and within the next few years extensive applications of it are going to be witnessed. Whether the application will be by means of the Wetherill grate or of the reverberatory smelting furnace (I think the blast furnace may be dismissed from consideration) will depend upon the nature of the gangue, the precious-metal content of the ore, and the commercial and metallurgical conditions that prevail at any given place. Before undertaking to analyze the factors that will govern, let attention be directed to the behavior of silver and lead. Gold may be disregarded, as it rarely occurs in zinc ores.

Lead is even more easily burned out of an ore either in reverberatory furnace or Wetherill than is zinc. In my own experience, the extraction of lead has almost always been higher. In treating a lead-zinc ore, therefore, the product will inevitably be a lead-zinc fume. If the ore that is being burned contains sulphides there will be sulphur in the fume, for lead sulphide is volatile as such. The behavior of silver is variable. With some ores the larger proportion will go into the fume. With other ores it may remain in the residue. It would be preferable if it would all stay in the residue or all go into the fume; that is, preferable in consideration of subsequent steps for its extraction, but that never is to be expected. As to what determines

the behavior of silver I am not prepared to pronounce. I imagine that if the ore contains a little copper, enough to form a matte as collecting agent, more silver will remain in the residue than otherwise. Anyway, that is the experience in blast-furnace smelting.

As between Wetherill-grate burning and reverberatory-furnace smelting and burning, I think it impossible to lay down any hard and fast rules. The subject has been insufficiently studied and analyzed. Reverberatory smelting follows the same lines as for the treatment of copper ore, but sufficient carbon is mixed with the charge to reduce the zinc oxide. No great excess over the theoretical quantity is needed, the conditions being very different from those of the retort for distillation. Nor does it appear that the quantity of coal that must be burned in the firebox is greatly in excess of what is used in smelting an ordinary copper ore, although it is, of course, somewhat larger per ton of charge, for the endothermic reactions that are to be effected are more severe. It will be interesting to make comparison of the fuel consumption in this kind of smelting with the fuel consumption in zinc burning on Wetherill grates. I am not sure that there is yet sufficient reliable data to permit such a comparison to be made with any safety. Of course, the idea must not be entertained that zinc reduction is effected in a reverberatory furnace with no consumption of fuel beyond what is required for scorification of the gangue, formation of matte, etc.

ZINC TENOR OF THE SLAGS

It might be feared that the loss of zinc by scorification in reverberatory smelting would be high. It is rather hard to keep zinc out of the slag in any kind of smelting. Even in electrothermic smelting it is common to have 5 or 6% of zinc in the slag, with good work, while the percentage may be very much higher. If, then, in order to make a proper slag for the running of the furnace, it is necessary to flux the ore so that the proportion of slag to ore is high, the zinc loss in the slag may be uncomfortably large, although the assay of the slag may be moderately low. However, by maintenance of proper conditions the zinc tenor of the slag may be reduced to rather surprisingly low figures and the extraction of zinc as fume may compare favorably with what would be obtained in burning on Wetherill grates. Among the conditions that should be maintained are, in the first place, the figuring of a charge high in silica, according to the well-established theory that highly siliceous slags are the poorest zinc carriers. The lead smelter who has to slag off a high percentage of zinc aims to make the slag low in silica and high in iron. One who is going to conduct smelting and zinc burning in a reverberatory furnace must plan just the opposite. Among other necessary conditions is the maintenance of a neutral or reducing atmosphere in the furnace.

Bearing on the latter subject, the *Metalbank und Metallurgische Gesellschaft* in German patent, No. 290,013, Oct. 8, 1913 (addition to No. 252,195), says that the driving off of the zinc from the mixture of ore and fuel has been found to proceed more satisfactorily the smaller the excess of air in the heating gases entering the reaction chamber. Ordinarily, in smelting a charge, a portion of the zinc is held back by the slag

which forms, while the reduced zinc vapor is reoxidized by the excess of air to ZnO , which is dissolved in the molten slag. In order to overcome this difficulty, the process should be carried out in a reducing atmosphere, avoiding fusion. In order that the highest possible temperatures may be used, the charge is mixed with ores or additions so that only a sintering results, without fusion. The CO_2 present in the heating gases has been found sufficient to oxidize the zinc vapors without excess of air.

W. Troeller, in German patent No. 291,853 (Apr. 2, 1913) reports that experiments have shown that the expulsion of zinc and other metals from liquid slags or melts is dependent upon the degree of oxidation of various metals contained in the slags; for example, iron, and that such expulsion is practically complete only when these metals have reached their lowest degree of oxidation or are maintained in that condition. In view of this fact, a current of reducing

practice are in line with this idea, but, as I have previously indicated, good work with the reverberatory furnace may discharge slag with only 3% Zn and that is not far behind in zinc assay of the cinder from the best grate burning.

In reverberatory smelting and zinc burning the charge must be computed, just as for ordinary smelting, figuring, of course, that the major part of the zinc is going to be eliminated. If the material to be smelted is basic, there must be added sufficient silica to form the highly siliceous slag that is required. Unless such silica can be added in the form of ore, the charge is likely to be loaded unduly with barren, and consequently costly, flux. There must be sufficient sulphur and copper in the charge to form matte as collector of the gold and silver. The smelting may not go with perfect smoothness. There may be trouble from accumulations of zinc scum just above the matte. It may be difficult to control the slag and prevent it



INTERIOR VIEW OF FURNACE BUILDING, EAST PLANT, NEW JERSEY ZINC CO., PALMERTON, PENN.

gas, for example, illuminating gas, water gas, or the like, may be conducted through the slag or melt of ores, maintained in a liquid state at the reaction temperature in a directly or indirectly heated furnace, whereby volatile metals such as zinc, bismuth, antimony, etc., are reduced from their compounds and are driven out with the escaping gases.

In other words, once the oxide of zinc is reduced, the zinc vapor must be given the best possible chance to be volatilized and be reoxidized above the slag bath, not in it. If slagging be prevented, the scorification of zinc oxide will be reduced. It should be theoretically possible, for this reason, to burn the zinc more completely out of an ore on a Wetherill grate than in a reverberatory furnace, and I believe the results of

from going higher in zinc than desired. In spite of the volatilization of the major part of the lead, there may be reduction to the metal of a small part, probably high in silver, attention to which is a nuisance. In short, many of the metallurgical phenomena that are observed in the blast-furnace used for smelting zinky ores are to be witnessed in the reverberatory furnace.

In the use of labor and fuel, the large reverberatory of the Anaconda type is far ahead of the best form of the Wetherill furnace. With a small reverberatory the difference will be less, and indeed may disappear. Local conditions will, no doubt, determine the choice of method in all cases. For a small plant to treat ore giving an essentially basic or essentially acid residuum of no value for silver or copper content, the Wetherill

furnace would be on the most advantageous terms. If, however, the residuum approximated self-fluxing character and contained silver and copper contents worth recovering by smelting, it would be likely to be most advantageous to smelt at once and be done with it, recovering the zinc incidentally. The latter process will of course suggest itself in connection with the metallurgical treatment of deposits of zinkiferous pyrites containing sufficient copper for matte formation.

Domestic Nitrate Possibility

BY MARK R. LAMB

Metallurgical Engineer, New York City

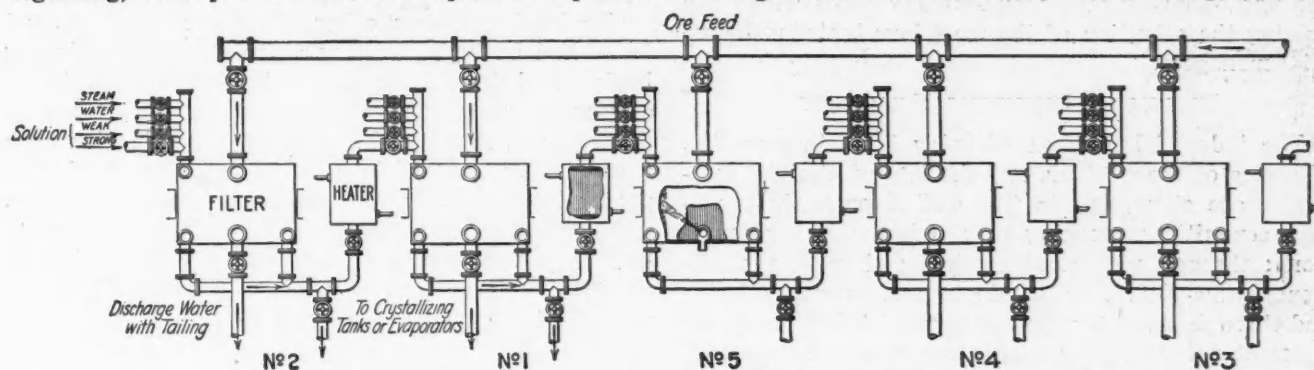
There is, or there is not, a commercially valuable deposit of nitrate on the Colorado Desert in California below the Needles and not far from the Colorado River. Even if this material contained 20% of nitrate it probably would not furnish a basis for profitable work if the usual system of treatment now employed in Chile were followed. Instead of 20% this deposit is said to contain 5%. The material containing nitrate is an impalpable clay which swells and disintegrates immediately upon the application of water. There is a similar deposit at Remiendos, Chile, and so far the Chilean deposit, which contains above 20%, has not been successfully worked.

As perhaps the only readers of this article will be those who are familiar with the technology of nitrate, I omit a history of the nitrate industry from the beginning, with special details of the process at present

they are diverted to crystallizing tanks while the weaker wash solutions and water washes, in turn, become saturated. This series operation with coarse, lumpy, rocky gravel and sand, is simple, as the solutions easily penetrate to a depth of 10 ft. of such material. The solutions would not penetrate an inch of the California material except under pressure. In order to give this California material the same treatment that the Chilean ore receives, it is necessary to use filters. Vacuum filters or pressure filters of the Kelly, Sweetland or Burch type are not suitable because they can not be operated in series.

For a number of reasons the ideal filter for this work is the Merrill filter. It can be built with a cake space suited to the ore, it can be built to be kept hot, the raw material can be fed to it as a thick pulp, the dissolution and washing can be carried on as a series operation, either with hot or cold solutions, and the only water which would have to be evaporated would be the wash water, which need not exceed five times the weight of the nitrate. The accompanying illustration shows an arrangement of Merrill filters to operate in series with the respective steam, water, weak-solution and strong-solution piping and heaters. The illustration is self-explanatory, with one exception—the solution drawn from the pipe marked "to crystallizing tanks or evaporators" would also be delivered to a mixer to which the ore would be fed.

If there really is any nitrate in California in the quantities stated, a set of five big Merrill presses, containing 50 tons each of dry slime charged, would



ARRANGEMENT OF PLANT FOR EXTRACTING NITRATE FROM CLAY

used in Chile. There are two ways of treating this California material, either of which would extract the nitrate; one being a commercial success and the other a failure. The latter would be as follows: The material would be wet with either hot or cold water in quantities sufficient to dissolve all the nitrate and would then be washed, either by decantation or filtration, the resulting solutions being evaporated. Assuming a content of 5%, at least 25 of water to one of nitrate would be needed for dissolving and washing, and this quantity of water would have to be evaporated, which would be too expensive. More evaporation would be needed if a decantation system of wash were used.

In Chile, and even with material containing 20 to 30% of nitrate, it is found necessary to dissolve the nitrate in a series operation—that is, the solutions are brought up to saturation at high temperatures by being sent through successive new portions of ore, the washing also being carried on as a series operation. In this way, as fast as the solutions become saturated,

complete a cycle of quotations of the five presses in an hour and would, therefore, produce 300 tons of nitrite daily. The cost of the plant would be a mere bagatelle compared with the cost of the proposed "hot-air" nitrate plant, and would have the rather important advantage—besides the fact that it would be erected and in operation in six months—that it can produce nitrate. Is there any nitrate in California?

OLD TIN CANS should be used again when suitable for paints, chemicals, etc., or should be utilized for their metal content, rather than wasted on unsightly dump heaps. A recent Commerce Report emphasizes the importance of the systematic collection of empty cans before rusting renders them unfit for detinning. The detinning process supplies steel scrap for openhearth furnaces, tetrachloride of tin for the silk-dyeing industry, pig tin for making new tin plate, babbitt metal and solder. The two companies now engaged in the detinning industry have indicated a willingness to increase their plants to handle additional tonnage that might result from the creation of a collection organization.

Mine Operation on the Leasing System

BY HENRY M. ADKINSON

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In spite of the popular conception that leasing indicates the final phase of mine operation, the system may be applicable to the main period of production. Workers may be transformed from shirking pay grabbers into responsible and serious men, willing and anxious to cooperate in every way with the management.

MANY mine presidents, directors, managers and stockholders are either overlooking or ignoring the advantages of mine operation on the leasing system. The general, and very erroneous, attitude toward this method of mine operation is that when a mine is tottering to its grave, then comes the proper and accepted time to prolong its life by artificial restoratives in the guise of leasers. Therefore the statement that a mine is being leased is equivalent to hanging crape on the door and announcing that the remains may now be viewed by sorrowing stockholders. I believe that the leasing system may be as advantageously applied to mines in robust health and with long expectancy as to those *in extremis*. I believe that mine operation by the leasing system is our nearest approach to the profit-sharing and bonus-earning plans which are holding the attention of the most broad-minded industrial managers.

INCREASING INDUSTRIAL EFFICIENCY

The industrial problem of today is to increase the efficiency of the workers, and the large industrial companies are struggling to this end through their welfare committees, working toward better living conditions; through piece-work methods; through the efficiency time-studies to eliminate unnecessary efforts; and through bonus-paying and profit-sharing plans. In a recent article telling of his experiences in developing the Bethlehem Steel Co. to its present standard of high production and profit earning Charles M. Schwab describes how he introduced the element of competition into his furnace crews by writing on the floor in front of the furnace the number of heats run by the day shift. When the night shift saw the figure, they asked what it stood for, and the next morning Schwab found his figure 6 erased and 8 in its place. The rivalry was started, and mounting rapidly it revived the entire organization. It resulted ultimately in the adoption of the profit-sharing system of wages which is now an integral part of the Bethlehem Steel Co.'s operations. Discussing this feature one day, a banker said to Mr. Schwab, "Your profit-sharing scheme works all right in your factory because it is applicable to your business, but it couldn't be used in our bank. Our business couldn't be handled by any such method." Mr. Schwab says that to prove his point of its general applicability he personally worked out the details of a profit-sharing system for bank operation. This holds a lesson for the mining profession. The leasing-system seems the most direct—and the most easily installed—

method to get results such as have been accomplished under profit-sharing plans. It puts the intensified efforts of a large body of men into the problem of producing the largest possible tonnage in the shortest possible time; which is, of course, the aim of our business. Just how its application is to be worked out in detail is the problem of the management. This is the management's business.

LEASING SYSTEM STIMULATES PERSONAL EFFORT

I have before me figures, which I am not at liberty to publish, showing how very profitably this method has been applied, both for the company and for the leaser. The company makes more net money per ton, and has a lower cost per foot of development work than it did while operated for many years solely on day's pay basis. The leasers make more money than mere day's pay would give them, and the mine as a whole is larger, better and developing faster than it could without this important factor of personal interest and financial stimulus injected into the whole organization through this profit-sharing system. This result has brought this problem directly home to me, and the possibility of its wide application induces me to suggest these prominent factors for the consideration of my fellow engineers.

The leasing system offers advantages that are not to be had through company operation on a day's pay basis. It brings forth the quality—very essential to any business—of interested, and therefore intensified, development. A leaser has a sense of possession in a part of the mine, and he aims to make his portion as productive as possible. He becomes an interested owner, and he loses all consideration of his former problem of how to put in his daily shift with as little labor as possible. His ownership provides a new and strong mental stimulus. The nearest approach to getting the same result on a day's pay basis is to provide a shift boss for each little group of miners, and even such a system falls far short of the desired object. There is no substitute for a mental interest directly stimulated by a financial participation in the result of personal effort.

MORE WORK ACCOMPLISHED PER UNIT OF CAPITAL

The leasing system makes for the operation of a mine by a force of men often so large that their employment by the company on a day's pay basis would be prohibitive. A hundred miners may be working in a mine whose treasury would not justify the day's pay employment of a tenth the number. This means rapid development and quicker expansion both in exploration and in production. I am reminded of a mine that was put on a leasing basis under conditions which did not permit the company to maintain a large force of miners. In a single month the new development work done by these leasers, by hand-mining alone, amounted to 859 ft. They worked shifts enough to have totaled \$17,000 in labor on an arbitrary wage scale of \$4 per day. Thus this company, which perhaps could have hired

\$2500 worth of labor on a day's pay basis, received \$17,000 in labor with no expense to itself, and obtained new development of its property in a ratio out of all proportion to the amount of work its treasury could have paid for. Such figures come directly home to the thinking manager with a force which impels investigation of their application to his particular problem.

The employment of leasers may have a correlative advantage in locations that are comparatively inaccessible. I have in mind a situation where a mine is 40 miles from the nearest railroad and during 6 to 8 months in the year the road to the mine is impassable. The mine is a large one and capable of supporting several hundred leasers, but the company is not affluent and can afford to hire only a small force on day's pay. Were the directors to convert their plan of management into the leasing system the direct result would be the establishment of a large town at the mine. There would then be so much traffic in supplies into the town to support the population, and so much ore would be hauled out, that the road would be open all the year. This would be of great financial benefit to the mine in even this one particular, because its production would be continuous. The company would be freed from the problem of delivering all its ore during the peak load of summer when railroads and smelters are rushed.

SUMMARY OF ADVANTAGES

It is not my purpose to offer an exhaustive discussion of this subject. I am merely pointing out some of the "high lights" which occur to me as advantageous in considering the leasing system as a direct method of mine management for mines with a long and prosperous life ahead of them—and not merely for such mines as obviously have one foot in the grave. Summarizing, some of the advantages are: 1. Intensified effort in each man's portion of the work, which is bound to result in economy of time and money; 2, expanded activity of the mine through increase in number of workers, regularity of production, increased production and exploration, and establishment of towns at mines, instead of small camps; 3, increased income to the company from company stores selling necessary merchandise; income from sale of compressed air, transportation, and such other services as the company can furnish better than the individual leasers.

All these advantages are obvious and others will occur to anyone considering a specific problem in relation to some particular mine. But they will not come of themselves, and *pari passu* with the change of operations from a day's pay basis to that of a leasing system. The success or failure of any plan rests with the management, provided that the plan is sound. In the issue of *World's Work* for July, 1917, this point is emphasized by A. J. Hemphill, chairman of the board of the Guaranty Trust Co., the largest trust company in the world. He says: "In considering employment of funds in any concern the greatest emphasis should be placed on the ability of the management. I would say that the most important consideration in any investment is management, management, management, and again management. It is not enough to know that it is honest, its ability in that particular business should be established. Ninety-five per cent. of the worth of an undertaking, I should say, is in the management." Does that hit home

to any of us, or do we calmly apply it to the other manager or superintendent?

Proper management of the leasing system is its *sine qua non*. If it is to be operated in a haphazard, indifferent and careless manner then it will fail as surely as any other method. In order to apply the leasing-system in the effective manner which will make it as highly efficient as it should be the company must maintain accurate records. It goes without saying that the technical data of mine mapping and assay records will be carefully compiled and preserved. But the pulse of the business will lie, as it always does, in detailed accurate accounting. The company must arrange its agreements with its leasers so that it will know the actual working costs of the leasers and the financial condition of each lease account. This information is the basis of the whole relation between company and leaser, and without the detailed data the rate of royalty cannot be adjusted fairly for both parties.

PROPER ADJUSTMENT OF ROYALTY IMPORTANT

The rate of royalty is the adjustable factor which makes the relationship of the two parties enduring. The costs of labor, of supplies, of transportation are all pretty definitely fixed, so far as the leaser is concerned, but the royalty rate is the connecting tie in which a link may be let out or taken up to make the conditions fair to both parties. We know districts where the royalty rate has become fixed through custom, 10% perhaps here, 15% elsewhere, and ignoring individual costs in individual mines, the whole district subscribes to this rate purely as a matter of custom. In other districts the royalty is on a sliding scale based on the metal prices in the New York market, but we may expect to hunt long and hard to find the rare instance where the costs have been thoroughly worked out and the royalty adjusted in a scientific manner from known figures. Proper accounting—proper detailed accounting—is the heart of the leasing system, as of any business, and it must be given first consideration. If you have your system based on proper accounting all else will be added thereto. Such systems have been installed and such systems are working now.

It is easy to soothe our own sense of satisfaction with the present manner in which we are conducting our operations by saying in effect, as the banker did to Mr. Schwab, "In our business it can't be done," but I am satisfied that not only the many mines which are today struggling along on a hand-to-mouth basis, but many other mines which are prosperous and paying handsome dividends will find that a radical change in method will be highly profitable. It is well worth while to put the business under the microscope of self-analysis and examine its possibilities from the viewpoint of intensified operations under the leasing system.

GUATEMALA ISSUED 116 applications for mining rights and patents and three titles for metal mines, in 1916, says *Commerce Reports*. From the zinc mines in Chiquimula 435 tons of ore were shipped to the United States. The Quebradas Gold Mining Co. produced 200 oz. of gold from its holdings in Izabal, the lead mines in Huehuetenango were profitably worked, and the company formed to develop marble quarries near Zacapa will soon be prepared to export its products.

Leadville Mines Again Operating

LEADVILLE CORRESPONDENCE

Mining throughout the Leadville district, after having passed through a period of comparative inactivity following the strike, is again assuming the proportions and scope of development in force prior to the disturbance when the outlook of the district was the best that had been known for years. With the exception of two large companies—the Yak and the Empire Zinc Co.—all of the big mines have resumed operation, several of them now producing the heaviest tonnage ever extracted. The Yak is active, but on a small scale. Future plans of the company, however, include a number of new developments that will bring the property back into the ranks of large producers. It is reported that the main tunnel is to be advanced into the Vega territory and a big interior shaft put down into the area that has previously been developed through small winzes incapable of accommodating the required draining equipment. This ground is known to contain orebodies. The Empire Zinc Co., which prior to the strike, was operating the Robert Emmet and McCormick shafts in Stray Horse Gulch, has temporarily abandoned its property. New and expensive surface plants were under construction at both mines when the strike was called, and preparations were under way to work the lead, zinc and silver ore opened on the property and the outlook was extremely promising. Officers of the company state that these mines will probably remain idle for at least six months.

MIKADO, WOLFTONE AND OTHER LEAD-ZINC PROPERTIES PRODUCING

The Mikado property of the Iron Silver Mining Co. has undertaken production since the strike and is now shipping 150 tons of lead-zinc sulphide and zinc carbonate daily. Bodies of sulphide ore have been uncovered in the R. A. M. property where the company is now developing at a depth of 1150 ft. On the upper levels carbonate ore is being mined. Draining preparations are about complete at the Mikado with the cutting of a pump station on the bottom level and the installation of machinery. This work is expected to be complete by the end of the month.

The Western Mining Co., operating the famous Wolftone shaft, continues to produce a heavy tonnage of zinc carbonate and lead-zinc sulphide. Development on the lower levels which have only recently been drained has opened bodies of sulphide ore and a number of new carbonate shoots have been discovered through continuous prospecting in the upper contact. This property is now operating on a normal scale and is producing 200 tons daily.

The Greenback property, the third member in the big draining enterprise that has effectively unwatered the Graham Park Basin, is again producing a steady tonnage of lead-silver ore.

Cramer & Co., operating a large tract of territory leased from the Star Consolidated Mining Co. on Carbonate Hill, have a new 200-ton mill for the separation of lead from low-grade lead-iron ores under construction. Ore has been uncovered in the property and the process of separation to be installed has been demonstrated a success. The mill will be put into operation

with a 50-ton unit on Oct. 1. The Cramer Co. is also shipping 200 tons of high-grade manganese ore daily.

Buchanan & Co., also leasing from the Star Consolidated, are shipping 100 tons of manganese ore. The same company has recently taken a lease on the Seneca property adjoining the Star to the north and has uncovered new bodies of manganese. These orebodies are now being blocked out and it is expected that shipping will start during the month at the rate of 50 tons daily and will be increased as accommodations for handling the output are prepared.

The Leadville unit of the United States Smelting, Refining, Exploration and Mining Co., operating the Harvard and Jamie Lee shafts on Fryer Hill, has just completed sinking the Jamie Lee through the parting quartzite into the second contact. No ore discoveries have yet been made in the new zone but little prospecting has been undertaken. The cutting of a pump station and the installation of draining equipment are still under way. The unit is shipping 50 tons daily from bodies of zinc-carbonate and silver ore opened on the upper levels of the property.

PRICE OF SILVER CREATES UNUSUAL ACTIVITY

An important strike was made recently at the First National property in Iowa Gulch, where lessees opened six feet of ore, showing good lead and silver contents. The oreshoot is reported as persistent and growing in proportions as development proceeds. The first shipment from the new discovery has just been made, but the returns have not yet been received.

The Tarsus property on Yankee Hill, operated by M. A. Nicholson and associates, is being prepared for the production of a steady tonnage of high-grade silver ore and silver-bearing iron oxide. Silver ore has been opened on the 335-ft. level. It is planned to extract 50 tons daily. On the upper levels iron carrying silver has been uncovered.

The Mt. Champion Co., operating in the Lackawanna district, is sinking an interior shaft on one of the veins opened in the property through the tunnels above. A 4-ft. shoot of gold-copper ore has been cut in the shaft. Sinking will continue to a depth of 300 ft. Shipping from the property has been stopped until the development is finished.

The present high silver market is the cause of unusual activity in the district. The surrounding hills have been thoroughly gone over and carefully examined for silver ore during the past two weeks, and new properties are being started up daily. Small leasing is enjoying a revival that promises to be the beginning of larger operations. A number of big concerns have for some time been waiting for an opportunity to enter the Leadville district and, should new territory be opened up by leasers and found productive of mineral, they will undoubtedly become interested.

The Louisville mine, probably the biggest producer of silver in the district, is now operating at full capacity, extracting 150 tons of ore daily. New shoots of the ore have been opened in different places in the mine.

The Bartlett tunnel on Sugar Loaf is another producer of silver that is deriving the benefit of the high market. A new vein showing good silver assays has just been opened and shipping again resumed. About 200 tons of ore per month is being extracted.

Plans for the erection of a power line across the Sugar Loaf and St. Kevin districts from the Dinero tunnel to the Griffin mine are being completed by Lucien W. Smith, manager of the Griffin. This line would traverse what is now considered to be one of the richest areas in the Leadville district and would enable property owners to secure power easily and cheaply. The cooperation of a number of operators is promised Mr. Smith in the undertaking which, if put through, will mean considerable activity in that section. New bodies of high-grade silver have been uncovered in the Griffin property at St. Kevin and an output of 40 tons daily is being shipped. Lessees at the Dinero are shipping a steady output of high-grade silver ore, and the company is planning new development.

Earthquake Crevices in Nevada

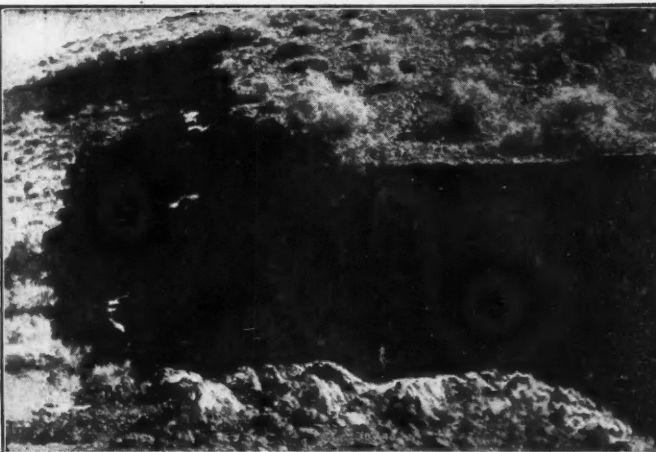
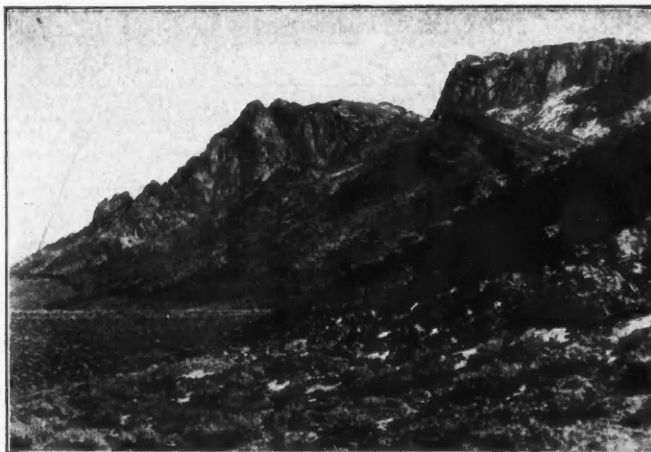
BY JOHN T. REID

Mining Engineer, Lovelock, Nevada

On the second day of October, 1915, several earthquake tremors were observed in the vicinity of Pleasant Valley, situated in the southeastern part of Humboldt County, Nevada. Three distinct shocks were noted; the first, at 3.47 p.m., lasting about 10 sec.; the next at 5.50 p.m., persisting for 30 sec.; while the last, at 10.58 p.m., continued for at least one minute. The last shock undoubtedly accompanied the definite faulting shown in the accompanying illustrations,¹ which were secured a comparatively short time after the earth movement took place.



WATERCOURSE DIVERTED BY EARTHQUAKE



PANORAMIC AND CLOSER VIEWS OF EARTHQUAKE CREVICE IN PLEASANT VALLEY, NEVADA

In numerous places within a radius of a hundred miles of this disturbance a great increase in the flow of water was observed. Creeks came into existence where previously there had been no water at all, though in other instances the flow of springs was noted to have decreased.

Although nearly two years have elapsed since the main earthquake, many lesser shocks have occurred at irregular intervals. Indeed, some persons who reside in the vicinity of the fault state that almost every day they feel a trembling of the earth. By way of corroboration of this, it is interesting to note the behavior of the mules and burros of various prospectors in the neighborhood. These animals manifest an instinctive and emphatic desire, to a degree more than ordinarily

characteristic of the breed, to depart to some region remote from the locality of the fault. Appreciating the asinine psychology, the prospectors generally compromise by permitting the beasts to select grazing grounds of their own choice. As to the future outlook, opinion seems to be divided. While some of the four-footed mining experts can be induced to linger in the vicinity of the crevice between tremors, nevertheless some of the prospectors, accepting the majority report, have abandoned their claims and departed with their faithful advisers.

The fault line extends along the east side of Pleasant Valley for a distance of 25 miles, skirting along the western slope of the Golconda or Mount Tobin Range and, at length, fingering out, to the southward, into the Dixie or Fairview Valley.

¹Photographed by P. Blanchard, Kennedy, Nev.

The Rustling Card System at Butte

A great deal of nonsensical "bogey-man" stuff has been written and spoken by opponents of what is called the rustling-card system, adopted by the Anaconda Copper Mining Co. of Butte, Mont. The plain facts of the case are that each holder of a rustling card ought to feel proud of being the possessor of such a certificate

of character and merit. Since the Anaconda company maintains no secrecy in the matter, the "iniquities" of the system are hereby exposed. We venture to predict that publication of the details will tend to extend the use of the system, with the unqualified approval of all intelligent and conscientious workmen.

