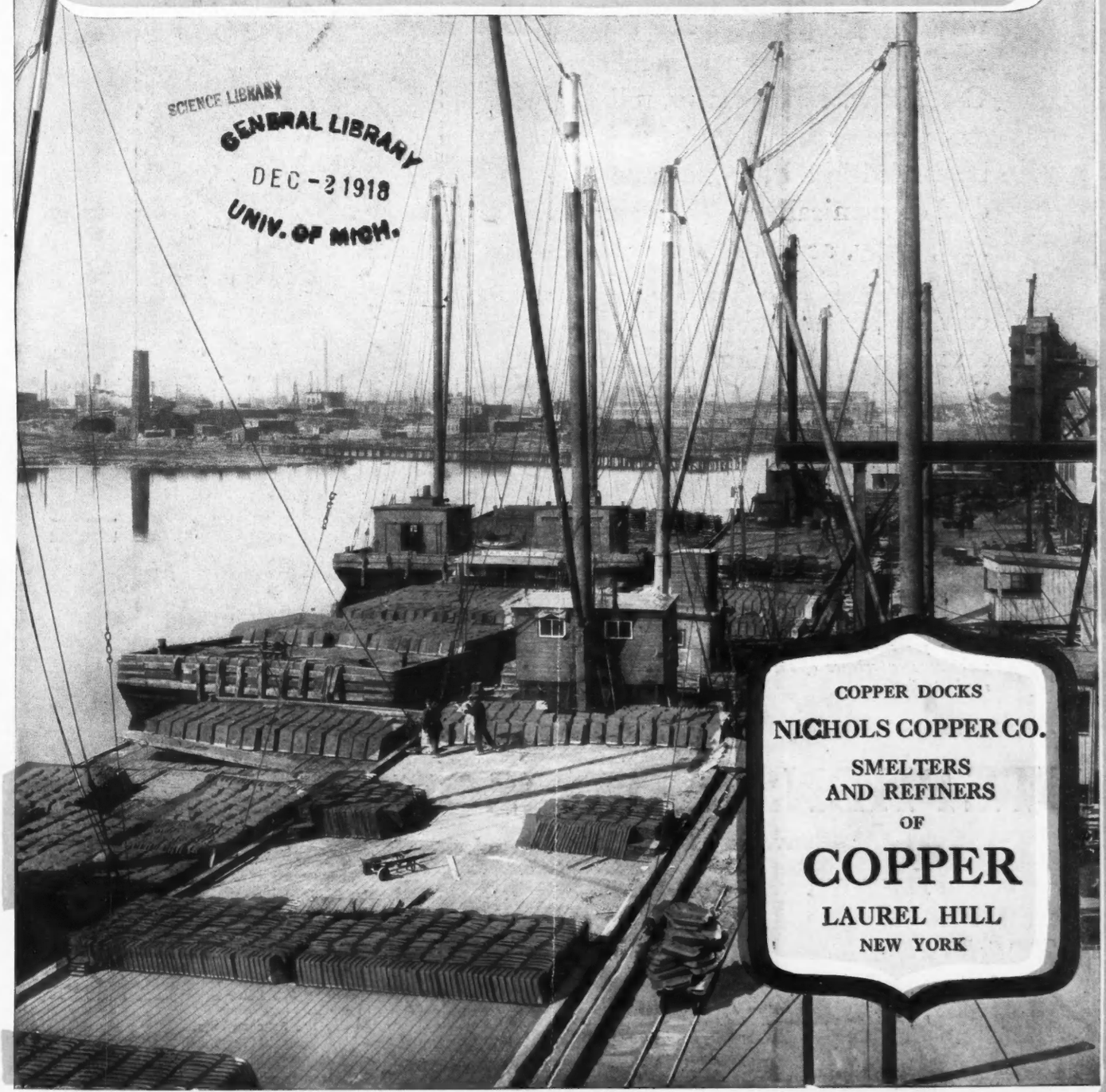
# Engineering and Mining Journal

McGraw-Hill Co., Inc, Price, 20c. New York, November 30, 1918





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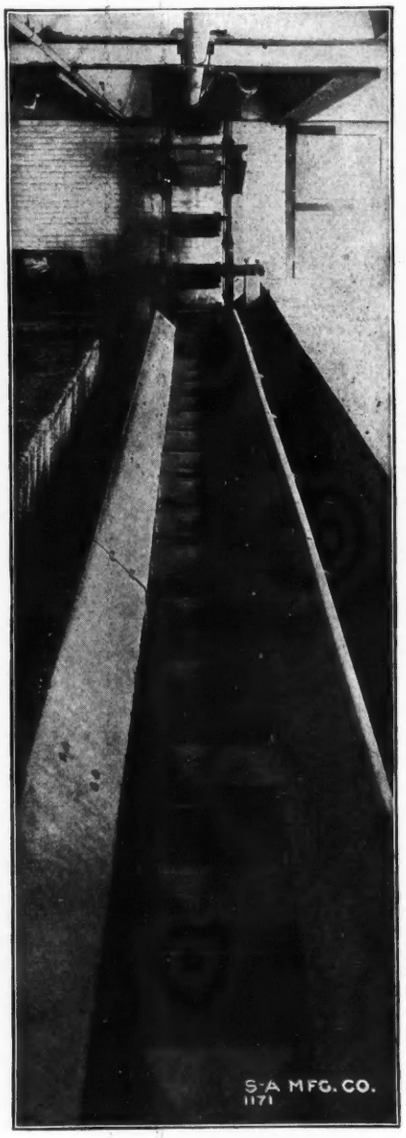


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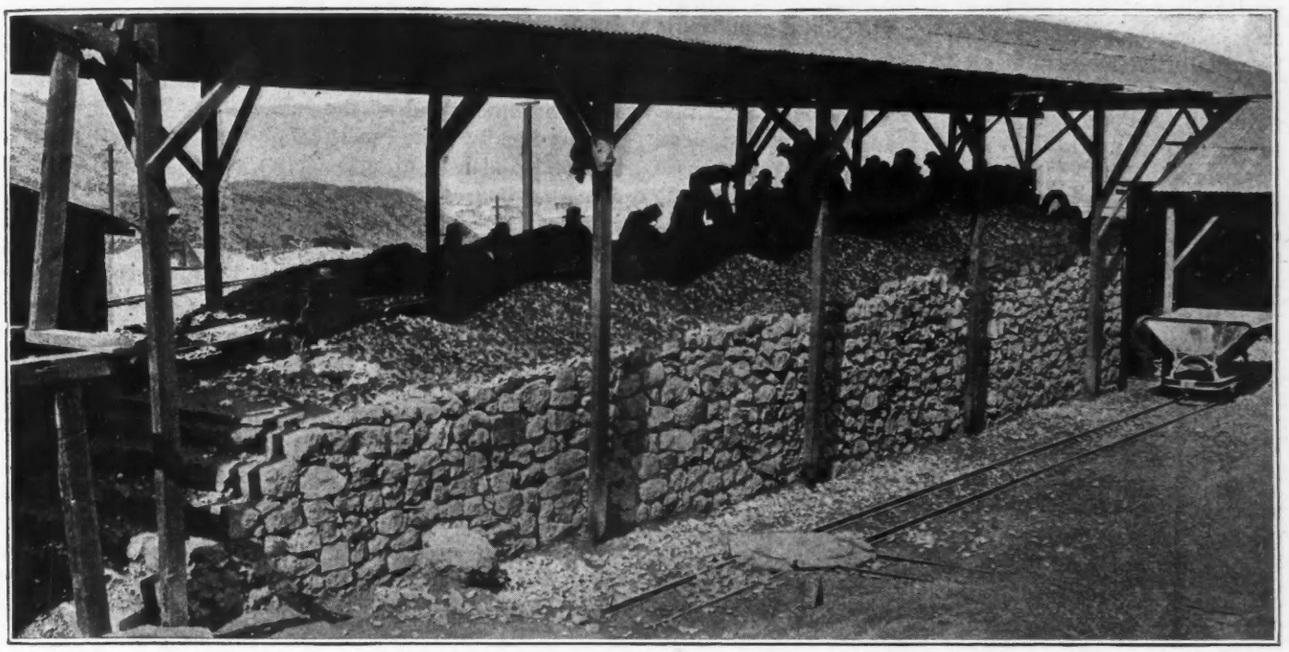
Volume 106 Number 22



SORTING TIN-SILVER ORE AT ORURO, BOLIVIA

# Sorting Ore for Metallurgical Treatment

By A. W. ALLEN

*An analysis of the factors influencing the question of the feasibility of hand sorting the ore going to a mill, and a consideration of the various advantages resulting, in comparison with the cost involved. Sorting is easy in some cases, difficult in others. It is obviously beneficial in many instances, although of doubtful value with certain ores. No invariable rule, to cover all the different conditions encountered in ore treatment, or applicable to the numerous classes of metallic minerals, could be logically formulated. An exact knowledge of conditions is an essential prerequisite toward determining the applicability of ore sorting and the forecasting of results.*

ORE sorting is the term applied to the separation, by hand labor, of a metallic ore into grades, usually according to values. It is preceded by the mining of the vein or deposit; it is followed by concentration—both elaborations of the practice of sorting, but both outside the purview of this paper.

Sorting may produce a high-grade product, or a waste product, or both; or two products of value, but with different characteristics; or two products whose collective value would be lowered if they were shipped mixed together. The purpose of sorting is to avoid the expense of complex treatment—crushing, concentration, classifying, and similar processes—by producing a concentrated product by direct and simple means; or it may be adopted to reduce the amount of waste or low-grade material associated with the ore, for the purpose of lessening the work of subsequent reduction, or in order to obviate the ill effects which might arise from the crushing of some undesirable barren or mineralized material, and its admixture with the ore.

The complexity of the purpose of sorting tends to cloud the issue, and often prevents a clear conception of the subject. Rich portions of an ore can sometimes be picked out and sent to the smeltery, yielding a higher return per ton than the final concentrate produced after considerable expense. In such cases there are obvious advantages in favor of sorting, especially as a greater net realization of metallic content is made by shipping direct rather than by intervening a complicated milling and concentrating process, where the rich mineral must first be intimately mixed with poor mineral and valueless rock before again being isolated into shipping form.

When the grade of material produced is lower than the grade of the concentrate that it is possible to obtain

by metallurgical treatment, the advantages of hand sorting may be determined only after a study of the comparative results of both methods.

### Removal of Waste by Hand Sorting

With regard to the removal of waste rock from ore, and obviously worthless ore from valuable mineral, the advisability of the operation is less open to argument; and, other than under conditions where the cost would be prohibitive, it is difficult to ignore the logic in the statement that there are obvious advantages to be gained by sorting out and rejecting the worthless material before milling is begun. In certain instances, however, the difficulty of separation is great—there may be no definite line of demarcation between the two substances, and the cost of labor may be so high that there is no apparent advantage in interfering with the mechanical progress of the ore and its associated waste as it passes through the various processes of reduction and concentration.

### Applicability of Hand Sorting

Sorting is applicable to a wide variety of conditions in which gravitational or levitational[1] concentration is practiced. It is especially suitable if the mineral to be saved is friable, and, to use a common phrase, "slimes" easily. Under such conditions practically the whole of the sortable proportion can be recovered by hand separation, whereas, if sent to the mill, there would probably be a considerable loss by dissemination of the finely divided material through the larger mass of low-grade gangue. As in other phases of metallurgical work, it is usually advisable to extract, before final crushing, and by simple and direct means if possible, what may be easily removed in concentrated form; and not to rely on a subsequent process, even if highly efficient theoretically, to make the separation which exists before the mineral is finely ground and intimately mixed with the low-grade gangue during the various phases of milling and conveying.

### Personal Element Affects Question of Applicability of Sorting

When there is no clear line of demarcation between what should be sorted for discard and what should go to the mill—between the appearance of high-grade and medium-grade ore—it is best to be less decisive as to the advantage of hand sorting. The personal element must be taken into consideration. Will the separation be made strictly in accordance with predetermined decisions as to exact metallic content of the various products, or must a variable factor, depending on the efficiency of the sampler in charge, be used in preparing all estimates?

A concentrating mill, when in regular operation and under competent supervision, is, to some extent, "fool proof" as regards metallurgical results. The personal element, although a potent influence in the first place, when the design is being decided and comparative processes or methods of reduction and treatment are under consideration, is more or less an indirect influence; and the mill crew is there to see that everything goes as the designer of the mill planned that it should go. This may be considered an extreme statement, but its purpose is to show that efficient concentration is the logical result of a properly developed scheme of mechanical and metallurgical treatment. Ore sorting by hand is an idea put into practice.

### Ore Sorting Demands Continuous Personal Attention

In the ore-sorting department personal attention is a continuous requirement. Perhaps in no other phase of mill work is it possible for a stupid workman to appear to do so much, and at the same time effect so small a total economy. The inefficiency of sorting, coupled with the real difficulty of making an efficient separation in many instances, is responsible for the fact that the alternative policy of milling sortable waste has often resulted in a net saving, it being cheaper to mill valueless material than to attempt to pick it out. On the other hand, the abolition of sorting may wisely be decided upon in a case where the method had been carried out in a highly efficient manner, as far as practicable, but where it was entirely unsuitable and should never have been adopted in the first instance.

### Sorting Previous to Chemical Recovery Methods

In wet chemical methods of ore treatment there are factors in favor of sorting which are not in evidence with simple concentration. Chemical processes of metal recovery are usually delicate operations, although the fact is not always realized; and expensive solvents are often used to a large extent in neutralizing refractory elements, besides being absorbed by colloidal and other retentive particles. Ore sorting under such conditions may result in important economies in the subsequent chemical treatment. A worthless clay can be removed by simple washing methods, and this may result in a higher milling duty, better classification, and less chemical consumption of solvent when the solvent acts in conjunction with an alkali to neutralize acidity and effect coagulation and settlement.

Many ores are harder and more dense than the incasing rocks, and, if a large quantity of the latter is included in the material going to the mill, one result will be the production of an unnecessary proportion of slime, with the concomitant ill-effects of hindered settlement, ineffectual separation, and difficulty of final filtering or drainage.

### Waste Often Deleterious

Colloidal clays—in common with numerous other materials in a similar physical condition—exhibit highly absorbent properties when brought in contact with a liquid, besides requiring an electrolyte to settle them effectively in the water or solution used. Such colloids may have a selective preference for a certain component of a solution which will effect coagulation and settlement, and this often results in the adsorption of the metallic ion of the electrolyte. As regards absorption, however, colloids will exhibit less preference under normal circumstances. If the solution is merely alkaline water, then alkaline water will be absorbed. If the solution is gold potassium (or sodium) cyanide—formed by milling a gold ore in cyanide solution—there is little doubt that this will be abstracted without material alteration, and in much the same way that a sponge will

[1] A term adopted to refer to flotation and similar methods of concentration.

suck up water. Experience has shown that solution absorbed into the structure of colloids is removed only with considerable difficulty. Consequently, with methods of recovery of metals from ores in which a chemical solvent is used, it should be realized that the presence of an absorptive colloid is likely to occasion serious loss. If the colloid can be removed by prior sorting or washing, there is every reason to advocate such a course.

### Difficulties Encountered With Clayey Ores

If, as frequently happens, the colloidal clay associated with or forming part of the ore contains metal to be recovered, in sufficient quantity to justify treatment, or in amount that would make it poor practice to disregard, then every effort should be made to see that full and complete absorption by all colloidal matter occurs in the first place with an electrolytic solution containing no metal of value. Thus a clayey gold ore may be milled in lime water and will, later, absorb less gold (to be retained in the residue after complete displacement treatment) than if milled in a cyanide solution containing gold, or in which metallic gold is immediately dissolved.

### Sorting Gold and Silver Ore

With gold and silver ore there are few instances in which sorting can result in the shipping of a product of so high a grade as is obtainable after complete metallurgical treatment. It is practiced more for the purpose of removing waste, although under unusual conditions a high-grade product, suitable for shipment or special treatment, may be made.

The fundamental idea underlying the removal of waste by sorting is that the method concentrates the ore for treatment. By reducing the bulk of the material going through the mill, the wear and tear will be lessened, and a greater net ore tonnage can be handled. From the mechanical standpoint there are obvious advantages in favor of the removal of waste before milling.

### Economic Results From Sorting

From an economic point of view, the question is more complicated. If the total milling and treatment costs in a particular installation are $5 per ton, then it is unreasonable to argue, as has been done, that $20 a day will be saved by reducing the amount of material going to the mill by four tons, i. e. by sorting out this amount of waste. Unless the amount of waste removed is a considerable proportion of the total tonnage being treated, little comparative effect will be made on working costs by the reduction in tonnage handled. Costs per ton are usually in inverse proportion to the magnitude of operations in the first instance; they can nearly always be reduced by an increase of tonnage—thus indicating a net rise in the total costs, but not in strict proportion to the added duty. Conversely, a small reduction in tonnage will usually be accompanied by only a slight lowering in total working cost and an increase in cost per ton. This point should be taken into consideration when the economic effect of hand sorting is under discussion.

### Effect of Sorting on Metallurgical Results

From the metallurgical standpoint there are obvious advantages in reducing the amount of worthless gangue that enters the mill. In concentrating plants, most of the equipment has an operating efficiency governed strictly by the quantity handled. Surprising results can sometimes be obtained from certain concentrating tables if the tonnage is reduced far below the generally accepted minimum. On the other hand, it is difficult to obtain consistently satisfactory results from machines which are continuously or periodically overloaded. In most mills the plant is operating at full capacity, and any scheme which insures a reduction in tonnage treated, without lowering the grade or amount of output, should be encouraged. It is undesirable to place too much support on theoretical considerations as to the cost of sorting as compared with the cost of milling. Practical operations usually disclose factors which seriously affect conclusions based on such data. The safest way is to operate by both methods, under conditions as nearly parallel as possible and for an ample length of time, and compare results.

### Effect of Sorting in Chemico-Metallurgical Operations

The concentration of ores by sorting, as a preliminary to treatment by some chemico-metallurgical process, results in a higher grade of solution being circulated than would otherwise be the case. Practical results have shown that the dissolving of the metal is the easiest phase of the process, and that the complete or nearly complete isolation of the metal-bearing solution presents the greatest difficulty.

When a solution containing a metal to be recovered is brought into contact with valueless gangue or waste —especially when the latter is of an absorbent nature, such as colloidal clay—there is liability of loss due to absorption and adsorption. Of the two it is probable that absorption figures more largely in actual effect; and experimental investigations and the results from large-scale operations tend to show that such absorption, as regards metal of value, is more or less proportional to the concentration of the solution, thus indicating a distinction between absorption and adsorption, where the amount removed does not increase in arithmetical progression, although the increase is regular. The main abstraction—by absorption—is therefore usually proportional to the grade of the ore. To avoid the high residue which may, and usually does, result from the direct chemical treatment of a high-grade ore by solution methods, it is advisable, wherever possible, to reduce the original amount of metal contained by some simple process such as amalgamation. This is done with gold ore with conspicuous success.

After such preliminary treatment, the tailing is, comparatively speaking, low grade; the subsequent wet process is invariably as successful, as regards final residue loss, as if it had been carried out on an ore of similar value. A preliminary treatment by amalgamation often recovers metal which is not in a condition to be effectively dissolved without an unjustifiable expense in preparing it, as well as the accompanying gangue. A lower residue is therefore obtained after (1) sorting to remove waste and so raise the grade; (2) efficient preliminary treatment to extract as much metal as possible, followed by (3) dissolution of the remainder by a chemical process, and final recovery by means of the usual methods of precipitation and realization.

An additional and important factor in favor of hand sorting of mill feed is that it affords ample opportunity for the removal of foreign matter which, if sent to the mill, might cause damage, loss of time in effecting repairs, and other troubles.

### Sorting of Tramp Steel and Dynamite Necessary in Many Instances

It is difficult to prevent an occasional stick of dynamite from reaching the crushing plant, where it may do no harm; but if it is not removed before it comes to the mill a serious accident may happen. Short pieces of drill steel, known as "tramp" metal, accidentally left by miners, may pass through the primary crusher without ill effect, but will certainly cause damage with secondary crushers designed with comparatively small discharge apertures. Metal of this description may be removed by means of electro-magnetic devices, or by hand. The sorter, if the latter system is employed, will also be available for the removal of high-grade ore, waste, or other débris.

The ill-effects of the passage of tramp metal through crushing machinery may be minimized by the provision of shearing pins on shaft couplings, or other connecting parts, or by constructing the toggle plates of swinging-jaw crushers in two parts, with a lap joint held together with shearing pins. In common with all safeguards, such provisions are well worth while. Prevention is, however, better than cure; and by adopting the precaution of primary sorting, the result will be that less time will be lost in effecting repairs, carelessness will be discouraged, and the shearing provision or other safeguard adopted will act as a safety measure in emergency only, leaving the operator with a sense of security and a freedom to concentrate his supervisory efforts in other directions.

### Removal of Débris From Rock

The advantages claimed to result from the practice of sorting tramp metal and dynamite from ore are equally pertinent with regard to débris. Such material comprises pieces of timber planking, paper, half-burned fuse, sacking, and, occasionally, organic matter and charcoal found in old stopes, or associated with surface deposits subsequently used for filling purposes. Débris of the sort mentioned can cause a vast amount of trouble in milling operations by choking screens and so causing delayed discharge and uneconomical reduction. Its inclusion with the ore results in an unnecessary and wasteful consumption of neutralizing alkali, and so hinders effective settlement and classification.

In chemico-metallurgical operations an element of instability is added to the process when foreign matter is not previously sorted out. High chemical consumption is likely to occur when an unstable solvent like cyanide is used, and foul solution will result, from which the valuable metals are precipitated only with difficulty. When charcoal is included with the débris, it often acts as an adsorbent of gold solution, thus occasioning serious and unrecoverable loss.

Sorting is a logical policy under such circumstances; and when the question of the removal of waste by hand is under discussion in the first instance, the fact that sorting of débris is highly advisable, in any case, should be taken into consideration.

## Subterranean Noises in Australia*

By W. H. Ferguson

Sounds resembling explosions which could not be traced to any mining or quarrying operation are heard at intervals in the Daylesford district of Victoria, Australia. When at Shepherd's Flat, Yandoit, and the Pickpocket Diggings, between Clydesdale and Newstead, I made inquiries as to whether the sounds were heard at these places, and, being assured that they were, I asked several people to point out the direction from which the sounds appeared to come. Compass bearings were then taken to the points indicated. One bearing was taken at Shepherd's Flat, one at the village of Yandoit, five miles to the north, and one at the Pickpocket Diggings, about three miles further north.

The sounds are described as resembling thunder, or the explosions made in blasting rocks. They may occur singly, or two may be heard in rapid succession, and more frequently in wet than in fine weather. The noises are said to come from a portion of the Yandoit hills known as the Stony Rises, near a branch of the Green Gully Creek. The residents are of the opinion that they are caused by explosions of gas, and state that birds and rabbits which were supposed to have been suffocated by gas have been found dead in hollows of the ground.

This part of the parish of Campbelltown was not visited, but an inspection of the geological map of the parish shows that basalt has flowed down a branch of the Green Gully Creek, and remnants of the flow exist as a series of low hills. These trend down the creek, which may have been eroded along the strike of the Ordovician rocks, or possibly along a fissure. Noises like those described by the residents of the district have been heard in many places in other countries, and are generally known as brontidi (like thunder); in India they are known as barisal (guns), in Mexico as bramidos (bellowings), in Italy as marina (sea shore). In some instances they precede earthquake shocks or volcanic eruptions; in others they increase in frequency and then gradually die out without any earthquake or volcanic disturbance.

It is not certain that the Yandoit noises are really brontidi, but it is not at all improbable that they are. The bearings taken indicate that the noises proceed from a part of the parish through which there apparently passes a line of weakness, the surface indications of which are a series of mineral springs, and on the southern extension of this line is a line of fissure eruption. It is possible that the noises originate along a fault line, that movements are yet taking place, and that these cause the sounds.

There is another possible explanation, in that the locality where the sounds are heard is volcanic, and the part indicated by the bearings is within five miles of Smeaton Hill, or Mount Koorocheang, an extinct volcano where faults are known. About 10 miles south of the place where the supposed brontidi emanate, three extinct volcanoes, Eastern Hill, Mount Prospect, and Langdon's Hill, indicate a line of fracture of the earth's crust. If this line be produced northward, it would pass close to where the sounds are supposed to originate.

*Excerpt from the records of the Geological Survey of Victoria.

# Standardization of Mining Methods III—Ventilation of Metal Mines*

BY CHARLES A. MITKE†

*The need for mechanical ventilation of metal mines, the various systems employed, and the benefits derived in lessened costs and increased output are discussed, with particular reference to mines of the Southwest. In general, there is no standard as to what constitutes a good working atmosphere. A ventilation system is best planned when developing new orebodies, and should be kept up to date as such work progresses. Prospect and development work may require auxiliary systems. Equipment and practice should be standardized to such extent as is possible.*

IN THE early stages of the development of metal mines, all prospect work is necessarily directed toward finding ore, and little or no consideration is given to the subject of ventilation until the orebodies are discovered. In prosecuting this work, natural ventilation is utilized to its fullest extent until all its possibilities are exhausted. It is then generally supplemented by the installation of a few small blowers. These answer the purpose temporarily, until the prospect develops into a mine, when, in the course of time, the natural ventilation frequently proves insufficient, and a scheme of mechanical ventilation must be worked out.

Much has been accomplished in solving the ventilation problems in coal mines, but it is only recently that this subject has received serious consideration by metal miners. In the past, practically all mines were ventilated by natural means, and the miners were expected to do their best under the varying conditions, which are always poorest during the summer, as is evidenced by the decreased labor efficiency in the summer months.

It became inceasingly apparent in recent years that conditions of natural ventilation were inadequate to meet the needs of the metal mines of the Southwest, and the question arose as to what extent improvements could be made in ventilation by mechanical means in order to bring about the desired change in the temperature, humidity, velocity and volume, and as to what should constitute a "good working atmosphere." No readings had been made to determine the volume of air entering or leaving a mine; the necessary quantity of air per man per minute; to what extent the humidity would be increased from the time the air entered the mine until it reached the different outlets; the amount of air needed to clear away the smoke during ordinary blasting in the average mine workings; or the total friction losses, due to the extreme irregularities of the workings, which may be termed "the mine resistance."

In some states standard requirements for ventilation in mines are prescribed by law, but, in general, this is left to the discretion of the operators. The Arizona mining law says that "the total quantity of carbon dioxide present in the air shall not exceed 0.25% by volume, except that at any place where firing of explosives has been done a higher percentage of carbon dioxide shall be permissible for a reasonable length of time after the last explosion. . . ." The Anthracite Mine Law of Pennsylvania specifies a minimum quantity of 200 cu.ft. of air per man per min., and the law further stipulates that the amount of air in circulation shall be sufficient "to dilute, render harmless, and sweep away, smoke and noxious or dangerous gases," proving that even in coal mines, where the problems of ventilation have not the intricacies found in metal mines, no fixed standard has been adopted upon which to base figures for a "good working atmosphere." This, then, was the problem that confronted the ventilating engineer.

There are two methods by which the degree of ventilation may be determined: (a) According to the quantity of pure air per man per min. entering the mine; (b) by determining the amount of impurity present by making a chemical analysis of the air. The quantity standard is less expensive and more practicable, and is the method most generally used. The quality standard is expensive, and its application is necessary only in exceptional cases. It has only a remote bearing on the efficiency of the men, but occasionally it is found advisable to have accurate determinations made on several samples of mine air.

### HUMIDITY CAUSES MANY MINES TO SEEM HOT

After a large number of readings had been taken, it was found that in many mines, though the temperature was not high, the humidity was excessive, the velocity low and the volume small. A stope having a temperature of 80° F. and a humidity of 99% seemed excessively hot, though another stope with the same temperature and a humidity of 75% was comparatively cool. This was affected somewhat by the velocity and volume of the air in the working places. The greater the velocity and volume (provided the temperature and humidity were constant), the cooler the stope appeared to be. For example, the following readings were taken in a stope that was evidently in need of better ventilation: Velocity, 10 ft. per min. (approximately); volume, 50 cu.ft. per min. (approximately); temperature, 84° F., and humidity, 96 per cent.

A small 5-hp. blower was forcing air into this stope. The miners were uncomfortable and complained of the excessive heat. Five months later, after a new ventilating system had ben installed, the following readings were made in the same stope: Velocity, 100 ft. per min.; volume, 500 cu.ft. per min.; temperature, 84° F., and humidity, 90%. The miners mentioned happened to be working in this stope on that date, and one miner remarked, "The stope is not nearly as hot as it used to be, and we can work much better." The men did not sweat excessively in this atmosphere, and the greater

*The third of the series of articles which began in the Nov. 9 issue
†Mining engineer, Bisbee, Arizona.

comfort that they experienced was due to the increase in velocity, which also means an increase in volume, with lower humidity, and not to the temperature, as it was the same in both cases.

After a number of experiments had been made, the following specifications were decided upon as constituting a "good working atmosphere": Temperature, 78° F.; humidity, 80%; velocity, 125 ft. per min., and volume, 350 cu.ft. per man per min. Though there were some places in the mines where the velocity and volume were much higher than this, there were others in which they were lower; consequently, this was taken as an average of all the velocities and volumes in working places in the mines in which the tests were made. It was found that in an atmosphere of this character men could be expected to perform a fair day's work, and that smoke and gases from the mine were diluted and finally carried off. This working atmosphere has been found to be particularly suitable for mines in the Southwest.

### Careful Study Must Precede Installation of Mechanical Ventilation Equipment

In mines where mechanical ventilation is required painstaking consideration should be given as to the kind of atmosphere which it is advisable to establish. When this has been determined, a thorough study of the mine and workings should be made in order to obtain definite information concerning underground conditions. In order, therefore, to estimate the amount of air which will be necessary for the desired working atmosphere, the following factors should be taken into account: Number of men and animals in each district, the production of $CO_2$ or other gases, relative humidity, temperature, amount of explosives used, the distance from currents of good air, the number of lights, air leakage, friction of the air currents, number of splits of the air current, and method of distribution.

In mines where there is considerable square-setting in ores containing much sulphur, and where a large amount of timber is used for doubling up, bulkheading and similar work, a greater volume of air will be required to maintain the same good working atmosphere than in mines where the cut-and-fill system is used, with its usual limited amount of timber. The same may be said of top-slice stopes. In top-slicing, there is a large timbered mat directly over the men, which usually cuts off any outlet to surface. Stopes of this character are more difficult to ventilate, and take more air, than shrinkage stopes, which have practically no timber and where the ground is so firm that connections above the usual workings are easily maintained as outlets for the air. In caving methods using the incline-raise system and extensive grizzly levels, it is necessary to do a large amount of blasting, first in drawing the ore down to the grizzly level, and, second, in breaking boulders on the grizzly. This naturally results in a large amount of powder smoke, and it is consequently necessary to provide for an unusual quantity of air in order to maintain a good working atmosphere.

### Ventilating Systems May Aid Fire Fighting

Ventilating systems have been planned in a few mines and installed primarily as safety measures to permit immediate attack being made on possible mine fires, and only secondarily as aids to ventilation, the natural air currents having proved fairly satisfactory. In most cases, however, the direct object for which a mechanical ventilating system is installed is to improve the atmosphere, and its use in fire-fighting is given only secondary consideration.

By far the most economical method of installing a ventilating system is to work out a comprehensive scheme of mechanical ventilation (using the natural air currents wherever possible), in connection with the development of new orebodies, so that, when the orebodies have reached the producing stage the necessary air connections will have been made. Ventilation should go hand in hand with stoping, both being planned simultaneously, so that, when the latter is begun, the ventilating system will also be in operation, making it possible for the men to perform their duties in good air.

One of the objections to installing a ventilating system as the orebody is developed is that, if the installation is delayed, it may be found possible to get along with the natural ventilation. However, in the majority of cases this can easily be foreseen, and in practically all deep mines mechanical ventilation is a necessity. It always costs more to put in such a system afterward, when many new connections must be driven, than it does if planned right in the first place with the development of the workings.

### Separate System for Development Work

Frequently, after a ventilating system has been installed, the necessity for its expansion, coincident with the stoping, is overlooked, and, while the stoping continues, nothing is done toward the ventilation, so that in course of time, as the workings increase, it loses its effect and fails to serve the purpose for which it was designed. It is therefore highly important that the ventilating system be expanded to meet the constant changes and progress in stoping.

There are two systems of mine ventilation, the exhaust and pressure. In the exhaust system, the fan is usually on the surface, and exhausts the vitiated air from the mine while the fresh air enters through the working shafts and flows in to take its place. The pressure system usually has the fan placed underground, near the main downcast shafts, which should also be the working shafts, and forces the air through the workings by putting the entire mine under pressure, the air finding its way out through shafts, raises, or ground caved and broken to the surface. Most installations in the Southwest are of this latter type, because shafts at many of the largest mines are all operating shafts and cannot be spared for ventilation purposes only. It is, therefore, impracticable to put a suction fan on the surface at an operating shaft. The placing of fans underground has given satisfaction, nevertheless, as, owing to the use of double doors, there has been practically no short-circuiting of the air.

### Correct Distribution of Air Principal Object

The mere installation of mine fans, however, does not constitute a complete system of mechanical ventilation. The proper coursing and distribution of air through the workings is the only effective test of the efficiency of a ventilating system. In a few mines large fans have been installed without much attention being given to this important consideration, and a thorough

study of the workings would show that better ventilation in general could be obtained with half the number of fans, provided the mining features that are involved received proper attention. This would not only improve the ventilation but would materially reduce the cost of the ventilating system.

The capacity of fans which have been installed varies from about 10,000 to 200,000 cu.ft. of air per min., the pressure or suction being from 1 in. to 5 in. The large-capacity fans of from 250,000 to 400,000 cu.ft. of air per min., which are found in coal mines, are impracticable in metal mines, except in a few instances, because the total intake or outlet areas of shafts in metal mines are not nearly equal to those in coal mines.

Some mining companies have installed reversible fans, the idea being to reverse the fan in case of fire in a downcast shaft. However, after consideration of the 35 mine fires which have occurred in the Southwest during the last seven years, I find that in no case was it necessary to reverse the fan. In fact, in nearly every instance the danger would have been increased, because the men expect the air to keep moving in a certain direction, and, if the air currents should be changed without their knowledge, there would be danger of the miners being caught in gas.

### Simplest System Uses One Central Installation

The most inexpensive ventilating system, using pressure, consists of one central installation (either on surface or underground) with large intake and a discharge into diverging drifts, from which the air is further discharged into still larger areas. In the suction system, the blower is usually on the surface, and all drifts from the workings should converge to the central intake at the fan, through which the air is drawn to the surface and discharged. One central installation, however, using either pressure or suction, ordinarily could not supply adequately the scattered workings, which require in most mines from one to four additional installations to be satisfactorily ventilated. Occasionally, "booster" fans are used as an aid to the general ventilating system. Two or three mines are sometimes so intimately connected that, in order to work out a ventilating system for one, it is necessary to work it out for all. In some instances a combination of both the pressure and exhaust systems is adopted.

The installation of the mine fans is the smallest part of the cost of putting in a ventilating system. By far the greater expense is incurred in the necessary changes in the mine, such as cutting a blower station for mine fans (in case they are underground); driving drifts and raises to allow sufficient air to pass to ventilate the stopes; erecting doors in suitable drifts and crosscuts and putting in stoppings to cut off old workings and leaks which would impair the efficiency of the ventilating system, and making other similar and necessary alterations.

### Development and Other Workings Must Also Be Ventilated

The systems described above are for the purpose of ventilating the major portion of the workings, which comprise about 80% of the mine; the remaining 20% must be taken care of in some other way. This 20% generally consists of the prospect and development work, such as drifts, raises and winzes, and must be done in advance of the usual stoping operations. For this work it is necessary to use an auxiliary ventilating system, which should be standardized wherever possible.

When the headings are being driven in such work the exhaust air from machine drills is used to furnish the necessary ventilation. No compressed air is required when machines are running. The exhaust of the average machine gives approximately 100 cu.ft. of ventilating air per minute. However, it is well known that this is not the purest air, as it is vitiated somewhat by the oil which vaporizes in the machine and comes out with the exhaust. After blasting, the full head of compressed air is usually turned on to clear out the heading.

After drifts, raises, or winzes have been driven a certain distance, a point is reached at which the compressed air is insufficient, and it then becomes necessary to install artificial ventilation. An air jet, for example the Koerting-nozzle type, which uses a small amount of compressed air, at the same time having a strong suction so as to draw a large amount of fresh air

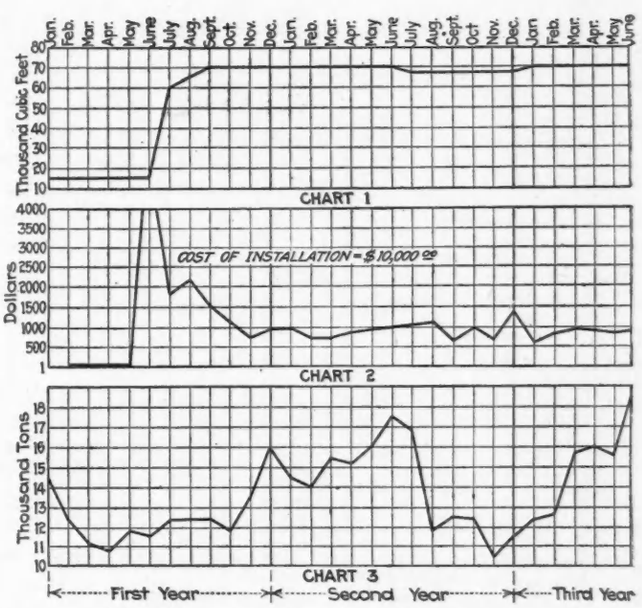



FIG. 1. CHART 1 ILLUSTRATES TOTAL VOLUME OF AIR MOVED PER MINUTE. CHART 2, TOTAL COST OF VENTILATION. CHART 3, TONNAGE PRODUCED

around the nozzle and force it through the ventilating pipe, is generally found sufficient. (One cu.ft. of compressed air will furnish approximately 18 cu.ft. of ventilating air.) As raises and occasional winzes are driven only about 100 ft., an air jet supplying air for 10-in. pipe should provide ample ventilation under average conditions. Drifts are usually driven longer distances, and should be provided with electric blowers. In general, a 10-in. blower, designed by standard manufacturers, using a 2½-hp. motor (both blower and motor mounted on one base) is suitable.

### Jets and Blowers Must Be Properly Placed

The position of air jets and blowers is important. If they are placed within the drift or raise to be ventilated, air will merely circulate between the blower and the end of the pipe. They should be situated outside or have the intake outside of the drifts and raises. The

pipe should reach to the working face, so that it will not be necessary to use compressed air. Before blasting, the sections near the face should be taken down and put where they will not be injured.

After the drift has progressed about 3000 ft., the blower should be provided with a reversing attachment in order that it may be reversed to clear the smoke away, and after that be run as a pressure fan, to furnish good air at the heading. In exceptional cases, principally in tunnel work, where speed is important, two blowers should be used, one for pressure and the other for suction. This permits almost continuous work at the heading.

### Ventilation May Be Standardized

With the introduction of mechanical ventilation, it has been found that the atmosphere in mines can be standardized instead of having shifting and uncertain currents of natural ventilation. It has also been demonstrated that this standard atmosphere is well within the economic limit and that it pays to ventilate a mine

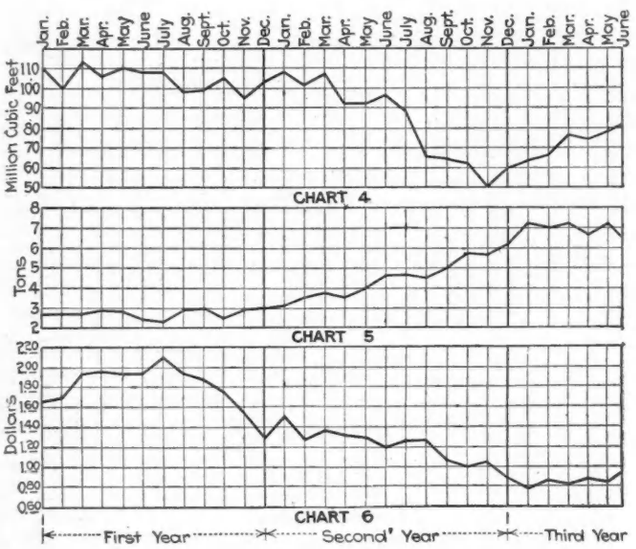



FIG. 2. CHART 4 ILLUSTRATES DECREASE IN COMPRESSED AIR USED AFTER INSTALLATION OF VENTILATION SYSTEM. CHART 5, INCREASE IN TONS PER MAN PER SHIFT. CHART 6, DECREASE IN COST OF MINING

by increasing the amount of air until such standard conditions are reached.

The velocity of air currents in working drifts has been brought up to 1200 cu.ft. per min., and in exceptional cases to 2000 cu.ft. The former figure approaches the economic limit at most mines where power cost is a large item, and the latter should be set as a maximum for safety. The "good working atmosphere" mentioned previously has been tried out in a number of mines in the Southwest for a period of over five years and has proved entirely satisfactory as a standard for conditions existing in this part of the country.

### Cost Sheets Prove Value of Good Air

Actual figures showing a reduction in costs and a decrease in consumption of compressed air prove the value of such an installation, and point to the results that might possibly be obtained were the standard made still higher by securing a lower humidity, lower temperature and greater volume of air per man per minute. The accompanying charts show the results obtained by installing a well-planned mechanical ventilating system, and cover a period of two and a half years.

Chart No. 1 shows the total volume of air moved per minute, and Chart No. 2 the total cost of ventilation. In chart No. 3 it will be seen that after the date of the installation of the mechanical ventilating system there was a marked increase in tonnage until the latter part of the second year, when, owing to unusual conditions, production was much curtailed. However, in the early part of the third year the tonnage again increased, and in June there was an increase of 4000 tons over that in January of the first year.

Chart No. 4 illustrates the decrease in the quantity of compressed air used, owing to the installation of the ventilating system. The curve shows the total amount of compressed air needed both for ventilation and machine drills. This accounts for the rise in the curve from November of the second year to June following, as the tonnage increased from 10,500 per month to 18,500 tons. Consequently more machines were used to break the ore represented in this added tonnage.

Chart No. 5 shows the increase in tons per man per shift. This is obtained by dividing the daily tonnage by the total number of men employed in the mine. The mining method used in this particular mine was practically all square setting, and all the ore had to be sorted. Only one stope in the entire mine was worked by the cut-and-fill method. The increase after the new ventilating system was installed was from about 2½ tons to 7 tons, or approximately 180 per cent.

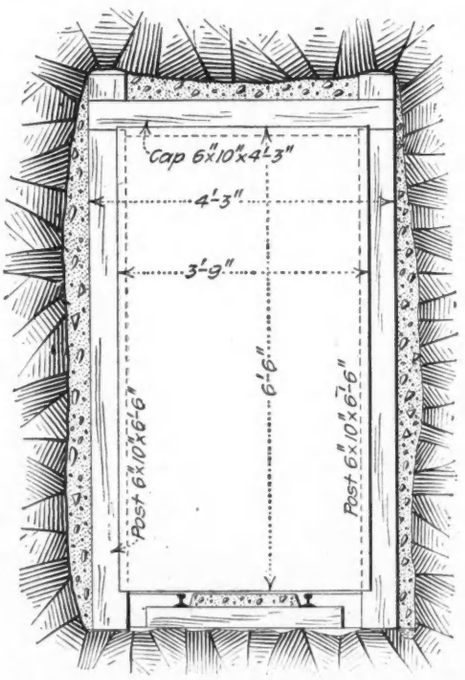



FIG. 3. DOOR FOR BOTH HAND AND MULE TRAM

Chart No. 6 illustrates the decrease in the cost of mining the ore, and an average for the first seven months of the first year, compared with an average of the seven months preceding June of the third year, shows a drop of from $1.57 to $0.85, or a decrease of $1.02 per ton.