F. 1405-6-21-17-20M

No. _____

APPLICATION FOR EMPLOYMENT

with the
ANACONDA COPPER MINING CO.
BUTTE, MONTANA.

Name of Applicant.....

Age..... Birthplace.....

If foreign born, are you a citizen of the United States?.....

Trade or occupation.....

Were you ever in the employ of this Company?.....

If so, at what mine or in what department
were you last employed?.....

State date of leaving last employment.....

Can you read and write English?.....

Married or single?.....

If married, where does your family reside?.....

My present address is.....

Date..... 191.....

Signature of Applicant

Witness.....

F. 1405-6-21-17-20M

GEO. W. LENZE, SUPERINTENDENT

No. _____ P. L. DERTING, ASST. SUPERINTENDENT

ANACONDA COPPER MINING COMPANY

EMPLOYMENT DEPARTMENT

Butte, Montana, 191.....

Dear Sir:

Mr., Age..... Birthplace.....

has made application to this Company for employment as..... He states that he was
employed by you as follows:

Kindly inform me if this statement is correct. Your reply will be treated confidentially.

Yours very truly,

Superintendent

PLEASE REPLY HEREON

Tours very truly,

The first step is for the applicant to fill out the above blank form

The second step is to confirm or disprove his statements by using the above blank form

PRELIMINARY STEPS FOR SECURING A RUSTLING CARD

F. 1408-7-26-17-20M

ANACONDA COPPER MINING COMPANY

Butte, Montana

Application No.

Name

Date of Issuance..... 191.....

ANACONDA COPPER MINING CO.

By.....

Face

Signature of Employee

Reverse

THIS IS THE FAMOUS "RUSTLING CARD" GIVEN TO THOSE APPLICANTS WHO ARE CONSIDERED TO BE TRUSTWORTHY AND COMPETENT MEN

Rôle of Manganese in Alloy Steels*

Manganese steel hardens under deformation, probably due to a renewal of the transformation from austenite to martensite caused by the pressure. Manganese retards the transformation, during heat treatment, from austenite to martensite and pearlite. One effect of the retardation is the production of finer structure.

PASSING by the deoxidizing and desulphurizing effect of manganese as foreign to the present discussion, its effect on the mechanical properties of steel seems to me in the last analysis due primarily to its retarding action both on the transformations and on the coalescence of the micro-constituents into progressively coarser masses which, while increasing the ductility, lessens the cohesion in general, including the hardness and the elastic limit, and thus lessens the effective strength.

Before considering the retarding of the transformations by manganese, let us refresh our memory as to these transformations, and as to the three prominent states of steel, between which they play, (1) the common low-temperature alpha or pearlitic state, (2) the high temperature or nonmagnetic austenite state into which the metal passes spontaneously when heated up through the transformation range, say 725-900° C., Ac1-Ac3, and (3) the intermediate or martensitic state, in which carbon steel is caught in transit from the austenite to the pearlite state by means of a rapid cooling, as, for instance, on hardening by quenching small pieces in water. The alpha state is magnetic and relatively soft and ductile, as in annealed carbon steel, the intermediate or martensitic state is magnetic, hard, and brittle as in hardened steel; while the nonmagnetic high temperature or austenitic state when preserved in the cold, as in manganese steel, combines great ductility with hardness of a peculiar kind to which I will refer shortly.

In carbon steel this transformation is so rapid that it occurs to a very marked degree even in the water quenching of thin pieces, as is familiar to us in the fact that when this steel is made nonmagnetic and austenitic by heating, say, to 900° C., and is then quenched in water, it transforms as far as the magnetic, hard, brittle, martensitic state of common hardened steel even in this rapid cooling.

AUSTENITIC CONDITION PRESERVED BY MANGANESE

Most of the alloying elements, and notably carbon, manganese, and nickel, retard this transformation greatly. Thus 2% of manganese plus 2% of carbon retard it so that in the water-quenching of thin pieces the austenitic state is preserved. With 5 to 7% of manganese it is so slow that even in air cooling it goes only as far as the intermediate martensitic state. Hence the brittleness of these steels of intermediate manganese content. With, say, 12% of manganese the transformation is so sluggish that the austenitic state is preserved even through a common slow cooling. The

water-quenching of manganese steel in current manufacture is not to prevent the loss of the austenitic state, but to suppress the precipitation of the iron-manganese carbide, cementite, which would occur during slow cooling. The broad plates of this cementite would embrittle the mass by forming partings of low cohesion. It is derived from the large carbon content of the ferromanganese used, the cheapest source of manganese. Carbon-free manganese steel should not need quenching.

The industrial value of this manganiferous austenite or manganese steel seems to be due to its combination of great ductility with great effective hardness. I say effective hardness, because initially it is rather soft. My own experiments indicate that the Brinell hardness of an undeformed specimen is only 125, or that of steel of about 0.22% of carbon when annealed, that of ultra low-carbon steel being about 75. But the hardness increases very greatly on the slightest deformation. Even that incidental to the Brinell test increases the observed Brinell hardness to 223 easily, or to that of 0.60% carbon steel when annealed.

MANGANESE STEEL HARDENS UNDER DEFORMATION

This hardening under deformation is one of the first things that forces itself on the user of this material. The first strokes of the hack saw cut it rather easily, but the deformation thus set up in the path of the saw quickly causes such hardness as to bring the sawing to an abrupt end, thus giving the absolutely false impression that the material has a soft skin. This hardening causes the apparently contradictory combination of effective hardness with very low proportional limit, even as low as 28,250 lb. per sq.in. The proportional limit represents the cohesion of the undeformed material, the effective hardness represents the cohesion as exaggerated by the deformation incidental to service. In the same way the act of tensile rupture may increase the Brinell hardness to 540,² or that of about 0.50% carbon steel when hardened.

The surface of the jaw of a manganese-steel rock crusher, deforming under the great pressure, quickly hardens itself, so that the combination of a very hard surface with a ductile back develops spontaneously. As fast as this hard surface wears away it is replaced by a new one made equally hard by the deformation which it at once receives.

This hardening probably represents in part the same cause which leads to the increase of cohesion in general, including the hardness, of all the malleable metals under all forms of deformation, such as wire drawing, and in part the martensitization of the austenite. That is to say, the arrested transformation from austenite through martensite to the alpha state which is due in cooling through the transformation range but is restrained by the retarding action of the manganese, is now stimulated by the deformation sufficiently to cause it to proceed as far as the martensitic state, with consequent hardening and embrittling effect. This

¹"The Metallography of Steel and Cast Iron," p. 464, 1916.

*A paper presented by Prof. Henry M. Howe at the twentieth annual meeting of the American Society for Testing Materials, at Atlantic City, N. J., June 26-29, 1917.

²Hadfield and Hopkinson, Transactions, American Institute Mining Engineers, Vol. 50, p. 486 (1914), and Journal, Iron and Steel Institute, Vol. 89, I, pp. 112 and 124 (1914).

martensitization through the stimulation of the arrested transformation by deformation is a common property of austenitic steels which have only a moderate excess of the retarding elements over the quantity needed for causing the retention of the austenitic state. It occurs strikingly in austenitic 20% nickel steel.³

RETARDATION CAUSES FINER STRUCTURE

The retarding effect of manganese on the structural changes of carbon steel shows itself by leading in general to finer structure,⁴ to finer ferrite masses, finer network structure, and finer pearlite, indeed probably often to the replacing of lamellar pearlite with sorbite. This greater fineness leads to better quality in general, and to a higher elastic limit in particular, though of course with a corresponding sacrifice of ductility. The great value of manganese for this purpose has not begun to receive the attention which it deserves. It is probable that a manganese content of, say, 1.25%, with a correspondingly lessened carbon content, may be used to lessen the danger of cracking and the residual stresses when a high elastic limit is sought, because this large manganese content in and by itself raises the elastic limit by giving a fineness of structure which otherwise would be sought by increased violence of cooling or by the use of a lower drawing temperature. In other words, the use of 1.25% of manganese lessens the needed violence of cooling and permits the use of a higher drawing temperature, in both ways tending to mitigate the residual stresses, and in the former way lessening the chances of cracking.

Ray Consolidated Report

The twenty-fourth quarterly report of the Ray Consolidated Copper Co. for the quarter ended June 30, 1917, shows 22,255,598 lb. of copper produced in concentrates, compared with 21,813,772 lb. for the preceding quarter. The following is the production by months during the last quarter: April, 7,365,840 lb.; May, 1,652,487 lb.; June, 7,237,271 lb.; an average monthly production of 7,418,533 pounds.

In addition to copper from concentrating ores, a total of 1,276,521 lb. of copper was sent direct to the smeltery. During the quarter 892,200 dry tons was milled, averaging 1.66%, which is the greatest tonnage of any quarter since commencement of operations. This gives an average daily tonnage of 9804, comparing with 9707 for previous quarter.

Mill extraction was 75.48% of total copper in concentrating ores. Underground development was 19,211 ft., bringing the total development to date 608,396 ft. Average mining cost of ore milled was 98.257c. per ton, of which 4.864c. was for coarse crushing, leaving net mining cost of 93.393c. as compared with net cost of 84.792c. for the previous quarter. The increase of cost is due to greater state and Federal taxes, increase in cost of supplies and wages. Average cost per pound of all net copper produced is given at 11.272c., comparing with 11.048c. in preceding quarter.

³Carpenter, Hadfield, and Longmuir, Seventh Report. Alloys Research Committee (British), Institute Mechanical Engineering, 1905, p. 949.

⁴Henry M. Howe, "Life History of Network and Ferrite Grains in Carbon Steel," Proceedings American Society of Testing Materials, Vol. XI, pp. 332 and 365 (1911). Also, Howe and Levy, Proceedings, Cleveland Institute of Engineers, July, 1914, p. 237.

The net operating profit was \$3,664,831, compared with \$3,471,698 in previous quarter. The fourteenth quarterly distribution of \$1 per share was paid on June 30, and amounted to \$1,557,179, being a dividend of 50c. per share from earnings and a capital distribution of 50c. per share.

Butte & Superior Report

The fourteenth quarterly report of the Butte & Superior Mining Co. for the quarter ended June 30, 1917, shows 126,734 dry tons of ore milled, comparing with 148,935 tons in first quarter. The ore averaged 15.304% in zinc contents and 5.583 oz. silver per ton. Zinc concentrates produced amounted to 37,670 tons, containing an average of 46.509% of zinc and 17.676 oz. silver per ton. Mill recovery was 90.329% of zinc in concentrates, comparing with 86.821% in first quarter. Mining cost was \$4.7596 per ton and milling cost was \$2.4001 per ton. The above does not include 6325 tons of old mill tailings which produced 337 tons of concentrates containing 277,081 lb. zinc.

The tonnage mined fell below the first quarter mainly because of labor troubles. The average recovery in concentration shows an improvement, and total cost of mining and milling, exclusive of taxes, decreased 18c. per ton, due in part to better milling operations. Replenishment of ore reserves by development amounted to 142,489 tons, or a net increase over tonnage mined of 17,500 tons.

The new man-and-timber hoist at No. 2 shaft was put in operation to 1600-ft. level. The hoist at No. 3 shaft is practically completed and also coarse-crushing plant, ore bins and conveyors; the shaft is being sunk below 1600-ft. level.

The profits for the quarter were \$1,003,236, comparing with \$1,061,020 in the previous quarter. The curtailment of production and decline of the metal market was responsible for the shrinkage of earnings.

Conflicting Grubstaking Contracts

BY A. L. H. STREET

Attorney at law, 829 Security Building, Minneapolis, Minn.

Plaintiff and an associate grubstake defendant under an agreement for location of any mineral discovery for the benefit of the three persons in equal shares. Setting out to prospect for mineral deposits, defendant was accompanied by one Robinson, who was grubstaked by his mother. It was agreed between defendant and Robinson that the latter should share with defendant in any location made under defendant's grubstake contract.

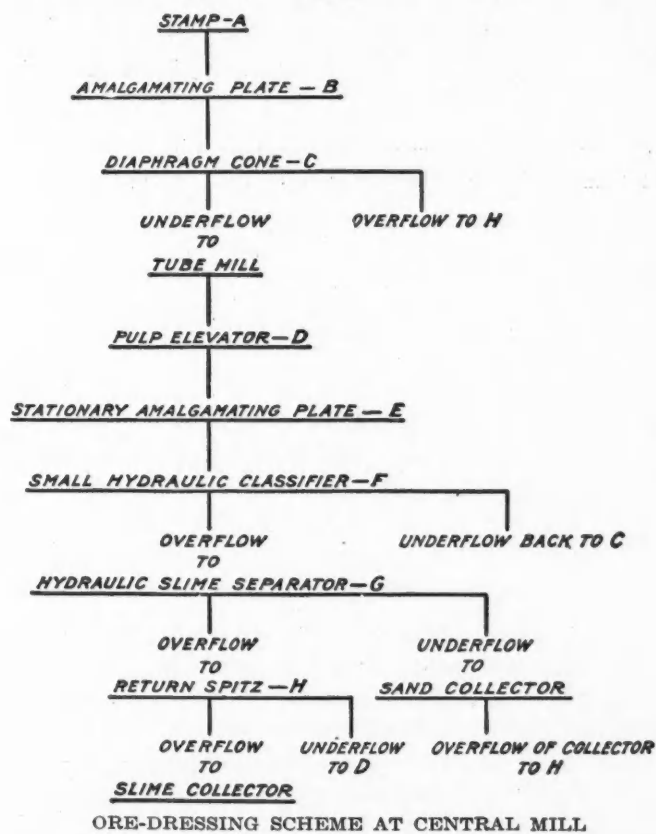
Under these circumstances it is held by the United States Circuit Court of Appeals, Ninth Circuit, that Robinson was not prevented from locating, free of any right of plaintiff and plaintiff's associate, claims discovered by Robinson, although Robinson was assisted by defendant in making the locations. (Turner vs. Wells, 238 Federal Reporter, 766.)

OUTPUT OF STEEL INGOTS IN BRITISH INDIA in 1916 was 131,092 long tons, all basic openhearth steel. This compares with 103,474 tons in 1915 and 66,603 tons in 1914. The make of finished steel was 68,634 tons in 1915 and 93,469 tons in 1916, an increase of 24,835 tons, or 36%, last year.

Cyaniding Gold Copper Ores at Pilgrims Rest*

The gold in the ore treated at Pilgrims Rest, in the Transvaal, by the Transvaal Gold Mining Estates, Ltd., is so finely divided that amalgamating must be followed by cyaniding to insure good recovery. Copper present in the ore in varying amount compels the use of a weak cyanide solution necessitating long treatment.

DURING 1916 the Pilgrims Rest district produced gold to the value of over \$3,950,000, and forms, after the Rand, the most important gold field in South Africa. The oxidized ore treated by the Transvaal Gold Mining Estates, Ltd., at Pilgrims Rest, may be described as deposits of vein quartz in more or less horizontal sheets in the dolomites. With it is associated much ferruginous matter. Copper exists principally in the form of the carbonates, malachite and azurite; chalcopyrite is only occasionally found and



appears to be attacked but slowly by weak cyanide solutions. It is interesting to note, as indicating the finely divided condition of the gold, that panning sometimes shows no colors though the assay may be good. Cyaniding or some other dissolving process is therefore essential.

MAIN PLANT KNOWN AS THE CENTRAL MILL

The plant known as the Central mill consists of 60 stamps of 1100 lb. running weight; three tube mills, 16 ft. x 5 ft. 6 in., each fitted with an Osborne liner and

a Schmitt feeder, five sand collectors and 20 treatment vats, each of 100 tons' capacity; four slime collectors, and 11 treatment vats, 40 x 12 ft., and the necessary storage. The capacity of the plant is 13,000 tons per month. Ore is delivered to the Central mill from five separate mines in varying percentages. The mill bins and crushers are so arranged that ore from any one mine can be kept entirely separate, thus enabling the management to be informed daily as to the mill heads from any particular mine. The average value of the ore milled is about \$9.50 per ton.

THE ORES TREATED ARE SOFT AND FRIABLE

The ore is stamped through 60 stamps with a 500 (about 22-mesh) screen, a duty of just over seven tons being easily maintained, owing to the soft and friable nature of the ore. Lime is added at the bins at the rate of 2 lb. per ton, and has a slightly beneficial effect on amalgamation. Amalgamation presents no great difficulty, an average recovery on the mill plates being 41.5%, at a cost of 44c. per ton, including preliminary crushing. This mill pulp contains 30% slime, and is passed direct to three tube-mill cones, 6 ft. x 4 ft. 6 in. The underflow from the cones, containing 30% moisture, and without any additional water, enters the tubes, while the overflow goes to spitzkasten H shown in the flow sheet. The gradings of pulp entering and leaving the tubes will be found in the table.

Tube-mill liners are not a serious item, owing to the soft nature of the ore. A recent liner lasted 520 days, but 470 days is a fair average. The tube-mill rock used is mostly white quartz picked out from the ore at the crushers and conveyed by tramway to the tube-mill ore bins and having an average value of \$5 per ton. The average recovery from the five tube-mill plates is 10.5%, bringing the total recovery by amalgamation to 52%. The cost of tube-milling is 12c. per ton milled.

The pulp from the tube-mill plates flows to cone F in the flow sheet, the coarser particles returning to the tube-mill circuit, and the overflow to the slime-separating cone G, which is fitted with a Brazier washing device and a Bayley regulating gate. The underflow from this cone goes direct to sand collectors and the overflow to the spitzkasten H, where any coarser sand is trapped and returned to the tube-mill circuit. The overflow from H goes to slime collectors.

The sand delivered from the hydraulic slime-separating cone G is very clean, and there are few slimy lumps. The grading of the sand charge may be seen in the table of screen analyses. Sand caught amounts to about 100 tons per day.

COPPER IN THE ORE NECESSITATES A WEAK SOLUTION

The objectionable constituent of the ore is copper, and it is necessary to use as weak cyanide solution as possible, consistent with good recovery and reasonable cyanide consumption. The low strength of cyanide used renders a long treatment necessary. Lime is added to the top treatment vats at the rate of 6 lb. (of 60% CaO) per ton of sand. The strength of the cyanide solution used throughout the sand treatment is 0.04% KCN. The charges are allowed to stand for several hours after each complete draining. The value of the

*Excerpts from an article entitled "Notes on Treatment of Pilgrims Rest Ore," by Robert Lindsay, published in the Journal of the Chemical, Metallurgical and Mining Society of South Africa, for April, 1917.

charge does not decrease rapidly during the early part of the treatment; rather is it a steady decrease all the way through. The value of the last sand draining averages 6c. per ton. Sand residues averaging 90c. were re-cyanided, after regrinding until 80% was -200 mesh, but did not give a lower residue than 70 cents.

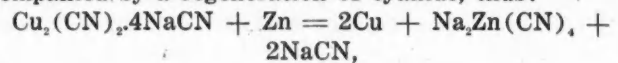
The cyanide consumption is seldom under 0.8 lb. per ton and sometimes as high as 2.5 lb., according to the copper content of the ore. A preliminary wash with weak sulphuric acid to remove the copper is prohibitive in cost, the consumption of acid being about 30 lb. per ton, owing to the presence of dolomite and iron oxide. The average recovery for the last 12 months was 83% and the cost 77.98c. per ton.

The slimes are treated by a combination of the decantation and Usher processes. Instead of using sand filters as clarifiers for the solution from the slime plant, the solution is allowed to flow quietly into two settlers (18 x 5 ft.), the first having one and the second two partitions of cocoa matting suspended from iron bars laid across the vats transversely to the flow. The matting is fastened to the sides and rests on the bottom. These settlers deal with 1000 tons of solution per day for 16 months before requiring cleaning out. They are then cleaned out with a fire hose and are ready again for use in three or four hours. The average recovery from slime is 87.5%, and the cost 79.16c. per ton of slime.

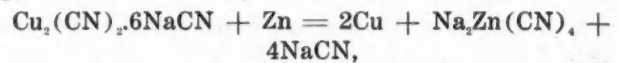
precipitation is not recommended. It gives temporary relief, no doubt, by keeping copper in solution, but the gradual accumulation of copper in solution detrimentally affects extraction, and the excess copper has to be got rid of eventually, either by precipitation or running some of the solution to waste.

If the soluble copper content of the ore should become abnormally high, it will be found advantageous to have uncoated zinc in the first compartment to precipitate a proportionally large amount of copper, leaving the remaining compartments of lead-coated zinc to precipitate the gold and a portion of the remaining copper. The first compartment of coppery zinc is taken out every four or five days and immersed in dilute acid for a few minutes, and returned to the box along with some new zinc to fill the compartment. There is an increase in zinc consumption, but the gold precipitation is good.

The precipitation of copper on zinc is, of course, accompanied by a regeneration of cyanide, thus:



or



consequently the cyanide strength leaving the extractor box is always higher than that entering it, as shown in the table.

SCREEN ANALYSES WITH ASSAY VALUES OF PULP ENTERING AND LEAVING THE VARIOUS UNITS

A—Stamp Mill; B—Amalgamating Plate; C—Diaphragm Cone; F—Small Hydraulic Classifier; G—Hydraulic Slime Separator; H—Return Spitz

Mesh of Pulp	A Screen		B Tails		C Underflow Tube Inlet		C Overflow		Tube Outlet		F Underflow		F Overflow	
	%	\$/ton	%	\$/ton	%	\$/ton	%	\$/ton	%	\$/ton	%	\$/ton	%	\$/ton
+60	32.0	3.90	32.0	3.80	45.1	3.30	0.0	...	2.1	3.80	6.8	3.60	0.7	} 3.10
+90	14.7	7.40	14.7	5.00	28.8	4.80	1.0	...	11.1	3.20	23.2	3.20	6.0	
+200	11.2	11.60	11.2	6.20	18.3	6.20	15.2	3.20	23.1	4.30	38.5	3.80	34.0	3.40
-200	11.5	33.90	11.5	10.00	5.8	12.20	23.8	8.50	19.7	8.00	21.8	6.80	22.3	6.00
Slime	30.6	6.20	30.6	4.80	2.0	5.40	60.0	3.90	44.0	3.50	9.7	3.70	37.0	3.50
	100.0	9.43	100.0	5.30	100.0	4.80	100.0	4.90	100.0	4.50	100.0	4.30	100.0	4.00

Mesh of Pulp	G Underflow		G Overflow		H Underflow		H Overflow = Slime Chg.		Sand Charge		Sand Residue		Slime Residue	
	%	\$/ton	%	\$/ton	%	\$/ton	%	\$/ton	%	\$/ton	%	\$/ton	%	\$/ton
+60	3.1	3.10	nil	—	2.5	—	nil	—	3.3	3.10	3.3	1.10	nil	—
+90	23.0	3.70	1.1	3.40	27.0	3.10	3.5	3.00	24.6	3.70	24.6	1.15	nil	—
+200	43.0	4.30	19.1	4.00	35.7	6.00	26.6	5.00	45.9	4.30	45.9	0.82	3.5	0.64
-200	20.9	6.50	33.0	6.00	34.8	4.50	69.9	4.10	22.4	6.60	22.4	0.76	26.6	0.57
Slime	10.0	4.10	46.8	3.00					3.8	4.20	3.8	0.60	69.9	0.46
	100.0	4.60	100.0	4.20	100.0	4.60	100.0	4.30	100.0	4.70	100.0	0.88	100.0	.493

Cyanide solutions containing copper deposit this metal readily on clean zinc; the copper forms a closely adherent metallic film or plating, which after a time coats the zinc so completely that the precipitation of gold almost ceases. Here the lead-zinc couple is used with advantage for cupriferous solutions. Lead-coated zinc does not precipitate copper so readily from working solutions as clean zinc, and the object aimed at is not to precipitate all the copper, but to keep the amount of copper in solution more or less constant. If the lead coating be too light, too much copper will be thrown down, and more zinc will have to be added to the extractors before cleanup is due, resulting in unnecessarily high consumption of zinc. The practice in dipping is to regulate the quantity of zinc dipped with the strength of the lead solution so that each 100 lb. of zinc carries 5 lb. metallic lead. That suits the copper content of the solution here and precipitates about one-half of the copper entering the extractors, while the gold value of the effluent is seldom above 3c. even in the cold season. Increasing the cyanide strength as a remedy for bad

The tendency of the copper to remain in the stronger solution of the sand boxes will be noted, the precipitated copper there being 41.7%, as against 44.4% in the case of the weaker cyanide solution of the slime boxes with a

STRENGTH OF SOLUTION ENTERING AND LEAVING ZINC BOXES

	Sand Boxes			Slime Boxes		
	% KCN	% CaO	Cu Lb. per Ton	% KCN	% CaO	Cu Lb. per Ton
Entering	.032	.007	.12	.022	.008	.09
After 1st Compt.	.039	.008	.11	.025	.011	.07
After 2nd Compt.	.044	.009	.08	.028	.010	.05
After 3rd Compt.	.042	.010029	.010	...
After 4th Compt.	.040	.010028	.011	...
After 5th Compt.	.039	.011	.07	.028	.011	.04

lower copper content entering. One cubic foot of zinc is allowed per ton of solution per 24 hours.

The cleanup takes place twice a month. The top compartment only of each box is taken out and treated as usual with sulphuric acid. Bisulphate is not used on account of difficulty of transport and inconvenience of handling, the mine being about 10 miles from the nearest railway station at Graskop. When all the zinc has been dissolved, the copper is attacked by nitric acid, or with sulphuric and nitric acids together.

Over 700 lb. of copper is dissolved out every clean-up. The acids are added in the proportion of 1 part sulphuric to 0.44 part nitric acid, and the temperature should not be under 60° C. if copper is to be kept out of the bullion. The precipitate, kept in suspension by mechanical stirrers, is tested for the presence of copper after each addition of acid, so as to insure no more acid being added than is absolutely necessary. When the copper is all in solution, the vat is filled with water and a few pounds of size added to assist settlement, which usually takes place in five or six hours. The solution containing the zinc and copper is passed through a sand filter to catch any fine gold slime in suspension. The surface of the vat is skimmed every other month and the sand used as flux. The solution now flows through a stoneware pipe to two copper precipitating vats, which are filled with scrap iron. Any old iron is put into these, grate bars, fire doors, worn-out plates, battery screening, etc. Every four months the vats are cleaned out and the precipitate screened to keep out coarse iron. It is air dried, thoroughly mixed, sampled, assayed and bagged in sugar sacks. A shipment of this precipitate assayed 10.99 oz. Au, 123.79 oz. Ag per ton and 40.95% Cu.

There is no gold or silver in the copper vat effluent, and only a trace of copper toward the end of the run. It is found that coarse iron gives a much purer product and by using that exclusively it is hoped to bring the precipitate up to over 60% grade. The copper recovered is equal to 0.13 lb. per ton milled, and agrees fairly closely with the difference between the copper content of originals and residues.

The washed gold slime is filter-pressed and dried. Calcining is not found necessary after using nitric acid. The gold slime assays about 30% Au and is fluxed with 25% borax, 12½% sand and 12½% MnO₂. The bullion averages 850 fine. The average total recovery from the plant is 94% and the cost \$1.34.

Manganese Ore in the Caucasus

According to a report from the British consul at Batum there was a remarkable revival in the Caucasus manganese industry in 1916. The Russian works, which formerly drew the bulk of their supplies from the Nikopol mines in South Russia, were unable to obtain sufficient ore from that source in 1916, and therefore supplies from the Caucasus deposits were in greater demand. During the 10 years preceding the war these works obtained, through the ports of Poti and Mariupol, an annual average quantity of about 2,000,000 poods (36,000 short tons). In 1916, however, their demands amounted to 12,000,000 poods (217,000 tons). The actual quantity of ore dispatched from Tchiaturi during 1916 was 15,755,250 poods (284,483 tons), of which 9,650,750 poods (174,253 tons) were sent inland by rail via Baku and the remainder went to Poti. Of the latter quantity less than half was for shipment by the Black Sea route to South Russia; the remainder was added to the stocks that were in Poti at the outbreak of hostilities with Turkey, and that at the end of 1916 amounted to nearly 8,000,000 poods (144,500 tons). According to official figures the stock of ore at Tchiaturi at the end of 1916 was 45,000,000 poods (812,500 tons), and 3,000,000 poods (54,000 tons) were calculated to be

in stock at Batum. Thus the total stock of manganese ore in the Caucasus at the end of 1916 was 56,000,000 poods (1,011,000 tons), and it would therefore appear that the production of ore in 1916 more than kept pace with the demand from the Russian market.

Notwithstanding the fact that the existing washing plants at Tchiaturi are capable of producing 45,000,000 poods (812,500 tons) of washed ore and that the installation of new plants at present is costly, preparations for an extension of washing plants were proceeded with during the year and several new ones were installed.

A large number of exploration certificates were issued by the Mining Department of the Caucasus in 1916 for prospecting work on petroliferous plots in many parts of Transcaucasia and the northern Caucasus, and also for similar work on manganese-bearing lands in the district of Sharopan in the Government of Kutais.

Antimony in South Africa

A report from United States Consul John P. Bray, at Johannesburg in the Transvaal says that antimony ore is found in the Transvaal at Gravelotte, near the town of Leydsdorp, Pietersburg district. At least four mines were producing in this district during 1916, and their aggregate sales and shipments amounted to 722 short tons, with an estimated value of \$73,419. The tenor of the ore ranges from 40 to 70%. This ore also is found near Steynsdorp, in the Barberton district of the Transvaal. As yet no ore has been produced from these mines, but it is understood that some activity took place in 1916 in the surrounding country, and particularly along the Murchison Range, from which more or less regular shipments were made during the year.

With reference to the occurrence of antimony ore in southern Rhodesia, the report of the Rhodesian Munitions and Resources Committee stated in part:

So far as is known, the occurrence of antimonite (sulphide of antimony) in Rhodesia may be divided into two types: (1) The sporadic gold-bearing type characterized by sporadic distribution in quartz veins and schist bodies. This is of granular texture, and it forms strings, patches and large pockets, or it may be disseminated through a schist body in the form of minute crystals. In the last-mentioned instance the mineral is the double sulphide of lead and antimony. (2) The type which forms definite veins, sometimes free from quartz. It is a coarsely bladed structure resembling that mined in Japan, and it is to be found 4¼ miles southeast of Gatooma, southern Rhodesia. It is a vein of coarse-bladed antimony weathering to a pale yellowish ocher, and it is about 6 in. wide and dips westerly at 60 deg. This vein is now being worked for the purpose of obtaining antimony ore.

Antimony ore is distributed through the central part of Southern Rhodesia in the belt of country extending from Hartley to Belingwe and from Gwelo to Selukwe. In this belt it occurs around Gatooma, Que Que, and Lower Gwelo, but apparently has been considered of too little importance to make it profitable to work.

NITRATE PRODUCTION COSTS in Chile have increased in every element since the declaration of war in 1914, according to brokers quoted in Commerce Report No. 194. On a production basis of Spanish quintals of 101.4 lb., labor is 6½d. higher than before the war; petroleum, 7d.; bags, 3d.; explosives, oils, spares, iron, etc., 2d.; export duties, 3½d.; making a total increase of 22d., or about 45c. It is estimated that before the war the average cost of production was slightly below \$1.22 and the average selling price between \$1.58 and \$1.64. These figures indicate a 37% increase of the cost of production.