Large fans are designed for the capacity, pressure or suction, as well as for the elevation where they are to be operated. Regarding small blowers, however, a standard size and design of electric motor, blower and ventilating pipe should be decided upon. A 2½-hp. motor, connected to a 10-in. blower and 10-in. ventilating pipe, is usually sufficient. It is important that a standard be selected, as, for example, the one mentioned above, as there are many mines where 8-in., 10-in. and 12-in. ventilating pipe, with different types of blowers and complementary apparatus, may be found in use at the same time. This is likely to cause confusion and delay because of attempts to attach pipe of the wrong size to blowers, and in other ways.

Either metal pipe or canvas tubing may be used for ventilating purposes. Metal pipe has been found satisfactory and is in general use in mines throughout the Southwest. When properly put up, with joints that are carefully sealed with burlap and tar, it requires no further attention, as joints of this character prevent leakage, and the angle at which the pipe is hung prevents water lodging in it. It stands up well under mining conditions, and when the usual precautions are taken to remove the lengths near the face before blasting, the pipe is usually not materially damaged by the small rocks which occasionally strike it.

Canvas tubing has the advantage of being more easily handled, as it can be taken down the shaft and hung in less time and at less expense than iron piping, and it is also more flexible in rounding curves, as iron pipe needs an elbow at every turn. There is, however, a question as to how its durability will compare with that of iron tubing under ordinary mining conditions. The difficulty arising through water gathering in it is also generally experienced, making frequent attention necessary. In some of my experiments underground, when the miners were ready to blast they would take down the canvas tubing, coil it up along the drift, and move it back a reasonable distance. At times some of the smaller pieces from the blast flew back and cut holes in the canvas, which damaged it considerably, and in addition, the tubing was subjected to the ordinary wear and tear of rolling it along the drift and coiling it up in places where there was frequently mud and water.

Some time ago experiments with small blowers and different kinds and sizes of ventilating pipe in 100 and 200-ft. lengths were made under my supervision. It was found that the velocity and volume delivered at the end of 200 ft. of 10-in. canvas tubing were considerably less than when delivered, under similar conditions, at the end of 200 ft. of 10-in. iron pipe. This made it evident that in order to deliver the same volume of air at the working face through canvas tubing that it is possible to deliver through the iron pipe, it is necessary to have a much larger size of canvas tubing, or else, if the same size tubing be used, the blower must be speeded up or a larger blower be installed. In places where the cost of power must be considered, the extra expense is important. Metal rings inserted in the canvas tubing at frequent intervals restore more nearly the condition effected through the use of the iron pipe, as they help to support the canvas, which otherwise would have only the air pressure as support. However, all these improvements add to the cost of the tubing, and

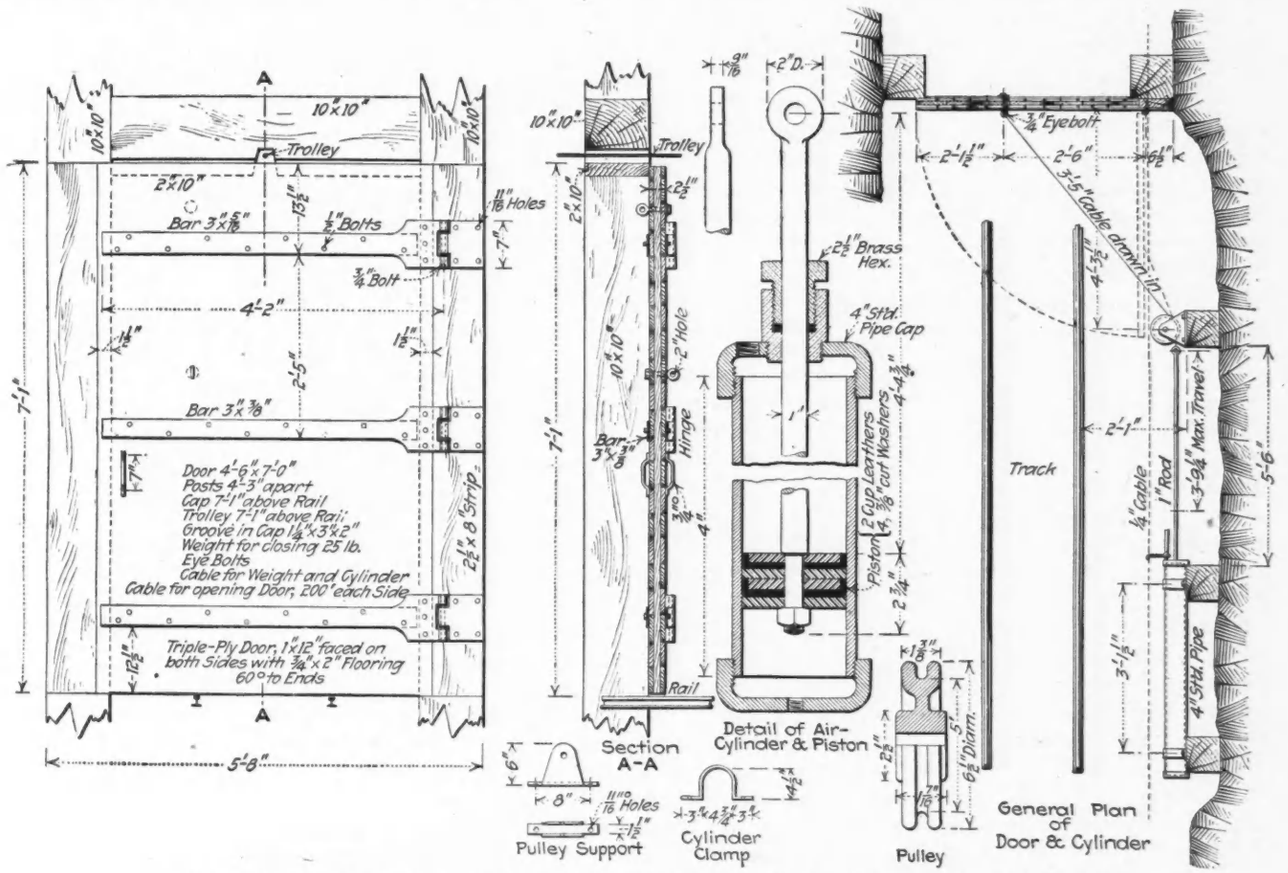



FIG. 4. DOOR FOR USE IN MOTOR HAULAGE DRIFTS, WITH AIR-CONTROLLING DEVICE

there is some question, when all is considered, whether, even under these circumstances, it would prove as efficient as iron piping.

In the mines in some districts stoppings are called bulkheads. These are used to seal off dead workings, air leaks, or drifts and raises leading to stopes which are not in operation. A stopping which may be adopted as standard should be constructed as follows: Suppose a drift is to be bulkheaded. The ground is first cut out around the drift where the stopping is to be placed. After that, 4 x 6-in. posts are set up, three feet apart, across the drift. Then 1 x 12-in. boards are nailed to the posts, making a partition. Metal lath is tacked on to the boards. In case metal lath is not available, double wire netting with small-diameter openings may be used. A fine coating of cement, ⅜-in. thick, put on either by hand or with the cement gun, is then applied. If only old workings are to be sealed off, and it is desired that some air should be allowed to pass through them, the cement and boards in the stopping, near the center, should be omitted. For example, a space 2 x 2 ft. should be left, but the wire netting should cover the entire surface. Should it be found desirable to seal up this space later, a cement coating may be put over the wire netting.

### Standardized Doors Should Be Used

All doors should be of standard size. In general, two standards are necessary. They are illustrated in Fig. 3 and Fig. 4. In Fig. 3 is shown the design of a door for both hand and mule tram. Fig. 4 shows a door for use in motor-haulage drifts. In the latter sketch details such as handles, hinges, weights, cable, pulleys and canvas are given. Fig. 4 also illustrates an air-controlled arrangement to be attached to the same door, so that motor trains may pass through without stopping.

The Canton automatic door has been installed in many mines and has given satisfaction when used against low pressures. Double doors should be placed in all important drifts where it is necessary to keep up either a high pressure or suction in order to force the air from the drift into more distant mine workings.

Regulator doors are constructed as are the doors, already mentioned, except that openings are cut in them and slides built in to regulate the flow of air. In this manner the volume of air to any area can be regulated so that all workings may receive their proportion of the air supply.

The necessary equipment in a mechanical ventilating system, such as doors, frames, hinges, weights, automatic arrangements, small motors, small blowers, and ventilating pipe, should all be standardized. Standard-size manways, timber compartments and chutes in raises should also be designed as an aid to the ventilating system.

In order to maintain the maximum production, with a corresponding high standard in the quality of the work, it is absolutely necessary that every working place should have a good working atmosphere, and that the ventilation should be so kept up with the progress of the work that the men may continue to perform their duties in health and comfort. Mechanical ventilating systems which have been designed with careful study and are now in operation have fully justified the cost of their installation, as evidenced by the increase in tons per man per shift and the decrease in cost. In mines where such a system has been carefully worked out and conditions have been standardized as much as possible, there has always been a great saving in the amount of compressed air used. In fact, in some cases the economy in this item alone has more than balanced the cost of installation.

Conditions can be made standard in mines only where a complete mechanical ventilating system is in operation. Fewer men will be gassed in headings when standard equipments are available and installed before the atmosphere becomes dangerous. There will also be less decay of mine timber. Further experimental work may suggest the advisability of raising the standard of mine atmosphere.

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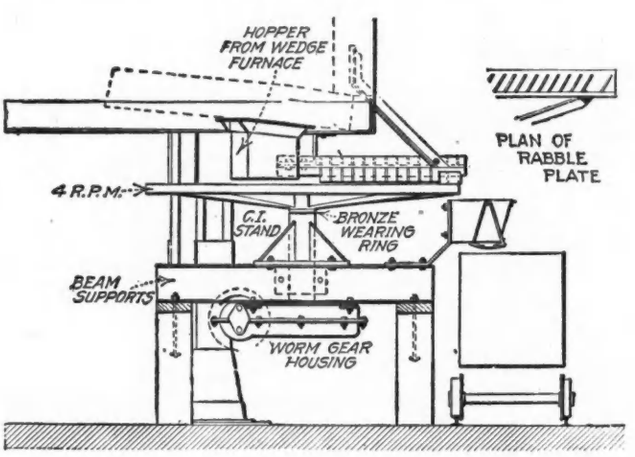
## Cooling Table for Roaster Product

By C. T. Rice

There are many ways of cooling the roast from a Wedge or other type of furnace. At smelteries where it is highly desirable, because of agricultural interests in the immediate vicinity, to avoid the discharge of all sulphur smoke except through the stack, the furnace product is sometimes cooled by means of a water spray on the bottom hearth, but at many smelteries such refinement in dealing with the smoke problem is not necessary. Under such circumstances the simple cooling table shown in the accompanying drawing, designed by Bradley, Bruff & Labarthe for use at the Bunker Hill smeltery, has much to recommend it.




COOLING TABLE FOR WEDGE FURNACE PRODUCT

This device consists of a rotating circular cast-iron table, driven by belt and worm gear from the same line shaft as the furnace. The roasted product falls on this, and is slowly worked over to the edge by a series of fixed rabble plates, and discharged into a hopper. From this hopper the product goes to a car, is weighed, sampled, and trammed to the steel bin which takes the Wedge roast. Water is sprayed on the roast in front of the fixed rabbles, in quantity necessary to cool it enough to permit mixture with the Dwight & Lloyd feed without injury to the belt conveyors used in making up the charge and in taking it to the different sintering machines.

# Utilization of Mine-Accident Reports

By D. E. CHARLTON

*Economy in the operation of a mine should include low accident costs, which are obtained only by means of preventive measures. A suggestive scheme is presented for the graphic expression of injuries that makes practical use of data already collected and incorporated in the standard mine-accident report. Some of the essential points in the study of accident prevention are considered, as well as the results that may be secured by a careful study of accident occurrence.*

THE standardization of mine-accident statistics has frequently been discussed, and through the excellent work of the Bureau of Mines most mining companies have followed a general form in the classification of accidents. Compensation laws of various states have made it compulsory that records of casualties be carefully kept, and mining companies in general have adhered to some plan or other which has enabled the public to know the manner in which their operations have been conducted and what efforts they have made toward providing safe working conditions for their men.

## Compilation of Statistics Is of Value in Safety Work

Filling out accident reports involves considerable labor, regardless of whether the information is secured in a careful or a careless fashion, but, assuming that average care is used in compiling an accident report, it is certain that the information could be used to more advantage than as a mere history of a specific accident, and that a careful analysis of the data secured would show that a number of reports, covering various accidents and carefully compiled, would constitute a basis for systematic accident prevention. Many operators adopt too much of the attitude taken by the man who bought a pulmotor "not because we really need it or think it is a good thing, but because the public demand it and it is good advertising." Records are sometimes kept merely to satisfy public opinion and the state or Federal authorities, and little thought is given to the possibilities of the report after due acknowledgment has been made to the authorities.

## Economy in Utilizing Mine Reports

There is no doubt whatever that accident prevention pays, and that its cost must necessarily be a part of the total operating expense, and the same care and study should be applied to the curtailment of accident cost as to economy in other branches of mine operation. It is seldom that new drilling or pumping equipment is purchased and then discarded without sufficient reason; in every case an effort is made to realize the fullest capacity from the material on hand, and the same principle may well be applied to the collection and compilation of accident data.

I recollect that while talking to a safety inspector for one of the large mining companies he made the remarkable statement that for that particular month 90% of their accidents had been caused by the men getting dirt in their eyes. Upon investigation I found that this was not a fact. The man had known merely that a number of accidents had resulted from that cause. Nevertheless, he realized that here was a prolific source of accidents, and, aside from the inaccuracy of his remark, he appreciated the necessity of efforts to prevent that type of accident. But the practice of singling out only the frequent and the major accidents cannot be considered to afford reliable data for a study of accidents, of their cause and of means for preventing them. The operator does not base his cost of production on the prorated price of the articles which he uses most, nor on the ones which require the greater outlay of capital. And in making use of accident reports in building up a safety campaign, all the data which in any way relate to safety are of value.

## Standard Accident Reports Aid in Securing Accurate Data

A careful study of a standard accident report will disclose latent possibilities. To many operators, a complexity of statistics is an abhorrence, and doubtless an overdoing in this direction will lead to indifference, but, with discretion, there is no reason why carefully prepared data cannot be classified in such a way as to be of great value to the mine manager and to those intrusted with the safety of the men.

The modern idea of having professional medical attendance for all accidents, no matter how trivial, is generally accepted as good policy, not only because it insures a complete understanding of the nature of the injury, but for the additional reason that it often prevents developments which may result seriously. Further, it offers an excellent medium for the collection of accurate data, as most of the information required can be secured at the time of injury. All accidents should be reported, regardless of the extent of injury, for, unless this is done, certain occurrences which appear trivial may go unrecorded, frequently developing complications long after there is apparent reason to look for them, and because lack of continuity in the records will be an obstacle to the institution of a safety campaign.

## Keeping the Men in Touch With Safety Progress

A further argument in favor of carefully kept statistics is the psychological effect upon the men. No conscientious miner is content merely to blast his holes and then maintain indifference as to the manner in which the round has broken. He usually finds out what the results are, and not infrequently determines his plans for the next round or for future work by the manner of breaking. Assuming that safety and accident prevention have been given prominence, the men will naturally show interest in the progress which is being made, and the mine safety bulletin board may be supplemented to excellent advantage by the posting of plats and charts showing the progress or retardation

of safety work. The manner of preparing charts and diagrams is limitless and lies entirely with the man in charge of the work, who can use his judgment in presenting those phases which he considers as best fitted to bring out the points he wishes to emphasize.

In suggesting various ways in which the compiled accident statistics may be made of value, I have made use of an accident report, shown in Fig. 1, which has been adopted as a standard by one of the larger iron-mining companies and embodies a mass of information which, if properly secured, constitutes not only a valuable record but a means of presenting the particular accident to the safety engineer or safety committee in such a way as to facilitate a study of the case and suggest a remedy. In common with most accident reports, its adoption was not agreed upon until it was found to embrace all necessary points.

A study of the report in Fig. 1 will show that some

.....Mine

**Mine Report of Accident**

**Employee**

(1) Name of person injured ..... (2) Brass Check No. .....

(3) Address ..... (4) Date of birth .....
Street No. Town

(5) Nationality ..... (6) Does he speak English ..... (7) Daily wages $ .....

(8) Single, married or widower ..... (9) Occupation ..... (10) How long in our service .....

**Time, Place and Cause of Accident**

(11) Date and hour of accident ..... M ..... 191 .....
Hour Day of Week Month and Day

(12) Place of accident in detail .....

(13) What caused the accident? Give all facts and circumstances in full .....

.....

.....

**Safety**

(14) Was accident caused by defect in appliance? Explain how .....

.....

(15) Did violation of any rule or safety regulation or improper use of safety device in any way contribute to the accident? Explain fully .....

.....

(16) Could accident have been prevented? If so, how .....

.....

(17) Who instructed him as to the hazards of the work and when? .....

(18) Was he informed as to the rules and safety regulations? ..... (19) When and by whom? .....

**Witnesses**

(20) Brass check numbers and names and addresses of witnesses .....

.....

**Care of Injured Person**

(21) Was first aid rendered? ..... (22) By whom? .....

(23) Where taken after accident? ..... (24) Attending surgeon .....

(25) Nature of injury .....

**General**

(26) Statement of injured person, and whom does he blame, if anyone .....

.....

(27) Duties of injured person .....

(28) How long employed on work on which injured? ..... (29) How long employed on similar work at places where injured or elsewhere? .....

(30) Name of former employer ..... (31) If injured person has ever received compensation for injuries, give facts and names of employers .....

.....

(32) Was accident due to negligence or want of care on part of injured, or any other person? If so, explain fully .....

.....

(33) Foreman in immediate charge of the work ..... (34) Number of children .....

**To Be Answered in Case of Serious or Fatal Accident**

**Dependents**

(35) Names and addresses of wife, and children under 18 and over 18 mentally or physically incapacitated, and dates of birth of all such children .....

.....

.....

(36) Names and addresses of other dependents (father, mother, grandfather, grandmother, brothers and sisters) and extent of dependency .....

.....

I certify that the answers to above questions 11 to 19, inclusive, are correct .....
Foreman.

Dated ..... 191 .....
Casualty Clerk.

Noted ..... Superintendent.