NEW PUBLICATIONS

Geologic Formations of California with Reconnaissance Geologic Map. By James Perrin Smith. Pp. 47. Bulletin 72, California State Mining Bureau, San Francisco.

Useful Minerals of the United States. Compiled by Frank C. Schrader, Ralph W. Stone and Samuel Sanford. Pp. 412. Bulletin 624, U. S. Geological Survey, Washington.

Production and Value of Mineral Products in Michigan for 1915 and Prior Years, and a Report on Michigan Limestones. Prepared under direction of R. C. Allen. 6 x 9 in., pp. 402; illustrated. Michigan Geological and Biological Survey, Lansing.

Chemical Tests for Minerals. By Arthur J. Burdick. 5 x 7 in.; pp. 93. \$1.25. The Gateway Publishing Co., Beaumont, Calif.

This is a book written chiefly for the benefit of the prospector of limited technical training. It gives simple qualitative tests that cover about everything the prospector is likely to find and is a convenient size for taking into the field.

The Utilization of Pyrite Occurring in Illinois Bituminous Coal. By E. A. Holbrook. Pp. 46; illustrated. Circular No. 5, Engineering Experiment Station, University of Illinois, Urbana, Illinois.

The possible recovery and utilization of pyrite is suggested. Prices as high as \$8 per ton are offered in market and a 50-ton plant can be built for about \$18,000.

Pulverized Fuel for Locomotives. By John E. Muhlfeld. Pp. 68; illustrated. Locomotive Pulverized Fuel Co., 30 Church St., New York.

Reprint from paper presented at American Society of Mechanical Engineers' meeting, December, 1916. Contains, besides many data, drawings of feeders, fireboxes and drying plants for powdered coal.

The Pan-American Magazine for June, 1917, published at 70 Fifth Ave., New York, N. Y., is devoted chiefly to articles on Bolivia and will be found of much interest and value to all who are interested in that country.

Articles on the following subjects are given: Economic Conditions in Bolivia; How the Industrial Development of Bolivia Should Interest the United States, by Adolfo Ballester, consul-general to the United States; Transportation in Bolivia, by W. W. Rasor; Oruro Mining Region; and the Uncia Mines. The magazine is well printed and has especially good illustrations. Single copies are 25 cents.

Poor's Manual of Industrials for 1917. Eighth Annual Number. 6 x 9 in.; pp. xlv + 2800; \$10. Poor's Manual Co., New York.

We can note no material change in the general arrangement of the regular annual volume of this well-known manual, except a small reduction in the number of pages. The present issue contains a great deal of useful information about all of the important industrial companies, including mining, and gives the latest income accounts and balance sheets, presenting them in most cases in comparative form, so that the growth of the business may be seen at a glance. The general statistical information is revised through Aug. 1, and there is a short section in the back of the book giving later data in some instances.

American Hydro-Electric Practice. A compilation of useful data and information on the design, construction and operation of hydro-electric systems from the penstocks to distribution lines. By William T. Taylor and Daniel H. Braymer. 9 1/4 x 6 in.; pp. 439; illustrated. \$5. McGraw-Hill Book Co., New York.

In the preface the authors state that no attempt has been made to create a textbook on design, but have drawn liberally on the published experience and solutions of system problems.

After a general survey of water-power engineering, in which numerous tables, diagrams and formulas are given, various plants are described, each of which serves as an example of what has already been done, using low, medium or high heads, descriptions being accompanied by plans, sections and general details.

In the matter of layout and selection of plant equipment, recent installations are compared with former practice, the overcoming of many difficulties having been successfully accomplished, and the general tone throughout the volume is the describing of what is proving successful, rather than the recommending of any cut-and-dried system or apparatus.

After giving general tables, costs, etc., special problems are considered, both in plant and line construction. Very complete reference tables and system diagrams and classified bibliography are appended.

Compressed Air. Theory and Computations. Second edition, revised and enlarged. By Elmo G. Harris. 6 x 9 1/4 in.; pp. 192; illustrated. \$2. McGraw-Hill Book Co., New York.

In the preface to this second edition the author states that it has been prepared "with the view of eliminating errors and ambiguities" of the first edition, and refers the reader to "trade circulars, of which there are many very creditable productions illustrating and describing a greater variety of machines than can possibly be shown in a textbook."

This statement is somewhat contrary to the text of the preface to the first edition, which implies that that edition is not to be taken as a textbook, but more as an authority to those "college-bred men—who only are to be trusted with the designing of compressed-air installations."

For the student mathematically inclined there are many problems to be solved, most of which have already been solved by the manufacturers and are well understood by the operators of compressed-air plants.

Novelty is claimed for a number of the tables appended, but in each there is something or other which has not been taken into consideration, "causing a slight error."

In the new chapter on fans it is stated that the practice falls far short of theoretical calculations—indicating that mechanics play a more important part in manufacture than mathematics, and the manufacturer is left to his own testing facilities for determining what his fans and blowers will do and the purchasers are taking the best they can get.

The Value of Peat Fuel for the Generation of Steam. By John Blizard, B. Sc. Pp. 42. Canadian Department of Mines, Mines Branch, Government Printing Bureau, Ottawa, 1917.

This report is the third and last of the series giving the results of the investigation undertaken some years ago to determine the value of peat fuel for the production of power. The former reports dealt mainly with the production of power through the media of gas producers and internal-combustion engines, while this volume presents the results obtained with peat when burned on the grate bars of two distinct types of steam generators. The conclusion reached is that under favorable conditions peat fuel can be economically utilized for the production of power by means of the steam generator and steam engine, but the controlling factor is the cost of obtaining the peat and delivering it to the steam power plant in a sufficiently dry state. This cost must be less than that of a quantity of good steam coal equivalent in heating value in order to permit of its competition. Moreover, the fact that peat fuel as manufactured by the only known economic process is much bulkier than coal of equivalent heating value must be borne in mind, and its storage becomes a problem of importance. The maximum cost per ton which peat fuel can stand and compete with coal is governed by the cost of steam coal at the place where the power plant is located. Generally speaking, peat fuel for steam raising cannot compete with good steam coal costing \$5 or less per ton. But as the price of coal increases, as it promises to do, peat fuel, wherever large deposits of peat are available, will become a very serious competitor of coal. It is, however, considered hardly likely that in the future any form of fuel will be utilized for steam generation for the production of power, unless steam is indispensable to the carrying out of some chemical process or other industry. So far as the generation of power is concerned the more economical method is the conversion of the peat fuel into a combustible gas, which can in this form be burned in a gas engine, or used for heating furnaces in metallurgical works. Many of the Canadian peats so far examined have a high nitrogen content which can be recovered in the form of ammonia, when the peat is burned in a byproduct recovery producer.

Rawley Mine, Saguache Co., Colorado



BUILDINGS AND SURFACE PLANT, RAWLEY MINING CO.

The Rawley mine is at the north end of the San Luis Valley and seven miles from the millsite at Shirley, on the narrow-gage branch of the Denver & Rio Grande R.R. A primary silver-copper-lead-zinc-pyrite ore is found as shoots in veins cutting through andesite flows, capping an older granite. The mine is opened by a shaft and over 15,000 ft. of development work, which extends in levels to a depth of 1200 ft. At depth the ore contains more silver and less lead and zinc



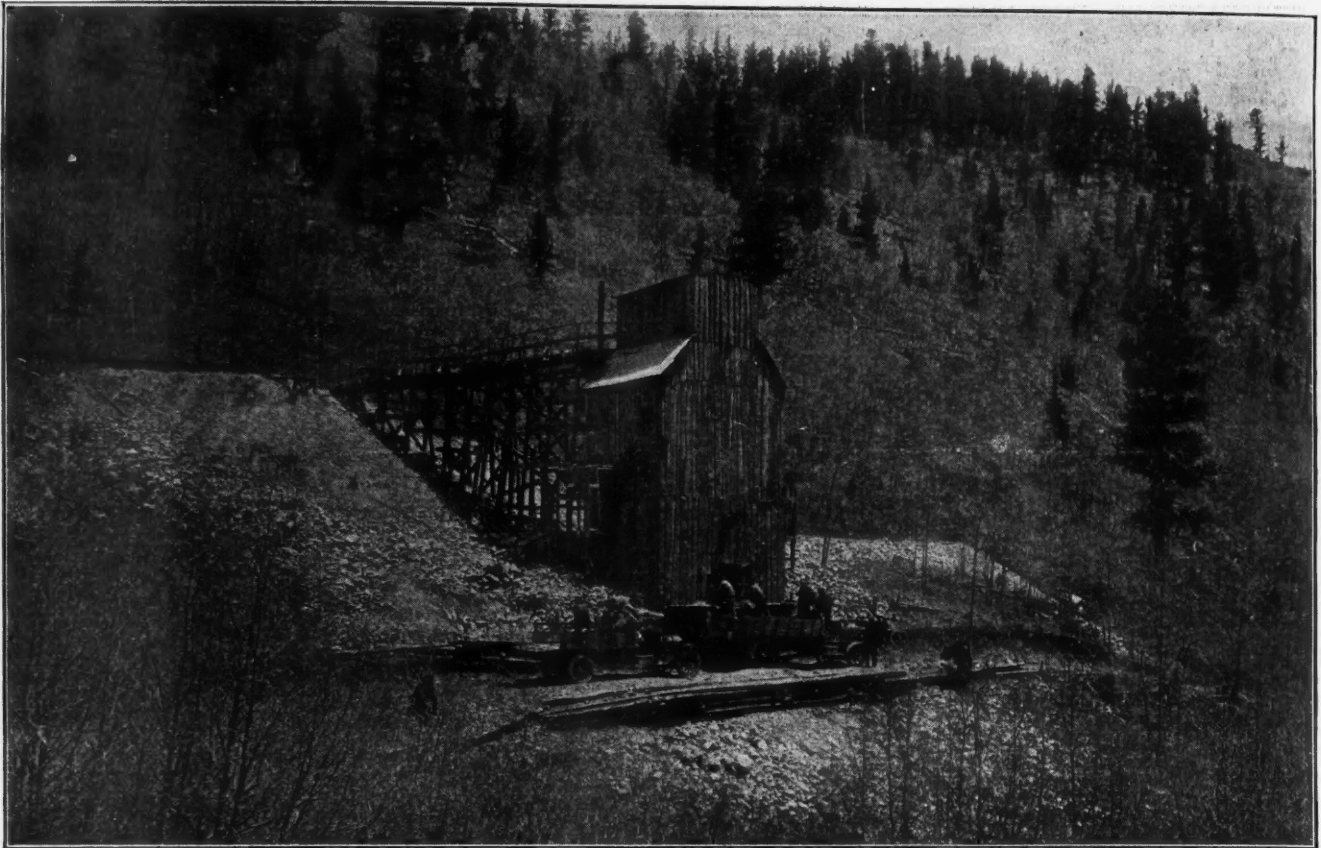
STATIONS OF MAIN RAISE AT THE 1050-FT. LEVEL

This is a three-compartment raise that is being put up to the 600-ft. level and will be used to handle the ore from all the levels. Large shaft stations will be cut at all levels



VIEW IN SOUTH STOPE ON THE 1200-FT. LEVEL

The ore on this level occurs in a vein 5 1/2 ft. wide, showing a marked increase in silver and iron content, a disappearance of lead and zinc, and no decrease in the percentage of copper



TEMPORARY ORE BINS AND MOTOR TRUCKS LOADING ORE

Six-ton White motor trucks were used for hauling ore from the mine to railroad station at Villa Grove, a distance of 18 miles. Climatic conditions are excellent for an altitude of 9700 ft., and the mine accessible throughout the entire year. There are numerous veins on the property, the Rawley vein being the most important. This has been explored by underground workings for over 1000 ft. along the strike and 1200 ft. in depth. The dip of the vein is nearly vertical and the width varies from a narrow seam to 20 ft., averaging about 6½ ft. From the surface to a point below the 400-ft. level lead and zinc predominate, with smaller quantities of iron and copper. Below this point to the 1200-ft. level there is an increase in iron and copper and a decrease in lead, zinc and silica.

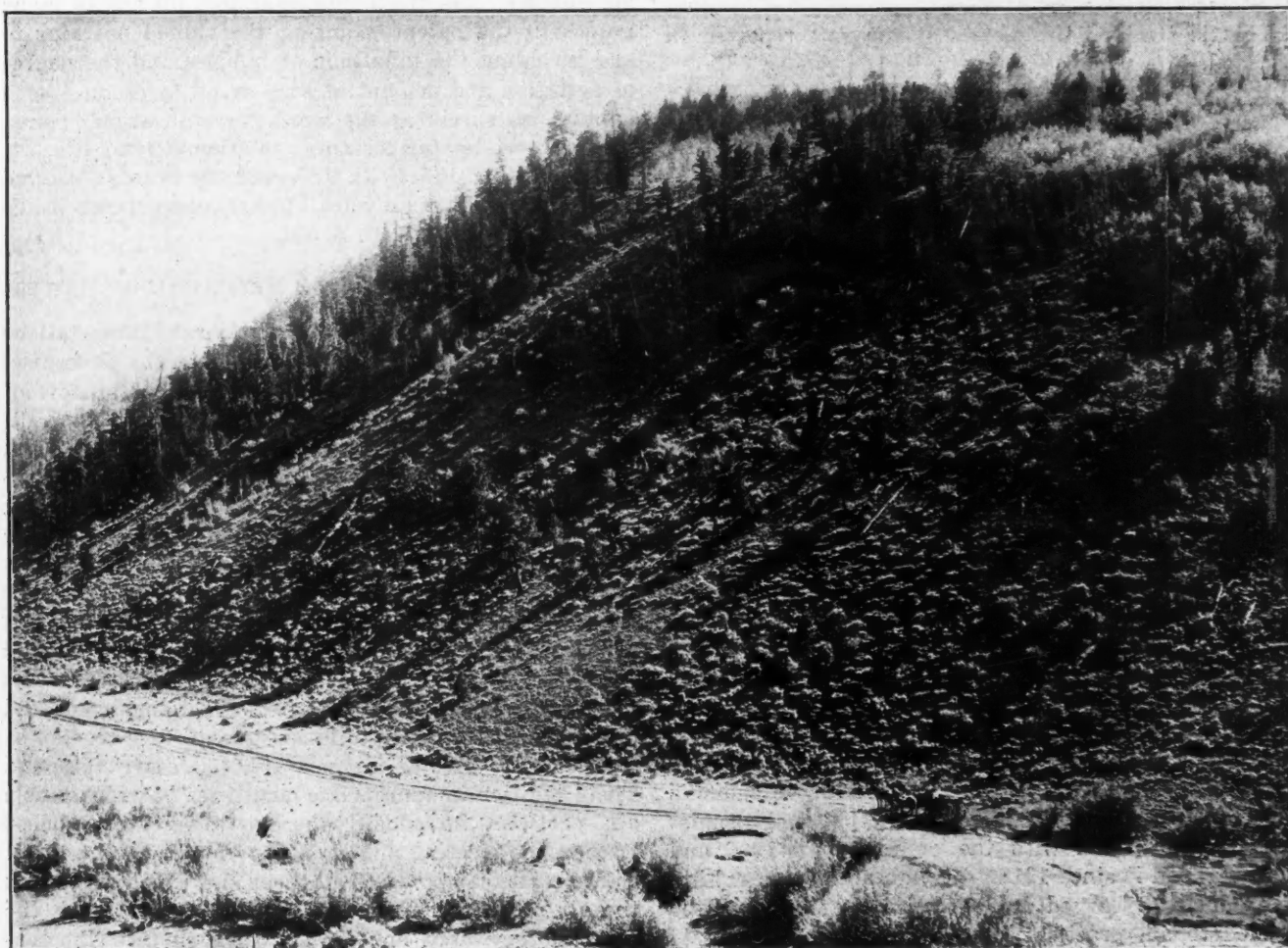


MAIN HAULAGE TUNNEL ON 1200-FT. LEVEL OF RAWLEY MINE, BONANZA, COLO.

This tunnel is equipped for electric haulage and has a length of 6250 ft. In the tunnel is shown a 12-in. exhaust pipe and alongside, a 3-in. compressed-air main



JEFFREY THREE-TON LOCOMOTIVE NOW USED FOR HAULAGE IN RAWLEY MINE



PROPOSED MILLSITE AT SHIRLEY, LOOKING TOWARD THE RAWLEY MINE

The mine is seven miles south and will be connected by aerial tram. The tram will be designed to handle 300 tons per shift and will cost about \$150,000. The Denver & Rio Grande R.R. tracks are directly opposite to this millsite and all supplies for the mine will be handled over the tram at a greatly reduced cost. The ore will be coarse crushed at the mine. Further crushing at the mill followed by classifiers, Wilfley tables, regrinding, fine sand tables and flotation complete the treatment. A ratio of concentration of 2:1 and a 95% extraction is expected. Concentrates will be shipped to the Salida smeltery, where a \$200,000 addition is being built to care for the product

Text of Judge Bourquin's Decision in Butte & Superior Flotation Case

UNITED STATES DISTRICT COURT
MINERALS SEPARATION, LTD, et al

vs.

BUTTE & SUPERIOR MINING CO.

No. 8

Herein the court finds the issues in favor of plaintiffs and against defendant—that the patent is valid as to all claims in issue; that defendant has infringed as charged and now infringes by the unlicensed use of the patent process, all claims in issue save 5, 6 and 7. And therefrom the court concludes plaintiffs are entitled to recover of and from defendant in accordance herewith and the prayer of the bill. The decision and opinion attached is made a part hereof.

Aug. 25, 1917.

BOURQUIN, J.

FOLLOWING is the text of Judge Bourquin's recent decision in the case of Minerals Separation, Ltd., vs. Butte & Superior Mining Co. in the United States district court at Butte:

This is trial on the merits of the suit reported in 237 Fed. 401.

It involves the patent and claims of the Hyde suit wherein the Supreme Court (242 U. S. 261) held the patent valid but some claims invalid. The issues are as in the Hyde suit, viz: Novelty, invention, infringement, and in addition defenses of unreasonable delay and defects in disclaimer of the invalid claims, and estoppel by reason of statements by plaintiffs' counsel to the Supreme Court in arguing the Hyde suit. The evidence herein is that submitted during 25 days and also the record in the Hyde suit. So far as heretofore known the nature and history of the discovery and invention (a process of ore concentration by air flotation) are fairly set out in reports of the Hyde suit (242 U. S. 261; 214 Fed. 100; 207 Fed. 956); of the Miami suit (242 Fed. —; 237 Fed. 609), and of foreign suits cited in a footnote on page — 242 Fed. This suit is an important contribution and yet it discloses that though the use of the process is very wide, extensive and growing, its simplicity, economy and success still surprise and gratify the metallurgical world and its laws or principles of operations still interest and puzzle the scientists. "In the beginning it was very little knowledge and mostly guesswork, and since then there has been every year a little more knowledge and still a great deal of guesswork," testifies one of defendant's experts, Prof. Bancroft of Cornell, a physical chemist of note, acquainted with the process since 1906 and lecturer upon it since 1912. Though speaking for himself alone, the learned doctor's estimate might well be applied to all, practical laymen and expert scientists alike.

At the same time though heretofore somewhat ambiguous and obscure, present knowledge warrants the conclusion that the gist of this remarkable and valuable process and the actual discovery and invention are that

whereas theretofore in ore concentration air had been used in desultory and fugitive bubbles as a makeshift incident of and supplement to oil and skin flotation, air can be made to do all the work by creating in water-ore pulp modified by a suitable oily contaminant an infinitude of bubbles.

It is the first of its kind, and the patent sufficiently discloses it and methods to those skilled in the art.

Ambiguity and obscurity were as much due to the extreme simplicity of the process as to the inability then and now to know and explain all its laws or principles. The tendency was to attach prime importance to reduction in amount of oil used, when in fact this is but a necessary incident (for which there are substitutes if not equivalents) to the creation of the infinitude of bubbles that do the work. Despite this tendency and to overlook the simple and obvious, the patent fairly clearly sets out the various ways and means to create this infinitude of bubbles and that they do the work.

The tests to determine which kind and amount of "oily substance yields the proportion of froth or scum desired," that flotation is "mainly from the inclusion of air bubbles," the froth, the agitation, all are so many guides in the patent, pointing the skilled operator to and including the infinitude of bubbles and the degree of agitation and amount of soap or oil to produce such bubbles, as surely as the word "crystalization" points to appropriate temperature in Commercial Co. vs . . . Co. 135 U. S. 189, and the words "uttered sound" by the "human voice," to articulate speech in the Telephone Cases, 126, U. S. 531.

PREFERENTIAL AFFINITY FOR METALLIFEROUS MATTER

Of the new evidence herein are learned dissertations upon the philosophy of the process—upon the philosophy of bubbles, the heart of it, by Professors Bancroft of Cornell, and Taggart and Beach of Yale, and Drs. Sadtler of Philadelphia, and Grosvenor of New York. From these it is gathered that the mere introduction of particles of air into a liquid does not create bubbles, but that they are created by subsequent agitation, either applied or self-agitation. Air particles introduced into pure water are incapable of creating bubbles. The reasons are the surface tension of the water and the lack of viscosity to create a sufficient film about the air particles, compel the escape of the air particles into the atmosphere and no bubble is formed. Some soaps and oils possess the quality to lessen this surface tension of water and to give or increase this necessary viscosity. Their addition in appropriate quantities of water enable air particles introduced therein to create bubbles. Rather, the meeting and co-action of water, oil and air create a film composed of all three and which surrounds the air particles. This film is more viscous than the mass of the water, and rising to the surface, the tension of which (and of the films) has been reduced by the oil, maintains itself as an air bubble. This quality of oil is of first importance in the process. Another of lesser importance and which all oils possess is the "preferential affinity for metalliferous matter over

gangue." Of lesser importance, because it is now known (and patented), that given another contaminant than oil, but which possesses the like bubble-making quality though not the said "preferential affinity," the process is equally successfully worked. Air also possesses this "preferential affinity," and in view of the foregoing it well may be that the capture as well as the flotation of the metallic particles is more due to the great volume of air than to the infinitesimal oil. That in this process air without oil cannot capture and retain the metallic particles, seems due to its inability to create bubbles without oil. And why this capture in any case, is still of the unsolved phenomena of the process. On the other hand, water has a preferential affinity for gangue over metalliferous matter. That is, it wets the former more readily than it does the latter. And this contributes to the process in that oil and air displace water from the surface of metalliferous matter more easily and quickly than from gangue, and so more readily capture and float the former than the latter. At the same time, despite these preferential affinities, in successful operation of the process the bubbles generally float more gangue than metal, more in quantity but not in proportion, and why is also unsolved.

NARROW RANGE IN AMOUNT OF OIL REQUIRED

There are "critical proportions" of any oil used in this process, perhaps not a sharp divide, but rather a broad one. For the amount of oil to produce sufficient and efficient bubbles must depend on many other factors, viz; the working cell space, amount of water, degree of agitation, kind and amount of ore and perhaps on occasion amount of metallic content, kind of oil, etc. For example, if a ton of ore be agitated in a lake of water, doubtless a lake of oil will be necessary to create sufficient bubbles to capture the metal in the ore. But with bona fide operations in a good workmanlike manner—with the proportion of space, water, agitation, etc., such operations and manner dictate—the range in amount of oil will be narrow and well within 1% on the ore. These "critical proportions" are like those known to and solved by every child with its pipe and bowl of suds. Too little soap, the bubbles are few, small, fragile, and break quickly. Too much soap, they flow from the pipe in a torrent, are heavy, and refuse to float. The right amount of soap, the "critical proportions," his bubbles are large, detach readily, and float high, far and for long. So is it with the bubbles in this process. With excess oil but not enough to defeat bubbles altogether, though of fair aspect to the eye the bubbles will not do the work. In the excess oil in the films the metallic particles do not cling but swim or slide to the bubble's lower surface, "neck off"—detach, and sink. The untechnical workman recognizes there are "critical proportions" of oil, and small deviation from the predetermined amount in the feed, whether more or less, manifests itself to him in the appearance of the froth and poorer results; and he knows and remedies the error in oil.

Metallic content of ore seems of little importance—sometimes seems to require oil inversely. For example, a local operator with the process upon ore from the same vein as defendant's, uses 0.7 lb. of oil per ton of ore of 11.23% zinc content, making 50.59% concentrates with 94% recoveries, and in the same plant uses

2.83 lb. of the like oil per ton of tails of 0.97% copper content, making 9.085% concentrates and 0.266% tails. It is apparent it is the air and not at all the oil that floats the mineral, noting that in the first of this example 211 lb. of zinc are floated by air bubbles in the creation of which only 0.7 lb. of oil is used. How the air particles are introduced into the pulp is immaterial. For introduced, they are still particles and not bubbles. Agitation subsequent to introduction is vital and alone can convert air particles into water-oil-air bubbles. It is this subsequent agitation that within the claims of the patent agitates "the mixture until the oil coated mineral matter forms into a froth" or "to form a froth." And it is all one, whether this be applied agitation or self agitation—the agitation set up by the air particles themselves in merely rising through the mass and thereby coming in contact with both water and oil, all co-acting to form bubbles which capture the metal. The mineral particles, either oiled before or by contact with bubbles, attach to and enter the viscous film of the bubbles. The particles also increase the viscosity of the bubble films, armor them and increase their stability, perhaps as stays that decreasing the area of unsupported surfaces, increase the latter's ability to resist rupture.

The great mass of new evidence herein is but cumulative of the Hyde suit. The only new publication is the *California Journal of Technology* detailing a suggestive but rather misleading and abandoned experiment, sufficiently referred to and disposed of in the Miami suit.

There is much evidence that progress in the process and methods of operating it, now discloses that with some ores and some oils or mixtures of oils, the process can be fairly successfully operated with 1% and more of oil. This is really admitted by plaintiff and is taken as proven. But it is also proven practically without conflict that in all the operations with this process not to exceed 0.2% of oil is used, save by defendant and others in like situation and only since the decision in the Hyde suit and solely to avoid infringement; that some oils are effective and more are ineffective to operate the process; and that the excess oil used is useless, wasted and harmful.

But the defendant contends that this evidence demonstrates the process lacks novelty and invention, and that because of it the record is substantially different from the Hyde suit the decision there should not control here, and the patent is and ought to be held invalid. This is without support in the patent and Hyde decision.

THE FORMATION OF FROTH

In describing the invention the patent refers to Cattermole and says that the patentees "have found that if the proportion of oily substance be considerably reduced—say to a fraction of 1% on the ore," after vigorous agitation the metallic particles rise to the surface in a froth; that the proportion thereof varies considerably with different ores and different oils, and so it is necessary to test "to determine which oily substance yields the proportion of froth or scum desired." An example of a particular ore and oil is of oil "say from 0.02% to 0.5% on the weight of ore," wherein on cessation of agitation "a large proportion of the mineral present rises to the surface in the form of a froth or scum which has derived its power of flotation mainly from

the inclusion of air bubbles introduced into the mass by the agitation, such bubbles or air-films adhering only to the mineral particles which are coated" with the oil which has "a preferential affinity for metalliferous matter over gangue." It adds that the minimum of that oil "may be under 0.1% of the ore, but this proportion has been found suitable and economical."

The claims are (1) for "oily liquid . . . to a fraction of 1% on the ore," (2) for oleic acid "to 0.02-0.5% on the ore," and (3) for "a small quantity of oil." These last were held invalid. In upholding the patent the Supreme Court says that "as described and practiced" the process consists "in the use of an amount of oil which is 'critical' and minute as compared with the amount used in prior processes, 'amounting to a fraction of 1% on the ore,' and in so impregnating with air the mass . . . by agitation . . . as to cause to rise to the surface . . . a froth . . . which is composed of air bubbles with only a trace of oil in them, which carry in mechanical suspension a very high percentage of the metal;" that "it differs so essentially from all prior processes in its character, in its simplicity of operation, and in the resulting concentrate, that we are persuaded that it constitutes a new and patentable discovery;" that the facts are not overstated by Liebmann that "the present invention differs essentially from all previous results. It is true that oil is one of the substances used but it is used in quantities much smaller than was ever heard of, and it produces a result never obtained, before. The minerals are obtained in a froth of a peculiar character, consisting of air bubbles which in their covering film have the minerals imbedded in such manner that they form a complete surface all over the bubbles.

SIMPLICITY OF THE OPERATION IS STARTLING

"A remarkable fact with regard to this froth is that, although the very light and easily destructible air bubbles are covered with a heavy mineral, yet the froth is stable and utterly different from any froth known before, being so permanent in character that I have personally seen it stand for 24 hours without any change having taken place. The simplicity of the operation, as compared with the prior attempts, is startling. All that has to be done is to add a minute quantity of oil to the pulp to which acid may or may not be added, agitate for from 2½ to 10 min. and then after a few seconds collect from the surface the froth which will contain a large percentage of the minerals present in the ore;" that the Court is convinced "that the small amount of oil used makes it clear that the lifting force which separates the metallic particles of the pulp from the other substances of it is not to be found principally in the buoyancy of the oil used, as was the case in prior processes, but that this force is to be found, chiefly, in the buoyancy of the air bubbles introduced into the mixture by an agitation greater than and different from that which had been resorted to before and that this advance on the prior art and the resulting froth concentrate so different from the product of other processes make of it a patentable discovery as new and original as it has proved useful and economical;" that the Court agrees with the House of Lords' decision that the process is not one before described but a new method in which flotation is by the "buoyancy of air bubbles;" that tests to determine the

necessary "amount of oil and the extent of agitation," and "the range of treatment within the terms of the claims," satisfy the law; but that while the patentee "discovered the final step, precedent investigations were so informing that this final step was not a long one and the patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions' 'amounting to a fraction of 1% on the ore,' and therefore . . . the patent is valid as to claims Nos. 1, 2, 3, 5, 6, 7 and 12 . . . but . . . invalid as to claims 9, 10 and 11." Those held invalid are those heretofore referred to as (3). It seems clear neither patent nor decision undertakes to say the process depends upon less than 1% of oil or is inoperative with 1% or more of oil.

PATENT REFERS TO FRACTION OF ONE PER CENT. OIL

It is true that in the beginning and during the Hyde suit the patentees inclined so to believe, or at least believed better results would be obtained with a fraction of 1% of oil. Perhaps limited investigation and experience with few ores and oils justified the belief. Indeed, all experience to date, plaintiffs', defendant's, strangers', demonstrates that with any ore and any efficient oil, less than 1% of oil gives better results, all circumstances considered. The "critical proportions" referred to seems absent, in terms, from the patent, and ought not to be adversely inferred in disregard of construction in favor of the patentee where the patent is ambiguous. The patent describes oil "considerably reduced," and refers to a "fraction of 1%" by way of example. And though some claims limit oil to such fraction, and a limited range within it, others are for "a small quantity" and for that reason held invalid by the Supreme Court. With the later knowledge of this suit, it is doubted that such would be the decision now. It is to be observed that this limitation of the patent indicates the Supreme Court believed the process might be operative with 1% and more of oil, and contemplated that this would not defeat the patent but might affect infringement. If the patent is limited to the use of a fraction of 1% of oil, that the process can be operated with 1% and more is not material to validity though it may be to infringement. For if a patentee limits his claim voluntarily or because he does not know the extent of his invention, he abandons the excess and the patent is valid to the extent of the claim. If it be conceded that new evidence might warrant and demand that a Trial Court hold invalid a patent by the Supreme Court held valid, such evidence must be unequivocal, clear and convincing, in quality and quantity that inspires confidence and produces conviction that the patent is invalid and that the Supreme Court would so determine beyond a reasonable doubt. Not only does it fail here, but it strengthens the conviction that the patent is valid.

The disclaimer to conform to the Supreme Court's decision that claims 9, 10 and 11 are invalid, was filed 107 days after said decision and after mandate but before expiration of time for rehearing. It was timely filed. In substance it fairly conforms to the language of the decision, disclaiming "from claims 9, 10 and 11 . . . any process of concentrating powdered ores excepting where the results obtained are the results ob-

tained by the use of oil in a quantity amounting to a fraction of 1% on the ore." The parties differ in its interpretation even as they do in respect to the decision. Written words, not oral claims, control. The patent claims included what the patentees were entitled to and more. The decision pointed out the excess. The patentees disclaim the excess. They can safely rely upon the decision, and a disclaimer conforming to the language of the decision is sufficient. The patent valid, defendant admits infringement from before suit commenced to Jan. 7, 1917, and denies infringement thereafter. During the period of admitted infringement it applied the process to some 1,598,000 dry tons of crushed ore, the tailings from water concentration, of mineral zinc content by yearly averages as follows: 1913, 15.14%; 1914, 14.14%; 1915, 13.66%; 1916, 12.89%. Oil used by yearly averages is as follows: 1913, 5.58 lb.; 1914, 2.22 lb.; 1915, 1.49 lb.; 1916, 1.43 lb. The concentrate grade by yearly averages is as follows: 1913, 47.60%; 1914, 53.03%; 1915, 54.62%; 1916, 53.83%, and recoveries (apparent) likewise, are for 1913, 80.03%; 1914, 86.08%; 1915, 90.18%; 1916, 92.63%. Progress is indicated by leaner ores, less oil, higher grade concentrates, greater recoveries, all coincident with advancing time.

PROCESS MODIFIED BY DEFENDANT

It is noted that the process is responsible for advance in methods, devices and machines for its operation. To describe briefly defendant's operations during admitted infringement, the water-concentrate tailings, oil added, flowed to the head of a pyramid machine of seven cells in series, each cell containing a revolving perpendicular spindle and horizontal blades, and having two opposed spitzkasten. The agitation was very violent. The tails from each cell flowed by gravity to the cell immediately below, those from the last cell flowing to Callow air cells which produced froth middlings returning to the head of the pyramid, and tails, to waste. The first three cells of the pyramid produced froth rougher concentrates which flowed to cleaners, and the other cells produced froth middlings which returned to the head of the pyramid. The rougher concentrates passed through five cleaner cells for washing. This produced concentrates which flowed to and through five re-cleaner cells, and tails which returned to the head of the pyramid. The re-cleaners produced final concentrates, and tails which returned to the head of the cleaner. Commencing Jan. 7, 1917, the defendant's methods are as before, save pneumatic as well as mechanical agitation is employed in the lower four cells of the pyramid, some spitzkasten are blocked, an additional cleaner operation is used and from which for some unexplained reason 8.65% zinc tails go to waste, and oil in amount 1% and more on the ore is used. Defendant, not very insistently, claims results for this latter period are more profitable than for the former, but plaintiffs' analysis (neither denied nor criticized and beyond both) of defendant's reports and tabulations makes manifest the fact is otherwise to the extent of about \$1.75 per ton of ore—an enormous loss on 45,000 tons monthly. There is considerable like testimony in reference to operations by other infringers. However, coming as it does after very large operations, investigations and experiments of several years, after the Supreme Court's decision in the Hyde suit, it is

incredible that use of 20 lb. of oil per ton results in more profit than 1½ to 4 lb. per ton. If it does, these great concerns would not have waited to discover the fact and employ it, until after the said decision. Defendant practically admits that it now uses the present amount of oil merely to avoid the patent. It is done, says its counsel in argument, "because the Supreme Court has said it is not at liberty to use less than ½%" and "out of abundance of caution" it uses "more than 1%." The evidence likewise persuades. If the excess oil were effective and useful and not inert, useless and harmful, it would be without the claims of the patent, would be of that the patentees abandoned to the public, and would involve no infringement.

PLAINTIFFS' CLAIM THAT WASTEFUL EXCESS OF OIL IS USED TO EVADE PATENT

Plaintiffs somewhat laboriously argue that though the Supreme Court held that the claim for use of "a small quantity of oil" to produce froth is too broad and so invalid, yet since the court identifies the invention by the "results obtained" though confining it to the "results obtained" by the use of oil "amounting to a fraction of 1% on the ore," the import of the decision is that if the results obtained by operation of the process with oil in amount 1% and more on the ore are like and the same results obtained with a fraction of 1% of oil, it is within the patent and is infringement. This is more ingenious than sound, and would deprive the decision of effect. The court does not confine the patent to the like or same results obtained, but to the results obtained by the use of a fraction of 1% of oil on the ore. It is believed, however, that the court employs the word "use" in its or the ordinary sense of beneficial service. Patent law is not concerned with the useless, and a valuable result sought is not "obtained" by but despite the use of an excess of an essential ingredient, which excess renders no or ill service. From the evidence it appears the larger part of the oil used by defendant and all in excess of a fraction of 1% on the ore, if not inert is ineffective, wasted and injurious to the process and results. Before Jan. 7, 1917, defendant used only pine oil and about 1.43 lb. per ton of ore, with excellent results. Since said date it uses a mixture of 20 to 24 lb. of oil per ton of ore, made up of 18% of pine oil, 12% of kerosene oil, and 70% of fuel oil, with poorer results. The kerosene and fuel oil are petroleum.

As before stated many oils are ineffective to operate the process, and that is because they have not the quality that contributes to bubble making. What this quality consists of, wherein it lies, does not appear. With these ineffective oils, agitation will not produce froth and so there is no flotation of the metallic particles. One of defendant's witnesses testifies that in the laboratory and plant of the Utah Copper Co., one thousand oils have been tried, of which but two mixtures give satisfaction. Petroleum seems generally ineffective, by the evidence of both parties, though some of defendant's witnesses testify to sometime successful experiments with them. Incidentally, there is suspicion that with experiments, as with figures, can be done anything for or against, without impropriety in the operator. Some petroleum is used in limited quantities but always in combination with a recognized bubble-making oil, and only, it is said, for a somewhat bubble-stabilizing effect. Defendant's

present mixture of oil contains more pine oil on the ore than it used alone before Jan. 7, 1917. The other factors the same, it is obvious the excess petroleum in the mixture are responsible for the poorer results.

Defendant uses the patent process, uses plaintiffs' invention of ore concentration by air-bubble flotation, uses the same elements in the same combination in the same way with the same function to the same but poorer results; and exceeding the patent claims in reference to one ingredient (oil), uselessly, wastefully and injuriously and merely with intent to avoid the letter of the patent, does not avoid infringement. The addition of the excess oil no more adds to or changes the process, no more avoids infringement, than would the addition of milk or other useless substance not a part of the process. The excess oil exercises either no function or less efficiently exercises the same function in the same way as the limited oil, and to the same but poorer results. To secure to patentees their invention, the law looks quite through mere devices and forms, to the substance of things. And if in substance the invention is taken, if the thing that does the work is taken, all devices to evade the letter of the patent avail nothing to escape the consequences of infringement. Neither principle nor authority to the contrary, is cited or known to the court.

In the matter of estoppel affecting infringement, it suffices to say neither in pleading nor proof do the elements of estoppel appear. Although the evidence is of great volume and the arguments of relative length, all have been carefully considered but require no additional reference herein.

The patent is valid in respect to all claims involved. Defendant throughout has infringed and now infringes all said claims save 5, 6 and 7, and decree accordingly.

Gold and Silver Production in 1916

The corrected and revised statement of gold and silver production in the United States in the calendar year 1916, prepared jointly by the Bureau of the Mint and the Geological Survey has just been issued and shows that the preliminary estimate made in January

GOLD AND SILVER PRODUCTION OF THE UNITED STATES
(Gold, Value; Silver, Fine Ounces)

	Gold		Silver	
	1915	1916	1915	1916
Alabama	\$5,100	\$7,400		
Alaska	16,710,000	16,124,800	1,054,634	1,266,317
Arizona	4,555,900	4,092,800	5,665,672	6,680,252
California	22,547,400	21,980,400	1,689,924	1,936,910
Colorado	22,530,800	19,185,000	7,199,745	7,551,761
Georgia	34,800	20,400	141	
Idaho	1,170,600	1,058,300	13,042,466	11,570,399
Illinois			3,892	5,782
Maryland				153
Michigan			581,874	759,068
Missouri			55,534	128,860
Montana	4,978,300	4,328,400	14,423,173	14,046,054
Nevada	11,883,700	9,064,700	14,453,085	13,682,067
New Hampshire				935
New Mexico	1,460,100	1,350,000	2,337,064	1,729,917
North Carolina	170,700	23,000	1,496	1,738
Oklahoma				606
Oregon	1,867,100	1,901,500	125,499	221,887
South Carolina		300		
South Dakota	7,403,500	7,471,700	197,569	210,100
Tennessee	6,800	5,700	99,171	93,837
Texas	1,800	500	724,580	664,319
Utah	3,907,900	3,859,000	13,073,471	13,545,802
Vermont		300	150	1,964
Virginia	500	500		508
Washington	461,600	580,600	213,877	294,516
Wyoming	13,900	20,200	2,910	3,407
Continental U. S.	\$99,714,100	\$91,075,500	74,945,927	74,397,159
Philippines	1,320,900	1,514,200	15,148	17,643
Porto Rico	700	600		
Totals	\$101,035,700	\$92,590,300	74,961,075	74,414,802

was rather conservative, though the differences were not large. The revised figures give the total production of gold in 1916 at 4,479,057 oz., or \$92,590,300 in value, or greater than the January estimate by \$273,900; while the output of silver was 74,414,802 oz. fine, which is 1,533,002 oz. more than the January figures.

As compared with the report for 1915, the gold value showed a decrease of \$8,445,400, or 8.36%. The falling off was generally distributed among the more important gold-producing states, being most marked in Colorado and Nevada; while South Dakota showed a small gain. In gold production California again came first, notwithstanding a decrease of \$567,000. Colorado was second, Alaska third and Nevada fourth. In a second group, considerably behind the first, South Dakota was the fifth state in amount, Montana sixth, Arizona seventh and Utah eighth. Eleven states produced over \$1,000,000 each. The Philippines reported a gain of \$193,300 or 14.6%, which was largely due to the extension of dredging operations.

In the total production of silver the change was small, a decrease of 546,273 oz., or 0.73%. The larger decreases were in Idaho and Nevada; Colorado and Utah showing small gains. Montana was the largest silver producer in 1916, Nevada being second, Utah third and Idaho fourth.

Foreign Trade in Copper

Exports of copper from the United States in June, 1917, and the first six months of the year, are reported by the Department of Commerce as follows:

	June Lb.	Jan.-June Lb.
Ore and concentrates, contents	587,357	3,211,188
Unrefined, in bars, pigs, etc.		4,995,699
Refined, bars, etc.	89,532,200	577,672,571
Old and scrap	46,974	863,595
Plates and sheets	700,932	17,187,879
Wire	1,961,517	15,336,663
Total	92,828,980	619,267,595

The weight of ore exported in June was 6560 tons; of concentrates, 63 tons.

Imports of copper into the United States in June and the first half of 1917, are reported by the Department of Commerce as follows:

	June Lb.	Jan.-June Lb.
Ore and concentrates, contents	14,466,518	77,873,502
Matte and regulus, etc.	1,141,067	10,454,043
Unrefined, in bars, pigs, etc.	44,779,479	205,085,123
Refined, in bars, etc.	320,935	3,962,735
Old, etc., for manufacture	3,454,978	11,848,422
Composition metal, copper chief value	15,548	162,552
Total	64,178,525	309,386,377

Material imported in June was 39,942 tons ore, 14,207 tons concentrates and 1178 tons matte and regulus, etc.

Minerals Separation vs. Miami

We are informed that there has been a decision in the suit of Minerals Separation against Miami Copper Co., tried in the United States district court at Wilmington, Del. The report of the scope of the decision as sent us by the attorneys for Minerals Separation is declared by the attorneys of the Miami Copper Co. to contain substantial inaccuracies. We therefore refrain from making any announcement until we can get a statement in which the attorneys for both sides can concur.

Dredging in the Nechi Valley

Dredging results of the Pato and Nechi companies in Colombia are reported for the last fiscal period and Chairman Baker of the holding company—Oroville Dredging Co., Ltd.—reviews the peculiar position of the Nechi company with respect to the effect of the British excess-profits tax on a mining company just coming into full production.

THE Oroville Dredging Co., operating the Nechi Valley, Colombia, S. A., in its annual report for the year ending Sept. 30, 1916, states that in Pato fields 1,484,721 cu.yd. of material dredged returned \$719,493, an average of 48.5c. per cu.yd. Notwithstanding abnormal costs of repairs and war prices for materials and freights, field costs averaged only 12.46c. per yard.

The Nechi dredge handled 1,617,975 cu.yd. for a recovery of \$651,068, an average of 49.27c. per yd. Field costs were 9c. per yd. including 5c. per yd. for repairs which under normal conditions would not have exceeded 2c. With the addition of £1000 per month rental paid to Pato Co. for the use of their plant, the proportion of expenses charged Nechi on the London books plus depreciation, the field costs for the period amounted to 15.20c. per yard.

NECHI DREDGE WORKED ONLY 58% OF TIME

The Nechi dredge commenced operations on Sept. 1, 1915. In consequence of the suspension of operations at various times, owing mainly to the necessity for alterations in the construction of the dredge and the erection of new bucket plant and a shortage of water power for a certain period during the dry season, the dredge was employed for only 58% of the possible running time. In the early days of the Nechi operation, the management decided that it would be prudent to operate the dredge along the banks of the river, so as to create a wall against heavy floods during the rainy season, and it was thought advisable for rapidity in work not to operate the dredge at its greatest operating depth, so that while that work was being done a much lower average per cubic yard was obtained than would have been the case if dredging had been done to bed-rock. To this fact may be largely attributed the average of only 49.27c. per cu.yd., while the operating costs were affected by the fact that the dredge only worked 58% of the normal running time, due mainly to certain defects in dredge construction.

Chairman Frederick W. Baker at the annual meeting in London, recently, commented on the peculiar position in which the Nechi company finds itself, as follows:

"Work carried on during the current year has confirmed the high value of the gravels on the Nechi property, and, while I do not think that the results which we are now obtaining during this current year will exceed materially the results for the period under review, I think I can state with the greatest assurance that, were it not for war conditions and the excess-profits situation, we could earn from this property in any year,

until we have exhausted the high-grade ground, an amount equal to approximately twice the earnings for the period ended Sept. 30, 1916, and probably at a large reduction in operating cost.

"I now come to a point where it will be necessary to consult with you as to what your wishes may be in operating the Nechi property, judged from the point of view of our position as it will be affected by excess-profits duty. Unfortunately we had no pre-war standard, and we are therefore assessable for excess profits after such allowances as the revenue authorities or the Board of Referees might be willing to give us, at the rate of 60% assessment on our earnings for 1915-16, at the same rate for this year, and at the rate of 80% for 1917-18, and in my judgment it certainly would be a reflection on the good sense of the Treasury authorities if they should show us no special consideration in respect of this form of taxation having regard to the facts which I shall put before you. We can all readily understand that mining companies operating base metals should be assessable for excess-profits tax, having regard to the enormous appreciation that has taken place since the commencement of the war in such metals as iron, copper, tin, lead, zinc, and some of the rare metals, and it is abundantly clear that companies operating this class of mines have had their profits abnormally swollen owing to the large appreciation in the metals produced and sold by them, in addition to which few of these companies have started since the commencement of the war. Most of them have had a pre-war standard, and they are only assessed on the excess over their pre-war standard of profit. Because we, unfortunately, had no pre-war standard we are to be assessed on every shilling earned, subject to certain concessions based on risk, duration of life of the property and interest on capital actually invested.

"Now, what is our position? We are producing a commodity which the government wants. The production of this commodity is costing us more, owing to the increase in price for all supplies, labor, insurance, freight, etc., than before the war. We receive no corresponding premium or appreciation in the market for the product we produce, and on top of this we have to look forward to what you might almost call a confiscation of our earnings, if, as is possible next year, 80% of these earnings are to be paid to the government in the form of excess-profits tax, in addition to the ordinary income-tax deduction.

PRACTICAL CONFISCATION OF EARNINGS THREATENED

"Now, gentlemen, this company, as now equipped, could earn approximately an income of over £200,000 a year until the richer gravels are worked out, and it is for you to determine what policy you want us to follow. Are you prepared to authorize us to work the property at its full capacity in the richer ground and pay from 60 to 80% of our earnings away in the form of excess-profits tax? We as a board have no desire to avoid in any way the reasonable and proper responsibilities that attach to us and to you as shareholders, and we wish—and we feel that you would also wish—that this company should bear its full share of the bur-

den of the cost of this war, providing always that these burdens are borne equally by all. But we feel that our case is one of peculiar hardship, for we are not getting, as operating base-metal mines are, the benefit of the enhancement in value of the metal produced. On the contrary, our gold is costing us more to produce, and, notwithstanding this fact, we are being put on the same basis for taxation purposes as base-metal mines, whose profits have been enormously enhanced by the increase in the cost of the commodity they are producing, so that they can well afford to pay the full burden of excess-profits tax where we should not—anyhow, not in the same proportion—and we as a board feel disposed to recommend that, unless we get some reasonable and fair treatment from the revenue authorities, our clear duty to you is to suggest that the dredge be put to work on the poorer gravels until the relief from inordinate and excessive taxation would enable us to work out the richer gravels, so that in this way you may earn some profit for the risk you have taken and the long patience displayed by you in the past. I am very hopeful that when the peculiar hardships of our case are properly put before the authorities they will take a reasonable view and enable us, by operating at the fullest capacity, to do as well for you as the present circumstances of the war would justify, to do as well for the government as everyone of us would wish to do and, in addition, enable us to furnish as large an output of gold to the country as the means at our disposal would enable us to produce.”

REASONABLE TAXES ACCEPTABLE

When a stockholder remarked that he had expected to hear something with regard to the extra sixpence which the Board promised to the stockholders last year, the chairman said that the point raised by the speaker was affected by the excess-profits tax, that the directors hardly knew where they stood in this matter and that there were really two questions involved. Did the shareholders want the directors to pay nothing to the government if they could get out of paying, or did they want the board to pay what they ought to pay in times like these providing that the amount was, in their judgment, reasonable and proper? His own view was that every company and every Englishman had an obligation to his government in these times, and he did not think this company would want to evade that obligation in any way. The directors had placed the whole matter in the hands of a very able accountant, who was taking it up, not with the Board of Referees, but with the Inland Revenue Authorities, and he believed there was a strong inclination on the part of the Treasury to meet the situation in respect of gold mining in a fair way. If they did that and gave the company an allowance for risk—which was a big item—for life—and in the Nechi the life of the property in the richer gravels was a short one—and for capital, the directors would be quite prepared to work to the full capacity. He suggested that the shareholders should give discretion to the Board to operate the property in a way which would be best for the shareholders and at the same time best for the country. They could not get off scot free, and personally he would not be a party to any attempt to do so. They would certainly make no attempt to evade obligations which it was their duty to fulfill. With

regard to depreciation, the government never permitted any allowance to be made for mineral areas, but an allowance was made in respect of depreciation of plant.

With reference to the life of the Oroville property in California, Chairman Baker stated that this was practically exhausted. The directors had, however, determined, before definitely abandoning the Bear River property, to have it thoroughly drilled again, and it was possible that, with modern improvements in dredging construction and higher technical knowledge in dredging they might find they could operate some portion of that property which in the earlier history of the company they were unable to work at a profit.

Replying to the question of the possibility of further properties being acquired, so as to give the company a longer life, the chairman said the directors had had that question in view. W. A. Prichard, the company's consulting engineer, had made two trips in Colombia—very hazardous trips—and had written recently to say that there was one district which he thought looked rather promising, and in which he wanted to spend six months for purposes of investigation. This the board had authorized him to do. They had also been looking into a property in South America, but had had to give it up. Then they had examined a gravel property in California. Whether it would come up to the standard they required he could not say, but it looked fairly hopeful. It showed up to the present about 13c., with a fairly large yardage.

Transporting Coal on Ohio River by Artificial Tides

On Monday, Aug. 13, there arrived in Cincinnati 13,000 tons of coal, floated down the Ohio River at low stage on an artificial wave created by order of Col. Lansing H. Beach, Corps of Engineers, U. S. A.

As always at this time of the year, the Ohio River is in extremely low water, and boats drawing more than a couple of feet of water are normally tied up. Under the direction of United States Army engineers 23 dams have been built between the upper waters of the Ohio and a point just below Cincinnati. These dams, which impound large volumes of water in the Big Sandy, Kanawha and upper Ohio Rivers, were opened, allowing water to run out forming an artificial crest 3 to 6 ft. high, and 30 to 60 miles in length. On this home-made floor wave the coal-labor barges made their way to Cincinnati, where the fuel shortage was so pressing that an industrial shutdown was imminent. Colonel Beach is quoted as saying that the saving in economic cost of such a shutdown undoubtedly equaled the cost of all the dams so far built in this project. To ship the 13,000 tons of coal from the West Virginia coal fields to Cincinnati by rail would have required 350 coal cars; in these days of car shortage and freight congestion it is decidedly worth while to transfer such shipments to water-borne traffic, whenever possible.

The water was drawn from only 19 of the 23 dams, and the feat has demonstrated that with proper manipulation these artificial waves with still higher crests can be created every ten days or two weeks, and the tonnage of coal shipped by water can be largely increased.

Correspondence and Discussion

American Academy of Engineers

I was much surprised to learn from the article in the issue of the *Journal* of Aug. 18, describing the organization and ambitions of the new American Academy of Engineers, that it had already received a Government charter from the Senate of the United States. I am inclined to the opinion that the reason for not commenting editorially in the same number on this new organization was that it struck the *Journal* much as it will a large proportion of the engineers of our country.

It is difficult to understand why a new organization of engineers should be created, and made to outrank the splendid institutes we now have, unless, indeed, it be intended to give greater professional prominence to the "nucleus of fifty," mentioned in the article, together with the additional 150 members they will elect to complete this "select body of practitioners." The reasons why this academy should receive its Government charter, as set forth by Dr. J. A. L. Waddell, who includes himself in the "select body of practitioners," will not prove at all convincing to the average engineer. There is much reason to believe that the younger members of the engineering professions will be discouraged by having an officially recognized body of engineers placed over them to which they can obtain admission only by the "dead men's shoes" trail.

Doctor Waddell advances as his first reason for a charter that, without it, this small coterie of men will not be recognized by the general public as the "select body of practitioners" they intend to make of themselves, to which our other engineering organizations will have to appeal for help and guidance in all matters relating to their welfare. It will be a shock to most of us to learn that our engineering institutes are to experience crises, in the near future, which will force us to turn tearfully to some other organization for guidance and help even if this other organization is made up of "purveyors to the king by royal charter."

The next reason in the good doctor's argument is that academies for other purposes have already been chartered by European kingdoms and monarchies, and if we do not move rapidly, our great sister republic, France, will "beat us to it" in creating an Academy of Engineers. This seems to be un-American. By the same reasoning we should appoint purveyors to the President by charter and thus follow other dynasties which appoint purveyors to the king by royal charter, a policy which to the average American has always savored strongly of discrimination against other merchants and tradesmen. The granting of a charter to this proposed "select body of practitioners" will surely be a discrimination in its favor if, as Doctor Waddell intimates, it is to arrogate to itself all the professional calls for technical aid from foreign governments as well as all those from our own national, state and municipal governments. It is true that we have a National Academy of Science which, it is

generally understood, is organized for the purpose of advancing the sciences and disseminating scientific knowledge. It is not an Academy of Scientists. An Academy of Engineering (not Engineers) for the advancement of engineering knowledge would not present the menace to the engineering profession that appears to be concealed in the organization of a "select body of practitioners" who propose to commercialize the prominence they will obtain from a government charter. Doubtless many of the members of this new organization, if they have yet had time to give it consideration, honestly intend that it shall act merely as a channel through which these various calls for aid from our own and other governments will be transmitted to the already established engineering societies. However, it will doubtless be found in practice that most of these commissions will pass promptly into the hands of some of the "Select Body of Practitioners" who may, of course, find it necessary to favor with subordinate positions some of the engineers from the less select, sub-rank class. An Academy of Engineers with the ideals expressed in your article will not be able to work hand in hand with the National Academy of Science.

The final argument presented for this Government charter is that such a select body could make a much more authoritative appeal in movements affecting the welfare of the commonwealth. The first of these stirring appeals to the commonwealth is to be made through the press to educate every war baby as an engineer of some kind or other. Incidentally the Academy of Engineers is to be a Richard born with teeth in that it is to have at the start a well-designed and thoroughly lubricated press bureau. I cannot speak for the other engineering professions, but there are many of us in the mining-engineering trenches who believe that our profession is nearly recruited up to full strength. It is true that many of the younger members have already volunteered or been drafted into the national service. Doubtless many more will be called, and we fear that, if the great war continues for a considerable period, many of them will give up their lives on the field of honor. However, few of us are so pessimistic as to seriously entertain the idea that our mining enterprises are to be seriously demoralized by the lack of engineering talent either during or after the war. The serious shortage will be in labor and not in engineers.

The objectionable feature of this proposed Academy of Engineers can be summed up in the question, Who is to select this "select body of practitioners"? Who selected the "nucleus of fifty" who have already established the membership at two hundred and will elect the remaining one hundred and fifty and fill the vacancies created by death, resignation and otherwise? Many of them will suspect that they were selected by a very small coterie of organizers who sent out a circular letter of invitation to the illustrious members of our engineering professions and did not fail to include their own

names in that "nucleus of fifty." The majority of engineers will doubtless agree that we should all have a voice in selecting the members of any organization which is to represent our professions in dealings with our own and other governments and to which we are to look for leadership and technical aid. It will naturally be charged that this argument represents the view of those members of the professions who cannot hope to be invited to membership in the "select body of practitioners." However, I doubt if all the members of the "nucleus of fifty" seriously believe that our great engineering professions will soberly accept as their representatives and superiors a small coterie of self-appointed men, however eminent and capable some of its members may be. There can be no doubt that the names in the "nucleus of fifty" published in your article include some of our most prominent engineers, but we all know the democratic ideas of some of these gentlemen so well that we can be safe in assuming that they will be the first to admit that this list contains the names of others who cannot rightly claim any such distinction. Also it is quite certain that an academy cannot be made up of 200 engineers without doing grave injustice to some of the ablest and noblest members of our professions.

The American Institute of Mining Engineers is already on record as opposed to such a classification of its membership as will unduly favor any particular class professionally. This professional preferment was sought to be attained at one time by creating a new and distinctive organization outside of the Institute, but it failed to meet the approval of the engineers themselves for the reason that our profession looks to such organizations as a means of advancing mining engineering and not mining engineers. Our Institute gladly concedes and encourages professional distinction where it is due to professional achievement. Surely there can be no logical objection to the suggestion that if any engineering organizations are to receive the official recognition of the Government of the United States it should be those long-established institutes which can justly claim to represent the engineers of America and not a "select body of practitioners." Every one of the members of those institutes has the right to demand that his Government does not discriminate against him professionally by methods that belong to monarchies. Let us keep our profession safe for democracy.

GEORGE BENTON WILSON.

Salt Lake City, Utah, Aug. 25, 1917.

Galena Crystals in Mine Water

In a recent issue of the *Journal*, there is communication from Missouri describing an apparently late formation of galena crystals in a ten-year-old deposit of water. I would report a somewhat similar crystallization in the old Tiger mine, in the Coeur d'Alenes. The general manager, the former superintendent of the Tiger mill and myself had occasion to visit the old workings and at the foot of a 500-ft. winze, sunk on the lead to prospect before sinking a vertical shaft, we found crystals of galena and pyrite formed on the surface of the walls upon blasted rock and a few crystals on rock filling behind the lagging. The winze had been driven through the lead at this point and a station cut into the vertical shaft, so that the station was under the foot-wall on the

dip. The galena crystals were cubic (not a plentiful form in that lead country) and the pyrites the ordinary bright yellow. We examined enough to satisfy ourselves (from what our eyes told us) that the crystals had been formed since the winze was sunk, a matter then of about six years. The ground was wet from drippings from the worked-out lead above, but had never been under water. The water must have contained excess of the silicic acids, as there were some cedar shingles behind the lagging that rang to the candlestick blows with a clear stony ring. The country is siliceous and not calcareous. That mine has since been abandoned, and filled with water, so that I was unable to get any of the crystals and silicified shingles after they had developed a few years longer, which I intended to do.

D. H. BRIEN.

Seoul, Chosen, July 24, 1917.

Credits in South America

With reference to the communication in the *Journal* of Aug. 25, under the heading "Credits in South America," the correspondent must surely be describing another transaction; so that we have two Case 3 examples. The circumstances described by "Truthseeker" are in no way detrimental to his New York bank and so my Case 3 should not have hurt his feelings, inasmuch as I did not mention the name of the bank.

When I left Lima in May the "confirmed credit" to which I referred was still "canceled" and upon arriving at New York I confronted the manager of the foreign department of the bank with the statement of the ore buyer in Lima merely as a matter of curiosity. I wanted to know not only whether my Lima acquaintance was telling the truth but, in case he was, what excuse the bank could give. You will be interested to know that the bank manager did not deny that a "confirmed credit" had been "canceled" and, on the contrary, gave as the basis for cancellation the facts that the ore buyer in Lima is a German and had done something to put the bank in a bad light. I was not given details of this. The manager of the foreign department is neither an American nor a German.

MARK R. LAMB.

New York, Aug. 27, 1917.

Winter Gravel Washing in Siberia

In reference to the article, "Winter Gravel Washing in Siberia," appearing in the *Journal* of Dec. 2, 1916, which, owing to my absence in Petrograd, did not come to my notice earlier, the credit for the methods employed in winter washings at the Lenskoi is due to Leon Peret, L. Grauman, A. K. Smith and R. E. Smith, the first three being Russian, the latter an American.

Bodaibo, Siberia, June 19, 1917. W. E. THORNE.

Look at Page 466, John!

The *Journal* ought to describe just what the "rustling-card" system is. As a union advocate, I am opposed to anything that don't give the laboring man a square deal; but I believe in waiting to find out what a thing is all about before getting up and raising a holler.

Mineville, N. Y. Aug. 31, 1917. JOHN DOWNEY.

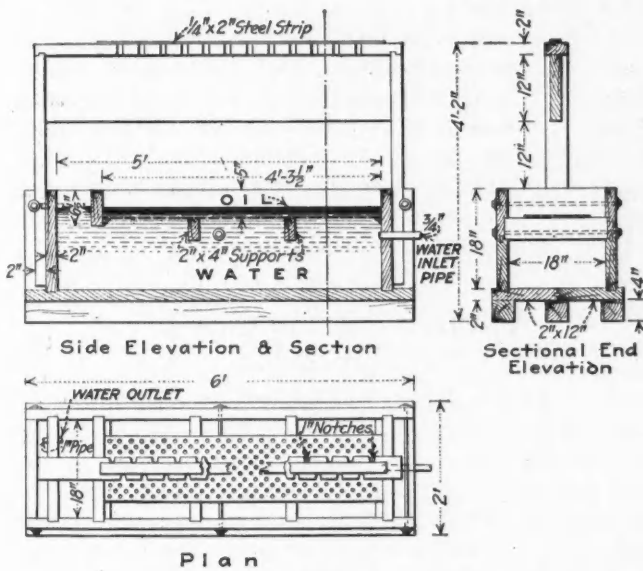
Details of Practical Mining

Oil Tempering Device for Drill Steel

BY O. F. WENZ*

A device for tempering tool steel, successfully used in Arizona and northern Mexico, is to be installed at Pilares de Nacozari by the Moctezuma Copper Co.