FIG. 1—FORM OF MINE-ACCIDENT REPORT

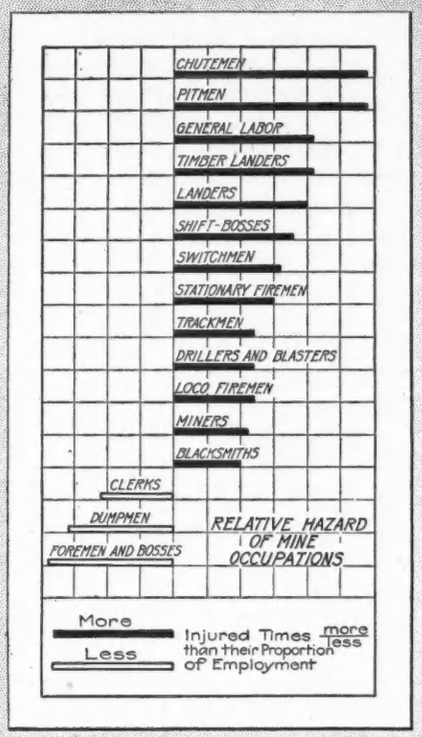



FIG. 2

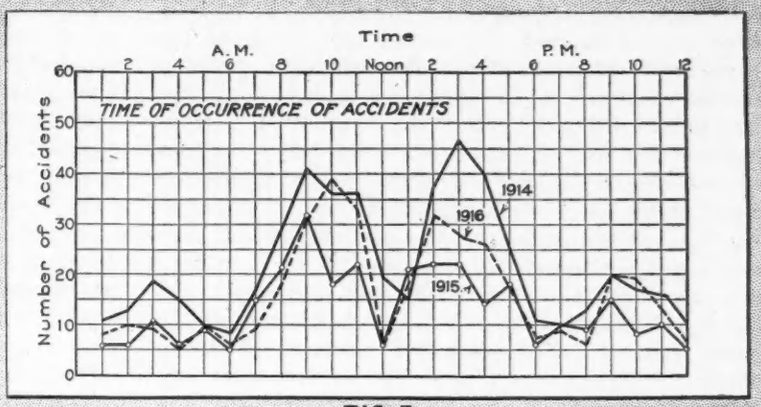



FIG. 3

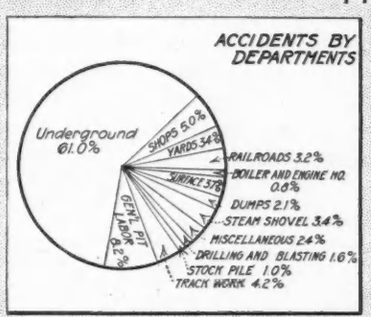



FIG. 4

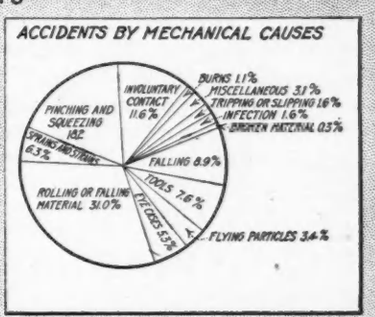



FIG. 5

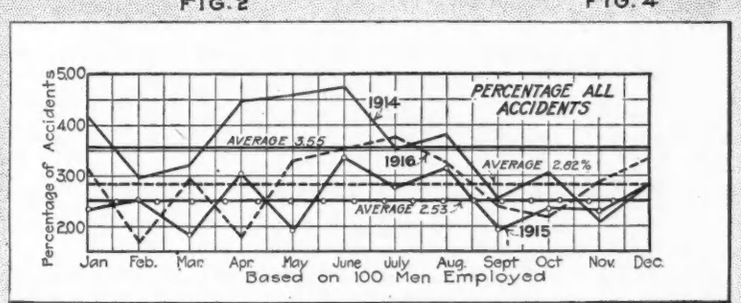



FIG. 7

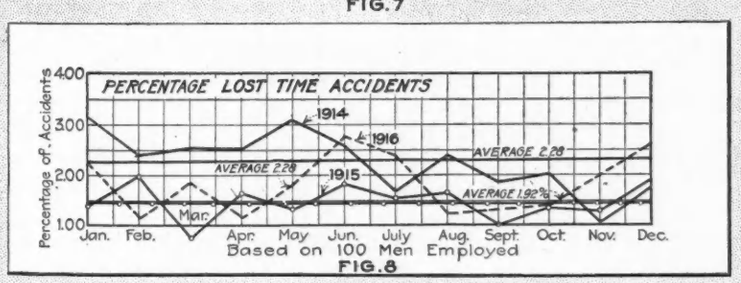



FIG. 8

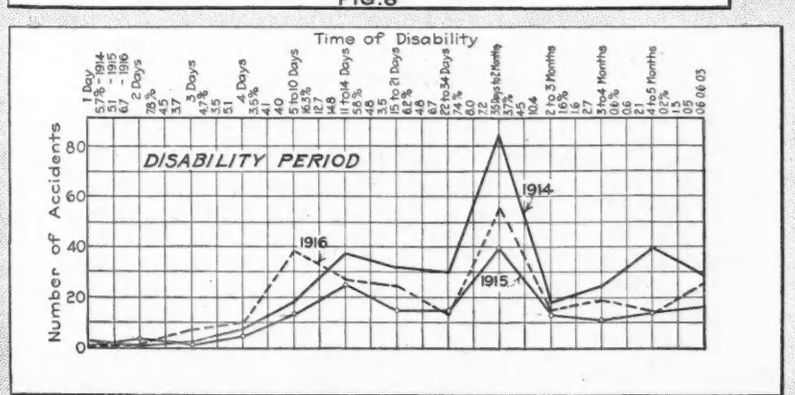



FIG. 9

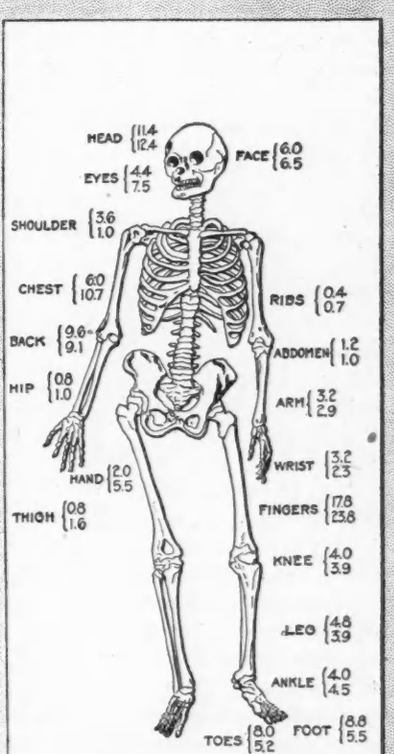



FIG. 6

FIGS. 2 TO 9. GRAPHIC METHODS OF REPRESENTING MINE-ACCIDENT STATISTICS

of the data are not necessary for consideration from the safety standpoint, although of unquestioned value as a history of the injured man. Just how much of the report may be of local value in the compiling of statistics depends largely on the judgment of those in charge of the work. Figures to show the occupations, periods of service and ages as relating to employees are of interest in collective quantities. Fig. 2 shows a "relative hazard" chart, based on the number of serious accidents which occurred during a two-year period, and considers only the occupations which were affected by those accidents. In preparing the chart, the total number of men in each occupation was used in comparison with the number injured in that occupation. The graph represents the number of times greater or less than their proportion of employment that the men in each division were injured. In view of the fact that a comparatively short period is represented, and that the number of accidents is small, the graph cannot be said to be representative or conclusive, but nevertheless it is an argument for the continuance of accident statistics, as each additional year will show a better average of the figures represented.

### Other Graphic Methods of Presenting Accidents

The time, place and cause of accident are subjects that should receive special study, not only in the individual case but as covering a number of accidents as well. Fig. 3 represents the hours at which accidents occur and is based on a three-year period. It may be mentioned, however, that the results obtained in a graph of this sort may be scattered unless some attempt is made at a separation of the two- and three-shift basis. That the graph maintains such continuity is accounted for by the fact that the ratio of the two-shift to the three-shift phase remains fairly constant during the three-year period and that the relation of the underground accidents to those occurring on the surface was approximately the same. Fig. 4 shows another method of comparing accidents, and the varying percentages of different departments are expressed. Only a one-year period is considered, and the percentage is based on the total number of accidents occurring. The mechanical causes, as found in the answers to question 13 of the report, expressed in a chart similar to the one used in Fig. 4, are shown in Fig. 5.

It has been my experience that the answers to the questions in the group relating to "safety" are subject to doubt as to their reliability, because not infrequently too much personal opinion is likely to be recorded. The report is usually made out by a foreman, a shift boss or a timekeeper, and though the intention, in making the report, may be good, judgment is sometimes made in haste and without taking account of all the circumstances involved. However, this part of the report may be changed, if necessary, in making up the figures to show comparative results in this group.

It may not be amiss at this time to emphasize an important factor that is worth consideration in accident prevention. That is the interpretation of the division which it is possible to make between "preventable" and "unpreventable" accidents. This is a matter which is dependent largely on the degree of thoroughness with which accidents and their causes are studied. If it be assumed that all accidents, barring of course those due to natural occurrences, are preventable, there is then afforded a tangible basis on which to build up the manner of prevention, whereas if all accidents be attributed to "hazards of the industry," and are assumed to be unpreventable, further research, frequently of value, will be discouraged. Each accident should be made a special object of study, and a practical method of preventing its recurrence should be suggested and put into application. Several companies have adopted the practice of making a periodical examination of all accident reports, preparing a record of their conclusions and carrying out the suggestions made. This policy, supplemented by other preventive methods, has attained excellent results in cutting down the number of accidents.

The value of the diagram presented in Fig. 6 may be questioned, but the figures show comparatives, and the representation is such as to draw attention on the mine bulletin board. In this figure the percentages of accidents are presented as to their distribution in various parts of the body and represent the comparison of injuries for two years, the information being secured from a compilation of the answers given to question 25 of the report.

Figs. 7 and 8 were plotted from calculated percentages based on accidents and the number of men employed. In Fig. 7, all accidents were considered, whereas in Fig. 8 only those which entailed the loss of time. The percentages shown in Fig. 9 were computed on periods of lost time which resulted from accidents, and, necessarily, only those involving loss of time were set down. The total percentage for any one year, as expressed in the graph, will equal the percentage represented by the lost-time accidents as compared to all accidents which occurred during that year. The mine report does not provide for a statement of the time lost on each accident, but this is always kept as a supplementary record, and should be available.

Primarily, the solution of the safety problem is education, and the suggestions included in this paper form only part of a general scheme that must be adopted if accidents are to decrease in number and in serious results. Statistics are of value only when showing a result attained or one to be attained, and the information gathered from mine-accident reports may be made of value in determining methods of preventing accidents.

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## Injury to Trespassers

By A. L. H. Street*

A path, leading between nearby mining towns and constantly used by the public as a footway for years, extended over defendant mining company's premises and within a few feet of a building in which defendant kept dynamite caps in an open box within plain view of passers-by. Plaintiff, an eight-year-old child, in passing stepped into the building, procured a cap and was injured in its accidental explosion.

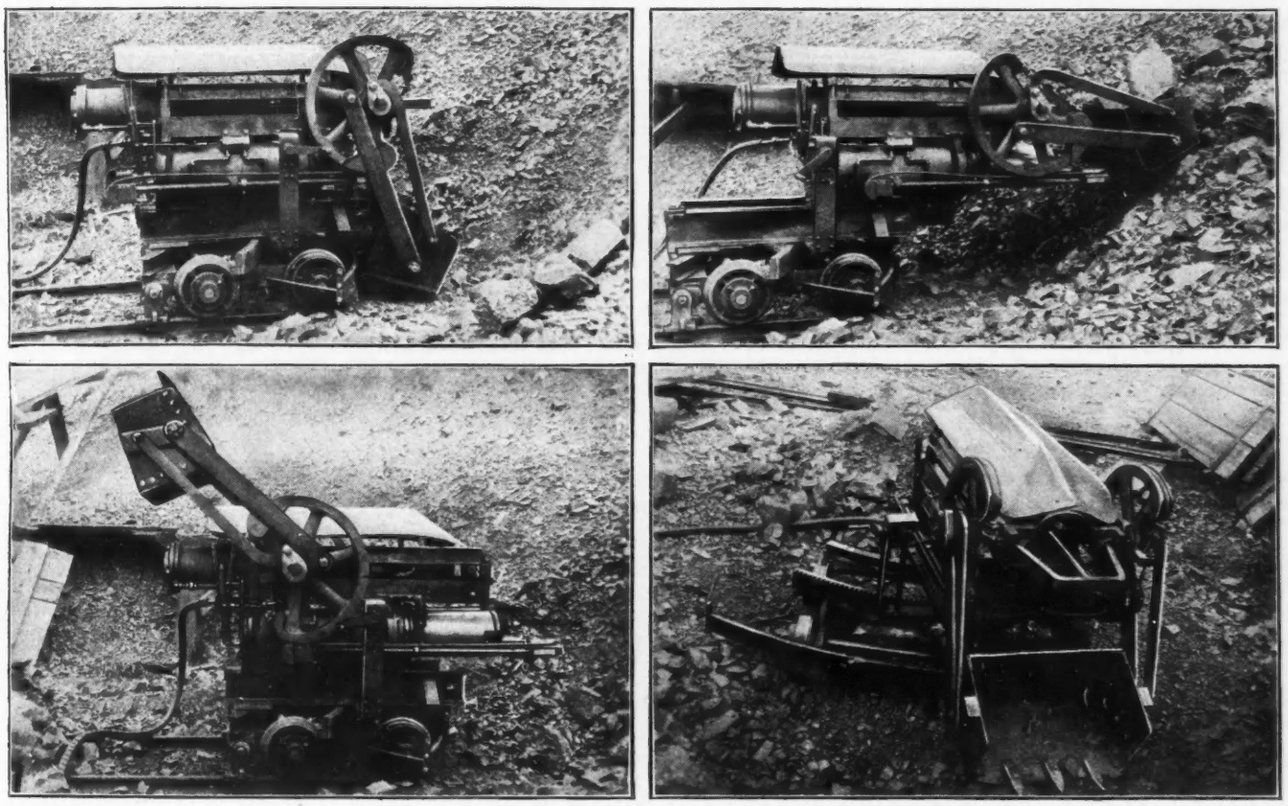
Under these circumstances, the Michigan Supreme Court holds in the case of Anderson *vs.* Newport Mining Co. (168 *Northwestern Reporter*, 523), that defendant was properly held liable in damages on the theory of negligent failure to adequately guard against the natural tendency of children to do just what plaintiff did.

*Attorney at law, 820 Security Bldg., Minneapolis, Minnesota.

# Armstrong Mechanical Shovel

THE demand for ore-shovelling machines for underground work has of late increased materially, and this condition will doubtless continue, as it has already been demonstrated that mechanical shovelling produces a greater tonnage than is possible by hand labor. In open-cut mining where the deposits are of sufficient extent, large-capacity steam shovels of standard types have been adopted, but in underground operations varying conditions have presented many problems for the designers of ore loaders.

In the design of the Armstrong shovel, which is shown in the accompanying cuts, several special requirements have been met successfully, and the type, as now developed, combines simplicity, small size, flexibility and portability, which, together with a moderate first cost and low upkeep, makes the machine desirable for underground use. The shovel consists of three principal parts: A truck suitable to the gage of the mine track; a platform that permits lateral swing, and a body-piece that rolls forward and back on a track provided by the platform. The body-piece consists of four cast-iron cylinders and a crosshead, which travels in horizontal guides and carries rope sheaves, the dipper arms, and the dipper.



ARMSTRONG MECHANICAL ORE-LOADING SHOVEL

In operation, the swinging of the shovel is done by hand, and the shovelling motion is obtained by the cylinders, which use direct air and require no gears, clutches, belts, or conveyors. The bottom cylinder pushes the body-piece forward, the center cylinders turn the dipper through 90°, and the top cylinder pulls back the crosshead. This carries the dipper up and over, where it is discharged into a car at the rear of the shovel. Simultaneously, the bottom cylinder pulls the body-piece to the rear, and this reversal brings the dipper back to the starting position in the front of the shovel. Each of the center cylinders is provided with a plunger piston, the center of which is bored and contains a stationary piston anchored by a rod to the back head, the space inside this latter piston being partly filled with oil. The effect of this arrangement is to limit the speed of the digging part of the stroke. This is necessary when the dipper strikes a solid piece of rock and the resistance causes a temporary building up of air pressure behind the piston. Without this provision the dipper, in sliding to one side of the obstruction, would be thrust suddenly forward, causing all the dirt to be thrown out.

The bottom cylinder which crowds the body-piece forward and pulls it back is smaller than the center cylinders and exerts a forward push at the point of the dipper-lip of about 1200 lb. The pressure given by the center cylinders is 3600 lb., so that if the dipper catches on solid ground, the push of the center cylinders will overcome the forward thrust of the bottom cylinder and thus force the body-piece back until the dipper clears the obstruction. Then, owing to the oil control, the dipper will move up slowly, while the bottom cylinder, with no oil control, shoves the body-piece ahead quickly, burying the dipper in the dirt after clearing the obstruction.

The shovel is 6 ft. long, 4 ft. wide and 4 ft. high, and on the upper extension allows headroom of 6 ft. 8 in. above the top of the rail. The swing allows a clean-up

of 9 ft. The daily capacity depends on the speed with which cars are supplied, but it is claimed that a small shovel loaded 105 tons in seven hours at the plant of the American Zinc Co., Mascot, Tenn. The Armstrong Shovel Co., Vulcan, Mich., are the manufacturers, and F. H. Armstrong is president and general manager, and William Kelly, secretary and treasurer.

## The Corrosion of Iron Piping*

With reference to the corrosion of iron or steel piping by water, it is possible to classify the latter under one or two types, which may be distinguished by the terms "active" or "inactive." The quality of activity is not primarily dependent upon the acid, alkaline, or neutral condition of water, but, rather, is contingent on certain dissolved substances which exert a modifying influence upon the universal tendency of even the purest water to cause corrosion. This characteristic will be increased in those cases where dissolved gases exist in the liquid; and, under such conditions, the term "active" typifies its corrosive qualities. An inactive water is one that cannot promote, in any marked degree, the corrosion of iron. The sharp boundary between the behavior of these two types of water furnishes a sufficient reason for thus distinctively classifying them. It is a simple matter to demonstrate the fact that an inactive water, after a few minutes' aëration, becomes capable of great damage to iron.

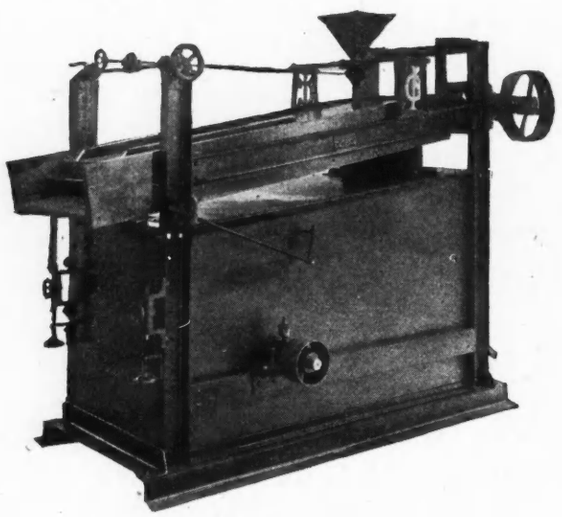
Every metal, when placed in water, is subjected to a fixed tendency to go into solution. This effect is wholly a matter of electrochemical activity, and varies to a definite extent with each metal. The initial reaction in the process of corrosion of iron by water is exactly analogous to its solution in acid. Water exists in the liquid state not only in the form of its molecule, but also as ions. These are formed by the breaking up or dissociation of the molecule, and are called the hydrogen and hydroxyl ions, the former bearing a charge of positive electricity, and the latter a negative charge. All water is broken up in this way, although the proportion actually so dissociated is extremely minute. Acids, like water, are ionized, but to a far greater extent, into hydrogen ions and those formed from the remainder of the acid molecule. The net result of the presence of an acid in water is, therefore, to increase the amount of positively charged hydrogen ions present. It is the concentration of these hydrogen ions in water that determines its ability to attack iron; indeed, the initial speed of attack is proportional to the number of hydrogen ions in the water. It is thus easily understood that, though pure water, with its low concentration of acid ions, is capable of inducing the corrosion of iron, water containing an acid will be proportionally more ruinous to the metal. It is, therefore, a fact that the tendency of iron to corrode depends to a certain degree upon the amount of acid present in the surrounding water. Corrosion, however, may be arrested even in a distinctly acid water. With this in view, too much emphasis cannot be laid upon the fact that two definite conditions must be recognized, under one of which water acts as a corrosive liquid, though harmless under the other.

*Excerpt from a paper by F. N. Speller and R. G. Knowland in the Journal of the American Society of Heating and Ventilating Engineers.

In broad terms it may be stated that corrosion is purely an electrochemical phenomenon, due to the fundamental nature of water itself, but aided by even a minute acidity. Also that corrosion is promoted, and made progressive and continuous, by the action of dissolved oxygen in water, the gas acting as a depolarizer, and thereby carrying on the activity of the corrosion process.

## Ideal Dry Concentrator

A dry concentrator recently placed on the market by the Ideal Concentrator Co., of 140 Nassau St., New York, has a number of novel features. Separation of mineral from gangue is made by means of a current of air drawn through the machine by an exhaust fan. This current lifts and carries away the particles of lighter specific gravity; and suitable controlling apparatus makes it possible to regulate the distance between the bottom of the suction plate and the top of the ore-distributing plate, thus insuring satisfactory separation under a wide range of conditions.



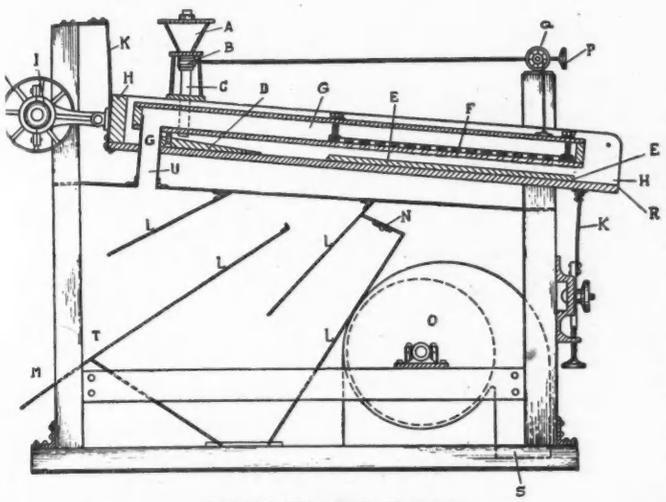
THE IDEAL DRY CONCENTRATOR

Ores should be classified into sizes for the machine to do its best work. Similar preparation of feed is desirable in the case of any wet concentration method except flotation. The sizing is usually accomplished by means of power-driven screens. The table vibrates at a frequency of 650 ¼-in. strokes per minute, the movement being transmitted by means of an eccentric on the shaft at the head of the machine. The exhaust fan, which operates at a speed of 1300 r.p.m., is inclosed in the machine, and is driven by means of belt connection with the pulley shown in the accompanying cut.

The ore, crushed to proper size to liberate the mineral from its associated gangue, and classified, is fed into the ore feed hopper *A*. It passes through the feed valve *B* and through the flexible feed pipe *C*, settling on the distributing plate *D*. The table *HH* is mounted on spring supports, *KK*, and is vibrated by means of an eccentric, *I*. The ore is fed between riffles *E* on the inclined table. As the ore travels downward, the lighter material is lifted and carried away through perforations in the suction plate *F* by the air which is drawn in at the lower end at *R*. The heavier mineral remaining

on the table continues its downward course, and discharges at the lower end, at *R*, as a concentrate.

As the ore passes over the surface of the table, air is drawn into the lower end at *R* by the action of the fan *O*, which exhausts through regulation valve *N* around the baffles *L*, along the channels *GG* and through the openings in the perforated plate *F;* thus drawing the lighter gangue or mineral, as the case may be, from




CONCENTRATOR PARTS

*A*, feed hopper; *B*, ore feed valve; *C*, flexible feed tube; *D*, ore distributing plate; *EE*, riffles; *F*, perforated plate (bottom of suction box); *GG*, passage for air and tailing; *HH*, vibrating table; *I*, eccentric; *J*, drive pulley; *KK*, supporting steel springs; *L*, baffles; *M*, tailing discharge; *N*, air-regulating valve; *O*, exhaust fan; *P*, feed valve handle; *Q*, suction-box adjustment; *R*, concentrate discharge; *S*, exhaust air discharge.

the ore being treated, and carrying it along to be deposited, by contact with baffles *LL*, in the lower compartment *T* as a tailing. This tailing is automatically discharged through the self-acting valve at *M*. The air drawn by the exhaust fan, after being freed of the tailing by means of the baffles, continues through an air-regulating valve *N*, then through the fan, and is finally discharged through *S* into the outer air, or, where necessary, into a dust chamber.

This machine is designed to treat any material suitable for concentration if the metal to be recovered is in the mineral and the associated gangue is lighter than the mineral to be saved. In the treatment of complex ores associated with a gangue of lower specific gravity than the mineral, the gangue is first removed by preliminary dry concentration on one of the machines described, and the minerals contained in the concentrate are separated in a subsequent operation.

All controlling mechanisms are conveniently situated and can be easily and quickly adjusted while the machine is in operation, thus making it possible to treat all sizes of material consecutively on one machine. The discharge of concentrate is always in sight of the millman, and the product can be readily kept up to the required standard. The ease of adjustment makes it possible for one millman to operate a number of machines. The product, which is dry, is immediately ready for shipment.