As shown in the illustration, the construction is very simple, and the principle is very clear. By keeping



OIL-TEMPERING APPARATUS AT NACOZARI

about 1/2 in. of water above the perforated iron stand and covering this with from 1/2 to 1 in. of oil, the too frequent soft bits are avoided. In case of overheating there is less likelihood of the bits being brittle and glassy.

Record of Accidents as a Basis for Rating Shiftbosses

BY D. E. CHARLTON†

It is generally recognized that the prevention of underground accidents is largely a matter of education, and thereby differs from accidents occurring in shops or other industrial plants by being largely preventable through the use of various safety devices. A great deal of thought and time has been expended in drawing up safety rules, and these vary to a great extent with different mining districts and methods. The degree to which such rules are carried out is entirely dependent upon the interpretation placed upon them by local managements. The old saying, "You can lead a horse to water but you can't make him drink," is remarkably true of underground accident prevention, for there still

exists, among a great many miners, that spirit of bravado so often the undoing of the fellow who knows better but "takes a chance."

The uptodate shiftboss is a man who is not only posted in his methods of mining and well read in his safety rules but also a born diplomat as well, and it is to him that the management looks for the best interpretation of those rules. Upon him devolves the task of educating his men as to the safe way of doing their work. He must be the example, and, while the use of signs, bulletin boards, etc., are all aids in accident prevention, the big factor is the personal work done by the man directly in charge.

The following is suggested as offering a means of putting this into practice. The idea is that each shift boss is considered accountable for the accidents to his men, and on this basis his rating is made. While at first glance this may seem unfair—for the reason that the boss is rarely present when accidents occur—the fact still remains that the largest proportion of accidents is due to carelessness, and this may be materially decreased through instruction given to the men by the boss. So, with the sense of responsibility placed on the boss, it is up to him to see that his men observe the rules and suggestions made for their safety.

At certain periods of time an "accident rating" can be given each boss and this may be used in conjunction with his production or other records, as a basis for promotion or bonus. The tabulation shows the figures covering an 11 months' period.

ACCIDENT RECORD FOR RATING SHIFT BOSSES

Rating of Shift Bosses, Jasper Mine, Based on Accidents January, 1916, to December, 1916

Shift Bosses	Williams	Dawson	Treloar	Wilson	Samsom	Nichols	
Months as Shift Boss.....	11	4	11	11	11	10	(1)
Number of Months having Accidents.....	4	2	6	6	6	9	(2)
Percentage Frequency of Accidents.....	36.4	50.0	54.5	54.5	54.5	90.0	(3)
Number of Men—Average per Month.....	29	42	36	35	32	44	(4)
Total Accidents.....	5	3	7	8	10	17	(5)
Percentage All Accidents per Average Men Employed.....	17.5	7.2	19.4	22.8	31.3	38.7	(6)
Accidents per Month, Each Shift Boss.....	0.5	0.8	0.6	0.7	0.9	1.7	(7)
Accidents per Accident Month.....	1.2	1.5	1.2	1.3	1.7	1.9	(8)
Total Days Lost.....	8	53	118	125	124	526	(9)
Days Lost per Accident.....	1.6	17.7	16.8	15.6	12.4	30.9	(10)
Percentage Injured.....	1.7	1.9	1.6	2.0	2.8	3.9	(11)
Comparative Standing.....	2.72	33.63	25.60	31.20	34.72	120.51	(12)
Accumulated Deduction.....	56.6	90.8	99.5	108.5	120.5	249.2	(13)
Final Deduction.....	18.9	30.3	33.2	36.2	40.2	83.1	(14)
Rating.....	81.1	69.7	66.8	63.8	59.8	16.9	(15)
Rank.....	1	2	3	4	5	6	(16)

Explanation: Line (1) shows the number of months the shift bosses were employed as such during the eleven months' period. Line (2) shows the number of months in which accidents occurred. Line (4) shows the average number of men in the charge of each shift boss. Line (5) shows total accidents occurring to the men working under each shift boss; this includes all accidents regardless of whether time was lost or not. Line (9) shows total days lost by injured men; in case of fatality, 300 days lost is used.

Line (3), Percentage Frequency of Accidents, is found by dividing (2) by (1). Line (6), Percentage All Accidents per Average of Men Employed, is found by dividing (5) by (4).

Line (7), Accidents per Month, Each Shift Boss, is found by dividing (5) by (1).

Line (8), Accidents per Accident Month, is found by dividing (5) by (2).

Line (10), Days Lost per Accident, is found by dividing (9) by (5).

Line (11), Percentage Injured, is found by dividing (7) by (4).

Line (12), Comparative Standing, is (10) multiplied by (11). This "standing" can be made each month as an indication of how the shift bosses are making out in their accident-prevention work.

*Mining Engineer, Pilares de Nacozari, Sonora, Mexico.

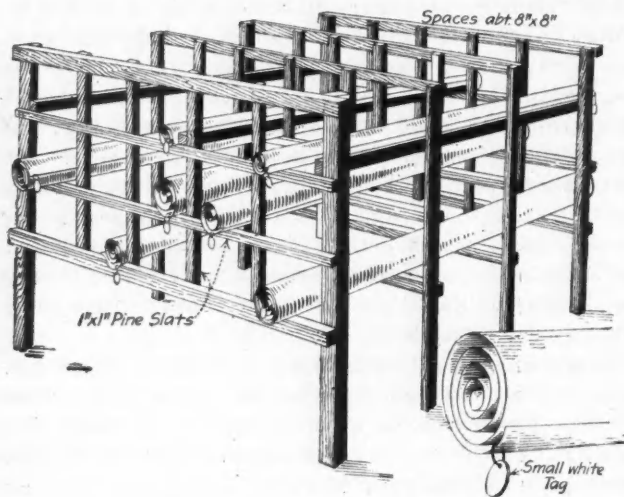
†Mining Engineer, Virginia, Minn.

Line (13), Accumulated Deduction, is determined by the sum of (3), Percentage Frequency, (6), Percentage All Accidents and (12), Comparative Standing. These three are weighted the same, and the total is divided by three to secure (14), Final Deduction. This is subtracted from 100—perfect score—and gives the rating (15). From that the rank (16) can be determined.

From this table it will be seen that all data available—magnitude and frequency of accidents and number of men employed—are taken into consideration. No doubt if the study of accidents were to cover a longer period of time it would show up other points not now apparent. Conditions such as mode of occurrence, time, place and preventability all go to make up a complete study of the accidents and should be given proper weight. It is impracticable, however, to show all this in the above record, which is offered only as a means of reducing accidents by interesting the "man on the job."

Rack for Holding Drawings

A good rack for long tracings and drawings can be made as shown in the accompanying illustration. It consists of a number of frames, the number depending



EASILY CONSTRUCTED RACK FOR DRAWINGS

on the length of the drawings, placed one in front of the other, and securely fastened together. Legs may be provided for resting on the floor or the rack may be hung from the ceiling. The number of compartments depends of course on the number of drawings to be filed. By making the compartments small, about 8 x 8 in., the drawings on the top are not sufficiently heavy to crush those on the bottom. If made of soft pine or other soft wood, the whole rack is not heavy and may be readily moved from place to place. The compartments may be numbered in any manner to facilitate making a card index of the contents. A small white tag, such as is used in clothing stores for marking prices, attached by its string to one corner of the drawing, eliminates the waste of time caused by hunting blindly for the desired drawing. The tag should be large enough to allow an abbreviated description of the drawing and on the reverse side to note, in fairly large figures, the number of the compartment to which it is assigned.

Protection for Ropes in Raises

In raw vertical raises driven on simple stulls for scaffolding and set at intervals along the raise of from 4 to 5 ft., heavy and somewhat expensive hemp ropes are tied to the uppermost stull before each round of holes is blasted. Such ropes are necessary to assist in climbing back into the raise after each blast and to haul to the top the machine drill, steel and timber. Where raises are driven to great heights ropes must be of a length to correspond. The life of such a rope can be greatly prolonged by the use of a light endless chain of a peripheral length of about 8 ft. The chain makes a loop hitch over the top stull and from the free hanging loop end the rope is suspended. The rope is thus protected from the blasted rock striking against the usual tie around the stull and it is subject to but little damage below this point.

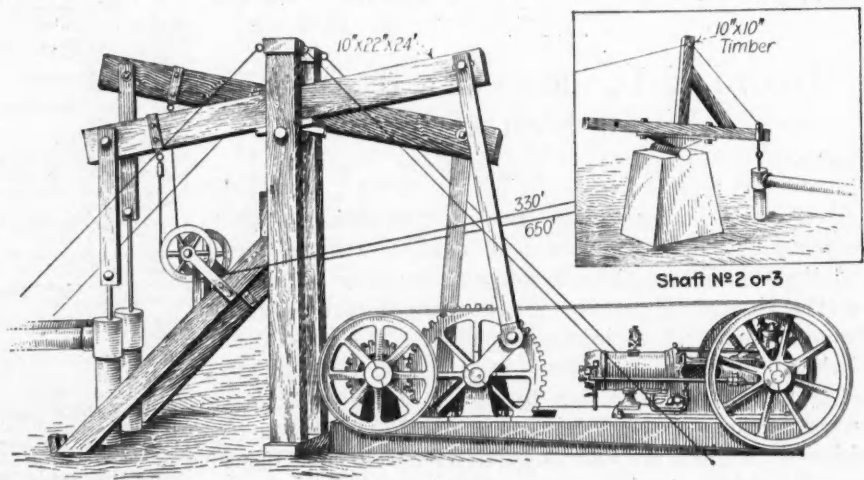
In this age, when "Safety First" is given so much consideration, the use of a chain, while undoubtedly adding to the already overburdened equipment of underground paraphernalia, is good insurance against the possibility of an accident, due to a weakened rope knot, which might occur when a miner was returning to his place at the top of a raise after a blast, and depending upon the rope for support in climbing back.

A Joplin "String Pump"

BY ABEL GREENE

Superintendent, Adams-Hicks Zinc and Lead Corporation

At the No. 1 shaft of the Adams-Hicks Zinc and Lead Corporation, Joplin, Mo., the operators installed an old-style walking-beam pump, driven by a 50-hp. Bessemer gas engine. When the shaft was pumped out, it was found that the pump would not drain the entire lease of 30 acres. Instead of installing another engine at No. 2 shaft, what is locally known as a "String Pump" was installed. At No. 2 shaft, distant about 330 ft. from No. 1, an angle beam was erected and operated by a $\frac{3}{8}$ -in. cable running over a 36-in. sheave, pulled by the engine on its original foundation. Later, another angle beam was placed 650 ft. from the engine, both in-



JOPLIN STRING PUMPS

stallations proving to be entirely satisfactory in every way. The engine, operating a 5-ft. stroke walking beam, consumes from \$60 to \$70 per month in gas. The illustration shows the general scheme as operated.

Events and Economics of the War

The sensation of the week was the revelation by Secretary Lansing that intercepted dispatches from the German charge at Buenos Aires had been transmitted through the Swedish embassy to Berlin advising complete destruction of Argentine ships if it were decided to sink them by submarine. Offices of the I. W. W. were raided throughout the country and much documentary evidence seized. A battle between an American steamship fleet and U-boats was reported on Sept. 5. The House has passed the \$11,000,000,000 bond issue and the Senate the tax bill for \$2,406,670,000. Nearly \$5,000,000,000 has been asked for army and navy. Movement of troops to training camps proceeds with little delay.

Civil war again threatens in Russia; Korniloff, chief of the Army, has been deposed by Kerensky for seeking the dictatorship and is advancing with troops against Petrograd. The Germans are extending their gains at Riga but Russian warships hold the Riga Gulf. Hard fighting continues on the Italian front for Monte San Gabriele against heavily reinforced Austrians. In France, Ribot has failed to form a ministry and the task has fallen on Painlevé, Minister of War; more vigorous government and less politics is demanded.

Unpreparedness for War

The testimony of General Crozier, the chief of ordnance of the War Department, before the Appropriations Committee of the House, in urging the estimates for the deficiency bill calling for nearly \$5,000,000,000, is illustrative of the inefficiency of bureaucracy.

He stated, according to the *New York Sun*, that the supply of machine guns was so limited that in some instances they have not been able to furnish manufacturers of small-arms ammunition with guns with which to make the necessary tests. Explaining his estimates of \$21,750,000 for armored motor cars, he said that little or nothing had been done with \$5,400,000 already appropriated for that purpose, because our border experiences did not tend to a very high idea of a machine-gun motorcycle and the armored and armed auto had not proved of any great value. The tank car, however, he said, seems to have come to stay. It is necessary, therefore, to provide for this general class of vehicle, but the ordnance bureau has not made any very definite programme of procedure.

American troops will be equipped with three different kinds of rifles—Springfield, American-Enfield and the obsolete Krag—for training purposes because there are not sufficient Springfields for the Regular Army and National Guard. The Enfields will not begin to be turned out for several months, no preparation having been made for their manufacture prior to the outbreak of the war.

The supply of pistols is so short, Gen. Crozier admitted, that it is impossible to supply even the Regular

Army and National Guard. Hand grenades can not be furnished, even to the Regular Army in France, except by drawing on the supplies of our Allies. Despite the fact that the demand for field artillery and machine guns is and for years has been recognized as the most pressing need of the army, the Government in the five months it has been at war has accomplished nothing toward increasing the production of these arms here.

"Some of these estimates," said Gen. Crozier, "might have been foreseen, and undoubtedly would have been foreseen if there had been time for a thorough and complete study of the probable requirements of the war before the passage of the last appropriation act."

Nation-Wide Raid on I. W. W.

The offices of the I. W. W. were raided simultaneously throughout the country on Sept. 5, at 2 p.m., central time, by agents of the Department of Justice who had carefully prepared their moves. William D. Haywood, head of the order, was taken in custody, though later released. Thousands of documents were seized, including in particular Haywood's private papers. The Government has reports that, in addition to its many acts of violence, the organization was planning the destruction of plants and other crimes to lessen the output of war supplies. At the same time the agents took possession of the national headquarters of the Socialist party in Chicago where many documents were also seized.

It was charged that the documents taken had been used in "committing certain felonies," specified as (1) insubordination, disloyalty, mutiny, and refusal of duty in the military and naval forces of the United States while the United States was at war with the imperial German government. (2) The felony of wilfully obstructing recruiting and enlistment service of the United States while it was at war. (3) The felony of using the mails and postal service for the transmission of non-mailable matter advocating treason, insurrection, and forcible resistance to the laws of the United States concerning the carrying on of the war.

Strike Agreement Proposed

To prevent strikes and lockouts during the war, a joint agreement between employers and employees was recently proposed to the Council of National Defense by members of the National Industrial Conference Board representing 50,000 manufacturers. The Board recommended that the Council's policy of discouraging changes of labor standards during the war be applied as follows:

"Concerning existing statutory regulations intended to promote safety and health, there shall be no suspension or modification of such provisions, except upon recommendation of the Council of National Defense;

demands for increase in wages shall be tested by the prevailing local standard of the establishment in effect at the beginning of the war, with such modification as necessary to meet any demonstrated advance in the cost of living; the standard number of hours shall be that established by statute or prevailing in the establishment at the beginning of the war, subject to change only when in the opinion of the Council of Defense it is necessary; as to 'open' or 'closed' shop conditions, every employer entering the period of the war with a union shop shall not by lockout or other means undertake to alter such conditions for the duration of the war, nor shall any combination of workmen undertake during the like period to close an open shop."

To settle the major labor disputes in war industries, the manufacturers recommended creation of a board of employers, employees and Government representatives with authority to render decisions binding on all parties, and "with full power to create all machinery necessary to execute its functions." It was said that the feeling was growing among manufacturers that labor bodies were not abiding by the recommendation made by Samuel Gompers, that unions should not insist on changing labor standards during the war.

Coal Miners Ask Increase

Bituminous coal operators of the central competitive field, including Indiana, Illinois, Ohio and western Pennsylvania, conferred recently with John P. White and others, representing the United Mine Workers of America, in an effort to agree on the miner's demands for a "substantial" wage increase. The extent of the demands has not been definitely stated. It is expected that Dr. H. A. Garfield, the Fuel Administrator, will attempt to settle the dispute. Operators will insist, it is said, on adding any increase granted to the prices fixed by the Government for bituminous coal.

Plans of Fuel Administration

To secure the largest possible production of fuel at just and reasonable prices, Dr. Harry A. Garfield announces that the following rulings will be observed:

The prices fixed for coal are provisional. They will stand unless changed by order of the President. The Fuel Administration will examine all applications for revision of prices accompanied by cost statements, presented in writing. These statements should be verified and cover at least the years 1915, 1916 and 1917 to date. If further explanation is needed, the Fuel Administration will ask complainants to appear in person. It is not proposed to require efficiently operated mines to produce coal at a loss, but the burden rests upon applicants to show that the prices fixed in particular cases are unfair.

It will greatly expedite the work of the Fuel Administrator if associations, whether of operators, miners or industries affected, would postpone the appointment of committees to confer with him, or for the purpose of taking action concerning prices and wages, until he has had opportunity to select his advisers and has heard from those who believe themselves likely to be adversely affected. Prompt attention will be given to all communications.

Plans will soon be announced whereby production may continue without affecting adversely either the producer or the purchaser pending the examination of applications for revision of prices. Until then it is suggested that sales and deliveries be made at the prices fixed, with a stipulation to the effect that if prices are readjusted, settlements shall be made accordingly. To determine a proper basis for sales by retail dealers, local committees will be organized throughout the country. Each will investigate and report

upon the local situation and advise concerning the regulations to be established. When the price is fixed, the local committee will be asked to superintend its enforcement.

The Fuel Administration is preparing a plan of apportionment which will secure to domestic consumers their fair share of the coal supply at prices which will reflect those already announced. Contracts relating to bituminous coal made before the proclamation of the President on Aug. 21, and those relating to anthracite coal made before the President's proclamation of Aug. 23, are not affected by these proclamations, provided the contracts are bona fide in character and are enforceable at law. The Federal Trade Commission has been asked to secure at the earliest moment possible a certified copy of all contracts held to come within the foregoing rule.

Sweden Wants Coal for Iron Ore

Sweden will try to exchange her iron ore for American coal, is the report from Stockholm. The appointment of Hjalmar Lundbohm to undertake a special mission to the United States is looked upon as indicative of a change in Sweden's commercial policy. Before the war Swedish iron ore was exported to a great extent to this country and a reopening of this traffic would cause a decrease in the quantity now sent to Germany. Not only does the general situation, which is the result of the commercial policy of the Entente nations toward Sweden, cause her to seek relief, but, in addition, she can no longer get all the coal she wants from Germany and so looks to the United States for it.

Government Buys Wheat

The Government through the Food Administration's wheat corporation entered the wheat market on Sept. 5 and bought wheat at the basic price of \$2.20 per bu., Chicago. It is buying on warehouse receipts only and will make no contract for future delivery. The wheat is being resold at an advance of 1% which is expected to cover the cost of handling. No profit is to be made on the transactions.

The control of the Food Administration over prices begins in the elevators and ends with the sale of flour at a 25-c.-a-bbl. profit by the millers. If bread prices are not lowered and the bakers seek to keep the increased profit that will obtain between the lowered milling prices and the present high retail prices, then the Food Administration will step in, but until that condition arises the corporation will not interfere.

Development of Water Power

The railroads are burdened to carry the coal needed to keep the nation's industries running, yet more than 35,000,000 hp. (according to Secretary Lane) are running to waste in American streams. "Once again a movement is gathering force to utilize this power, says the *Annalist*. "Four-fifths of the possible electric energy that could be developed from it must be developed on lands belonging to the Federal Government, which are under the jurisdiction of the Secretary of the Interior, or on navigable streams which are controlled by the Secretary of War. The agitation in favor of conservation of natural resources resulted in restrictions so severe that resources were not only conserved, but reserved. Present laws permitting the utilization of these sites for hydro-electric plants provide that

any permit is revocable at the pleasure of the Federal department concerned, and the possibility of this summary action has tended to scare capital away."

Legislation, including the Walsh Public Domain Water Power bill and the re-introduced Shields General Dam bill, is now pending in Congress providing among other things for issuance of 50-year permits for the erection of hydro-electric plants for the "diligent, orderly and reasonable development of power." These permits are irrevocable except that they may be canceled by legal proceedings if the permittee fails to comply with the provisions of the act.

Engineer Regiments Forming

At present, there are being organized and enlistments are invited for the following: 20th Engineers, forestry, at American University, Washington, D. C.; 21st Engineers, light railway, at Rockford, Ill.; 23rd Engineers, highway, at Annapolis Junction, Md.; 25th Engineers, construction, at Ayer, Mass. (less one company camouflage); 25th Engineers, construction, one company camouflage, at American University, Washington, D. C.; 26th Engineers, supply and water supply, at Wrightstown, New Jersey.

Rising Cost of Alaskan Railway

Rapidly rising costs of labor and material have faced the Government with a possible curtailment of the work on the Alaskan Railway or an ultimate increase in the cost of the road, first estimated at \$35,000,000. The work is now costing 22% above the estimate.

Secretary Lane has advised the House Appropriations Committee that a special commission now is investigating and will prepare a report for Congress. He says it may come down to a business question of whether it is advisable, with the high cost of labor, rails, and other supplies to push the railroad through the Susitna Valley immediately, or merely to connect up the Matanuska Valley with Seward, so that the Navy can get coal either at Anchorage or at Seward, and also connect up the Tanana field with the Tanana River, so that coal field could be made available for the Fairbanks mining district.

Camoufleurs Wanted

The first American *camouflage* company is now being organized for service in France, it is announced from Washington. The *camoufleur* "practices the art of military concealment." Faking is his strong point. "Therefore," says the announcement, "the Chief of Engineers of the War Department is looking for handy, ingenious men who can fight one minute and practice their trade the next." Whenever a machine gun is set up, or a trench is taken and reversed, or a battery of artillery goes into action or a new road or bridge is built, there the *camoufleur* must use his art to render things invisible. Ironworkers and sheet-metal workers, carpenters, property men, photographers and scene- and sign-painters are included among those who will make up this force.

Dummy cannon that recoiled and flashed a puff of smoke have been used to deceive hostile airplanes as to

the location of real guns a short distance away. Airplane sheds have resembled wheat fields and railroad trains cottages. Even canvases painted to resemble rivers have been stretched across bridges in the daytime and rolled back at night, often saving the structures from serious damage.

To Develop the Torpedoplane

For the development of the torpedoplane into a craft able to carry and launch a 2000-lb. torpedo, \$30,000 has been put at the service of the inventor, Rear Admiral Bradley A. Fiske, U. S. N., by Godfrey L. Cabot, vice-president of the Aero Club of America. Admiral Fiske's device, patented in 1912, has been used successfully but only with 200-lb. torpedoes which weight has heretofore been the limit in this country. Seaplanes now are being built, however, capable of handling a much larger missile.

The Government, as usual, has left the development of Admiral Fiske's idea to private subscription, although Great Britain, Italy and Germany have seemed to see value in it and have experimented with it to some extent. In 1915, by its use, the British sank four Turkish vessels using 14-in. torpedoes weighing 731 lb. each. The Italian Navy tried out the scheme successfully, hitting the target nine out of ten times at 3000 yards. Germany disclosed her adoption of the plan when a torpedoplane sank the British steamship *Gena* off Aldeburg, England.

War Causes Silver Problem

The rising price of silver has presented the Government of Honduras with a problem arising from a shortage of silver coin which is being drained from the country in accordance with economic law because it is now worth more as bullion than its face value. An attempt will be made to meet the situation, in part at least, by issuing a coinage about 50% fine. It is announced semi-officially that the national mint, long closed, will be reopened for the reminting of about 250,000 pesos, which will make 500,000 pesos of the new silver currency. The Honduras peso, which has been worth for the silver it contains about 75c. or even more in New York, and which also contained a small quantity of gold, has long been quoted around 44c. (gold) in Honduras.

Embargo on Gold

To conserve the huge store of gold in this country, lately drawn upon rather heavily by Japan, Mexico and Spain, the President has placed an embargo on the exportation of coin, bullion and currency. This applies to all nations and became effective Sept. 10. The control of gold exports is thus placed in the hands of the Secretary of the Treasury and of the Federal Reserve Board. The former is authorized to license such exports where, in the opinion of the latter, they are not harmful to the public interest. The stock of gold in the country is about \$3,000,000,000, about 40% of which has been imported since January, 1915. The trend of gold has, however, been distinctly away from the United States recently. This movement is said to have started with the financing of the Allies.

Industrial News from Washington

BY OUR SPECIAL CORRESPONDENT

Manganese Output in 1917

Domestic mines that produced but 1% of the country's manganese needs before the war are expected to yield 15% in 1917. The metal will come from 22 states and 75 producers this year. Production was limited to five states in 1912, to four in 1913 and six in 1914. Steel companies are said to be changing their practice so as to use alloys having as low as 30% manganese, thereby lessening their dependence on imported ores. One plant making several grades of mild steel has not used a pound of ferromanganese in two years though it has maintained the quality of its product and even increased its output.

The United States Geological Survey has carefully revised its lists of producers and purchasers of manganese ores. Lists of the former will be mailed to each of the latter. Likewise each producer will receive a list of the purchasers. In each case the class of ore purchased or produced is indicated.

Copper Mining in Chile

Mine operators in Chile are not disturbed by the threatened imposition of an export tax on minerals, according to E. S. Bastin, of the United States Geological Survey, who has just returned from Rancagua, Chile, where for eight months he has been studying the geology of the Braden copper properties. A Chilean commission is at present engaged in studying conditions to determine the advisability of imposing export taxes. While it is impossible to forecast the decision, Mr. Bastin says that there is no apprehension felt by the mining industry; the policy of the Chilean government in encouraging investment in the industry is too well established to allow any shortsightedness in the matter of taxation.

Despite the great difficulty in obtaining supplies the production of copper from the Braden mine is being increased materially. Work is also progressing rapidly on the new smeltery and on a large flume for the development of hydro-electric power as well as on the tunnels which are being driven to permit tailings disposal in an adjacent valley. A plentiful supply of efficient labor is said to be available. The difficulty in securing supplies from the United States is stimulating the manufacture of many articles in Chile.

A geological department was also organized by Mr. Bastin for the Braden company and has been placed in charge of Leroy Le Duc who will carry on the geological work systematically as the development proceeds. Mr. Le Duc received his geological training at the University of Chicago. A geological examination of the Chuquicamata mine in northern Chile was also made by Mr. Bastin during his stay, in association with Prof. Waldemar Lindgren of the Massachusetts Institute of Technology.

To Study Quicksilver Industry

Research into the metallurgy of quicksilver is to be the sole work of the Berkeley (Calif.) station of the United States Bureau of Mines. Production of the metal is retarded, it is believed, by ignorance of its technology. The quicksilver industry, though employing relatively few men and requiring but small investments of capital, is nevertheless most important, due largely to the use of mercury as a fulminate and in amalgamation. The metal's use as an antiseptic is increasing and as a constituent of marine anti-barnacle paint is of probable future importance.

Efforts will be made to determine the sources of loss in mining. In many quicksilver mines a 60% recovery is considered good. Assaying and sampling of the ore will be investigated, the latter being peculiarly difficult. A study will be made of direct furnace treatment, and of the type of furnace best suited for low-grade ores. Wet treatment and retorting of concentrates will receive attention and improvement of the present method of condensing mercurial vapors will be sought. War prices have greatly stimulated the industry and operators so far have cooperated willingly with the Bureau.

A study of all the important quicksilver deposits in the West has been undertaken by F. G. Ransome of the United States Geological Survey, who will visit the localities to determine the most promising places for new development. Special attention is to be given to prospects.

Export Licensing Systematized

Congestion at ports is diminishing, as the work of licensing shipments becomes systematized and as shippers become more familiar with the procedure, according to word from the Exports Administrative Board. By providing a certificate for partial shipment against an export license, those shipping through several ports are spared much inconvenience. In explaining the handling of such shipments, C. A. Richards, the director of the board, says:

If the applicant is shipping through various ports, he should make a separate application for the total amount he expects to ship through each port. Shippers then can make the shipments as desired during the ensuing 60 days. For this purpose the certificate for partial shipment is used which enables the consignor to make as many shipments under one license as he requires. These certificates may be used against shipments to all countries regardless of whether or not they are for shipments to countries associated with us in the war.

The organization of the Exports Administrative Board is as follows: Vance McCormick, chairman; Thomas B. Jones, representing the Department of Commerce; J. B. White, representing the Food Administration; Dr. Alonzo Taylor, representing the Department of Agriculture; a representative of the Shipping Board who has not been named; C. A. Richards, director; Harry A. Engman, assistant director; and Weldon E.

Judd, chief of the administrative division. Specialists familiar with the commodities exported are being retained. Another division within the bureau has charge of imports.

Ground Frost in Alaska

Commenting on the wide distribution of ground frost in Alaska, Alfred H. Brooks, in charge of the Alaska division of the United States Geological Survey, says:

In numerous excavations made in mining operations, it has been found that the alluvium is frozen down to hard rock. In the Klondike the alluvium is frozen to a depth of about 200 ft. At Fairbanks, permanent ground-frost has been found at many places to a depth of more than 200 ft., and the deepest shaft sunk there penetrated 318 ft. of frozen alluvium. In Seward peninsula many holes in permanently frozen alluvium are more than 75 ft. deep and one is nearly 200 ft. deep.

Some ground in the province is not frozen, for causes not determined. Underground channels of water have been encountered in some mine workings and have played havoc with the operations, but these appear to be exceptional. When the moss is stripped, the ground thaws, and with open-cut mining or cultivation the upper level of permanent ground-frost seems gradually to descend. It appears that this ground-frost is a survival of a climate colder than the present and is preserved by the nonconducting mat of moss and other vegetation. It is natural to attribute it to the climatic conditions that brought about the last glacial advance in Alaska, during which but little of the central region was ice-covered, though glaciers advanced into it from the higher mountains on the north and south.

More Domestic Pyrites Needed

With a demand for sulphuric acid declared to be fully 25% greater than at this time last year, the pyrites situation is taking on increasing importance. The experience of the last few weeks makes it apparent that pyrites can not be imported in anything like pre-war quantities. It is becoming more evident that recourse must be had to the domestic sulphur supplies. The War Minerals Committee has begun an investigation to determine how far sulphur resources can be relied upon. The pressing need of more domestic pyrites has caused every Government agency concerned to redouble its efforts to encourage production.

Defense Council Resignations

Reports that wholesale resignations are taking place in the committees of the Council of National Defense are denied vigorously at the offices of the council. At the time of the passage of the Food Bill, certain tentative resignations were submitted for fear of violations of Sec. 3 of that act. Officials of the council are certain, however, that no such interpretation of this section was intended as has been placed upon it, and expect soon to have an opinion on the subject from the Attorney General. To increase efficiency by avoiding duplication of effort, specific problems are being worked out for each of the committees.

Report on Potash Bill

A favorable report will probably be made on the potash-leasing bill when the Public Lands Committee of the House meets on Friday. Several requests have been made that hearings be conducted before the committee acts on the bill. These will hardly be granted, however, as the limited time before adjournment of Congress is making the committee anxious to get the bill on the calendar at the earliest possible moment.

Alabama's Graphite Production

Alabama's output of graphite in 1917 will more than double that of 1916, it is predicted. This is the more remarkable because Alabama's 1916 production was 50% greater in quantity and 141% greater in value than that of 1915. Mining conditions in the state are good, and costs are low. Improvements in concentration will result in a large per cent. of good flake in the finished product and a higher saving of graphite of all grades.

Attacking the Potash Problem

A way of obtaining potash from silicates is being persistently sought by the Salt Lake City and Golden stations of the United States Bureau of Mines. Tailings are being collected from a number of mills throughout the West to ascertain what points are richest in potash. Tailings are preferred for this experimental work as they are already mined and ground. Tests are being made on large samples.

Visitors at the Bureau of Mines

More Japanese visit the Bureau of Mines to study its methods than do representatives of all other foreign governments combined. Most of the visitors from Japan are specialists who come each to investigate a single activity of the Bureau. Visitors from other governments usually try to become familiar with all the activities of the organization.

Heavy Demand for Tin Plate

An increase of 25% in the domestic production of tin plate during 1917 is estimated by the Department of Commerce. Exports this year will be one-tenth of the total production. Since the demand is larger than the greatest possible output, Secretary Redfield urges the substitution of fiber and paper cans wherever possible.

Three additional sections of the Geologic Atlas of the United States have been issued by the United States Geological Survey. The folios and their authors are as follows: Deming, N. M., N. H. Darton; Detroit, Mich., W. H. Sherzer; Leavenworth-Smithville, Mo.—Kan., Henry Hinds and F. C. Green.

An effort to pass the Shafroth bill for the suspension of assessment work, by unanimous consent, having failed, Representative Taylor, of Colorado, will bring it up for vote under suspension of the rules at the first opportunity.

Editorials

American Academy of Engineers

ELSEWHERE in this issue is published a rather tart communication respecting the American Academy of Engineers which has recently been voted a charter by the Senate of the United States, but not yet by the other house of Congress. We are inclined to agree with Mr. Wilson in the opinion that such an organization is un-American, for the simple reason that its membership is limited and engineers do not have an equal chance to be included among the number. The Congress of the United States is limited in number, but any citizen possessing certain simple and equitable qualifications may be elected to Congress. We are not for a moment making any comparison between the Congress of the United States and the American Academy of Engineers. The latter may be a body of higher distinction and many persons may be willing to accept membership in it who might be averse to an election to Congress. Our point pertains rather to the matter of election to a body of limited membership. As it is created, Congress is a thoroughly American and democratic body, but, if it filled vacancies by an election confined to its own members, it would certainly cease to be democratic.

Now the American Academy of Engineers, with a membership of only 200, can not hope to be thoroughly representative of the American engineering profession. Among the 50 incorporators we count nine who may be classed distinctly as mining and metallurgical engineers. If the same ratio be preserved in filling the ranks to the number of 200, there would be 36 mining and metallurgical engineers. Speaking for our own profession, it would be impossible in this era of specialists to select 36 men as preëminent. Many of the leading specialists would have to be excluded.

If, then, such an organization were not thoroughly representative, why should the United States Government "as a matter of course, turn to it for expert aid and advice?" Why should state and municipal governments feel that they would have the privilege of appealing to such an academy for information and advice? What good ground is there for the statement that foreign nations desiring to send commissions to America for expert technical aid do not know to whom to appeal? What is the matter with our existing national societies, to which the bureaus in Washington appeal freely in every case of need, and to which appeals the societies respond with generosity?

The proposed American Academy of Engineers is a very different thing from the proposal to classify members of existing societies and is a very different thing from those societies which have and maintain strict qualifications for membership. Respecting societies

of the latter class, we know of none that does more than say that it limits its membership to professional men of good character and a certain degree of professional experience. There is nothing undemocratic about that, any more than there would be in the organization of a society to which only the red-headed men of the United States were eligible. The organization of an academy limited in number is a very different thing, and one that is likely to create unjust and invidious distinctions. The fact that the nucleus of 50, which is to elect the remaining 150, was created in some unknown way will not contribute to the popularity of the movement. Nor will the fact that the 50, while in main consisting of engineers of distinction, nevertheless include some who would not be recognized as leaders by their respective professions. We prophesy that the American Academy of Engineers will not be taken very seriously.

Judge Bourquin's Decision

WE HAVE refrained from any comment upon Judge Bourquin's decision in the case of Minerals Separation vs. Butte & Superior until we could read the full text of it. The text is published elsewhere in this issue.

Back in the dark ages theologians used to discuss such questions as how many angels might stand on the point of a needle, so trifling was their quibbling. The arguments of the learned counsel in the interminable flotation litigation, and Judge Bourquin's recent decision, remind us of the ancient theological controversies. We have no patience with it.

The flotation litigation was carried up to the Supreme Court of the United States, which in itself was an unusual event. The Supreme Court rendered a decision upholding the Minerals Separation patents upon the use of less than 1% of oil plus a certain kind of agitation. Whether anybody dislikes that decision does not matter in the least. It stands as the decision of the highest court and is to be obeyed and respected accordingly.

The Supreme Court was perfectly clear regarding the matter of less than 1% of oil. It was the patent claims so reading that were upheld. The claims that specified simply "a small quantity of oil" were declared invalid.

The Supreme Court was not equally specific about the matter of agitation. The Minerals Separation consequently pushed its suit against the Miami Copper Co., which involved that question, and won its case on appeal to the Philadelphia court. Unfortunately the Miami Copper Co. did not present a clear-cut case with respect to the Callow process, the status of which has not yet been legally defined. The Philadelphia court intimated, however, that in its judgment the Callow pro-

cess involves a kind of agitation that is different from what the Supreme Court contemplated.

Meanwhile, Butte & Superior changed to the use of more than 1% of oil and Minerals Separation brought suit against it, claiming that to be an infringement of its patents. Last week we remarked that Judge Bourquin's decision seemed to us to be contrary to the letter of the ruling by the Supreme Court. Mr. Williams, the distinguished counsel for Minerals Separation, has objected to that characterization, alleging that the Supreme Court's decision protects Minerals Separation against the use of any quantity of oil when the results obtained are the same as with less than 1%. We are unable so to read the decision of the Supreme Court, and look upon such a claim as a species of the quibbling that we find so irritating.

Judge Bourquin, however, falls right into this. What shall we say of the mind, which, after quoting the Supreme Court as saying that the patent must be confined to the results obtained by the use of oil within the proportion amounting to a fraction of 1% on the ore, and holding invalid the claims that simply refer to "a small quantity of oil," says, "It seems clear neither patent nor decision undertakes to say the process depends upon less than 1% of oil or is inoperative with 1% or more of oil"? Judge Bourquin's reasoning and his decision follow this line.

With all due respect to the learned judge, we do not think that he viewed the case in the light of common sense. The keynote of the decision of the Supreme Court was its upholding of the contention of Minerals Separation that in experimenting with agitation with oil the inventors had discovered a critical point at which a result was obtained that was different from any ever obtained previously. Inasmuch as that point could not be defined precisely, the claims of the patent were drafted to cover the use of less than 1% of oil, which would embrace the critical point. The Supreme Court was convinced, moreover, that preceding investigations were so informing that the final step of these patentees was not a long one. Common sense tells us that the Supreme Court would not have expressed itself in those ways if it had thought that the quantity of oil were immaterial, nor would it have declared invalid those claims which specified merely a small quantity of oil.

The inverted reasoning of Minerals Separation is that with a fraction of a per cent. of oil there is a critical point at which the important thing happens, and that the use of more oil than that is simply a loading of the apparatus with useless material. Judge Bourquin accepts that view. But according to it any use of oil, with a certain kind of agitation, falls within the scope of these patents. Now, reversing the reasoning, suppose that Butte & Superior working in the light of preceding investigations, so informing in character as the Supreme Court says they were to Sulman, Picard and Ballot, had developed a process using 1.1% oil and were operating with it. Suppose that unbeknown to it, Sulman, Picard and Ballot, pursuing their similar investigations, later discovered the "critical point" at

0.2% oil. Suppose that, hearing of the Butte & Superior operation, they said to it, "You've got to pay us royalty. You're simply using our critical point plus 0.9% of useless oil." This did not happen, but it is conceivable that something of the sort might have happened. It is certain that, according to Judge Bourquin, nobody who might have undertaken the development of the Everson, Froment or any of the other early processes would have had a ghost of a chance against the present claims of Minerals Separation.

The several decisions of the American courts in the flotation case have exhibited much clever analysis and clear reasoning. Judge Bourquin's recent decision is the poorest contribution to this juridical literature. We do not think that the loser will be content to let the matter stand as it does now.

Sulman, Picard and Ballot, who obtained the basic patents now owned by Minerals Separation, are entitled to the highest possible credit for carrying forward the early work of others in the field of flotation to a brilliant outcome in the laboratory. The management of Minerals Separation exhibited great skill and perception in collecting a far-reaching group of patents pertaining to the new art. With bulldog persistency they have fought their case through the courts of Australia, Great Britain and the United States. No fair-minded person ought to want to deny them the rights that the highest courts have given them. But when, in the same breath, Minerals Separation asserts that the use of more than 1% oil gives woefully inferior results as compared with the use of less than 1%, and yet claims the right to collect royalty on the use of any quantity of oil, in certain ways, there is created a feeling that hoggishness is being exhibited. While the mining public ought generously to admit the service that Minerals Separation has rendered to it, that company ought on its own part to recognize the service that mining and mill men, especially those of Broken Hill, rendered to it in making a commercial success of its process. In this, as in many other new steps in metallurgy, as, for example, in the cases of basic copper converting and in coal-dust firing, there was a big gap between the idea and the successful development of it in practice. The enormous success of the flotation process of ore concentration, which is admittedly one of the major improvements of all times in metallurgy, is the result of the work of many men. That being the case, one small group of men can not be permitted to sit astride the mining industry of the world, claiming and collecting royalties at its own sweet will. So long as any such wish is expressed there will be litigation.

Rightly or wrongly, the mining industry of the United States has obtained the idea that the management of Minerals Separation is arbitrary, dictatorial and grasping. In its own interest that management ought to dispel that idea. Instead of antagonizing the mining industry, it ought to seek to win its friendliness and cooperation. If such a wish were exhibited, the mining industry would meet the company half way. It would be a good idea for the management of the American

subsidiary of Minerals Separation to hold a conference with representative men of the mining industry and talk things over, giving the mining men a chance to say what in fairness they themselves think they ought to do and not telling them what they must do.

The Butte Rustling Card

THERE has been so much talk about the Butte rustling card that we have taken the trouble to secure a copy of it, together with the accompanying papers, and are publishing them in this issue so that everyone may see what they are. They look very innocent. We must confess to using similar records for employees in our office and we fancy that in many large establishments such records are common.

Of course it is a pity that we can not go back to the customs of our native villages, wherein everybody knew all about everybody else and no vouchers or records were necessary. There are many things that used to be done in the little shops that have to be done in a less agreeable way in big work. The personal salutation of the boss in the morning is more likable than hanging a brass check on a tally board, and at the end of the week, one feels better to have the "old man" come around with the pay than he does to stand for half an hour in a queue moving up to window A to G.

However, if we want to enjoy the advantages of big work we have got to put up with things that we do not like, such as time-clocks, tally boards, credentials and rustling cards, for 10,000 men can not be handled so intimately as 10. And if it were not for big things we could not enjoy all that we have now. If it were not for the Standard Oil Co. we should not have such cheap gasoline, and if it were not for the Anaconda Copper Mining Co., and its great improvements in mining and metallurgy, Butte miners would not have the high wages that they get (or can get when they want to go to work).

Mining on the Leasing System

THE interesting article by Mr. Adkinson, published elsewhere in this issue, discusses an old but important subject from a new angle. Mr. Adkinson is excellently qualified to treat of this subject, for he is one who has actually practiced what he preaches. Among other things, he has been recently engaged in the development of a leasing project on a large scale in a mine that has been worked by 250 miners, distributed among about 60 leases. In this work he has had occasion to examine the figures of other mines operated under the leasing system, and has found that those with the most accurate and most detailed accounting systems are the ones in which the best results are obtained, this being another tribute to the importance of the accountant in mining work.

We understand from Mr. Adkinson that he has found that many mines operated under the leasing system are making a higher profit on every basis of comparison than when operated on day's pay account. This is an-

other example of the rule of increased efficiency of workmen when they have a direct incentive, when they are made partners in the business, so to speak, and can see from week to week or from month to month how they are coming out. We wish that Mr. Adkinson had been free to transcribe and publish some of the illuminating figures on this subject that he has accumulated.

The sum and substance is that we all turn automatically to the leasing system of operation in mining at the time when it is proper to administer extreme unktion, but it does not often occur to us that this system is equally as applicable as a direct method of mine management for flourishing and prosperous property. It goes without saying that the more carefully and exactly the management does its work, the better will be the results. Detailed accounting is the essential factor which throws the spotlight on the whole subject. Especial emphasis should be paid to that point.

Suppression of the I. W. W.

THE raiding of the offices of the I. W. W. all over the country was one of the best steps that the Government has taken. There is strong ground for the suspicion that Germany seeing herself sure to be beaten, has been attempting as a last resort to sow internal dissensions among her enemies. Therein is her only chance. What she has done in Russia is well known. Probably she has attempted to do similar things in the United States, and it is likely that her hand has played a part in Socialist agitations everywhere.

The elements that she has incited are everywhere the same. First there are the anarchists—the Bolsheviki in Russia and the I. W. W. in the United States—who want to destroy everything, hoping to get some brokerage out of the wreckage. Next there are the theoretical socialists—the believers in the internationalism of Karl Marx—who dream of a Utopia in which all people will be happy and consider that they are going to reach it by eliminating nationalism and capitalism. Beyond them stand the simple pacifists, another set of theoretical dreamers. Finally there are the deliberate traitors, who conceal their pro-German sympathy in order to deal a blow to the land of their adoption. No, we should add another class, namely, the politicians, like some of our senators, who for their own selfish purposes, cater to the foolish and the traitorous.

Washington has now put an end to the machinations of one of the dangerous classes. Let us hope that it will next proceed against the German elements that are sowing sedition in our midst. Let us hope, furthermore, that it will take steps to deal with the traitorous members of Congress.

Why This Governmental Secrecy?

SOME time ago there was issued from Washington a Ukase that no information respecting governmental transactions in the metal market should be published except through a certain official in Washington. This

ties the tongues of the producers' committees, and acts as a serious and unnecessary handicap upon the trade in general. Since the ban was imposed, important transactions have been effected, but Washington has not reported them at all.

There might be some good reason for imposing secrecy while negotiations are pending. There might even be some good reason for prohibiting news of such transactions if the Government were trying to manipulate the market and were dealing with only one or two producers. But the Government has not aimed to do business in that way. Even in transactions where contracts have been awarded to the lowest bidder, the unsuccessful bidders have a right to know what was done. In cases where business is done with the producers' committees, and then is allotted among the several producers, they naturally have to know about conditions, wherefore there is no general secrecy and no such thing is possible.

The main effect of this bureaucratic policy is to keep the consuming public in the dark, and also the general public, whose business and industrial affairs are based more or less directly upon market conditions. Publication of the terms on which the Government is buying zinc and lead cannot lend any aid or comfort to the enemy. Secrecy in such affairs is to be construed rather as an example of bureaucratic stupidity, inspired probably by the desire to aggrandize the importance of officers in Washington and contribute to the vanity of new officials who have been clothed with powers.

High prices and demand have served to increase largely the production of tungsten ore and concentrates in Siam and in the Federated Malay States. In the Malay States the increase has been largely from working tailings dumps in which much of the ore mined was formerly deposited on account of its comparatively low value. In Siam the gain has been from newly opened deposits found by active prospecting. As in many other cases, active demand is bringing out new supplies of tungsten and its ores.

Since the United States has been in the war, American metal refineries have been closely guarded and the managers have been averse to receiving visitors. Metallurgists from other countries who intend to visit the United States with a view to inspecting our works should take steps to learn whether entry may be obtained before embarking on long journeys that may result only in disappointment.

What a pity it is that in this great national emergency so many of our best men of business should be relegated to Red Cross work, while the great business affairs of the nation are entrusted to second-raters, to inexperienced men and to doctrinaires.

What use is it to reduce the price for bituminous coal so that the public may have cheaper coal, if it cannot get any coal at all? Something of that sort seems likely to happen in some districts of the United States.

BY THE WAY

Today—Sept. 15, 1917—is the 100th anniversary of the starting of the first iron rolling mill in the United States. Previous to that bars and sheets had been forged under the hammer. The mill was at Middletown, in Fayette County, Penn.; it was owned by Col. Isaac Meason of Connellsville, was designed by Thomas Cotton Lewis, a Welshman by birth, and was run by him with the assistance of his six brothers.

After getting a decision from the United States Supreme Court for a process of concentration with a critical reaction when less than 1% of oil is used, the attorneys of Minerals Separation, Ltd., argued at the recent trial in Butte that the use of more than 1% is likewise an infringement. The Shade of Carrie Everson, after listening to some of these arguments, is reported to have prepared for a hasty and noiseless departure, saying: "I had better leave here *spurlos versenkt*, or those M. S. attorneys will be coming after me for back royalty."

Notwithstanding the strict censorship rules, it may interest readers to learn that war-time developments in England include a new ——— 3-phase furnace installation at ——— on the ———, for the production of ——— acid from the air. It is stated that the ——— are so arranged and disposed relatively that they inclose a central space communicating with a free space surrounding said ———, by means of free spaces between the ———, in which the arcs are maintained and which the ——— is made to traverse. In truth, a regular *luft-verwerthungs-geschäft*.

The strikers at Metcalf, Ariz., are suspicious; they do not believe that the Coronado mine is on fire. The oxygen-helmets and other paraphernalia of fire fighting are to them merely camouflage, obscuring the diabolical machinations of the company in attempting to break the strike. "*Por Dios, hermanos,*" cries one, let us send a *junta*, one comeetay, to examine the mine and see if there be some damliars by here." Committee sees superintendent. Explanations. Courteous refusal. Committee pleads, "Just to satisfy the *'gente.'*" Superintendent softens and explains, "Permit this once. Thorough examination. Examine whole mine." Gratified committee smile and acquiesce. Superintendent remarks, "Seventh level two miles long, gas all the way. Committee please leave names and addresses, to notify sorrowing relatives." Committee serious, silent, timid and suspicious. Brave Santiago volunteers. "I go alone. Not afraid of man nor God." An inspiration of law, protection, etc., bids him add, "Deputy sheriff, come with me?" Deputy answers, "Sure."

Heroic Santiago trims lamp. Yawning tunnel, waiting motor. Hands tremble. "Hurry," says deputy. Brave Santiago's knees shake. "*Pronto!*" says motor-man. Brave Santiago's face grey. "Me no go." Scurries off, tail between legs. Rejoins committee. Pow-wow. More pow-wow. In the meantime courageous Americans are fighting in smoke and gas to save the mine.

Personal

F. G. Clapp has gone on a trip to Texas and other parts of the West.

W. H. Wright is making an examination of gold-placer properties in Idaho.

J. B. Tyrrell, of Toronto, is examining some mining properties in Newfoundland.

F. R. Weekes has been examining mines in the Trout Lake district, British Columbia.

Benjamin Magnus has joined the metallurgical staff of the American Metal Company.

John W. Mercer has been visiting Montana and the Northwest. He is now in California.

H. W. Baker, of Boston, is examining several properties in the Kirkland Lake district of Ontario.

B. W. Knowles has been appointed superintendent of the Nickel Plate mine at Hedley, B. C., in place of W. Sampson.

Horace V. Winchell, who has been in the Far East for several months on professional business, is due to arrive in San Francisco on Sept. 13.

J. C. Shepherd, president of the Shepherd Mining Co. in Marion County, Ark., left for the training camp at Leon Springs, Texas, last week.

Prof. Arthur L. Walker, of Columbia University, has been appointed consulting metallurgist at large for ordnance in the War Department.

Heath Steele, formerly associated with J. R. Finlay, has been appointed assistant to Dr. Otto Sussman, vice-president of the American Metal Company.

Henry A. Oesterle, ore buyer of Joplin, has been appointed resident agent for the Illinois Zinc Co., for the Joplin district, succeeding the late John Immel.

John C. Wilkes, of Trenton, N. J., is examining the feldspar deposits of the Ottawa Valley district in Canada on behalf of American manufacturing interests.

J. H. Means, of New York, who has taken options on several claims in the Tashota gold camp, is making an examination of the Manigotagon district, Manitoba.

S. R. Brown is now with the Porphyry Dike Gold Mining Co. at Rimini, Mont. He was recently mill superintendent at the Plymouth Consolidated mine in California.

Erle P. Dudley, construction engineer at the Bunker Hill & Sullivan concentrator at Kellogg, Idaho, has been commissioned captain in the Engineer Officers' Reserve Corps.

William Yeandle, Jr., of Boston, representing the United States Smelting, Refining and Mining Co., is making an examination of the Newray mines, Porcupine, Ontario.

R. M. Stone, president of the R. M. Stone Mines Co., Ltd., has returned to Phoenix, Ariz., after having arranged for the financing of copper and lead properties in Mohave County.

Edward L. Dufoureaq is now manager of the Teziutlan Copper Co., and is engaged in organizing the force to operate. He expects to return to New York about the end of September.

George J. Carr, for several years division manager of the Yuba Consolidated Gold Fields dredges at Hammond, Calif., has resigned and will probably devote his time to his ranch interests.

L. H. Duschak, superintendent of the Berkeley, Calif., station of the United States Bureau of Mines, was in Washington recently to confer with officials in regard to research work in the metallurgy of quicksilver.

Harry J. Wolf was recently in the East on professional business. Upon his return to Colorado he examined properties near Bonanza in Saguache County, and is now engaged in the examination of a copper property in Fremont County.

Dr. Colin G. Fink, for the last 10 years in the research laboratories of the General Electric Co., has been appointed head of the new laboratories of the Chile Exploration Co. at 202nd St. and 10th Ave., New York. His new work will be largely research along metallurgical and electrochemical lines.

H. E. Hollister, chemical engineer, has resigned his position as chief engineer with both the Kalberr Corporation and the Kalbfleisch Corporation to attend to his private engineering practice and to push the sale and use of his new process for converting niter cake into salt cake and sulphuric acid.

Dr. C. L. Parsons, chief chemist of the United States Bureau of Mines, and Dr.

H. P. Talbot, professor of chemistry at the Massachusetts Institute of Technology, have been appointed by Secretary Baker as members of the committee to investigate the defective ammunition sent to the American Expeditionary Force in France.

J. F. Berteling has been appointed superintendent of the iron properties recently acquired on the Mesabi Range by the Schlesinger interests, of Milwaukee, Wis., which are to be operated by the Newport Mining Co. His headquarters will be at Grand Rapids, Minn. He was formerly with the Sullivan Machinery Company.

A. H. Ramage, manager and part owner of the various Ramage properties in the Joplin district, has gone to the officers' training camp at Niagara, N. Y. **J. H. Capelli**, of Webb City, Mo., and superintendent of the Carterville No. 4 property, has been appointed general manager for the Missouri and Oklahoma mines. **S. L. Kenny**, superintendent of the No. 6 mine at Joplin, has succeeded Mr. Capelli at No. 4 mine.

Obituary

John Immel, ore buyer for the Illinois Zinc Co. in the Joplin district for 45 years, died on Aug. 25, at the age of 85.

George E. Scarfe, a metallurgical and construction engineer, died at Nevada City, Calif., Aug. 24. He was 51 years old and born in London. After traveling in various parts of the world he went to California where he later designed and directed the building of the North Star electrical hoist and the late improvements at the Empire mine in the Grass Valley district. For the last two or three years he was consulting engineer for the chief mines in Nevada City and Grass Valley. He also designed the plant for the Allison Ranch mine. Overwork was evidently the cause of the recent illness from which he never recovered. He was a member of the Institute of Mechanical and Electrical Engineers.

Societies

American Institute of Mining Engineers—Certain members of the New York Section tendered a dinner at the Engineers Club on Tuesday evening, Sept. 11, to the three mining engineers composing the Russian Mining Commission now in this country.

War Committee of Technical Societies, appointed by the United Engineering Societies' Engineering Council to act as an intermediary between members and the Government in presenting to engineers technical problems requiring solution, has mailed recently to members of the societies, a bulletin of information on the submarine problem which has been prepared by the Naval Consulting Board. Each recipient is asked to study this problem and to transmit any ideas, thought to be of use, to the secretary of the Naval Board. Members of the committee are: J. M. Boyle, J. V. Davies, American Society of Civil Engineers; A. M. Greene, Jr., R. N. Inglis, American Society of Mechanical Engineers; D. W. Brunton, Edmund B. Kirby, American Institute of Mining Engineers; C. R. Corning, G. C. Stone, Mining and Metallurgical Society of America; Joseph Bijur, American Electro-Chemical Society; A. S. McAllister, H. W. Buck, American Institute of Electrical Engineers.

Industrial News

Asbestos Protected Metal Co., of Pittsburgh, Penn., announces the appointment of C. A. Crowe, formerly manager of the Grand Rapids office, to take charge of the Detroit office. M. W. Taber, formerly Detroit manager, has been appointed factory manager.

Morse Bros. Machinery and Supply Co. has purchased the Colorado Smelting Co.'s smeltery and equipment at Alma, Colo., and will dismantle it and ship the equipment to Denver. This plant, which ran only about three months, had a capacity of 200 tons of copper matte daily.

Locomotive Pulverized Fuel Co. announces that it has contracted with the Milwaukee Electric Railway and Light Co. to equip 25,000 hp. of boilers at the Onelda St. plant with its apparatus for burning pulverized fuel. It claims that this is the first central station to be so equipped and the largest equipment of the kind ever furnished.

Trade Catalogs

"Crown" Coal Pick and Core Breaker, Ingersoll-Rand Co., 11 Broadway, New York. Form No. 8212. Pp. 4; 6 x 9 in.; illustrated.

"Imperial" Motor Hoists and Stationary Motors, Ingersoll-Rand Co., 11 Broadway, New York. Form No. 8006. Pp. 20; 6 x 9 in.; illustrated.

Air Receivers, Pressure Tanks and Moisture Traps, Ingersoll-Rand Co., 11 Broadway, New York. Form No. 9102. Pp. 8; 6 x 9 in.; illustrated.

"Little David" Pneumatic Chipping, Chalking and Sealing Hammers, Ingersoll-Rand Co., 11 Broadway, New York. Form No. 8213. Pp. 16; 6 x 9 in.; illustrated.

"Michigan" Combination Steel and Wood Water Pipe, The Michigan Pipe Co., Bay City, Mich. Catalog. Pp. 83; 6 x 9 in.; illustrated. Interesting historical data on wood pipe are given; also various tables for hydraulic calculations.

Buchanan All-Steel Rock and Ore Crusher, Type C, C. G. Buchanan Co., Inc., 90 West St., New York. Bulletin No. 10. Pp. 16; 8 x 10 1/2 in.; illustrated. This contains a table of standard sizes, etc., and other data including outline cuts showing general construction of crushers.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Alloys—Process of Alloying Metals. Chauncey C. Baldwin, Perth Amboy, N. J., assignor to Standard Underground Cable Co., Pittsburgh, Penn. (U. S. No. 1,235,872; Aug. 7, 1917.)

Aluminum Fluoride—Process for Obtaining Aluminum Fluoride. Charles A. Doremus, New York, N. Y., assignor of one-half to John Sherman Hoyt, Darien, Conn. (U. S. No. 1,237,488; Aug. 21, 1917.)

Crushing Machinery. Robert William Pringle, Gatooma, Southern Rhodesia, South Africa. (U. S. No. 1,237,383; Aug. 21, 1917.)

Drill-Steel Retainer. Charles A. Hultquist, Los Angeles, Calif. (U. S. No. 1,238,018; Aug. 21, 1917.)

Electrolytic Cell. Frank G. Wheeler, Appleton, Wis., assignor to Bleach Process Co., Appleton, Wis. (U. S. No. 1,236,025; Aug. 7, 1917.)

Fume Condenser—Thomas B. Stewart, Portola, Calif. (U. S. No. 1,237,571; Aug. 21, 1917.)

Fume Disseparator. Vern Slater and Leonidas D. West, Denver, Colo., assignors to The Electro-Fume Co., Denver, Colo., a corporation of Colorado. (U. S. No. 1,238,068; Aug. 21, 1917.)

Gold-Separator. Benjamin P. Tuggle, Portland, Ore., assignor, by direct and mesne assignments, to Redemption Gold Co., Seattle, Wash. (U. S. No. 1,235,945; Aug. 7, 1917.)

Iron Ore—Method of Treating Iron Ore. Frederic A. Eustis, Milton, Mass. (U. S. No. 1,237,765; Aug. 21, 1917.)

Lamp—Acetylene Miner's Lamp. Nelson Llewellyn, Cainesville, Mo., assignor of one-half to John W. Solel, Cainesville, Mo. (U. S. No. 1,238,032; Aug. 21, 1917.)

Openhearth Furnace. Thomas S. Blair, Jr., Chicago, Ill., assignor to Blair Engineering Co., New York, N. Y. (U. S. No. 1,236,140; Aug. 7, 1917.)

Ore-Concentrating Method—Alfred Schwarz, Joplin, Mo., assignor to Metals Recovery Co., New York, N. Y. (U. S. No. 1,237,961; Aug. 21, 1917.)

Sampler—George S. Backus, Leadville, Colo., assignor to Frederick W. Braun, Los Angeles, Calif. (U. S. No. 1,238,058; Aug. 21, 1917.)

Settler—Apparatus for Separating Liquids from Solids in Fluid Suspension. Alfred L. Blomfield, Colorado Springs, Colo., assignor, by mesne assignments, to the Dorr Co. (U. S. No. 1,237,745; Aug. 21, 1917.)

Tin Oxide—Process for the Direct Production of Pure Oxide of Tin. Johann Terwelp, Neuss, Germany. (U. S. No. 1,237,840; Aug. 21, 1917.)

Tunneling Machine. Ferdinand Stolzenburg, New York, N. Y. (U. S. No. 1,238,592; Aug. 28, 1917.)

Editorial Correspondence

SAN FRANCISCO—Sept. 5

Miner's Iron Deposits, in Madera County, reported to be under examination by Noble Electric Steel Co., operating electric smelter at Heroult, Shasta County. Prospecting will be done by diamond drilling, if undertaken extensively. Reported that high-grade silver-lead ores, tungsten and medium-grade copper have been disclosed in region. Iron is present, as reported by State Mining Bureau, but situation of deposits and inaccessibility, together with lack of economic smelting facilities, have combined to retard development. Several years ago an effort was made to open these mines and within two or three years it was reported that the Southern Pacific Co. was making a move toward acquiring the holdings.