The concentrating machine, with the exception of the vibrating table, which is of wood, is constructed of steel, iron and aluminum. Its capacity is from five to eight tons per day, depending upon the character of the ore. The capacity can be increased by using the machine first as a rougher producing no middling product, and then again to clean the concentrate, if expedient. Material dry enough to be screened can be treated satisfactorily. The machine does not require more than ½ hp. for operation, occupies only 7 x 3½ ft. of floor space, and is 5 ft. high at its highest point. Its total weight is 1200 lb. The heaviest section weighs 200 lb. The machine can be shipped whole or knocked down.

## Diamond Cutting for Disabled Men

At the fifth annual meeting of the South African Diamond Corporation, the chairman, Bernard Oppenheimer, drew attention to the fact that he had personally instituted a plan for finding employment for legless sailors and soldiers, and a diamond-cutting factory is now in operation at Brighton. Mr. Oppenheimer, in explaining the objects of the project, said:

As an entirely private enterprise I purposed training up to 2000 disabled men, the Ministry of Pensions merely paying them their training allowance of 27s. 6d. per week for six months, as under all training schemes. I undertook to pay the men a minimum of £2 per week after six months' training, and to guarantee continuous employment for three years; and, though I bound myself to the men, the men are not bound to me, but can leave me at a moment's notice if they can earn higher wages elsewhere.

Ninety-nine per cent. of the diamonds produced come from British dominions; yet all this wealth was previously exported in the raw state to the Continent to be polished, and the wages were, consequently, lost to the British workman. Any number of fairy stories were circulated by interested parties, when I started the scheme, that diamond cutting could not be learned or acquired except by long years of practice, and even then it was said the British workman would prove incompetent. I was always, long before the war, of a different opinion, but could not find adherents; but the old idea took hold of me again to start a diamond-cutting factory to keep, anyhow, part of the wages in the country, but to start it with men who were broken in the war. In short, I conceived the idea that, being too old myself to fight in the trenches, I could oppose the enemy commercially, and could find work—and remunerative work, not charity—for men who were prepared to lay down their lives for you and for me so that here we could live in peace.

The world, to my mind, is big enough for everyone. It would be foolish to say that I want to create a monopoly for cutting and polishing diamonds in England. In my attempts to establish an industry I do not intend, and never have intended, to go against our ally, gallant Belgium; but I do say we here are entitled to do some of the work, and I maintain that by doing it we are not only not competing with Belgium, but an interchange of workmen at a later date will make the industry more stable in both countries, and will not make it easy for the enemy, after peace is declared, to foster another industry on which he had an eager eye. It is a well-known fact that before the war Germany had begun on a big scale to polish diamonds, and most of these diamonds were sold to them in the raw state by Belgian and Dutch merchants, who bought more raw material in England than they manufactured. This I aim at stopping. The raw article, or, as we term it in the trade, the rough diamond, which was traded in Germany before the war, must be manufactured in this country and the wages must go to the British working man.

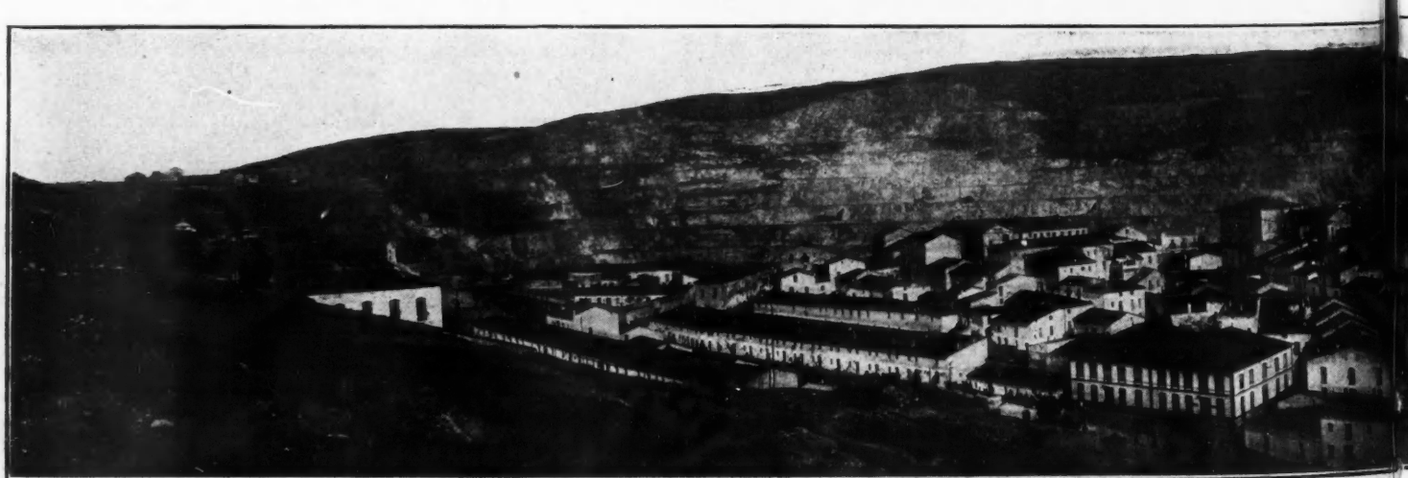
The chairman said that the results, after 12 months of experimental effort, were proving successful. The company has been accorded the privilege of joining in the enterprise as soon as it had reached the productive stage; and it was expected that conditions would justify this step in the near future.

**At the Turf Shaft** of the Village Deep mine, on the Rand, it was found that the slotted steel guides in use were wearing badly on one side. The unevenness was found to be due to the spin of the winding rope; and in order to make the guides last as long as possible, new winding ropes needed were ordered with the lay in the opposite direction to those used formerly. This proved satisfactory, and further wear on the thinner side was eliminated.

# The Rio Tinto Copper Mine. in Spain

CORTA DEL LAGO, AT RIO TINTO

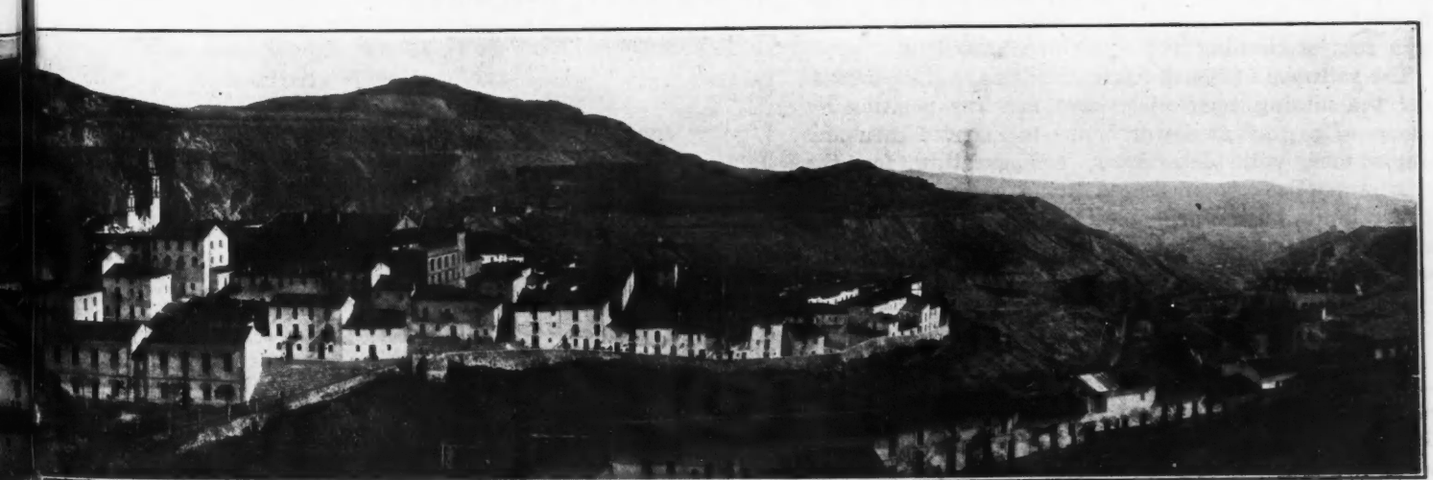
CORTA DEL LAGO (PIGUERA), SHOWING LOWER WORKINGS OF CUT



PANORAMA OF THE TOWN OF RIO TINTO, SPAIN, TERRACED MINE WORKINGS IN THE

THE SAN DIONISIO MINE IS THE DEEPEST OF THE RIO TINTO GROUP

CORTA DEHESA, AT RIO TINTO, SHOWING TERRACED WORKINGS



BACKGROUND. THE SMELTERY IS AT THE RIGHT, BUT IS NOT SHOWN IN THE PHOTOGRAPH

# Wages, Working Costs, and Ore Reserves Of the Rand

By A. COOPER KEY

*The Rand gold field is the most important gold-producing area of the world, and the question of ore reserves and output will materially affect future international economics. The writing off of a vast tonnage of ore reserves as unprofitable rock, containing insufficient gold to warrant the expense of extraction under existing conditions, is due to abnormal increases in operating costs and to the stationary value of the product.*

AT SHORT notice, the engineers of the Johannesburg municipality power station struck for a wage of £8 2s. per week, the men to receive, also, a fortnight's holiday on pay, and pension privileges. The council offered £7 10s., and agreed to arbitrate, but the engine drivers would not accept the proposal; and, after they had held up traction and lighting for three and a half days, the municipality surrendered. The actual resolution also gave a rise of 25% to artisan and unskilled employees who were not earning the £8 2s. per week. This general advance has involved the municipality in a deficit of £205,000; and the amount of revenue to be raised is equal to £15 per head of its by no means large population, 130,000.

The engineers did not base their demands on the rise in cost of living, which is determined monthly by a specially appointed commission, but on the simple and brutal argument that they were entitled to sell their labor at the highest possible price, as the shopkeepers sold their goods at the maximum profit. The commission has estimated the rise in cost of commodities to an average family at 35% on pre-war prices; but if rent, which forms a large item in the budget, be taken into account, it is only 25%. In point of fact, the rise in the cost of living varies with every individual circumstance. The single man is as well off as ever he was. Board and lodging have gone up 10s., to £9 or £10 per month, for high-class accommodation. The man with a family, however, is hard hit, owing to the high cost of clothing and other necessaries.

The railways of South Africa, which are state owned, and the mining companies, have met the position by means of a graduated war bonus to married men and single men with dependents, compensating for the greater part of the increased living costs. There are salary limits on the principle that the higher paid men are able to bear the whole of the increased cost themselves, as their share of the burden of the war.

## Mine and Municipal Mechanics

As soon as the municipality employees were given the basic wage of £8 2s. per week, the mechanics employed in the mines, who receive 2s. 6d. per hour plus 3d. war bonus, equal to £6 12s. per 48-hour week, naturally thought that they should do equally as well. The Federation of Trades deplores the sectional action of the A. S. E., and realizes the dangers attendant on the demand for equal treatment.

Gold is one of the few things which has not increased in price; indeed, it is really lower, owing to the higher cost of realization, 25s., against a pre-war charge of 7s. 7d. per £100. Before the war the average Rand profit was about 9s. per ton, several mines making only about 6s. The latter figure is now the average. Working costs have risen from 17s. to 20s. 8d., and if this rise of 3s. 8d. (not so far short of a pennyweight per ton) be accompanied by a drop of only 1s. per ton in grade, the effect will be to wipe off the profit of the lower-grade mines. The blunt fact is that 20 out of the 50 producing mines of the Rand

RAND ORE RESERVES—REVISED FIGURES

| Producing Companies | December, 1916(a) Tons | Dwt. | In. | December, 1917(a) Tons | Dwt. | In. |
|---|---|---|---|---|---|---|
| Aurora West | 502,320 | 5.6 | 41.7 | (m) 399,275 | 5.54 | 41. |
| (m) | 68,500 | 5.2 | 42 | (m) 38,500 | 5.54 | 42 |
| Bantjes Con (b) | 412,000 | 5.6 | 42 | (b) 470,100 | 6.0 | 44 |
| Brakpan | 3,054,000 | 9.2 | 62 | 3,268,000 | 9.2 | 67 |
| City Deep (b) | 3,676,087 | 9.0 | 60 | (b) 3,326,900 | 9.0 | 55 |
| City and Suburban | 602,200 | 8.8 | 51 | 511,900 | 7.7 | 58 |
| Con. Langlaagte (c) | 2,174,536 | 6.2 | 49 | (c) 2,132,778 | 6.0 | 53 |
| Cons. Main Reef | 856,740 | 7.51 | 48.2 | 1,002,740 | 7.66 | 50 |
| Crown Mines (b) | 11,429,000 | 5.9 | 66 | (b) 8,988,000 | 6.3 | 64 |
| Durban Rood. Deep(b) | 1,259,300 | 6.3 | 48 | (b) 1,174,200 | 6.5 | 50 |
| East Rand Prop | 4,200,000 | 6.1 | 56 | 2,732,000 | 6.2 | 59 |
| Ferreira Deep | 1,854,100 | 8.3 | 70 | 1,632,609 | 8.3 | .. |
| Geduld Proprietary | 2,150,000 | 7.4 | 60 | 2,200,000 | 7.5 | 61 |
| Geldenhuis Deep (b) | 1,616,000 | 5.9 | 55 | 1,811,000 | 5.8 | 53 |
| Ginsberg (c) | 270,504 | 5.6 | 51 | (c) 169,722 | 5.6 | 50 |
| Glencairn (c) | 76,560 | 4.6 | 90 | (c) 11,600 | 4.63 | 50 |
| Govt. Areas (Modder) (c) | 4,930,000 | 7.2 | 75 | (c) 7,016,000 | 7.5 | 79 |
| Jupiter | 829,500 | 5.0 | .. | 858,000 | 5.24 | .. |
| (m) | 157,800 | 5.5 | .. | (m) 122,000 | 4.80 | .. |
| Knights Central | 296,800 | 5.35 | 63 | (b) 280,800 | 5.86 | 68 |
| Knights Deep | 2,614,000 | 4.4 | .. | 2,301,000 | 4.4 | .. |
| (m) | 71,000 | 4.1 | .. | (m) 37,000 | 4.32 | .. |
| Langlaagte Estate | 1,161,119 | 6.08 | 50 | 1,315,813 | 5.58 | 54 |
| Luipaards Vlei Estate | 826,138 | 5.67 | .. | 792,400 | 5.48 | .. |
| Main Reef West | 386,960 | 5.73 | 50 | 487,030 | 5.92 | 50 |
| Meyer & Charlton | 512,787 | 14.5 | 51 | 493,194 | 17.66 | 49 |
| (m) | 161,410 | 17.1 | 47 | (m) 59,750 | 13.34 | 49 |
| Modder B | 3,371,950 | 9.2 | 59 | 3,523,810 | 9.2 | 616 |
| Modder Deep | 3,320,000 | 8.4 | 78 | 3,320,000 | 8.7 | 782 |
| New Goch | 404,185 | 5.32 | 77 | 214,877 | 5.27 | 802 |
| (m) | 48,100 | 4.76 | .. | (m) 23,701 | 4.93 | .. |
| New Heriot | 477,767 | 7.6 | .. | 335,000 | 7.14 | .. |
| New Kleinfontein (c) | 2,943,994 | 5.4 | 61 | 2,214,000 | 5.64 | 61 |
| New Modderfontein(b) | 8,013,370 | 8.4 | 61.5 | (b) 8,914,400 | 8.5 | 66 |
| New Primrose (c) | 205,311 | 5.2 | 54 | (c) 167,900 | 5.2 | 53 |
| New Unified (c) | 377,264 | 5.9 | 46 | (c) 247,843 | 6.4 | 47 |
| Nourse Mines (b) | 2,169,300 | 6.2 | 5.6 | (b) 2,160,400 | 6.4 | 54 |
| Princess Estate | 476,000 | 7.1 | 27 | 503,000 | 7.1 | 35 |
| Randfontein Central(i) | 4,944,302 | 7.8 | .. | 5,185,000 | 6.8 | 53 |
| (j) | 3,486,917 | 4.6 | .. | ..... | ... | .. |
| Robinson, MRL&SR | 490,000 | ... | .. | 443,000 | ... | .. |
| Robinson Main R | 500,000 | ... | .. | 500,000 | ... | .. |
| Rose Deep (b) | 3,267,280 | 5.3 | 62 | (b) 3,219,700 | 5.4 | 62 |
| Robinson Deep | 1,814,000 | 6.16 | .. | 1,725,000 | 6.43 | .. |
| (m) | 178,000 | 6.7 | .. | (m) 131,000 | 6.52 | .. |
| Roodepoort United | 677,273 | 6.03 | 46 | 526,256 | 6.85 | 45 |
| (m) | 110,776 | 6.87 | 45 | (m) 109,557 | 6.16 | 49 |
| Simmer & Jack | 1,935,000 | 5.2 | .. | 1,862,000 | 5.3 | .. |
| | (n) | ... | .. | 401,000 | 4.78 | .. |
| | | | | (n) | | |
| Simmer Deep | 1,246,000 | 4.56 | .. | 1,097,000 | 4.83 | .. |
| (m) | 173,000 | 4.55 | .. | (m) 146,000 | 4.59 | .. |
| Springs Mines | 1,784,000 | 9.86 | 56 | 2,567,000 | 9.8 | 58 |
| Sub-Nigel | 214,000 | 9.1 | 41.8 | 359,000 | 10.4 | 44.2 |
| (m) | 24,000 | 9.6 | .. | (m) 31,000 | 9.4 | .. |
| Van Ryn | 1,950,191 | 6.69 | 53 | 1,730,772 | 6.57 | 50 |
| Van Ryn Deep (c) | 2,168,851 | 8.7 | 68 | (c) 2,258,600 | 8.9 | 67 |
| Village Deep (b) | 2,378,100(l) | 6.8 | 60 | (b) 1,874,000 | 6.6 | 61 |
| West Rand Cons | 1,600,000 | 6.1 | 50 | 1,269,918 | 5.3 | 54 |
| (m) | 404,000 | 8.3 | .. | ..... | ... | .. |
| Witwatersrand (c) | 1,462,100 | 6.4 | 67 | (c) 1,317,900 | 6.4 | 69 |
| Witwatersrand Deep | 1,571,300 | 5.79 | 59 | (b) 1,383,000 | 5.66 | 61 |
| Wolhuter | 1,263,320 | 5.8 | 53.2 | 1,302,160 | 6.0 | 53.6 |
| Non-Crushing Company | | | | | | |
| Cinderella Cons (k) | 1,024,800 | 7 | .. | (k) 1,024,800 | 7 | .. |
| (o) | 436,000 | ... | .. | (o) 436,000 | ... | .. |

(a) Or latest date in respective years, Cons. Main Reef, Luipaards Vlei, Main Reef West, New Modder, Nourse, Sub-Nigel, Simmer and Jack, Knights Deep and Van Ryn Estate, June 30th. (b) Includes shaft and boundary pillars. (c) Mining tons. (i) Payable. (j) Unpayable at present costs. (k) Mr. Denny's report. (l) Plus 649,000 tons developed but not valued, Springfield area. (m) Partial. (n) Plus reclamation. (o) Suspense.

are working at a profit of less than half a dollar per ton. That means that they cannot pay dividends, because the working profit is not debited with head office charges, realization claim licenses, directors' fees and similar disbursements.

The Mayor of Johannesburg recently said that the town was on the brink of a volcano. After the municipal strike, the government promptly appointed a commission of inquiry. E. A. Wallers, the president of the Chamber of Mines, who has a fine reputation for fairness and has always endeavored to see the viewpoint of the working man, gave evidence. He said that were the wages of mine mechanics increased in the same manner as those of the municipal mechanics, the addition would be 42% on pre-war standards, and 23% above present rates. A similar increase to all employees would involve an expenditure of £1,840,000, equal to 1s. 4d. per ton. He established, further, that 17 mines made a smaller profit than that. They employ over 8000 white persons, who receive £2,850,000 in wages yearly, and the companies spend, altogether, £9,250,000. Moreover, this rise of 1s. 4d. per ton, would bring "many other mines not at present in danger of closure to the verge of it; and it is no exaggeration to say that the prosperity of the Witwatersrand would be destroyed, while the credit and stability of South Africa would be seriously jeopardized."

I do not altogether endorse Mr. Wallers' opinion, as he includes certain mines which it is the declared policy to close down, *e.g.*, the East Rand Proprietory mines, employing 1660 white persons and spending £1,700,000 yearly, and Knight Central, with 295 employees and spending £425,000; the Robinson, which is practically exhausted of ore, and the Randfontein, whose profits were only occasionally down as low as 1s. 4d. per ton, employing 1700 white men and spending over £2,000,000 a year, which has no intention of closing. But the position is serious enough even if one discounts the president's figures by 40%. It looks as though the mine employees will realize the danger of the position, and that, if they strike, the occupations of many of them will be gone forever, or at least until the time that it is again possible to work mines at 17s. per ton.

Working costs have an intimate bearing on ore reserves. A compilation of figures for the 50 mines shows an aggregate of 95¾ million tons, which is about eight millions less than the estimate of a year previous. This is due to cutting down, or economic elimination, at several low-grade mines. It is specially noticeable in the case of two of the three great consolidations. The East Rand Proprietary has cut out 1½ million tons; the Crown Mines, 2½ million tons. Randfontein Central in 1916 included 3½ million tons declared as unpayable on the then current basis of working costs. No notice is now taken of such tonnage.

| | Companies | Tonnage |
|---|---|---|
| Below 5 dwt. | 4 | 4,139,300 |
| Between 5 and 6 dwt. | 17 | 19,073,100 |
| Between 6 and 6½ dwt. | 7 | 18,246,900 |
| Between 6½ and 7 dwt. | 6 | 11,532,400 |
| Between 7 and 7½ dwt. | 4 | 10,054,000 |
| Between 7½ and 8 dwt. | 2 | 1,514,600 |
| Between 8 and 8½ dwt. | 2 | 10,547,000 |
| Between 8½ and 9 dwt. | 3 | 8,905,500 |
| Between 9 and 10 dwt. | 3 | 9,389,800 |
| Over 10 dwt. | 2 | 911,900 |

A classification of ore reserves may be made as is shown in the preceding tabulation.