New Ore in Hardenberg Mine, in Amador County, recently disclosed below the poor zone, has confirmed the opinion of W. J. Loring, manager, that the Hardenberg ground is similar to other Mother Lode properties. The new ore was found at the 1500-ft. level. The total development since the Hardenberg syndicate took hold of the property has amounted to 1621 ft. from the 1068-ft. point to the 1500-ft. point. The results obtained at the 1200- and 1330-ft. levels were discouraging in the extreme, no pay ore having been found; and the only reason for further deepening the vertical shaft to the 1500-ft. point was the hope of repeating the history of the Mother Lode in the recurrence of good gold content below the point where the payable ore shoots are worked from the surface down to about 1000-ft. depth. At the 1500-ft. level the vein where intersected gave a low assay. Extension of the drives north and south on the vein have disclosed a northward section 20 ft. in length, 12 in. wide, containing visible gold. The vein continued in the face of the drive but showed less than \$1 per ton. The south drive at a point 125 ft. distant from the 20-ft. chute has developed a section 35 ft. in length, 50 in. wide, showing about \$4 per ton. Compared to the results obtained at the 1200- and 1300-ft. levels, these results at the 1500 are highly satisfactory, and the management hopes that this means a recurrence of permanent improvement of the mine at this point. Two winzes will be sunk from the 1500-ft. level and it is believed that payable ore may be encountered at further depth.

Labor Problem in California Mines is becoming acute. Gold mines are in worse condition than copper and lead-silver properties because they cannot profitably support higher rate of wage than they are already paying. The copper mines, the lead-silver and tungsten mines have recently made an advance in wages but the growing demand for these metals and increasing prices urged the miners to demand still further advancement in wages. The miners at Atolia, the chief tungsten camp in California, are asking for an increase upon the scale of \$3.50 and \$4 per day. The copper miners along the Shasta copper belt, particularly on the west side of the Sacramento River, are demanding an all-round increase of \$1 per day and certain betterments in working conditions. The copper mine operators have from the beginning of the rise in price of copper increased wages in accordance with advanced prices. But just now the scarcity of labor due somewhat to the army needs seems to have induced miners to make still further demands. There has been no disorder either in the copper or the tungsten region. The men are simply standing out for their demands and the latest news from Shasta County was that the matter would most likely be submitted to arbitration. Most of the gold mines along the Mother Lode region are running shorthanded and it would not be surprising if some of the important producers as well as properties being developed may have to curtail active operation still further. The demand for metals other than gold has given a strong impetus toward development and production while the decreasing purchasing value of gold and the increased cost of supplies has had the effect of discouraging development of new ground and the reopening of old known producers. The large producers not only in the Mother Lode region but in Nevada City and Grass Valley districts are

feeling these effects of the extra cost of mining and some of them are better able to discontinue progressive development and new exploration, holding their operation down to the actual necessity of keeping the mines clear, so it would not be surprising if some of the larger mines would reduce production to a point greatly below normal. The smaller mines and properties under development cannot afford to curtail their operation, because in most cases this would mean a closing down of the property indefinitely. Of course the ultimate result is going to be an advance in gold mining when the demand comes for an increased amount of gold. However, the future is not of so much interest as present conditions. One thing is certain. The gold miner, whether he is a producer or a developer, cannot afford to make material increase in wages. If the workmen persist in further increase in the wage schedule it will simply mean a closing down of a number of gold mines. While there is a good deal of chrome and some manganese being mined in several districts of the state, these operations do not call for a large amount of labor and much of the labor employed is unskilled, so that these operations do not have any direct effect upon the labor situation in the mining districts. [Later—Dispatches report that in Shasta County, 1000 miners and smeltery men are on strike and saloons at Kennett and elsewhere closed. Important companies affected are Mammoth Copper Mining Co. and First National Copper. The production affected approximates 26 to 27 million pounds per annum.]

BUTTE—Sept. 11 (By Telegraph)

Anaconda Mines and Smelteries will probably resume operations in a few days. Representatives of smeltery employees at Great Falls and other labor unions in Butte, including representatives of miners, met with smeltermen and other unions in Anaconda tonight in a big mass meeting and voted unanimously to return to work declaring the company to be fair. The action means that the radical element among striking miners in Butte is repudiated and defeated. There has been pretty strong evidence that the leaders among the strikers, including some I. W. W.'s, have been financed in the interest of Germany, and this phase of the situation is under investigation by the Federal authorities. A large majority of the miners have long been anxious to return to work under the advance in wages, but have been prevented by the radicals and fear of violence and of being called "scab." It is probable that mines can reopen with 60% of normal working force, but thousands of best miners have left district, many of whom have entered other occupations and will not return.

BUTTE—Sept. 8

Anaconda Mines Remain Closed on account of labor troubles, and also those of independent concerns which ship to the Anaconda smelteries. The Butte & Superior, East Butte and Elm Orlu mines are working at capacity for the first time since the strike was inaugurated in June. Among the independent producing companies that have been compelled to suspend production are the Tuolumne, Davis Daly and the copper producing portion of the Elm Orlu mines. The Tuolumne, Davis Daly and Butte Detroit are taking advantage of conditions to push development work. The changes at the Butte Detroit mill, made to treat a large tonnage of manganese ore, have been completed and development of the mine is being prosecuted.

I. W. W. Headquarters in Silver Bow County, together with a number of other places suspected of harboring traitors known to be active in spreading seditious propaganda in this community, were raided on Sept. 5, under orders from Washington, by the Federal authorities assisted by the police. While no arrests have been reported as yet, a large number of I. W. W. members are being detained at Finlander's Hall while officers are examining records, literature and correspondence seized when they took possession of the place. The raid was so well planned that it was effected

without serious resistance on the part of the I. W. W. members and in spite of the fact that a large crowd of sympathizers had gathered quickly around the hall when it became known that the raid was taking place. The story is current that the authorities had reason to believe they might be able to connect the I. W. W. activities in Butte with certain German propaganda. It is said that Joe Shannon and Tom Campbell are among those detained by the officials for further investigation and hopes are expressed that this action of the Government will clear the way for an early resumption of mining and smelting operations on which Butte and over 20,000 of its population depend for a livelihood.

Labor Situation in Butte and other districts of the Anaconda company, is gradually resolving itself into another fight between labor unions themselves, and each faction is accusing the other of being influenced by the company. The strike of the miners made it possible for all the other unions to get in and make demands for increased wages. The miners were not organized, but a score of other unions are and these, using the strike of 10,000 miners, forced material concessions from the companies and then joined with the companies in refusing to deal with the striking miners because they were not "regularly" organized and had no international affiliation. The miners, having a sad recollection of their many years of experience under a grafting regime declined to affiliate again with the Moyer organization, and so they have remained, dubbed "outlaw," "I. W. W.," "traitors," etc., and everyone who has sympathized with the striking miners, or attempted to advise them or suggest a basis for a peaceful settlement, has likewise been listed and published as an I. W. W. and traitor to the country. It is evident that the strike is slowly dying of starvation, and the first fall of snow will see the men breaking away from all restraint and fear, and return to work. Even then it will be many months before anything like a normal working force will report, as thousands of the best miners have left the district, have gone to other districts where wages are better and working conditions preferable. Many have abandoned the mines for good, and hundreds have joined the army. [Later—Dispatches report that some of the trade unions which endorsed and helped finance strike of miners before general shutdown of Anaconda mines and smelteries are backing down and some of the trades are expected to offer to return to work in the next few days, and committees will negotiate with striking smeltermen at Anaconda. Company officials, however, say that they have no interest in different moves of the union.]

DENVER—Sept. 7

High Price of Silver is stimulating development work in old silver-lead properties, which have been idle for years and are now being reopened. Some properties contain ore which could not be mined at a profit when silver ranged near 50c. per ounce, and pocket mines are attracting small leasers.

Tariff on Tungsten Ore has been advocated by producers of tungsten in Colorado, who claim that tungsten produced in South America can be laid down in New York for about \$8 per unit, while average cost of production in Colorado is about \$16.50 per unit. The high cost in Colorado is because the ore occurs in lenses and pockets, and requires a large amount of development work to keep up production, while the relatively low cost in Bolivia is possible because, it is claimed, the ore occurs in continuous shoots, requiring less development work. It is proposed that a tariff of \$10 per unit be placed on ores coming from South America.

Coal Operators of Colorado, represented by a committee consisting of H. F. Nash, Frank Bulkeley, Geo. W. Harris, D. W. Brown and W. W. Curtis, have protested against the prices published in a coal schedule for the State of Colorado bearing President Wilson's signature. The local operators claim that these prices are lower than have obtained in Colorado for the last 10 years, and labor and supply costs have steadily advanced, especially during the last year. The operators offer to submit pro-

duction costs to substantiate their claims that under the abnormal costs now existing many mines will be unable to operate at the proposed prices except at a substantial loss. The committee is endeavoring to bring about a suspension of the proposed schedule of prices, pending an investigation of operating conditions. It is reported that the Reliance mine, at La Veta, and the Wolf Park property, at Canyon City, will be compelled to shut down if the proposed schedule goes into effect.

WALLACE, IDAHO—Sept. 8

Cœur d'Alene District Miners' Union, affiliated with the International Union of Mine, Mill and Smelter Workers, has sent a communication signed by the president and secretary to every mine manager in the Cœur d'Alene district, in which an early conference is asked for the discussion of certain propositions, but upon which it is apparent there can be no agreement unless the mining companies accept them. Before stating the propositions, the communication calls attention to the "universal unrest that is permeating the entire country, and especially the mining industry," which renders immediate consideration of the proposals necessary. As a further preparation of the manager's mind for a favorable reception of the propositions, it is stated that they are not submitted "in the shape of demands, but to call your attention to conditions that should have been changed long ago, but that still exist almost universally in the district, and to impress upon you the necessity of improving conditions before sentiment crystallizes to any greater extent than it has at present." It is further pointed out that "developments of the last six months have shown that the workers are not satisfied with conditions in the mining industry, and that they are going to organize to improve them," and that "it is only a matter of time until some incident may occur that may bring on turmoil and strife in the Cœur d'Alenes. Such a condition can be avoided by intelligent action and foresight on the part of the managers." Further kindly advice is volunteered to the managers in the suggestion that "we should profit by the mistakes of others, and while the opportunity presents itself you should open negotiations now with the bona-fide labor movement to the end that through conference and discussion of grievances, either real or fancied, friendly relations may be preserved between the workers and the operators while the war is in progress." Then follows the propositions which the "bona-fide labor move-

ment" desires to discuss with the managers, namely: "An eight-hour day from 'portal to portal' for all miners, and an eight-hour day for all outside men employed in or around the mines, mills or smelters; change and dry rooms with bathing facilities at all mines; a payday at least twice a month; two men to be placed on all Leyner machines; enforcement of the state law relative to a spray to be used on all machines not equipped with water machines; readjustment of the wage scale, and a continuation of the sliding scale upward based on the price of metal; recognition of the grievance committee; recognition of the International Union of Mine, Mill and Smelter Workers, and a union shop." In order to reassure the managers of their peaceful intent, the officers close the communication with "Yours for industrial peace." Up to this time the managers of all the mining companies have ignored this request for a conference, and there is nothing to indicate that this attitude will be changed. Even the large interests represented by men who were formerly closely identified with the Western Federation are understood to be in line with the other companies in their opposition to giving any recognition to the old gang under a new name.

SALT LAKE CITY—Sept. 10

Deep Creek District Shipments for August of 126 cars, or about 5000 tons of ore, show that this new camp is fulfilling its promise of profitable operation for the recently completed railroad into the district. The major part of this output—119 cars—came from the Western Utah Copper, which property has been under development for several years, with a view to production as soon as adequate transportation could be afforded. The remainder came from the Pole Star Copper, Woodman Mining, Spotted Fawn and Silver King, the two latter properties being operated by lessees, and each producing one car of ore. The Woodman Mining Co., owning two properties, is operating the Frankie mine and producing copper ore. There is stated to be a considerable amount of low-grade ore of this character proven, as well as higher-grade copper also being found on the property. The Pole Star, which is next to the Western Utah in point of development, etc., resumed shipments last week in August, and management announces that from now on it expects to maintain a regular output, hauling its ore by truck to the loading bin at the railroad at Gold Hill. The first car for the present month was shipped Sept. 4, and it is expected to make ship-

ments every two or three days. The ores from this property carry bismuth, tungsten, copper, silver and gold. In the case of the Western Utah Copper, reserves are stated to have been increasing during the period of shipments, so that the present rate of output can be increased at any time. The production coming from the district—with this mine as the chief producer—is estimated to have been about \$500,000 since last spring, when the railroad began operation—exceeding in value the cost of the installation of the road.

JOPLIN, Mo.—Sept. 8

Site for New Lead Smelter of the Ontario Smelting Co., of Joplin, after an unexpected delay, has been obtained two miles north and one mile east of Quappaw, Okla., and construction work will be started Sept. 10. The company found it necessary to purchase the fee and mineral rights to a 40-acre tract. The situation is only a short distance from the Frisco R.R., to which it will be connected by a switch, and the Mineral Belt R.R. also will connect with it from the northwest. One result of the delay in securing the site will be the construction of a larger plant than originally intended, it having been decided to build five furnaces instead of four, which will give the plant a capacity of about 100 tons of lead ore per day. The plant will thus be larger than the Eagle-Picher company's lead plant at Galena, Kan. C. V. Jones, of Joplin, who is president and treasurer of the Ontario Smelting Co., said today that construction work will be rushed, and that all the machinery has been purchased and is ready to ship. He hopes to have the new plant in operation at the end of the 12 weeks, though it is likely it will take longer than this. It will be built entirely of brick and steel and will be thoroughly modern.

HOUGHTON, MICH.—Sept. 8

August Output of Copper of Lake Superior mines will show close to 10% increase over July, although smeltery figures are not yet at hand. Further increase can be reasonably expected for September, as many workmen are coming in from farms and taking underground positions; the influx from Butte continues to some extent. Estimated rock outputs for August follow: Calumet & Hecla, 244,400 tons; Centennial, 11,600; South Lake, 5185; Isle Royale, 70,000; Osceola, 100,000; La Salle 15,615; Hancock, 32,800; Mass, 16,000; Superior, 10,000; Ahmeek, 103,400; Wolverine, 28,980; Mohawk, 48,090; Franklin, 27,045; Allouez, 48,465.

The Mining News

ARKANSAS

Marion County

WILLETT (Yellville)—Operated by Liberty Lead and Zinc Co. New 150-ton mill purchased and construction work will start immediately.

OLENA (Flippin) — Owned by Glynn Bros. of Tulsa, Okla., and local people. Opening up shallow deposit of zinc and carbonate ore, in massive and disseminated form.

ARIZONA

Cochise County

SHATTUCK ARIZONA (Bisbee)—Production for August was 644,677 lb. copper comparing with 205,081 in July; 42,997 lb. lead, comparing with 104,044 in July; 8277 oz. silver, compared with 3213 in July; 77.29 oz. gold, compared with 30 oz. in July.

Gila County

MIAMI (Miami)—Production for August was 260,000 lb., comparing with 5,349,000 in June. No production for July as properties were shut down entirely because of strike. Announced that 50% of men are now at work. September production expected to be over 50% and still further increase in October.

Mohave County

NEW MOHAWK MINING CO. (Chloride)—Just shipped carload gold and silver ore to Selby. No. 2 shaft opening shoot of silver ore, showing ruby silver. No. 3 shaft down nearly 50 ft. J. J. Robertson, superintendent.

UNION METALS CO. (Chloride)—Just made arrangements with Union Basin Min-

ing Co., operating Golconda mine, to run 600-ft. crosscut from latter's 1100-ft. level to cut Fredonia and other veins of same group of former company. Will open these veins on Fredonia at depth of 800 ft. Shaft on Fredonia down 60 ft., with 14 in. good ore on hanging wall and same amount on foot wall. Surface cut on Golconda Annex claim opened silver-lead ore. J. P. Ryan, superintendent.

Pima County

TOTAL WRECK (Tucson)—Situating near Pantano and being operated by E. L. Vail & Co.

NEW CORNELIA (Ajo)—Will continue diamond-drill explorations on the Ajo Consolidated property recently acquired. Underground exploration also in progress.

ARIZONA CONSOLIDATED (Greater-ville)—Subsidiary of General Mining Co., of Nevada, has undertaken development of J. B. Anderson property, under direction of C. H. James.

HECLA-ARIZONA (Tucson)—Adjoining the San Xavier Extension is sinking a two-compartment shaft to 200-ft. depth before crosscutting. Considering building custom plant to handle ores of Twin Buttes district.

Pinal County

MAMMOTH DEVELOPMENT CO. (Shultz)—Have bonded the Mammoth and Collins group. Shaft down 833 ft., under water at 742 ft.; operating on 700-ft. level, where 1800-ft. drift connects both groups. Hoisting 150 tons wulfenite ore daily and shipping 4 tons of concentrates, carrying 20% MoO₃ and about \$35 gold. Installing flotation process, giving 90% extraction to

displace present means of concentration by eight Wilfley tables. Epes Randolph, of Tucson, secretary.

Yavapai County

CALUMET & JEROME (Jerome)—No. 2 crosscut from 600-ft. level penetrated 75 ft. south of station same black slate that No. 1 west crosscut entered about a week ago. East crosscut driven 51 ft. without reaching sheared zone.

DUNDEE-ARIZONA (Jerome)—New electric pump insufficient to handle water in shaft, and air lift being rigged. The 8 x 12 compressor was too small and larger compressor has been installed to furnish air for new lift.

CALIFORNIA

Amador County

PLYMOUTH CONSOLIDATED (Plymouth)—Report for July shows 11,000 tons of ore treated, with estimated total yield, including concentrates, of \$54,188.

Del Norte County

OLD CROW (Crescent City)—This copper property is in the monumental district. $\frac{1}{2}$ mile from line of the proposed Grants Pass and Crescent City railroad. Copper vein $\frac{3}{4}$ ft. wide opened 100 ft. Owned by F. E. Bauman of San Francisco and managed by E. A. McPherson.

Mariposa County

YELLOW STONE MINING CO. (San Francisco)—Permitted to issue 100,000 shares capital stock to C. R. Burt as partial payment of 160 acres of patented land in Hunters Valley and to sell 100,000 shares at 25c. cash for development.

Sacramento County

SACRAMENTO CLAY PRODUCTS CO. (Sacramento)—Permit to issue stock. Stipulating that 997 shares to be issued in exchange, for property formerly known as Sacramento Clay Products Plant controlled by D. A. Cannon, and associates.

NATOMAS CO. OF CALIF. (San Francisco)—Report for year ended Dec. 31, shows gross gold recovery amounted to \$2,137,120 from 25,868,000 cu.yd., against \$2,416,960 the previous year. Net operating profit was \$988,885, against \$1,313,800. In 1916, \$108,248 expended in salvaging and rebuilding Natoma dredge No. 7 charged to operating expense. Fair Oaks plant operated 195 days, producing 19,500 tons crushed rock and 42,500 tons screened gravel. Oroville operated 107 days, output was 85,000 tons crushed rock and 69,000 tons screened gravel. Reclamation and drainage of lands practically completed and crops planted. Reclamation cost to date has been \$4,270,000.

San Bernardino County

MOJAVE ANNEX TUNGSTEN MINING (Ivanpah)—Completed 20-ton concentrating plant and operating on wolframite ore. Development work shows presence of good tungsten ore. J. B. Evans, consulting engineer.

Shasta County

ARPS COPPER CO. (Copper City)—Reported machinery for installation of hoist, compressor, machine drills and engine received. Sixth carload ore sent to Mammoth smelter at Kennett.

SHASTA KING (Kennett)—Mammoth Copper Mining Co. leased this copper property and started 30 men exploring and developing. Ore extracted being shipped to Mammoth smelter. Is included in Trinity Copper Co. holdings, owned chiefly by Thomas Lawson of Boston. Prospected and sufficiently developed by John Filius and Fred Grotfeld 17 years ago to prove its approximate value and was kept alive for a few years, but finally shut down by Lawson. Believed to be one of the best copper mines or prospects on west side of Sacramento River. Stated there is no option of purchase attached to lease as Lawson is not inclined to sell, but willing that other operators shall develop, even if something is made out of development and extraction.

Siskiyou County

POLAR BEAR COPPER CO. (Calahan)—Permit granted to L. K. Stam, Albert Stone and Charles F. McAlmond to issue 150 000 shares of stock.

RANCHERIA MINING CO. (Hornbrook)—Notice served by debris commission that mining work must stop on account of pollution of Rancheria Creek by tailings.

GRAY EAGLE (Happy Camp)—James F. Mahoney, of Sullivan Machinery Co., has removed diamond drills after completing contract to drill aggregate of 8000 ft. Machinery is being moved to Mendocino County.

Tuolumne County

SAN YSABEL (Stent)—Fay Chadbourne, superintendent, met with fatal accident in mine, July 24. Workman slightly injured. Cause not reported. Operated by Nyman Consolidated Mines Co. of San Francisco.

WESTERN EXPLORATION AND MINES CO. (Sonora)—Permitted to issue 14,995 shares of capital stock to Alexander Hamilton, William F. Rose and F. B. Kinsman in exchange for assignment of option of Fortuna and Sirius No. 2 mining property, situated near Italian Camp. Also permission to sell 10,000 shares at \$5 for development and equipment.

COLORADO

Boulder County

MINING REVIVAL at Jamestown is under way.

WHITE RAVEN (Boulder)—Regular shipments of heavy lead-silver ore made; production two to three cars weekly. Development work carried on for two years; mine now in shape to take advantage of high price of silver.

Clear Creek County

PRIMOS CHEMICAL CO. (Camp Boerick)—Erecting flotation plant to treat molybdenum ore from its property about 10 mi. above Empire. Survey made for new power line to connect plant with Colorado Power Co.'s line, 12 mi. distant; cost estimated at \$24,000. Charles A. Chase, consulting engineer; E. A. Strong, mill superintendent; Benjamin Essig, construction engineer.

Gilpin County

SILVER PLUME activity still increasing. Many old silver mines being reopened. High price stimulating production.

C. H. W. MINING CO. (Central City)—Operating Hampton mine. Concrete piers for additions to shaft house and ore bins completed; work on ore bins under way, and will be completed before new headframe is installed in order to interrupt underground work for as short a time as possible. New 100-hp. G. E. motor to run compressor installed. Shaft sinking will be resumed when improvements completed. Development work continues to open good-grade ore, and regular shipments of crude ore and concentrates made.

Park County

WESTERN MINING CO. (Alma)—Fifty-ton mill completed and regular shipments of concentrates being made.

COLORADO POWER CO. is surveying for power lines throughout Alma district; will build lines to Paris, Dolly Varden, London and other mines.

JIM BLAINE (Alma)—Tungsten property, being worked under lease and bond. Vein in upper workings 6 ft. wide shows shoots of tungsten ore. Crosscut tunnel being driven to cut vein at greater depth. J. T. Dollison, manager.

San Juan County

DIVES LEASING CO. (Silverton)—Operating Shenandoah mine.

PRECIOUS METALS CO. (Chattanooga)—Lessee shipping good-grade ore.

TELESCOPE (Chattanooga)—High-grade lead ore opened by lessees.

COMING WONDER (Silverton)—Ore being shipped to North Star mill for treatment.

WYGALL-VANSLYCK (Silverton)—This group in Stony Pass being developed. High grade gold-silver ore discovered.

San Miguel County

LIBERTY BELL (Telluride)—New electric locomotive installed on lower tunnel level.

CARRIBEAU (Ophir)—Flotation installation completed and mill has resumed operations. Old tailings being retreated first.

GERTRUDE & MODENA (Telluride)—Being operated by lessees. Car of copper ore from development work shipped recently. Property in Bear Creek Cañon.

CARRUTHERS (Telluride)—Leasing company operating lease on block of Smuggler-Union Co.'s ground and Carruthers mill making regular shipments.

Saguache County

EAGLE (Bonanza)—Developing 7-ft. vein of payable ore.

KAPI MINING AND MILLING CO. (Bonanza)—May Bell tunnel advanced 100 ft. during August to total length of 542 ft.; new vein cut containing 12-in. streak of copper and iron pyrite ore. Tunnel being advanced to cut Shawmut vein, in which raise will be made to bottom of shaft. Upper workings now full of water, contain lead and copper pyrite ore.

Summit County

MOLLY B (Breckenridge)—Further shipments bismuth ore being made.

BLUE FLAG (Breckenridge)—Property in Illinois Gulch being reopened.

IRON MASK (Breckenridge)—Reopening old workings nearly completed. Shoot of iron-manganese ore opened.

ORO EXTENSION (Breckenridge)—Large flow of water encountered in development work this spring just now under control.

MONTE CRISTO (Breckenridge)—Mill being remodeled and flotation plant installed. Property in upper Blue River district. F. A. Peabody, in charge.

OURAY (Breckenridge)—Tunnel levels repaired; machinery will be installed and shaft unwatered. Worked for several years by lessees.

Teller County

BLUE FLAG (Cripple Creek)—Work resumed on this Raven Hill mine. Main shaft will be sunk from 1100 to 1400-ft. level; work to begin at once. Property adjoins Cresson.

QUEEN BESS (Cripple Creek)—Good-grade ore discovered in development work on this Tenderfoot Hill property. Reopened by drifting on 500- and 900-ft. levels of El Paso Gold King mine adjoining. Was once a producer of gold ore from Mollie Kathleen shaft.

IDAHO

Bonner County

ARMSTEAD MINES (Sagle)—Completed reconstruction of No. 3 tunnel at Rainbow and driving 2200 ft. to cut vein exposed in upper workings; now in 1400 ft. Size of tunnel increased from 6 x 7 ft. to 7 x 8 ft. and using 20-lb. rails. Two-in. air pipe and

20-in. ventilating pipe run in length of bore. Has 70,000 tons milling ore blocked out above tunnel No. 2 according to report of H. H. Armstead, president. Survey being made for road from mine to Sagle.

Shoshone County

BIG CREEK (Wallace)—Returns received this week from 39-ton carload of gray-copper ore shipped believed to have broken the record for the district. Driving crosscut to cut this rich oreshoot at further depth of 560 feet.

DOUGLAS (Beeler)—Shipments from this zinc property worked under lease to Anaconda company, discontinued on account of the closing of Anaconda smelteries. Other zinc properties on Pine Creek are seriously affected also, but expect to ship to other smelteries.

LIBERTY KING (Beeler)—Consists of five claims being developed since November. One drift, 550 ft. long, shows ledge carrying ore 11 to 14 ft. wide of hard quartz. Two oreshoots found from six to 10 in. wide of high-grade lead-zinc ore. Iron and copper sulphide in crosscut at end of drift. Leslie Lamb, principal owner.

NATIONAL (Mullan)—Meeting of directors in Wallace on Aug. 31 levied assessment of 1c., to provide necessary funds to place mine in shape to produce and make repairs to the mill, which is expected to be running by Sept. 15. Body of copper ore in lower level of better grade than in upper workings.

MICHIGAN

Copper

COPPER RANGE (Painesdale)—Exploration work on options south of Globe tract continue with three diamond drills. Production close to normal.

SOUTH LAKE (Houghton)—Butler lode continues to furnish the best rock coming from this lode and 200 tons daily taken out. Better ventilation will be had when sixth level cuts into the Lake extension.

MICHIGAN (Rockland)—Plat cut on seventh level. Laterals will be pushed to explore the three lodes. Ogimah lode shows fairly good rock at both sixth level openings. Considerable amount of mass and barrel rock coming from the Butler lode. Fourth-level crosscut getting into copper rock.

WOLVERINE (Kearsage)—Rock coming from No. 3 shaft on 14th level is picked carefully as it is lean, but profitable at present price of copper, with short tram and hoist to surface. The 31st and 34th levels are out to the boundary. Three other north levels are stoping and five on the south, the 25th, 31st, 34th, 37th and 38th.

OSCEOLA CONSOLIDATED (Osceola)—No. 4 shaft, North Kearsage resumed operations after a short shut-down, during which steam engine in rock house was replaced by electric motor and another Farrell crusher in operation. Shaft continues in low-grade copper rock not much better than the old Osceola lode. Expect improvement when shaft gets to point on same shoot Wolverine and Allouez operates.

QUINCY (Hancock)—Management denies operating at 8000-ft. depth and have not done any diamond drilling below bottom of shafts. New hoist, capable of hoisting loads from inclined depth of 10,000 ft., purchased. Silver is becoming important source of income, mainly because of increasing amounts in lower openings. In early days "picking" silver was an important branch of mill work. Calumet & Hecla's lower conglomerate workings likewise are showing more silver right along.

MINNESOTA

Cuyuna Range

PENNINGTON (Ironton)—Finished shipping for this season; the tonnage amounted to about 125,000.

KENNEDY (Cuyuna)—Fire in the Rogers Brown Ore Co. property still smouldering. Started on 210-ft. level and burned up raise. This section bulkheaded and mining under way in other sections. Half of stockpile has been shipped.

CUYUNA SOUTHERN RAILWAY was incorporated by Cuvier Adams, discoverer of Cuyuna iron range, and reported will tap mining properties of Southern range, pass through Clearwater range and western Mille Lacs lake and thence to St. Paul.

FEIGH (Ironton)—Temporarily abandoned at 71 ft. on account of water and quicksand trouble. New timber shaft being sunk within 300 ft. Plan is to drift under main shaft to drain water. R. H. McDonnell, superintendent.

WILCOX (Riverport)—Acquired by Omaha Iron Co. Name of mine changed to Omaha. Idle at present. Shipped 84,834 tons during 1914-16. Has 65,000-ton stock-

pile at mine. Estimated ore deposit of 5,000,000 tons with 1,000,000 tons accessible for extraction. New owners plan construction of ore-drying plant. Capacity of mine equipment, 200 tons. A. A. MacKay, of Ironton, superintendent of the Hoch and Ferro mines, will be in charge.

Mesabi Range

BESSEMER IRON-ORE property near Eveleth known as Burns Mine, has been opened by the owners, H. C. Dudley and associates.

MISSOURI

Joplin District

MELROSE (Quapaw, Okla.)—New 300-ton mill virtually completed on lease north of Quapaw and will be in operation by Sept. 15. H. B. Lappe, president.

LARSH (Commerce, Okla.)—Will erect mill on lease near Commerce where rich strike recently was made. Face of lead-bearing ore 45 ft. thick indicated by drill cuttings, coming in at 244 feet.

CHAPMAN BROS. (Joplin)—Have completed rebuilding of 1000-ton mill formerly located at Webb City on Goodeagle lease near Tar River, Okla., and plant now in operation. Three shafts in ore. Lease drilled out by L. C. Church, 40 drill holes showing ore.

HACKETT L. & Z. (Webb City)—Has taken lease on 1580 acres land just west of Picher and Tar River, Okla., and will thoroughly develop with drills. Is virgin territory but near good mines.

WOLFTON (Picher, Okla.)—Plans construction of two modern mills on lease west of Picher. One shaft down to ore and another started. Company recently organized with \$200,000 capital. A. P. Mackel, president, is also president of Central Lead and Zinc Company.

BIG START MINERAL (Picher, Okla.)—Will start drilling operations on 120-acre lease recently acquired southwest of Tar River. Stock in company held almost exclusively by women, Mrs. M. C. Robinson and Miss Gertrude Chaffee, of Oklahoma City, among principal owners.

MONTANA

Beaverhead County

BOSTON & MONTANA DEVELOPMENT CO. (Wise River)—Reported to have cut the Park vein, uncovering about five to six ft. of ore.

Lewis and Clark County

HELENA MINE (Helena)—Two car loads a week to smeltery.

JULIA (Helena)—New shoot of \$25 ore in east 300-ft. drift.

QUARTZITE DIKE (Helena)—Twenty tons of ore through Umatilla mill. Concentrates carry \$10 gold, 34 oz. silver and 35% lead.

Silver Bow County

ANACONDA (Butte) — Production for August was 11,175,000 lb., comparing with 12,400,000 lb. in July, and 20,400,000 lb. in June, and 28,800,000 lb. in August, 1916. August is smallest output since December, 1914, when 11,800,000 lb. was produced.

NEBRASKA

Box Butte County

ALLIANCE POTASH CO. (Alliance)—Purchased 40-acre tract at Antioch to erect plant to take potash from water in lake east of here. Pipe line to be constructed. Recently incorporated. F. C. Krause, president.

NEVADA

Clark County

BIG CASINO (Searchlight) — Have proved up orebody on 550-ft. level, drifting east and west. Expect to sink to 1000-ft. level when financing is completed. W. W. Wishon, consulting engineer.

HOOSIER (Goodsprings) — Development work being done since July 15 and lead orebodies opened. One 50-ton carload shipped, but returns not yet available. Has ore on dump and management reports 6000-7000 tons in sight. Nels Nelson, owner.

Esmeralda County

GOLDFIELD CONSOLIDATED MINES CO. (Goldfield)—Report for July shows 18,400 tons produced, realizing net profit of \$9809. Development work amounted to 1610 ft. at cost of \$7.10 per ft. Mining cost was \$3.048 and net operating cost was \$7.808 per ton of total ore. Leasers during month produced 1386 dry tons, yielding \$22,436, netting company \$8505.

Nye County

TONOPAH ORE PRODUCTION for week ended Sept. 1 was 9374 tons, valued at \$164,045, comparing with 9407 tons the previous week. Producers were: Tonopah

Belmont, 2431 tons; Tonopah Mining, 2350 tons; Tonopah Extension, 2380 tons; Jim Butler, 800 tons; West End, 1109 tons; Rescue, 109 tons; Montana, 48 tons; Cash Boy, 53 tons.

TONOPAH EXTENSION MINING CO. (Tonopah)—Receipts from operations for July were \$115,732, showing profit of \$32,952.

MUSTANG (Manhattan)—New oreshoot discovered close to surface on apex of Mustang Hill. Lens has same general characteristics as that worked by Train & Chase and hope similar conditions will be encountered. Dimensions are increasing with depth. Excess of water from recent heavy rains prevented exploration of lower workings of shaft from which it was expected to extract ore for a trial mill test.

NEW MEXICO

Socorro County

TRIBULLION (Kelly)—Property under lease to Ozark Smelting & Mining Co., subsidiary of the Sherwin Williams Co. Receiving \$4000 to \$5000 royalties per month from lessees who are treating 40-50 tons per day in mill at Kelly, N. M., and shipping 25 tons copper ore daily. Shareholders' meeting of Tribullion company called on Oct. 2 to reduce capitalization and provide for reorganization.

OREGON

Josephine County

COW BOY AND LYTTLE (Takilma)—These copper mines, leased by C. E. Tucker and George Fife, are shipping two carloads per week.

LOGAN SIMMONS (Waldo)—The season's output of this placer mine was \$40,000 gold. Also platinum and a little osmium and iridium. Gold is very fine. Deposit is from 10 to 25 ft. deep. J. T. Logan, manager.

PITTSBURG-OREGON MINING AND MILLING CO. (Grants Pass)—Incorporated Aug. 21 for \$2,000,000. A general mining and ore-marketing business is planned. Victor W. Brown, C. C. Bippus, W. H. Stroup, Howard Q. Turner, of Pittsburgh, and Lester A. Brown, of Grants Pass, are interested.

UTAH

Beaver County

GOLDEN REEF CONSOLIDATED (Frisco)—Property north of Horn Silver mine being developed. Double-compartment shaft down 450 ft. Mineralization, horn silver.

Juab County

DESERET MOUNTAIN (Tintic Junction) Provided with equipment, and production of copper ore expected to begin. Shaft being sunk, and will begin drifting when 400-ft. level is reached. W. Mont Ferry, J. H. Turner and W. D. Livingston, interested.

TINTIC STANDARD (Eureka)—Stated to be in condition to ship car daily. Shipped four cars week ended Aug. 24. Drift being run from 1300-ft. level, the bottom of new shaft, now in 25 ft. in shipping ore; objective point is productive orebody on higher level, and showing ore going down.

TROUT CREEK MINING CO. (Gold Hill)—Situating at Trout Creek, 45 miles from Gold Hill, nearest railroad point. Inclined shaft down 130 ft. on a lead-silver vein. Will also develop zinc ore found on property. Recently scheelite discovered in mica schist showing good percentage of tungsten. Several tungsten discoveries on property immediately east of this will be developed by H. Prvor of Colorado. Hoist installed. H. J. Meyer, president.

Salt Lake County

VICTOR (Alta)—Two fissures showing mineralization cut by tunnel being driven through limestone, also showing some mineral. Objective point "Cardiff" contact, expected in 100 to 150 ft. of work.

SOUTH HECLA (Alta)—Shipments hindered by lack of teams, smelter embargo, etc., are being increased. Shipped about 150 tons week ended Aug. 18, and expects to double this amount week ended Aug. 24.

Tooele County

GARRISON MONSTER (Gold Hill)—Better haulage conditions being arranged for, by this Deep Creek property, and necessary buildings, etc., to be built.

SEMINOLE COPPER (Gold Hill)—High-grade tungsten ore continues to be shipped. Shipments of molybdenum to be made soon. Four veins on property carrying tungsten, but so far only one has shipped. Fifty-ton mill being built. Company owns 300 acres with tungsten-molybdenum ground and indication of possible commercial gold-silver and copper-lead ore. Portion of property from which tungsten ores being shipped opened to 135-ft. level.

CANADA

British Columbia

D. C. JACKLING states that he and associates have no interest in iron-ore properties, or iron and steel business on Pacific Coast as reported in the "Journal" of Sept. 1 and elsewhere.

Manitoba

MOOSEHORN (Herb Lake)—Operated by Northern Manitoba Mining and Development Co. Shaft down 80 ft. and vein widened from 15 in. on surface to 30 in. with increased gold content.

Ontario

CONIAGAS (Cobalt)—Has purchased Maidens MacDonald property in Porcupine for \$20,000. It adjoins the Ankerite optioned to the Coniagas and formerly to the La Rose.

TEMISKAMING (Cobalt)—B. Neely, manager of the Penn-Canadian, making examination at instance of Max Morgenstern, to determine accuracy of report on ore reserves.

WETTLAUFER (South Lorrain)—Pittsburg Lorrain Co. will take over this mine. Mill being overhauled for treatment of large accumulation of low-grade ore.

LUCKY CROSS (Swastika)—Shareholders on Sept. 3 adopted resolution to wind up the company and sell property at auction. Bondholders to the amount of \$56,400 stated they were prepared to bid for the property.

NIPISSING (Cobalt)—Flotation equipment of five callow rougher and one cleaner cell will be increased to eight roughers and two cleaners to give a 250 to 300-ton capacity per day. Heads in flotation will average about eight oz. per ton and expected to extract six oz.

McINTYRE (Schumacher)—Annual report covering 15 months ended June 30, shows current assets at \$307,137 and fixed assets, \$4,432,249. Surplus is \$741,903, comparing with profit and loss account balance for March, 1916, of \$383,149. Depreciation reserve fund is \$252,000 and \$148,987 charged to general reserves.

TEMISKAMING (Cobalt)—The report of Balmer Neilly, appointed to examine the property places total broken ore reserves at about 11,572 tons. Silver content estimated at 400,000 to 450,000 oz. Only positive ore was taken into account. Shareholders at meeting held Sept. 6 were not satisfied and ordered another examination by Douglas Mutch of the Hudson Bay mine, to get estimate of probable ore contents, which Mr. Neilly's report did not give.

MEXICO

ESPERANZA (El Oro, Mex.)—Ore milled in June was 10,896 tons. Estimated profit was \$20,052, comparing with \$40,911 in May.

SANTA GERTRUDIS (Pachuca, Hidalgo)—Ore milled in June was 27,550 tons at estimated profit of \$41,063. Manager reports for quarter ended June 30 85,705 dry tons crushed, producing bullion valued at \$702,109; estimated profit at mines, \$115,157. Mine development amounted to 2186 ft., of which 783 ft. were in payable ore, 626 ft. in vein below pay and 777 ft. in country rock. On South crosscut, 16th level, parallel 2195 ft., being driven to explore outlying hanging-wall territory after passing through quartz-porphry dike 30 ft. wide, entered wide zone of altered andesite, and 1654 ft. south of north vein cut small new vein striking N 50° E and dipping nearly vertical. Drifting thereon exposed ore shoot 128 ft. long, 4.7 ft. wide, averaging 15 oz. silver and \$1.50 gold per ton. Unable yet to say if new vein will prove of much importance. Scarcity of cyanide caused mill to run at 86.5% of capacity except during May when full rate of crushing maintained. Improved cyanide deliveries in July expected to allow mill operation at 100% of capacity. Flotation experiments on tonnage scale to replace cyanidation will be resumed shortly. Earnings decreased by high price of labor, increased cost of supplies and taxes.

PERU

CERRO DE PASCO (La Fundicion)—Production of copper for August totalled 6,036,000 lb., comparing with 6,262,000 lb. in July.

SOUTH AFRICA

GOLD PRODUCTION in the Transvaal in July was 757,839 oz., being 1885 oz. less than in June and 3248 oz. less than in July, 1916. For the seven months ended July 31 the total was 5,412,954 oz. in 1916 and 5,330,775 oz.—or \$110,187,119—in 1917; a decrease of 82,179 oz., or 1.5%, this year. The number of negro laborers employed in July was: Gold mines, 171,653; coal mines, 11,381; diamond mines, 5223; total, 188,257, showing a decrease of 4097 from June, and of 20,674 as compared with last January.

The Market Report

SILVER AND STERLING EXCHANGE

Sept.	Sterling Exchange	Silver		Sept.	Sterling Exchange	Silver	
		New York, Cents	London, Pence			New York, Cents	London, Pence
6	4.7550	95½	48½	10	4.7550	97½	49½
7	4.7550	96½	49	11	4.7550	98½	50
8	4.7550	96½	49	12	4.7550	98½	50

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.

DAILY PRICES OF METALS IN NEW YORK

Sept.	Copper		Tin		Lead		Zinc
	Electrolytic	Spot	N. Y.	St. L.	N. Y.	St. L.	St. L.
6	@ 25	61	@ 9½	@ 9½	@ 9½	@ 7½	@ 7½
7	@ 25	60½	@ 9½	@ 9½	@ 9½	@ 7½	@ 7½
8	@ 25	60½	@ 9½	@ 9½	@ 9½	@ 7½	@ 7½
10	@ 25	61½	@ 9½	@ 9½	@ 9½	@ 7½	@ 7.70
11	@ 25	61½	@ 9½	@ 9½	@ 9½	@ 7½	@ 7.80
12	@ 25	61½	@ 9½	@ 9½	@ 9½	@ 7½	@ 7.90

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 the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes; ingots and wirebars. Electrolytic copper is commonly sold on "regular terms" (r.t.), including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Sept.	Copper		Tin		Spot	Zinc
	Standard	Electrolytic	Spot	3 Mos.		
6	120	119½	137	241	240	30½
7	120	119½	137	241	240½	30½
8	120	119½	137	241	240	30½
10	120	119½	137	241	240	30½
11	120	119½	137	242	241½	30½
12	120	119½	137	243½	243	30½

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15=3.21c.; £20=4.29c.; £30=6.43c.; £40=8.57c.; £60=12.85c. Variations, £1=0.21½c.

NEW YORK—Sept. 12

The leaking of the news that a large quantity of copper had been bought for the Allies, which became generally known on Sept. 6, had a favorable effect on the copper market, which became much stronger. Spelter, which was previously considered to be bottomed on bedrock, was sentimentally affected. Similarly with respect to tin. Lead was the only metal to exhibit weakness. Readjustment of the prices of lead is necessary to bring it in line with the other metals.

Copper—It became generally known on Sept. 6, not through any official communication, but rather through the leaking of a party to the transaction, that about 77

million pounds of copper had been purchased at 25c. by the War Industries Board in behalf of the Allies. Although the principal producers were, of course, acquainted with this transaction for some time previous, it was not generally known in the trade until Thursday last. Upon the news becoming public buying by domestic consumers was immediately stimulated and there was considerable activity, in comparison with the dullness of many weeks previous, at advancing prices. We estimate the sales of electrolytic as upward of 25 million pounds. The bulk of the business was for October-December delivery, but it is noteworthy that some considerable transactions were made that extend forward to next April and also others covering the first quarter of 1917. At the close, the market was firmly established on an average basis of about 26½c. net cash, New York.

Our Washington correspondent reported by telephone at 4:30 p.m. that Mr. Baruch and Mr. Meyer had informed him that no decision on the matter of the price of copper had been reached, and might not be for several days yet. They said moreover that there was no basis for any intimations as to what the price might be and especially requested that there be no speculation on that subject. No special significance is to be attached to the meetings with the producers this week, which are simply a continuation of conferences that have been going on for the last six weeks. We inferred from our correspondent that a decision in the matter might not be reached until after the return of the President to Washington.

News from Butte this morning is to the effect that the strikers will shortly return to work, but it is not expected that the Anaconda company will be able to resume right away at anything more than 60% capacity. Production at Bisbee, Ariz., has now attained nearly normal capacity. A small production is being made at Globe and Miami, but Clifton-Morenci continue idle.

Among the refiners, one is closed and two others are operating at greatly reduced capacity. Another refinery is reported being near the end of its stock of blister copper, with every prospect that its production will shortly be curtailed. If there be any demand at all for copper during the next three months there is bound to be an acute situation.

The copper producers and the purchasing section of the War Industries Board have been holding sessions this week. Early in the week it was reported that a decision as to the price the Government would pay for its requirements of copper would be announced today, but early in the afternoon news of another postponement came from Washington. It is disgraceful that there should be these delays, while producers are called upon to supply copper to the Government and are not getting any money for it. At present the Government must be owing them in the neighborhood of \$10,000,000.

Copper Sheets are quoted at 35c. per lb. for hot rolled, and 1c. higher for cold rolled. Wire is quoted nominally at 31c. per lb. f.o.b. mill.

Tin—Market was small, but there were signs of increasing activity, which was reflected by a slight stiffening of price. Banka tin regained its normal differential of about 1c. below the price for Straits and at the close was quoted at 60½.

Lead—This market was very dull; transactions were so small that quotations are based on offers to sell, rather than on sales. Right through the week September lead was offered at 9½c., New York, and at the same price, St. Louis. The A. S. & R. Co. maintains its price at 10c., but the market looks for a further reduction.

Zinc—Transactions were small, but there was an advance in price and a firmer tone generally. This resulted in part from the better situation in copper, and in part from the prevailing idea that the price for zinc had bottomed on bedrock. Important interests were inclined, moreover, to help along an advance in zinc by themselves staying out of the market. There was some speculative bidding for the metal,

but producers were at all times willing to sell to consumers at ½c. less than to speculators, while some producers refused to sell to speculators at all.

Zinc Sheets—Price of zinc sheets has not been changed. Market is still at \$19 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

Other Metals

Aluminum—This market continues inactive with quotations nominal at 45c. for No. 1 ingots at New York.

Antimony—This market continued dead, and we simply repeat our nominal quotation of 14½c. for spot. An important seller reported firm bid at that price but order not filled. Important consumers report having as much as six months' supply on hand. We quote futures nominally at 14c., c.i.f., in bond, but large foreign producers say that they cannot afford to sell at less than 15c., c.i.f., in bond, here, or £80@85, c.i.f., Great Britain. Another foreign producer reports itself out of the market until 15½c. is reached.

Bismuth—Unchanged at \$3.50 per pound. **Cadmium**—This metal is quoted at \$1.40 @ 1.50 per pound.

Nickel—Steady at 50c. per lb., premium of 5c. per lb. for electrolytic.

Quicksilver—Unchanged at \$115. San Francisco reports, by telegraph, \$114, steady.

Gold, Silver and Platinum

Silver—This metal has shown unusual strength, owing to the advance in the London price. The market there being rather bare of supplies, the advance is made on small buying. The inquiry from San Francisco on China account is still being maintained.

Mexican dollars at New York: Sept. 5, 75c.; 6, 75c.; 7, 76c.; 8, 76c.; 10, 77c.; 11, 78c.

Platinum—In fair demand at \$103@105.

Palladium—Firm at \$120@125. Certain producers report inquiries on which they were unable to quote.

Zinc and Lead Ore Markets

Joplin, Mo., Sept. 8—Blende, per ton, high, \$79.50; basis 60% Zn, premium \$75; medium to low, \$70@65; calamine, per ton, basis 40% Zn, \$40@38; average selling price, all grades of zinc, \$69.60 per ton.

Lead, high, \$97.35; basis 80% Pb, \$95@90; average selling price, all grades of lead, \$89.57 per ton.

Shipments the week: Blende, 12,014 tons, calamine, 908 tons, lead, 1416 tons. Value, all ores the week, \$1,027,080.

With intermediate grades selling on a lower base, a higher average price denotes larger sales of premium ore. A larger influx of cars is permitting the shipment of ores purchased two and three weeks ago, swelling the shipment far above the week's purchases.

Platteville, Wis., Sept. 8—Blende, basis 60% Zn, \$70 base for premium ore down to \$65 base for second grade. Lead ore, base 80% Pb, \$85 to \$90 per ton. Shipments reported for the week are 2965 tons of zinc ore, 154 tons of lead ore, and 512 tons of sulphur ore. For the year to date the figures are: 98,525 tons of zinc ore; 4869 tons of lead ore; and 19,642 tons of sulphur ore. Shipped during the week to separating plants, 3894 tons of zinc ore.

Other Ores

Antimony Ore—Considerably lower, high-grade ore being quoted at \$1.70@2 per unit.

Manganese Ore—Metallurgical ore continues strong at \$1 per unit, but some of the buyers are more particular respecting silica content.

Molybdenum Ore—Molybdenite containing 90% molybdenum sulphide was sold at \$2.15 per lb. of molybdenum sulphide contained.

Tungsten Ore—A fair amount of business was done at \$23@25 per unit for high-grade wolframite, the top price being for ore as-

saying 70% tungsten trioxide, free from impurities. Low-grade ore was quoted at \$18.50, that price being named on some lots of 60% material. Scheelite fetched \$26 per unit.

Pyrites—Spanish lump quoted at 15c. per unit on basis of 10s. ocean freight, buyer to pay war risk, excess freight and any duty. Ocean freights are 32s. 6d. for northern ports, and 40s. for southern ports.

Iron Ore—Shipments of iron ore down the Lakes were 10,146,786 tons in August, against 10,241,633 tons in July and 9,850,140 tons in August, 1916. The season total to Sept. 1 is 36,523,554 tons, against 39,215,864 tons to the same date last year. Prices remain on the season basis, at \$5.05 for Mesabi nonbessemer on Lake Erie docks, with a premium equal to the extra Lake freight that would be paid above the season basis of \$1. The rate is now fully \$1.50.

Iron Trade Review

PITTSBURGH—Sept. 11

The gossip in the iron and steel trade continues to be that everybody is waiting upon the much advertised price fixing by the Government, and the prediction made a week ago, that the Government's announcement as to steel prices would be made within a week, is repeated again this week, naturally receiving correspondingly less attention.

There is beginning to be serious doubt whether this is really what the trade is waiting for. When the market is stagnant, as it has been for weeks, it is necessary to assign a reason, and this is a convenient one. The Government can fix prices for the general trade only in the case of coal and coke. As to pig iron and finished steel it can fix prices only on what it buys itself, being in position only to recommend in the case of the general trade, and if the Government makes an announcement covering everything it is authorized to do the market would probably continue stagnant, awaiting a time when the mills would have to seek business. The decrease of 437,115 tons in the Steel Corporation's unfilled obligations during August, reported yesterday, suggests that it will be only a few months until the steel mills will stand in need of booking additional business in some departments.

The softening tendency continues in scrap, pig iron, unfinished steel and finished steel but the actual declines recorded in the market are relatively small and serve merely to show the trend. In finished steel the only clear-cut decline is in plates, which are now quotable at 8c. as maximum, whereas a few weeks ago the market was quoted firm at 9@10c. as minimum.

Steel production continues to be interfered with in various ways. The weather is better but coke is as scarce as ever. The Carnegie Steel Co. has every one of its 59 blast furnaces in physical condition for operation, but two are out of blast and five banked, on account of insufficient coke. Its ingot production is about 12% under rated capacity.

Pig Iron—Bessemer iron can be had at \$50, valley, without difficulty, or \$2 below last week's quotation, but there is no demand. Foundry iron has been resold at \$50 or less, and while furnaces state that their price remains \$53 this is purely nominal. There is not enough buying to establish prices definitely. We quote bessemer at \$50, basic at \$48 and foundry and malleable at about \$50, at valley furnaces, 95c. higher delivered Pittsburgh.

Steel—Billets are offered by middle interests at \$75, as reported a week ago, but it is now thought they could be bought at \$70. Mills as a rule are making no quotations.

Ferroalloys

Ferromanganese—The market is very quiet, demand being limited, and there are some irregularities in price in consequence, but in general the market remains quotable at \$375@400 for prompt and remainder of year, and at \$350 for first quarter of next year, delivered.

Coke

Connellsville—There is no news from Washington as to the fixing of prices on coke for the general trade. The recent allotment of 16,000 tons for the Navy Department to July 1, 1918, was at \$3 for heating, a small tonnage, and \$3.50 for foundry, comprising the bulk of the 16,000 tons. The spot market has fluctuated during the week but is down again approximately to the basis of a week ago, being quotable at \$13@13.50 for spot furnace and at \$13.50@14 for spot foundry, per net ton at ovens.

STOCK QUOTATIONS

N. Y. EXCH.†		Sept. 11		BOSTON EXCH.†		Sept. 11	
Alaska Gold M.	34	Adventure	5.62	Alaska Mines Corp.	.50	Alaska Juneau	2
Am. Sm. & Ref. com.	96	Ahmeek	100	Bingham Mines	11	Am. Sm. & Ref. pf.	108
Am. Sm. Sec., pf. A	96	Algoham	.50	Boston Ely	72	Am. Sm. Sec., pf. B	193
Am. Zinc	18	Allouez	65	Boston & Mont.	63	Bethlehem Steel	100
Anaconda	72	Ariz. Com., etfs.	10	Butte & Lonsdale	16	Butte & Superior	29
Batoplas Min.	1	Arnold	25	Calaveras	3	Cerro de Pasco	32
Bethlehem Steel	100	Bonanza	21	Calumet & Ariz.	77	Chile Cop.	17
Bethlehem Steel, pf.	100	Butte-Ballaklava	.50	Calumet & Hecla	535	Chino	54
Butte & Superior	29	Calumet & Ariz.	77	Centennial	17	Colo. Fuel & Iron	45
Cerro de Pasco	32	Calumet & Hecla	535	Copper Range	17	Dome Mines	10
Chile Cop.	17	Centennial	17	Daly West	2	Federal M. & S.	18
Chino	54	Copper Range	17	Davis-Daly	5	Federal M. & S., pf.	42
Colo. Fuel & Iron	45	Daly West	2	East Butte	11	Great Nor., orv. etf.	33
Dome Mines	10	Davis-Daly	5	Franklin	6	Greene Cananea	40
Federal M. & S.	18	East Butte	11	Granby	78	Hackey	69
Federal M. & S., pf.	42	Franklin	6	Hancock	13	Homestake	107
Great Nor., orv. etf.	33	Granby	78	Hedley	17	Inspiration Con.	53
Greene Cananea	40	Hancock	13	Helvetia	25	International Nickel	33
Hackey	69	Hedley	17	Indiana	2	Kennecott	41
Homestake	107	Helvetia	25	Isle Royale	30	Lackawanna Steel	31
Inspiration Con.	53	Indiana	2	Keewenaw	1	Miami Copper	36
International Nickel	33	Isle Royale	30	Lake	1	Nat'l Lead, com.	52
Kennecott	41	Keewenaw	1	La Salle	3	Nat'l Lead, pf.	102
Lackawanna Steel	31	Lake	1	Mason Valley	6	Nev. Consol.	22
Miami Copper	36	La Salle	3	Mass	10	Ontario Min.	6
Nat'l Lead, com.	52	Mason Valley	6	Mayflower	1	Quicksilver	1
Nat'l Lead, pf.	102	Mass	10	Mohawc	82	Quicksilver, pf.	1
Nev. Consol.	22	Mayflower	1	New Arcadian	3	Ray Con.	27
Ontario Min.	6	Mohawc	82	New Idria	14	Republic I. & S., com.	81
Quicksilver	1	New Arcadian	3	North Butte	1	Republic I. & S., pf.	101
Quicksilver, pf.	1	New Idria	14	North Lake	1	Sloss-Sheffield	46
Ray Con.	27	North Butte	1	Old Dominion	53	Tennessee C. & C.	16
Republic I. & S., com.	81	North Lake	1	Osceola	87	U. S. Steel, com.	108
Republic I. & S., pf.	101	Old Dominion	53	Quincy	84	U. S. Steel, pf.	116
Sloss-Sheffield	46	Osceola	87	Santa Fe	1	Utah Copper	98
Tennessee C. & C.	16	Quincy	84	Shannon	7	Va. Iron C. & C.	58
U. S. Steel, com.	108	Santa Fe	1	Shattuck-Ariz.	23		
U. S. Steel, pf.	116	Shannon	7	So. Lake	3		
Utah Copper	98	Shattuck-Ariz.	23	So. Utah	15		
Va. Iron C. & C.	58	So. Lake	3	Superior	7		

STOCK QUOTATIONS—Continued

COLO. SPRINGS Sept. 11		LONDON Aug. 27	
Cresson Con.	5.62	Alaska Mexican	£0 10s 0d
Doctor Jack Pot.	.04	Alaska Tre'dwell	1 2 6
Elkton Con.	.05	Burma Corp.	4 1 3
El Paso	.25	Cam & Motor.	0 9 6
Gold Sovereign	.04	Camp Bird	0 8 6
Golden Cycle	2.05	El Oro	0 11 6
Granite	.40	Esperanza	0 10 6
Isabella	.10	Mexican Mines	5 17 6
Mary McKinney	.12	Neehi, pf.	0 13 3
Portland	1.40	Oroville	0 16 9
United Gold M.	.18	Santa Ger't'dis.	0 12 6
Vindicator	.60	Tomboy	0 18 6

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1915	1916	1917	1915	1916	1917
January	48.855	56.775	75.630	22.731	26.980	36.682
February	48.477	56.755	77.585	22.753	26.975	37.742
March	50.241	57.935	73.861	22.708	27.597	36.410
April	50.250	64.415	73.875	23.709	30.662	36.963
May	49.915	74.269	74.745	23.570	35.77	37.940
June	49.034	65.024	76.971	23.267	31.080	39.065
July	47.519	62.940	79.010	22.597	30.000	40.110
August	47.163	66.083	85.407	22.730	31.458	43.418
September	48.680	68.515	82	23.591	32.584	40.409
October	49.385	67.855		23.925	32.361	
November	51.714	71.604		25.094	34.192	
December	54.971	75.765		26.373	36.410	
Year	49.684	65.661		23.675	31.315	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine

Copper	New York			London		
	Electrolytic	Standard	Electrolytic	1915	1916	1917
Jan	24.008	28.673	88.083	131.921	116.167	142.895
Feb.	26.440	31.750	102.667	137.895	133.167	148.100
Mar.	26.310	31.481	107.714	136.750	136.000	151.000
April	27.895	27.935	124.319	133.842	137.389	147.158
May	28.625	28.788	135.457	130.000	152.522	142.000
June	26.601	26.662	112.432	130.000	137.455	142.000
July	23.865	26.620	99.119	128.099	132.500	140.409
Aug.	26.120	25.380	110.283	122.391	126.304	137.000
Sept.	26.855		113.905		134.071	
Oct	27.193		122.750		142.523	
Nov.	30.625		134.659		155.432	
Dec.	31.890		145.316		162.842	
Year	27.202		116.059		138.281	

Tin	New York		London	
	1916	1917	1916	1917
January	41.825	44.175	175.548	185.813
February	42.717	51.420	181.107	198.974
March	50.741	54.388	193.609	207.443
April	51.230	55.910	199.736	220.171
May	49.125	63.173	196.511	245.114
June	42.231	62.053	179.466	242.083
July	31.612	62.044	158.367	242.181
August	38.565	62.681	169.870	243.978
September	38.830		171.345	
October	41.241		179.307	
November	44.109		186.932	
December	42.635		183.368	
Av year		43.480		182.096

Lead	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
January	5.921	7.626	5.826	7.530	31.167	30.500
February	6.246	8.636	6.164	8.595	31.988	30.500
March	7.136	9.199	7.375	9.120	34.440	30.500
April	7.630	9.288	7.655	9.158	34.368	30.500
May	7.463	10.207	7.332	10.232	36.967	30.500
June	6.936	11.171	6.749	11.112	31.011	30.500
July	6.352	10.710	6.185	10.644	28.137	30.500
August	6.244	10.594	6.088	10.518	29.734	30.500
September	6.810		6.699		30.786	
October	7.000		6.898		30.716	
November	7.042		6.945		30.500	
December	7.513		7.405		30.500	
Year	6.853		6.777		31.359	

Spelter	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
Jan	16.915	9.619	16.745	9.449	89.810	48.329
Feb.	18.420	10.045	18.260	9.875	97.762	47.000
Mar.	16.846	10.300	16.676	10.130	95.048	47.000
April	16.695	9.459	16.525	9.289	99.056	54.632
May	14.276	9.362	14.106	9.192	94.217	54.000
June	11.752	9.371	11.582	9.201	68.591	54.000
July	8.925	8.643	8.755	8.473	60.750	54.000
August	8.730	8.360	8.560	8.190	51.587	54.000
Sept.	8.990		8.820		52.095	
Oct.	9.829		9.659		54.159	
Nov.	11.592		11.422		56.023	
Dec.	10.665		10.495		55.842	
Year	12.804		12.634		72.071	

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

Pig Iron, Potts.	Bessemer†		Basic‡		No. 2 Foundry	
	1916	1917	1916	1917	1916	1917
January	\$21.60	\$35.95	\$18.78	\$30.95	\$19.70	\$30.95
February	21.16	36.37	18.93	30.95	19.51	30.95
March	21.81	37.37	19.20	35.49	19.45	35.91
April	21.65	42.23	18.95	38.90	19.45	40.06
May	21.78	46.94	19.11	42.84	19.58	43.60
June	21.95	54.22	18.95	50.05	19.34	50.14
July	21.95	57.45	18.95	53.80	19.20	53.95
August	21.95	54.17	19.20	50.37	19.22	53.95
September	22.88		19.58		19.53	
October	24.61		21.26		21.51	
November	30.07		28.18		26.55	
December	35.16					