Over 40 million tons, say 45% of the Rand ore reserves, have a value of 6½ dwt. or less. This is 27s. 6d. per ton, and there is little margin with costs at 20s. 6d., the present figure, when allowance is made for inevitable mining and metallurgical losses. The Meyer & Charlton, with 17½ dwt. rock, is twice as rich as any Far Eastern Rand mine; but there are only two other high-grade concerns in the Central Rand—the City Deep and Foreign Deep—with reserves at 9 and 8 dwt., respectively. Assay values in the Far East, however, are much better. With the exception of two old mines, all go over 7 dwt. Nine mines in this group have 33½ million tons developed. All of these, with the exception of two—Government Areas and Geduld—record over 8 dwt. New Modder's reserve contains over £14,000,000 in gold, after making allowance for mining and metallurgical loss, whereas the Government Areas has doubled its reserve in two years. This policy of expansion is being checked by restriction of explosives, owing to the demand of the British government for glycerin.

### The Index of Pennyweight-Inches

The best showing on the whole Rand is (combining value with width) the 865 pennyweight-inches of the Meyer & Charlton. In the Far East tract, Modder Deep is conspicuous with 679 pennyweight-inches. Brakpan, in this district, and City Deep, in the central section, are the only mines with over 600 each, recording 616 pennyweight-inches. Government Areas and Van Ryn Deep are of equal value—593 pennyweight-inches; also New Modder and Modder B at 561. Intercalated is the Springs Mines' 568 pennyweight-inches. Geduld and Sub-Nigel come at the bottom of the district, at about 460 pennyweight-inches. Certain of the Western Rand companies' deposits have proved disappointing in recent development. For example, the West Rand Consolidated's reserve of commercial ore has dropped 330,000 tons, and by 0.8 dwt. in value, to the disconcerting figure of 5.3 pennyweight.

## El Oro Mining and Railway Co., Ltd.

Speaking at the annual meeting of the El Oro Mining and Railway Co., Ltd., the chairman, R. T. Bayliss, referred with regret to the fact that, for the third consecutive year, the publication of the usual statement of account and balance sheet would be withheld, in the interests of the company and the stockholders.

Progress has been made in increasing the output to about 30,000 tons per month, in an effort to reduce costs per ton, which have risen from an average of $3.50 per ton in pre-revolutionary times to $7 per ton during the last 12 months. The estimate of ore reserves has been reduced by the exclusion of all material having a combined gold and silver content valued at less than $7 per ton, and eliminates from consideration large quantities of low-grade ore which, prior to the revolution, it was possible to treat at a profit.

The ultimate success of the El Oro property is assured, according to Mr. Bayliss, if the Mexican government will only display a sympathetic concern for the mining industry and the company is permitted to work the mines without interference.

# The Lilly Hoist Controller

The Lilly hoist controller consists of three parts, the controller, the brake and throttle operator, and the brake regulator. The controller has for its purpose the prevention of overspeeding and overwinding in hoisting or lowering. The horizontal shaft of the controller is driven from the hoist by means of shaft and gears or sprockets and chain. By means of the small upper gear

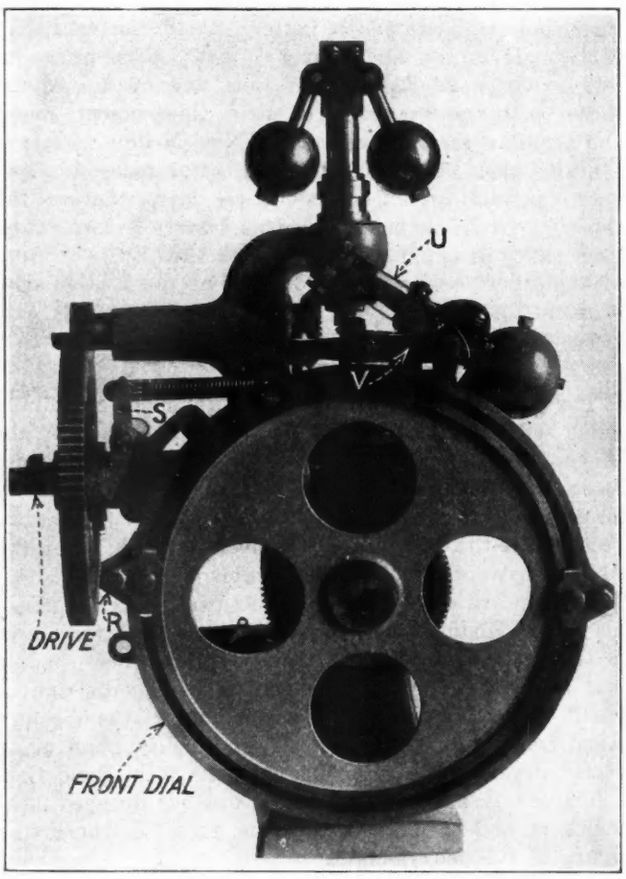



FIG. 1. FRONT VIEW HOIST CONTROLLER

wheel (driven by the large gear shown in the front view) the vertical shaft from which the governor balls are suspended is driven. A worm gear, attached to the horizontal shaft, drives the dial shown in front view. The speed reduction is such that only a part revolution of the dial is completed for a "shaft trip" or for any part of a trip.

Between the parts of the shaft trip, at top and bottom, the hoist under normal conditions is operated at full speed. Between the two points, which might be called the slowing-down points, the lower contact arm *V*, shown above the dial in the front view, remains in the position shown. The upper arm, *U*, however, is brought down by the action of the governor as the speed increases. This arm carries two contacts, each on a flexible spring. When the lower moving contact touches the stationary or bottom arm, it closes a bell circuit and rings an alarm bell. A further increase in speed causes the second contact to be made, and this closes the knock-out circuit, which operates a solenoid shown at *C*, Fig. 3. The solenoid operates a trip which releases the weight *W*. The falling weight closes the throttle and applies the brakes. A gag-pot *D* cushions the falling weight *W*.

In hoisting or lowering, when the slowing-down point is reached, a contact is made by the small arm *N* on the dial *Q*, at the rear of the machine, and the alarm is rung, regardless of speed. If the hoist does not then begin to slow down, the cam *R* on the large dial, raising the lower arm, makes contact as above described, and unless the speed continues to decrease at an accelerated rate, determined by the cam, the lower contact will take action, first with the alarm, and then the knock-out.

On the last turn of the horizontal shaft in either direction, the compound levers shown at the left of the front view, *S*, are forced outward toward the gear wheel, by a cam on the back of the large dial, and a small fraction of a turn in the wrong direction at the end of the travel causes this quick action to take effect and makes contact quicker than it could by direct action from the large dial.

At the rear of the machine is an arm or lever, operated by cams and roller, and it is also shown diagrammatically, *T*, on the brake-regulating unit. When the

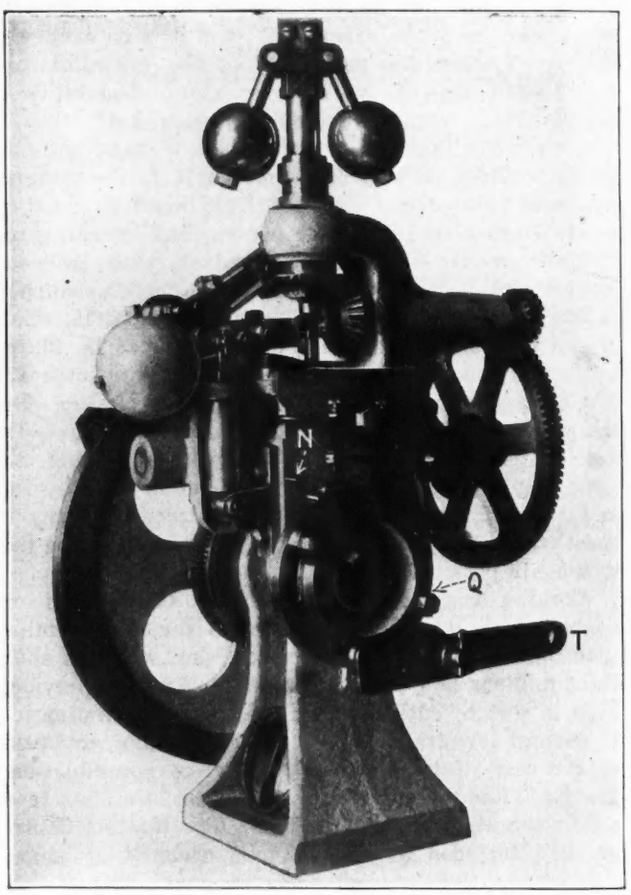



FIG. 2. REAR VIEW HOIST CONTROLLER

controller trips with the hoist at maximum speed, the arm that operates the brake auxiliary would only be allowed to fall to the long point of the notched rest, which sets the brake at its slowest rate, just as an engineer should under such conditions. As the end of the trip is approached, and the hoist starts slowing down, the brake action is increased, so that at the end it acts at the highest speed in case the engineer fails to stop after slowing down, or if he should fail to reverse and

start the hoist in the wrong direction after the stop. All points between are graduated to suit speeds and distances from landing.

As the bell rings at each trip to warn for slowing down, and is rung from the same current that operates the solenoid, it furnishes a guide for the strength of batteries, and having resistance greater than the solenoid, there is assurance that the solenoid will operate even after the bell fails to ring, and if the bell becomes weak it is warning to attend to the batteries. It is easy to test the apparatus by raising the lower arm to make contact at any time.

amalgamation of the fine or float gold, which might otherwise be lost.

It has been stated that two of these machines will treat 100 cu.yd. per hour, of gravel mined by steam shovel, scrapers, or elevators. Cost of installation may be estimated at $5000 per machine, and it will handle average river gravel at a cost of 6c. per cu.yd. The machine has the advantage over a dredge in that its cost of installation is a mere fraction of the cost of a dredge, and it is capable of giving relatively good results in the amount of gravel handled, with effective saving of the gold.

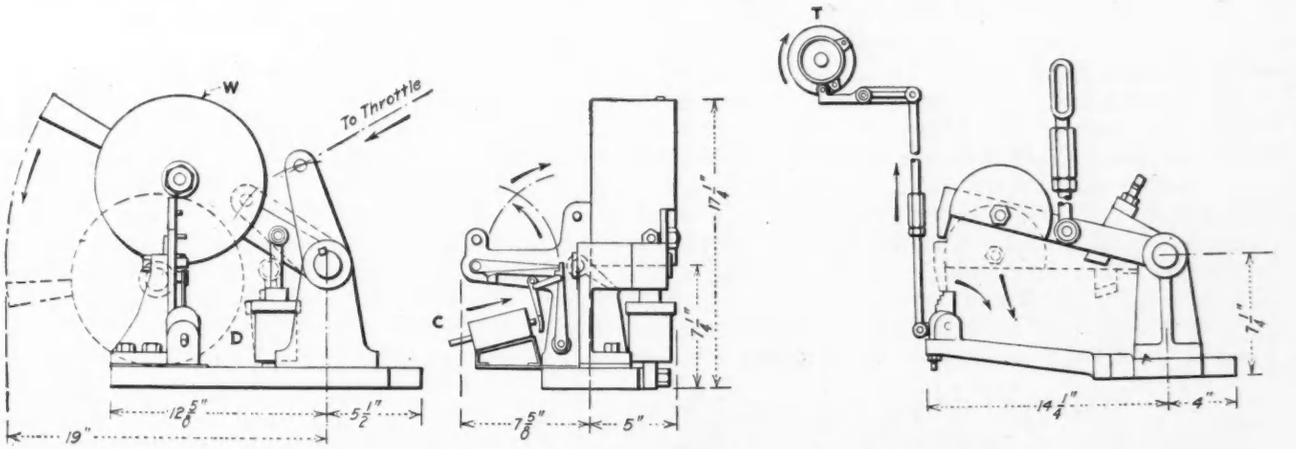



FIG. 3. BRAKE AND THROTTLE OPERATOR AND BRAKE REGULATOR

The original type of Lilly controller, which was a radical departure from any device of the kind hitherto produced, has been in successful operation in many of the large Western mines since early in 1914, and the new model is simply a more highly developed machine, retaining most of the features of its predecessor and introducing a number of others entirely new. It has the advantage of occupying a small amount of space, and, like the former machine, requires no piping, or power of any kind outside of itself, and gravity, for operating.

All the machines are supplied with guards for gears and contacts, which are not shown on the cuts. The conroller is one of the few effective inventions of its kind. An automatic device should be used upon every hoist, and particularly upon hoists by which men are handled. Its use is an insurance against accident, delay and damage to the hoisting system.

## The Roberts Amalgamator*

The Roberts amalgamating machine consists of a revolving screen, with its lower part immersed in a trough filled with water and supplied with mercury to amalgamate the gold. On the outside of the screen are lugs attached in spiral form which agitate the water and mercury in the receiving box. The gravel passes through the screen, which is in the form of a trommel.

It is claimed that the revolution of the trommel in water facilitates the separation of the gold; and the constant agitation of the water and mercury by the lugs on the trommel as it revolves promotes effective

*Abstracted from an article by E. A. Haggen in *Mining and Engineering Record.*

## Remote Motor Control

There has always been a demand for a device for starting small induction motors from remote points. The General Electric Co. has recently developed and placed on the market a starter, known as the CR-7006 remote control switch, and arranged for push-button control. This starter is applicable for use with motors up to and including 5 hp., 110 volts, and 7½ hp., 220, 440 and 550 volts. In addition to its starting function and overload, the starter also protects against undervoltage.

The device consists of a 25-ampere three-pole contactor, with two inverse time-limit gravity reset overload relays mounted on a slate base totally inclosed in a sheet-iron case. A small "start-and-stop" push-button station is used as a remote control switch. Completion of the starting circuit by pressing the button energizes the coil of the magnetically operated switch, closing the contacts, which throw the motor directly on the line. Interruption of the circuit or a radical decrease in voltage permits the contacts to reopen by gravity, thus stopping the motor, which cannot start again until the button is pressed.

The overload relays can be adjusted for various degrees, ranging from normal up to 50% above normal. They can also be adjusted over a wide range of time values. The relay trips automatically and resets by gravity. The cover of the inclosing case is furnished with a hasp so that, if desired, it can be locked in a closed position by a padlock.

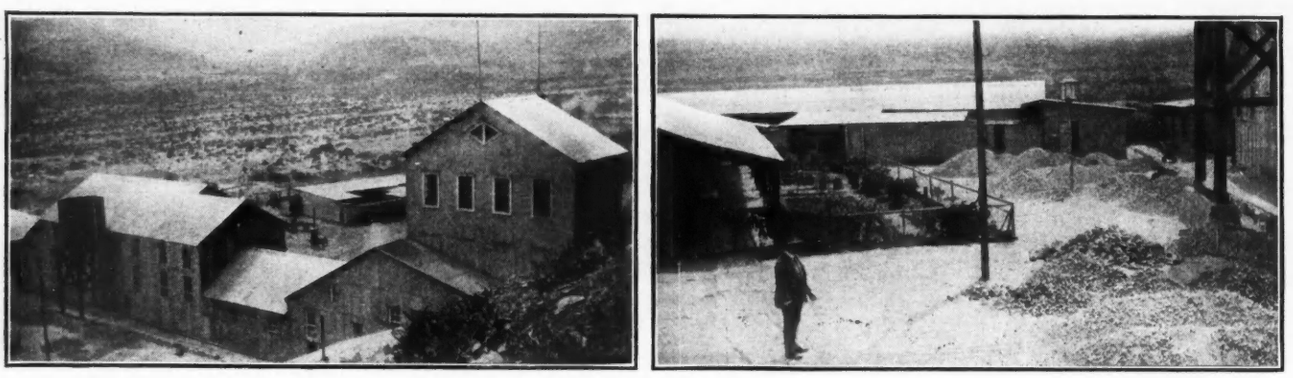
**Today is an opportune time to send a check for the Comfort Fund of the 27th Engineers.**

# Las Vacas Gold Mine, Chile

By E. DAVID POPE*

*Unsuspected orebodies were discovered at Las Vacas mine, in Chile, by a new management working on a different geological theory from the one formerly held. The ore is hand picked, and the gold, which occurs in pyrites, is extracted by amalgamation and cyaniding, a 90% recovery being thus attained. The account deals with conditions of the mine up to the middle of 1915.*

THE gold mine worked by the Compañia Minera Las Vacas is the only gold-producing property now in operation in Chile. The mine is at the extreme southern end of the large coastal gold field existing between Latitude 30° 30′ S and 32° 00′ S. Near by there are many other gold-bearing deposits, among which are the Casuto, Magui, Cueca, and Talco properties, all of which are of practically slight importance. The Vacas mine, the only important property, is entirely in granite, which is unaltered, hard and compact, even in the vein walls. Lying over the granite, and forming the high country behind the mine, is a recent quartz porphyry, which is barren. Crossing both granite and porphyry are a large number of andesite dikes, which fault the veins slightly. Some rhyolitic flows are found, which appear to be relatively recent. Pegmatitic quartz veins are common throughout the granite and have occasionally carried enough gold to invite prospecting, which in no case has continued long.



LAS VACAS MILL

The property of the Las Vacas company, about 150 hectares in extent, is a rectangle, covered in large part with alluvium deposited by the Pupio River, which crosses it. The alluvium obscures the outcrops, but four principal veins are visible, all striking N 80° W and dipping south at an angle of 80° generally. These veins are approximately 100 m. apart. The only one actually worked is the most northerly, or Las Vacas, vein.

Crossing the property in a direction running N 25° W, with easterly dip, are at least six andesite dikes. One outcrops at the eastern boundary; four are found in the mine workings, and the last dike outcrops at the western end of the group of company claims. These dikes show the usual indications of a quickly cooled intrusive body—glassy edges and fine structure passing inward into coarsely crystalline material.

When a new management took control, with instructions to develop and explore the mine, the theory pursued was that the mineralization followed the vertical stringers meeting the vein, and that either the andesite dikes themselves had produced it or the dikes had been thrust through the lines of weakness along which the mineral of value had entered the vein channel. In either case they seemed to indicate the probable zone of enriched vein matter.

The Vacas vein is 3 to 12 m. wide in the upper workings and at the lower levels varies from 5 cm. to 2 m. The walls carry well-marked striæ, and at times considerable kaolin gangue is found. The outcrop has been almost completely removed, but in a few places the original vein is visible. Little oxidation has taken place, and unaltered pyrites is found at the surface. In depth, some chalcopyrite occurs with a little galena and brimstone. The gold is carried in fine grained, very friable pyrites that leaves a black streak; and although 66% is generally recoverable by amalgamation, no free gold is visible even in the richest ore. The pyrites is segregated over short lengths, thus giving a patchy character to the vein. Generally there is a richer band of pure pyrites varying from 4 to 50 cm. wide, which usually occurs in the middle, but sometimes is found in the edges of the ore channel. The quartz is white and extremely hard, and, where of low grade, specular hematite abounds, together with large spotty crystals of pyrites of cubic formation which show the striæ of twinning very highly developed. When the pyrites is 15% of the vein matter, the gold content usually runs 45 gm. per ton. A slight increase in pyrites, accompanied by a green coloration in the quartz, indicates high gold content, which frequently reaches 300 to 500 gm. per ton.

As will be seen from the sectional view of the mine, the oreshoot worked by the old miners had a strong westerly pitch on the eastern end. Its western end was almost vertical for a considerable depth. This was thought to indicate that the entire body of ore was pitching west, but expenditure of much money proved the error of this assumption.

The early owners had concentrated all development work to the westward of the oreshoot as defined. The

*Care of El Nilhue, Chagres, Chile.

new work was given a horizontal easterly direction, and four drifts were carried eastward as fast as possible. This policy was promptly rewarded, and a new oreshoot was cut on passing to the east side of the first andesite dike reached (No. 1 in section) on the No. 3 level. The first samples over a width of 60 cm. assayed 230 gm. per ton. The oreshoot was subsequently proved to extend horizontally 160 m. to the east.

In the eastern end of the new workings, on the fourth pump level, at 215 m. vertical depth, a cross vein was encountered, nearly vertical, 80 cm. wide and striking north, older than the Vacas vein, which showed indications of widening. This vein carried 40 gm. of gold to the ton, over a length of 30 m., and the face was in good ore. The exact conditions with regard to this vein are not yet understood. The mineralization is distinct from the Vacas vein, in that it carries considerable galena and much bismuthine. The silver content is also higher.

The mine is entered by an inclined shaft sunk in the vein at the western end of the old oreshoot and which reaches the 220 level. Work is in progress to connect this shaft with the 250-m. level. A crosscut adit 300 m. long connects with the shaft 60 m. from the surface. The ore was previously hauled through this adit and dumped on a floor outside, where it was picked to raise the grade before being passed by an elevator to the mill bins. Under the new system, the ore is hoisted to the surface and delivered to the mill by gravity.

### Filling in Old Stopes Carries Gold

From the 220-m. level to the surface and for a distance along the latter of 240 m., all the ore has been stoped, and only a few communication ways are open. The oreshoots worked formed a right-angled triangle, 220 by 240 m., with an average width of 2.5 m. Not all the ore was hoisted, however, and it is estimated that at least half the rock broken was left in the stopes. This old filling assays from 12 to 15 gm. in gold per ton, but it is difficult to remove it, as the ground is heavy.

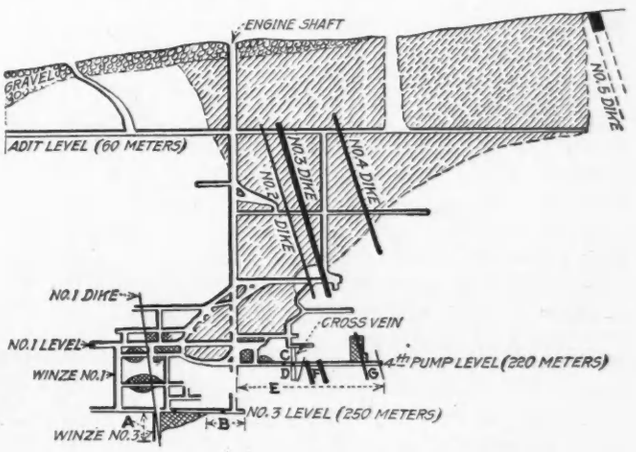
The modern workings are all in the bottom of the mine, and are indicated in the sectional map. Driving and stoping were done (in 1915) by air drills, supplied from the surface by two 10 x 10 Ingersoll Rand straight-line compressors, with air at 90 lb. at the drills. The drills used were butterfly-valve stopers and Jackhamers. All stoping was overhand and done on daily wage.

Driving was on contract, the use of Jackhamers or stopers depending on the nature of the ground. An average price was 70 pesos ($15 U. S. currency) per meter of advance, the company paying for all supplies. Were it not for the compressed air, it would be impossible to work in the damp lower levels, because of the heat and smoke. To make matters worse, it was considered necessary to install a series of steam pumps that would handle about 1000 cu.m. of water per day that came chiefly from the middle levels. When the pumps were in operation the temperature in the workings was high. Little timber is required, fortunately, the more so because local timber is of poor quality.

The hoisting shaft is a poor, crooked affair, sunk in the vein to 220 m. It is not straight in any direction. The measurements inside the timbers are 10 x 4 ft. A double skipway occupies the eastern end and a ladderway and pipe lines occupy the western. When the steam pumps were operating, it was strenuous work to climb out from the bottom with only a hot steam pipe for a hand rail. All workers entered the mine by the ladders, as, owing to the crookedness of the shaft, hoisting ropes have a short life, and a trip in the skip was not considered safe. The one-ton skips dump into a car, in which the ore is transferred to the picking floor. The hoist is a geared two-cylinder winch with 4-ft. drums having hand brakes only, and is uneconomical.

### Quartz Assaying $2.80 Rejected in Hand Picking

The ore as hoisted contained (1915) considerable quartz, with no pyrites, which was picked out and thrown away. The reject assayed about four grams of gold per ton. This low-grade material amounted to a trifle more than 50% of the ore hauled. The picked ore, averaging about 22 gm. of gold, was passed through a crusher set to 1¾ in., and stored in bins. From these it was lowered by gravity to the mill, a distance of 250




ELEVATION OF LAS VACAS MINE WORKING

m., where it was dumped into a chute leading to the battery bins.

The mill is a modern one equipped with five 750-lb. Fraser & Chalmers stamps and five 1200-lb. Allis & Chalmers stamps crushing to 30 mesh with 101 9-in. drops per min. Inside amalgamation was practiced, and an 8 x 4½ ft. apron plate was used in front of each battery. The pulp from the plates ran to a Dorr Simplex classifier. The sand passed to a 28 x 3-ft. pebble mill, which discharged to a 10 x 4-ft. silvered plate. The pulp was then elevated to the classifier again by a 52 x 10-in. Frenier pump. About 66% of the total gold was recovered by amalgamation, most of which came from the inside plates and the first two feet of the battery apron plates.

The classifier discharge contained 3% of plus 200-mesh material, and was run to a 20-ft. Dorr thickener, and thence to three 18' x 6-ft. Pachuca tanks, where individual charge agitation was carried on for about 18 hours with cyanide solution carrying 3 lb. of cyanide per ton. The tank contents were then passed to a 20-ton Moore filter. The tailings, carrying from 2 to 3 gm. per ton, were elevated to the dump. The liquor was settled in 20-ton tanks, passed through zinc boxes, and thrown away, a considerable cyanide loss resulting. No difficulty was experienced in cyaniding the ore beyond the high cyanide consumption; and by the flow

sheet outlined a total extraction of 90% was attained. The high cyanide consumption could have been avoided part of the time, but soluble copper salts were sometimes present in the ore.

The amalgam was restored, and the gold sponge obtained was melted, together with gold from the zinc-box precipitates, into a common bar. The treatment given the precipitates consisted of the usual acid wash, drying, and fusion with carbonate of soda and manganese dioxide in a Monarch oil-fired furnace. The gold as shipped was about 780 fine and contained 170 parts of silver. Thus the base-metal contents were rather high.

The following table gives the work done for the six months ended June 30, 1915:

TABLE I. ORE AND CONCENTRATES ANALYSES, LAS VACAS MINE

| | Concentrates | No. 1 Ore Samples | No. 2 Ore Samples | No. 3 Ore Samples |
|---|---|---|---|---|
| Cu, % | 1.22 | 2.2 | 1.9 | 2.0 |
| Insoluble: | | | | |
| $SiO_2$, % | 22.20 | 57.6 | 32.8 | 54.40 |
| Fe, % | 33.06 | 14.17 | 26.56 | 18.21 |
| CaO, % | 1.91 | 2.10 | 1.00 | 1.20 |
| $Al_2O_3$, % | 2.79 | 7.76 | 4.40 | 3.99 |
| S, % | 36.19 | 14.38 | 32.35 | 19.88 |
| Pb, % | 0.57 | ..... | ..... | ..... |
| Ag, gm., per ton | 172.00 | (a) | (a) | (a) |
| Au, gm., per ton | 516.00 | 66.6 | 300.00 | 132.00 |

(a) Not known.

The analyses which are given in Table I were selected from a considerable number and are fairly representative of the ore as hand picked for the mill. There was, however, about 75% more of No. 1 ore than of Nos. 2 and 3. The concentrates referred to were made in a trial run on tables in the mill. Because of their density, they gave difficulties in agitation, but as shipping conditions did not warrant their shipment elsewhere for treatment, straight cyaniding was continued.

TABLE II. MILLING RESULTS OBTAINED ON ORE COMING FROM DEVELOPMENT WORK AT LAS VACAS MINE DURING THE FIRST SIX MONTHS OF 1915

| Date | Crushed, Metric Tons | Au, gm., per Ton | Recovery | Total Cost, Dollars U. S. A. |
|---|---|---|---|---|
| January | 268 | 29 | 89.77 | $7,682 |
| February | 425 | 23 | 88.92 | 8,132 |
| March | 583 | 24 | 89.32 | 9,043 |
| April | 553 | 21 | 90.83 | 8,504 |
| May | 615 | 20 | 87.91 | 8,751 |
| June | 259 | 20 | 87.42 | 8,400 |
| | 2,704 | 22.43 | 89.16 | $50,512 |

The totals and averages include all mining and development work. In this period, during which expensive development had to be done, the company managed to pay two-thirds of its total expenses from the gold recovered. At the end of this time, when I left the company, the mine was in much better condition.

## War Trade Board To Aid Russia

The War Trade Board, to which the President has intrusted the execution of plans for rendering economic aid to Russia, has now established a corporation to carry out or administer certain details of this economic program in regions and lines of trade where it is not possible to accomplish this through the ordinary channels of trade. Articles of incorporation have been filed for this corporation, to be known as the War Trade Board of the United States Russian Bureau, Inc. The capital of the corporation, which is to be operated in the interest of the Russian people, is placed at $5,000,000, the amount of the revolving fund placed at the disposal of the War Trade Board for the purpose of financing the plans and policies of economic assistance to the Russian people.

## Davis-Daly Copper Co.

The Davis-Daly Copper Co. owns mines near Butte, Mont., and operations for the year ended June 30, 1918, were hampered by labor troubles, according to the annual report. The heat in the lower levels has also been considerable; and the work of connecting the Colorado shaft with the Belmont shaft of the Anaconda Copper Co. is proceeding slowly, the average temperature recorded being 100 degrees.

The property has passed into the producing stage, the output for the year being as follows: Colorado mine, 52,996 tons, containing 260,672 oz. silver, and 5,894,396 lb. copper; Hibernia mine, 5724 tons, containing 129,816 oz. silver, 356 oz. gold, 1,316,310 lb. zinc, and 611,907 lb. lead. During the year an initial dividend of 50c. was paid, and extensive improvements are contemplated to facilitate mining and lower costs of production.

## Economic Future of North Chosen

The effect of improved railway communication on the economic future of North Chosen was recently discussed by the director of the Korean Department of Agriculture, Commerce, and Industry, who is quoted in a consular report as saying:

The region of North Chosen—that is, the whole district of North Kankyo Province—was, in the past, regarded as valueless for colonization because of the lack of means of communication. Even where promising openings for commercial and industrial undertakings seemed to exist, this inconvenience made it doubtful whether profits could be realized. On that account North Chosen has lagged behind South Chosen, but today communications are gradually being opened, and now not only can the products of the interior be easily transported to Seishin over the newly opened Seishin-Kainei Ry., but, by the further opening of the route across the Sea of Japan, financial connection between North Chosen and Japan proper has become closer—an excellent thing for the whole of Chosen. For the present the Seishin-Kainei line and the Japan Sea route can probably not show the expected results, but when the Kirin-Kainei Ry. is completed, new industries will spring up in North Chosen.

The Kirin-Kainei Ry. is a line of about 280 miles to connect Kirin, in Manchuria, with Kainei, in Chosen, and is to be laid by Japan and China at an expense of about 40,000,000 yen [roughly $20,000,000 United States currency], in accordance with the Kando agreement, signed between Japan and China in September, 1909, but the details have not yet been settled in a concrete form. The opening of the Kirin-Kainei Ry. is necessary for China, and it is also necessary for Japan; but there is nothing so important as this railway for bringing about the prosperity and development of Chosen, and especially the region of North Chosen.

Changchun is said to absorb annually about 100,000,000 yen worth of merchandise; but it is probable that, when the Kirin-Kainei Ry. is opened, some of these goods will enter Kainei, and, coming over the Seishin-Kainei line, be exported from Seishin. Not only so, but with the opening of this railway the great forests of Kirin, which contain vast supplies of good timber, will be made accessible, especially if a forest railway be laid. If this were done, with the completion of the Kirin-Kainei Ry. the timber from this district could be sent to Seishin by rail, and for the first time supplied to the rest of the world. At the same time, the produce of the districts traversed by the Kirin-Seishin line would be sent to Seishin, and Seishin would become not only a port of Chosen but a port in a real world sense.

Hitherto there has been no special industry in the region of North Chosen except agriculture, but Japanese capitalists now appear to be directing their attention to this section and to be planning the establishment of various industries. As before stated, North Chosen suffered originally from inconvenience of communication, and so its sources of wealth were unknown; but since the opening of the Seishin-Kainei Ry. the development of its resources has gradually become possible, and its rich stores of all kinds of industrial materials have become known. Much attention has recently been paid to mining, especially the working of the iron deposits of the district.

**Remember the Comfort Fund of the 27th Engineers.**

# Correspondence and Discussion

## The Gold Question

In a recent editorial in the *Journal* it was suggested that the gold question might best be discussed and solved by economists and financiers, but it was pointed out that there are certain features relative to the economy of its production respecting which the advice of engineers should be sought and accepted, and in all the above I am in entire agreement. Recalling the several articles that have recently appeared in the technical press over the signatures of mining men, some of them very capable engineers, I fail to find any suggestion that is satisfying. The arguments presented are not convincing, and more may be said against them than can be said in their favor. Aside from the suggestion that a commission be appointed to study the situation carefully, and advise upon legislation, if any new legislation appears desirable, the specific remedies offered give little hope of being sufficiently practicable to bring relief.

One paper, however, that you published in May, by a distinguished mining engineer, contains considerable food for thought. It is more illuminating than the writings of any economist that I have chanced to see. I refer to the article by Hennen Jennings, consulting engineer to the Bureau of Mines. In again reading this paper, one paragraph appears to me to be of particular interest. It clarifies in a few words this very cloudy situation: "Our Government securities and Liberty bonds, pledged on a gold basis, take the place of gold coin only as long as the people in this and foreign countries have faith that the Government can make good its promises. When this is seriously doubted by the many, gold will go to a premium. The great gold reserves of the past would not be so necessary if the fundamental necessity of measuring gold value in units of labor necessary to win it were better recognized and insisted upon by governments that pledge their credit on a gold basis."

Units of labor, a day's work, the energy required to produce the gold—that is the valuable thing, not the gold itself, which is only a token of work done and useful to hand around as a medium of exchange.

It is not possible for the lawyer to pay his baker, his milkman, and coal dealer with legal advice. He must get something from where the advice is serviceable, and use that something in exchange for the wherewithal to satisfy his own needs. That something was formerly largely an indestructible rare metal, a small quantity of which required considerable labor to produce. Except as an ornament, the metal has little value. It cannot be eaten. It will not clothe the body and keep it warm, but it has an indirect value in being exchangeable, all the world over, for things that one can eat and for things that will keep one warm.

Later, the actual passing of the rare metal has become less and less common. We use paper which, by common consent, we imagine can be exchanged for gold upon demand. That paper is measured by the gold yardstick, but no serious-minded man could think that at any one time all of it could be exchanged for gold. That paper is a measure of labor performed, and, when indorsed by a country whose credit is good, it is exchangeable for labor, or what labor can produce, and only becomes "a scrap of paper" when its author is unable to deliver gold, material, or labor under his contract.

What is it the Allies will demand of Germany? It is not gold, for she has little or no gold with which to pay, and it would take years to accumulate such an amount as will be asked. The indemnity that will be asked will be measured in pounds sterling, francs, or dollars, but it will be paid in labor, or in the products of labor. Perhaps it would be better to say that it will be paid by the expenditure of useful energy, rather than by labor, for the payment will be made by all classes, and not alone by the man who works with his hands.

How would we feel if we had to collect such a debt from Russia, a country of millions of souls and with vastly more gold in its terraine than has Germany? We would probably feel like writing off the indebtedness, and save ourselves the trouble of bookkeeping. Germany has little gold in her banks, and, so far as we know, less in her hills, and yet we all feel confident that Germany can and will pay the bill that is to be handed her, a bill made out in pounds, francs, and dollars. We think of the bill in terms of gold, but we neitner expect nor hope for more than a trifle to be paid in gold. It will be paid in units of labor; it will be paid directly or indirectly with useful energy.

Gold is tangible. The "results of useful energy," "a day's work," are something rather intangible. We cannot put our hands upon them, and place them in our pocketbooks, and hence, when there is a large amount of this commodity to be passed from nation to nation in order to satisfy balances, it is difficult to get the idea out of our heads that it will be necessary to have a lot more gold stored up somewhere to render the exchange possible.

If, before the war, gold reserves and the debts of nations were properly proportioned, the amount of gold that should be placed in reserve today would require an additional weight greater by far than all previous production. Indeed, any increased production that may be brought about by artificial stimulation will be so small as compared with the vast obligations that have recently been incurred as to have practically no effect on the situation. In the case of the United States, with her resources developed as they are, with highly trained and efficient men of business and laborers busy in productive occupations, with ample sources for the raising of taxes, there is little reason to expect her to fail to meet all of her obligations, if not another ounce of gold comes into her treasury for years. England

and France may not be in quite so enviable a position, but both will probably make good. It is in Russia and similar countries of inefficiency that we would like to see gold plentiful, and would like to know that they had fifty cents' worth of gold stored away for every dollar of paper money issued. We have a great deal more reason to feel worried about Russia paying her few millions of obligations than we have respecting the ability of France and England to pay their billions, and that is because we have doubts respecting the units of labor in Russia, but know that they exist in England and France.

But all this is cold comfort to the gold miner, now patriotically robbing his mine at a loss; doing his best to furnish the Government what gold he can; doing the best that he can for the community dependent upon him; doing the best that he can for his own mine in a bad situation. For him we can see no hope until the commodities he uses in accomplishing production fall in price, or until some foreign nation, needing the gold badly, offers him more goods, more labor, or more facilities than he can now secure for the ounce of gold that he produces. F. F. S.

New York, Nov. 21, 1918.

## The Porphyry Coppers

With regard to L. H. Goodwin's interesting article on the resources and achievements of the "porphyry coppers," which appeared in the Nov. 2 issue of the *Journal*, it is to be noted that the average assay contents of the ore reserves in the various mines are taken as a basis of comparison. Such a method appears to me undesirable, as a misleading impression of the comparative worth of each property may be thus conveyed.

Utah Copper, for example, saves about 65% of the copper in the ore, as indicated by assay. Inspiration saves about 75%. It appears to me that, in such estimates as those under discussion, the actual results should be taken as bases for comparison. Utah's present saving of about 16 lb. of copper per ton, in concentrate form, would be a more reasonable figure to use, for comparative purposes, than the 24 lb. or so originally contained in the ore.

What have assays to do with results? It is the amount of copper or other metal saved that counts, not the average content of the ore treated. WILLIAM TUDOR.

Temple, Ga., Nov. 7, 1918.

## What Is an Engineer?

I note with interest a definition, by A. Krom, appearing in the Nov. 16 issue of the *Journal*, which reads as follows:

> An engineer is one who economically directs man-power, and, by scientific design, utilizes the forces and materials of nature for the benefit of mankind.

A new definition, to be worthy of attention, must be complete. The first point of criticism with that quoted is that it fails to take cognizance of recognized usage. In the United States the operator of a railroad engine or a stationary motive plant is an engineer. The word has been generally accepted in that sense; it is widely used; and no stroke of the pen can summarily displace it. If custom dictates a change, a change will result—but in slow stages. It is illogical to exclude recognized usages in defining the word "engineer." If they are uncommon or secondary, they can be placed in a position which is subordinate to the primary significance.

Mr. Krom's definition appears to me to lack pertinence. Had I seen it by itself, or had I been asked to give a typical example of one who "economically directs man-power, and, by scientific design, utilizes the forces and materials of nature," my mind might have turned to some captain of department-store industry, such as John Wanamaker or Gordon Selfridge. "Science," as Huxley said, "is nothing but trained and organized common sense"; and a scientific mind is an asset in any branch of endeavor.

With regard to the economical direction of man-power, I have encountered many brilliant engineers who were distinctly wasteful of the resources at their command. The history of perhaps the most widely advertised mechanical product of the twentieth century—the Liberty Motor—would seem to indicate that the question of economy was a factor of little or no importance. An engineer who directs man-power economically may be preferable to one who is lavish, but that does not make him any more of an engineer, *per se*. Again, no human effort could be consummated without enlisting the aid of natural forces and materials. The great inventor from whom a brilliant idea may spring surely utilizes them—his own perceptions and his own brains—just as another engineer uses steel and concrete and available water pressure.

The second part of Mr. Krom's definition appears to be unduly altruistic. A few engineers may carry out their duties with no other thought than the resultant benefit to mankind, but they are indeed few. Others, and they constitute the great majority, work primarily for a salary, wage, or bonus; others, again, in the hope that their investigations and inventions will result in ultimate material profit to themselves.

Practically all honest effort results in a benefit to mankind in general, but little of it is performed with this object in view as the primary consideration. These are plain, blunt facts; but, nevertheless, they state conditions as they are. Much engineering effort is beneficial to mankind, but it would be invidious to emphasize this fact in the formulation of a definition of an engineer. German invention of recent years has shown that the subjugation rather than the benefit of mankind was the main object of many devilish, though none the less brilliant, engineering achievements.

Mr. Krom's definition has served to point out the inadequacy of available information; and the great body of professional men will appreciate the initiative in his effort to standardize nomenclature in this direction. The primary need for such a revision arises from the fact that the engineer's work must be emphasized. There are engineers and engineers. The purely mechanical class will not be deprived of their accustomed appellation by a new definition which ignores their existence. A wider recognition of the fundamental meaning of the word will do much good, and the secondary significance will gradually become obsolete.

Engineering, to my mind, is, primarily, creative effort. An engineer may direct man-power or he may work alone. He may utilize the material forces or products of nature in consummating his ideas, but this

is of secondary importance. His difference from his fellow lies not in the economical way he can handle labor, or by the science which he may apply to his work. Neither are his efforts undertaken for the benefit of mankind, any more than those in many other groups of human endeavor. His main characteristic is an ability to bring to his work a creative, inventive spirit of initiative, which marks him as distinct from the technician who merely works under his instructions.

I would suggest a complete definition as follows:

Engineer: 1. A technician who applies creative effort to the solution of a problem, or the operation of an enterprise. 2. One who is skillful, or artful in design. 3. The operator of an engine or other mechanical equipment—an engine driver.

New York, Nov. 20, 1918. A. W. ALLEN.

## A Neglected Course in Mining Schools

For 30 years or more, American institutions that have devoted their efforts to the education of mining engineers have followed or improved upon the methods used in colleges and universities offering various courses in engineering. The directors of mining schools soon recognized the necessity of bringing their students into touch with the practical at an early stage in the courses of engineering. Even in the freshman year, or at the end of it, the mining student is at work in the field, underground, or in the shop. The success of this plan has been so marked that one wonders why it has not been carried still further.

The making of men who can mine and recover the merchantable product with the least loss and greatest profit—who can mine and treat ores in the most economical manner—has been and still is the object of mining schools. They have been eminently successful in making men of science, who have used skill in its application. They have taught men how to value and how to determine costs. They have taught them how to make commercial use of geology, and have taught all about the the composition and value of the materials used, and the details of the mechanical appliances that are handled. Yet with all this knowledge, why is it that so many successful managers and superintendents are not technical men, and that so many of our mining school men drift off to other work?

It is because production depends mainly on two factors, materials and labor, and the intelligent use of both. Education respecting the former has been eminently successful. Education respecting the latter has been noticeably absent; not completely so, perhaps, but woefully neglected.

The man who is foreman, superintendent, manager, or director, and who holds his position, generally occupies it because of his ability. If he is a non-technical man, he is holding his position not because of his lack of technical knowledge, but in spite of that handicap.

Success in the production of minerals depends largely on human beings, and no matter how well we know the geology of our formation, the details of our pumps and hoists, the value of our powder and steel, if we do not know our men and how to use them, we are not going to hold a commanding position long.

Those who have been of the laboring class, who have worked with them, who know their minds and angle of observation, their desires and ambitions, are, if leaders, the men whom we often see making successful production where a solely technical man has failed. Where the human element is the largest factor in production, there the humane side in the manager counts for more than scientific training.

Have our mining schools not neglected this side entirely or made too little of it, simply being satisfied that a short time devoted to doing the work of the laborer would suffice for all practical purposes?

Leaders of men, be they managers, bosses, or brigands, are generally born as such. When we see our boy, and the boys of all the neighborhood, going over to Smith's every night after school, and making Smith's their headquarters on Saturdays, we can be pretty sure that there is something magnetic about the Smith boy; and a little later we will see him as captain of the local baseball club, then class president, and still later as leader in some enterprise, good or bad, large or small, as opportunity offers. Such boys will not remain laborers, while many of their companions, though given all opportunity, can never be educated to be anything more than laborers.

But, granting that some men are born leaders and that others are born followers, can we not still further help those whom we are trying to advance from the latter to the former station?

We teach our boys mineralogy, geology, chemistry, mechanics, electricity, mathematics, and we see them become far more useful members of the community than their brothers who were not so educated. We have taught them to use, to the best advantage, the inanimate materials that go to maintain production, but have carefully avoided mentioning the fact that production is largely dependent upon their ability to handle successfully the animate element that enters into it.

We read much of efficiency, scientific management, Americanization, strikes, housing, education, and kindred subjects, all having to do with the human element—all of admitted importance; and it is time for our mining schools to be helping the future engineer to study these questions in a scientific manner, to show him what he must contend with and depend upon, and if it be not possible to make a leader of him, at least to indicate the direction in which his efforts should be directed in securing the coöperation of his men.

New York, Nov. 9, 1918. ENGINEER.

## Dust Abatement in Mines

Mr. Borcherdt's paper entitled "Dust Abatement in Mines" in the Nov. 2 issue of the *Journal* prompts the thought that the more generally successful feeding of water through hollow drill steel may still leave serious problems for solution. It is an unpleasant and a disappointing fact that the current models of mounted water-drills atomize both water and lubricant to such extent that a fog of water vapor is now common about these drills when in operation. It is not a wholesome atmosphere, even though measurably better than the old clouds of dust; and the danger should be recognized by those who are leading in the necessary campaign to better the mine atmosphere. CHARLES A. CHASE.

Denver, Colo., Nov. 16, 1918.

# The Determination of Tin In High-Grade Wolfram Ores*

By A. R. POWELL

THE specifications for wolfram used in the manufacture of ferrotungsten require that the ore shall contain not more than 1% of tin; sometimes the stipulated maximum is lower still, namely, 0.75%. A rapid and reliable method for determining tin in wolfram concentrate is, therefore, of the greatest importance for the purpose of controlling the work of the electromagnetic separator and for testing the adaptability of the magnetic separation process to new parcels of tin-wolfram ore, as some varieties of cassiterite show marked magnetic properties.

In the volumetric determination of tin by means of iodine, even a moderate quantity of tungstic acid masks the end point completely by the intense blue color of the lower oxides of tungsten formed in the reduction. Hence the necessity for removing the tungstic acid before titration. Several methods to this effect have been proposed and used, but they are, on the whole, too tedious for rapid work, and not always reliable. Of the four methods described herewith, the first three, though slow, were found to give good results, and are useful as a check. The fourth method is rapid, and has proved satisfactory.

## Determination of Tin in Wolfram Ores

Tin occurs both as cassiterite and stannine in wolfram ores. The former is insoluble in acids and in fused bisulphate; the latter dissolves in aqua regia, and fusion with bisulphate renders part of the tin soluble. In case cassiterite alone is present, an attack with acids or fusion with bisulphate will dissolve the wolfram and leave the tin oxide unattacked; with stannine, however, the solution must also be examined for tin. In my experience cassiterite is quite insoluble in aqua regia, but, on fusion with bisulphate, a small amount goes into solution when the melt is extracted with dilute sulphuric acid. This rarely exceeds 1 mg. and is often negligible.

*Method* 1. The ordinary aqua regia attack of the slimed wolfram ore leaves the cassiterite with the tungstic acid; and, when the latter is dissolved out with ammonia, the small residue left may be fused with sodium peroxide and the tin determined as in the well-known Pearce assay. This is the usual method for removing the wolfram, but its great drawbacks are: (a) The ore must be very finely powdered before attack; (b) the complete solution of the wolfram is a long and tedious operation; (c) the extraction of the tungstic acid with ammonia or soda introduces another filtration; (d) if stannine is present, the acid filtrate must be treated with hydrogen sulphide, the precipitate extracted with sodium sulphide to remove copper, and the tin precipitated with acid in the filtrate from the copper sulphide, the washed tin sulphide being ignited with the residue from the ammonia extraction.

*Method* 2. Fusion of the ore with potassium cyanide was also tried, but, though a much more rapid method, it was not free from objections. Thus, when many assays are being conducted at the same time, the fumes from the hot, strong cyanide solutions are likely to be dangerous. Again, the wear on the porcelain crucibles is great, one crucible rarely surviving more than three fusions. The analysis is conducted as follows: 5 gm. of cyanide is gently fused in a porcelain crucible and allowed to cool again until a crust forms, on to which 1 gm. of ore is gently transferred. The crucible is covered and the temperature raised slowly until vigorous effervescence ceases, after which the contents of the crucible are stirred gently and heated for 5 min. longer. After cooling, the melt is extracted with hot water, and the insoluble residue, consisting mainly of metallic iron and tin, is filtered off, washed free from cyanide with hot water, and dissolved in hydrochloric acid and a little potassium chlorate. The resulting solution is ready for reduction and titration. If the ore contains arsenic, copper, or bismuth, it must be treated with 20 c.c. of nitric acid (sp.gr. 1.2) prior to fusion. The insoluble matter, which contains all the tin, is filtered off, well washed with hot water, ignited, and fused with cyanide. Although the method gave, on the whole, reliable results, inexplicably low figures were obtained at times, so that, though useful as a check, it did not answer well as a control method.

*Method* 3. The possibility of separating the two metals after getting them into solution as sodium tungstate and stannate was next investigated. Augenat has described a method in which the tungsten is precipitated as blue oxide by means of zinc and hydrochloric acid, but this was found to be slow and the separation imperfect. As in the separation of molybdenum from tungsten, it appeared possible to separate the tin from a tartaric acid solution of the sodium salts by precipitation with hydrogen sulphide. It also seemed probable that boiling the alkaline solution of the two metals with ammonium nitrate would precipitate the tin as metastannic acid. Both the above procedures were found workable, as the following experiment shows: 0.5 gm. of pure tin oxide was fused with 5 gm. of sodium peroxide in an iron crucible, the cold melt extracted with boiling water, the solution cooled, made up to 500 c.c. and filtered through a dry filter. A number of 20 c.c. trials (= 0.0158 gm. Sn) were pipetted into small flasks and treated as follows: (a) The solution was acidified with hydrochloric acid and reduced direct; (b) the solution was acidified with tartaric acid and saturated with hydrogen sulphide, the precipitate was filtered off, washed, dissolved in hydrochloric acid and reduced; (c) the solution was treated with 5 gm. of ammonium nitrate, boiled till free from ammonia, the precipitate filtered off, washed, dissolved in hydrochloric acid and reduced; (d) the solution was treated as under (c) but the precipitate was ignited and fused with peroxide as in Pearce's assay. The amounts of tin found were (a) 0.0157, (b) 0.0154, (c) 0.0153, (d) 0.0158 gm

*Excerpt from Trans. Soc. Chem. Ind., Vol. 37, No. 18.

The precipitation with hydrogen sulphide generally gave slightly low results, ascribed to loss of colloidal sulphide in washing. The method as applied to ores is as follows: 2.5 gm. of ore is fused with 10 to 12 gm. of sodium peroxide in an iron crucible in the usual manner. The cold melt is extracted with water and a little alcohol, the liquid diluted to 250 c.c. in a graduated flask, and 200 c.c. filtered through a dry filter. The solution is transferred to a beaker and 5 gm. of tartaric acid added, followed by hydrochloric acid to produce a distinctly acid reaction. The hot solution is saturated with hydrogen sulphide, the precipitate filtered off and washed with warm 2% sodium acetate saturated with hydrogen sulphide. If arsenic is absent, the precipitate is dissolved directly in hydrochloric acid; if present, the precipitate is ignited in an iron crucible at a very low temperature and the residue fused with peroxide.

Precipitation with ammonium nitrate is carried out by boiling the alkaline filtrate, obtained as above, with 20 gm. of ammonium nitrate and a little filter pulp until the smell of ammonia is barely perceptible. The precipitate is allowed to settle, filtered off, and well washed with hot 2% ammonium sulphate. It may either be extracted with hydrochloric acid and the filtered solution reduced as usual, or ignited and fused with peroxide. Arsenic, if present, is carried down by the metastannic acid, and may cause trouble in the reduction and titration. It should preferably be removed by a preliminary digestion of the ore with nitric acid. The methods given under (3) work equally well when the tin is present in the form of stannine as when present as cassiterite.

COMPARISON OF RESULTS OF DETERMINING TIN CONTENT IN HIGH-GRADE WOLFRAM ORES BY VARIOUS METHODS

| | | Method 1 | Method 2 | Method 3 — Fusion with $Na_2O_2$ | | 4. Powell Method — Bisulphte Fusion | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Separate Determination of Sn | |
| Ore | Composition, Per Cent. | Aqua Regia, Per Cent. Sn | Fusion With NaCN Per Cent. Sn | Tin Pptd. by $H_2S$ Per Cent. Sn | Tin Pptd. by $NH_4NO_3$ Per Cent. Sn | Total Per Cent. Sn. | Insoluble Residue | Recovered by $H_2S$ |
| A | $WO_3$, 70.4; Cu, 0.25; As, 0.16: contained stannine | 0.35<br>0.36 | 0.37 (a)<br>0.34 (a) | 0.33<br>0.30 | 0.37<br>0.37 | 0.37(a)<br>0.35(a) | 0.24<br>0.24 | 0.16<br>0.11 |
| B | $WO_3$, 72.9; As, 0.08; Bi, 0.07 | 0.61<br>0.59 | 0.59<br>0.55 | 0.53<br>0.57 | 0.55<br>0.51 | 0.60<br>0.59 | 0.59<br>0.59 | nil<br>nil |
| C | $WO_3$, 65.4; As, 1.19; Cu, 0.24 | 1.97<br>1.97 | 1.90(a)<br>1.95(a) | 1.93<br>1.92 | 1.95(a)<br>1.79(a) | 2.00(a)<br>1.96(a) | 1.83<br>1.89 | 0.14<br>0.06 |
| D | $WO_3$, 63.8; As, 0.22; Bi, 0.96 | 7.10<br>7.08 | 6.97(a)<br>7.04(a) | 7.02<br>7.07 | 6.95<br>7.09 | 7.05(a)<br>7.07(a) | 6.78<br>6.82 | 0.29<br>0.20 |
| E | $WO_3$, 74.3; As, nil; Cu, Bi, traces | 0.12<br>0.12 | 0.08<br>0.10 | 0.10<br>..... | 0.12<br>..... | 0.14<br>0.12 | 0.12<br>0.11 | nil<br>nil |
| F | Synthetic mixture | 5.48<br>5.45 | 5.40<br>5.47 | 5.42<br>5.44 | 5.45<br>5.36 | 5.46<br>5.46 | 5.44<br>5.41 | nil<br>trace |

(a) The ore was given a preliminary treatment with nitric acid.

## Powell Method

After removal of the wolfram by fusion of the ore with bisulphate, as usually carried out, the melt is heated with dilute sulphuric acid, which dissolves iron, manganese, and titanium sulphates, but precipitates the tungstic acid in a white flocculent form which is difficult to filter and wash free from iron salts. Consequently, on leaching the residue with ammonia, ferric hydroxide is formed, which retains tungstic acid, and re-precipitation is impracticable when time is an important factor. Caustic soda readily dissolves tungstic acid; it also precipitates iron, but in the presence of sufficient tartaric acid both metals remain in solution. It was thus found possible to obtain a clean residue in one operation. Further work showed that addition of caustic soda was not necessary, as a solution of hot 5% tartaric acid readily dissolved the fused cake without separation of tungstic acid.

The exact details of this method, which has proved its superiority, after nearly three years' continual use, are as follows: 1 gm. of the sample, crushed to pass a 90-mesh sieve, is mixed with 5 gm. of previously fused bisulphate in a capacious silica crucible, and the mixture heated, gently at first, finally to a red heat. The crucible is cooled by standing it in a shallow basin of cold water (taking care that no water enters the crucible). When nearly cold, it is covered with a watch-glass to avoid loss by the splintering of the melt. The crucible is half filled with hot 5% tartaric acid and gently warmed over a small flame, whereby the melt is readily detached. It is then transferred to a beaker, together with 70 to 80 c.c. of tartaric acid solution, and the whole boiled until the cake has completely disintegrated and all soluble matter dissolved.

Another method of removing the melt from the crucible consists in pouring it on to a cold iron or nickel plate. When cold the mass is boiled with 5% tartaric acid in a beaker, and what remains in the crucible is rinsed out with the same liquor into the main solution. The insoluble material is filtered off on a Whatman No. 1 or 2 filter, well washed with hot water, ignited wet in an iron crucible, and fused with 2 gm. of sodium peroxide. In washing out the crucible and beaker, care should be taken that all the tinstone, which has a great tendency to hang back, is washed out.

It was soon found that some ores give slightly low results by this method, and this was traced to solution of a little tin in the tartaric acid liquor. It may be recovered by a hydrogen sulphide treatment, the tin being precipitated as sulphide and filtered off, together with the insoluble matter. Gentle ignition converts the sulphide to oxide without loss.

Ilmenite, columbite, and monazite, if present, are dissolved by the bisulphate fusion and subsequently dissolve in the tartaric acid liquor. Scheelite dissolves completely, and no separation of calcium sulphate occurs. If much copper, bismuth, or molybdenum is present, the ore should first be treated with 20 c.c. of nitric acid (sp.gr. 1.2), the residue filtered off, washed with hot water, ignited wet, and fused with bisulphate. Arsenic is volatilized on igniting the residue from the fusion, but large quantities of mispickel or iron pyrites cause much effervescence and consequent danger of loss during the fusion, so that it is better, in these cases.

also, to give the ore a preliminary treatment with nitric acid.

SUMMARY OF RESULTS

The table gives a comparison of the results obtained by the method detailed. After the removal of the wolfram, the stannic chloride solution obtained either by fusion or solution was reduced in a round flask with three iron nails for 30 min. after the color of the ferric chloride had disappeared. The reduced solution was cooled in running water after the addition of a piece of clean marble, the nails were removed and washed with air-free water, and the solution was titrated with a weak solution of iodine (1 c.c. = 0.002 gm. Sn, approx.). The iodine was standardized against pure tin, and due allowance made for the amount of iodine consumed by the nails (this correction never amounted to more than 0.3 c.c. of the iodine solution).

The synthetic mixture F was made by sliming together 20 gm. of a pure crystal of wolfram and 1.6 gm. of a pure crystal of tinstone.

## France's Iron and Steel Industry

Under the name of Société Corporative des Mines de fer et de la Sidérurgie des régions sinistrées, a company has recently been formed in France for the purpose of conducting commercial or industrial operations useful in bringing about the reconstitution and reorganization of the iron mines and steel works of the invaded regions, says a consular report.

The company is affiliated with the Comptoir Central d'achats industriels pour les régions envahies, and has its offices with that organization at 40 Rue du Colisée, Paris, and is practically a technical commission of the Comptoir Central. For convenience, however, a separate share company has been organized Its capital stock of 1,000,000f., divided into 2000 shares of 500f. each, is held by iron-mining and steel companies owning properties in the invaded regions of France.

The society is administered by a conseil d'administration (corresponding to the board of directors of an American corporation) composed of not less than 10 and not more than 25 members elected by the shareholders. The present board of directors is composed of Edouard Dreux, civil engineer, No. 35 Boulevard Haussmann, Paris and representatives of the following companies:

La Société Civile de Joudreville, No. 84 Rue de Lille, Paris.

La Société des mines de fer de la Mourière, No. 58 Rue de Provence, Paris.

La Société Anonyme des Forges et Aciéries du Nord et de l'Est, No. 10 Rue Auber, Paris.

La Compagnie des Forges et Aciéries de la Marine et d'Homécourt, à Saint-Chamond (Loire).

La Société Anonyme des Aciéres de Micheville, à Micheville (Meurthe et Moselle).

La Société Anonyme des Hauts Fourneaux et Fonderies de Pont à Mousson, Pont à Mousson (Meurthe et Moselle).

La Société en commandite per actions Schneider & Cie., No. 42 Rue d'Anjou, Paris.

La Société Métallurgique de Senelle-Maubeuge (Société Anonyme) Longwy (Meurthe et Moselle).

MM. de Wendel & Cie., Joeuf (Meurthe et Moselle).

La Société des Mines de Giraument, No. 19 Rue de la Rochefoucauld, Paris.

The new company is making estimates of the raw material and equipment that will be needed to restore the damaged iron mines and steel works in the northern and eastern part of France. Its method is to gather the best information available regarding the extent to which iron mines, blast furnaces, and steel works have been destroyed, and on the basis of this data prepare purchase programs covering the materials needed for replacement.

These programs, when approved by the directors of the Société Corporative des mines de fer et de la Sidérurgie, are turned over to the Comptoir Central d'achats for execution. The Comptoir Central is a quasi-official organization, and is authorized to purchase any and all materials for the reconstruction of the invaded regions out of funds placed at its disposal by the French government.

It will not be possible to gain an accurate idea of the quantity or the value of raw materials and equipment needed to restore the iron and steel industry of the invaded regions until the Germans have completely evacuated the Lorraine sector. The size of the task may be inferred from the following facts: In 1913 France produced 21,714,000 tons of iron ore, of which 19,800,000 (90%) came from the Department of Meurthe et Moselle, in which are the iron bases of Nancy, Longwy, and Briey. The last two regions, which furnished the great bulk of France's iron ore, have been in the control of the enemy since the beginning of the war.

Of the 5,300,000 tons of pig iron produced in French blast furnaces the year before the war began, 86% came out of the blast furnaces of the north and east. Of the 4,600,000 tons of steel ingots cast from French converters and furnaces in the same year, 3,390,000 tons came from the regions which are now being evacuated by the Germans under the pressure of the Allied armies.

Much of the special equipment needed in the restoration of the French iron mines, blast furnaces, and steel works must be furnished by the United States.

## Board Rules on Iron-Ore Imports

The War Trade Board announced on Nov. 11, 1918, that, in addition to the general license PBF No. 14, covering the importation of iron ore from Sweden and Spain, when coming as ballast in ships returning from those countries, licenses may be issued for bringing in a total of 70,000 tons of low-phosphorus ore from Spain, Sweden, Norway, and North Africa, provided the ore be imported and entered prior to July 1, 1919. By low-phosphorus iron ore is meant ore which contains phosphorus in the proportion of not more than 0.012% thereof to 50% of metallic iron. The total amount of the ore thus allowed to enter will be allocated by the Bureau of Imports.

**Prospecting for Gold in Rhodesia** is being encouraged to the extent that the expenses of prospectors may be subsidized at a rate not to exceed $75 per month. The scheme is one that leaves no loophole for fraud, the allowance being in the form of credit notes redeemable for stores. The amount received is sufficient to accelerate a prospector's efforts without furnishing him with anything approaching a competency.

# Industrial News from Washington

By Paul Wooton, Special Correspondent

## Platinum Licenses Void

The rules and regulations governing the handling of platinum, iridium, and palladium have been suspended by an order approved by the Director of the U. S. Bureau of Mines. That section of the explosives regulations which applies to ingredients which are not to become a part of an explosive has been revoked. The order in this connection reads as follows:

Because no longer required for the public safety, the Director of the Bureau of Mines in charge of explosives regulation has made the following changes in the general information and rulings under the act of Oct. 6, 1917, and as amended by the Sundry Civil Act of July 1, 1918:

1. All regulations relating to ingredients not used or intended to be used in the manufacture of explosives are revoked, and no further license of such ingredients will be required.
2. All regulations relating to fireworks are revoked, and no further license of fireworks will be required.
3. All regulations relating to platinum, iridium, and palladium, and compounds thereof, are revoked, and no further license of platinum, iridium, and palladium will be required.

The order was accompanied by the following statement from C. H. Conner, chief of the platinum section of the War Industries Board:

The effect of the foregoing order is to render void any licenses heretofore issued to you under the so-called platinum rules and regulations, dated Aug. 17, 1918, to render unnecessary further compliance with said rules and regulations, and to terminate the necessity for securing further licenses thereunder.

The foregoing order shall not operate to relieve any person upon whom an order requisitioning platinum, iridium, and palladium, or compounds thereof may have been served, from any obligation imposed upon him by such order.

Cancellation of requisition 342, covering platinum, is to become effective Dec. 1. In connection with the above, it may also be noted that dental platinum, iridium, and palladium, as well as platinum and rhodium, have been removed from the export conservation list.

## War-Minerals Program Developing

Although no complete plan has been formulated at this writing (Nov. 22) by the Secretary of the Interior for administering the War-Minerals Act, such a program is rapidly taking form. Some features of the scheme doubtless will be affected by the conference called for Nov. 27, at which all phases of the chromite situation will be presented. The Executive order conveying the administration of the War-Minerals Act to the Secretary of the Interior reads as follows:

By virtue of the power and authority vested in me by the act of Congress, providing further for the national security and defense by encouraging the production, conserving the supply, and controlling the distribution of certain ores, metals, and minerals approved Oct. 5, I hereby direct that the Secretary of the Interior shall exercise the powers and authority given under the act to the President, except those relating to duties upon imports.

An unusual and rather amusing feature of the order was the fact that it had already been issued a week before Secretary Lane himself learned the powers granted by the act had been transferred to him. By some slip, the usual notification was not sent out. The Secretary learned of the matter through the correspondent of the *Engineering and Mining Journal*, whose weekly inquiries at the White House regarding such an order finally were rewarded with the information that it had been issued.

The last clause of the order, which excepts the powers referring to duties upon imports, necessarily had to form a part of the order, as such powers may not be delegated by the President. Practically the same power is conveyed, however, with the right to allocate. By failing to allocate any imports which might not be desirable, the effect would be practically the same as that which would be occasioned by a prohibitive tariff.

## Preference List No. 2 Eliminated

A long step toward turning the transportation of materials back into normal channels was made on Nov. 20 by a partial cancellation of priority ratings. The purport of the long legally worded order is set forth in the following announcement:

The priorities division of the War Industries Board announces the formal cancellation of all outstanding priority ratings, whether by certificate or automatic rating, excepting those for the Navy, the Emergency Fleet Corporation, railroads, telegraph, and telephone companies.

The order becomes effective as of Nov. 22, 1918. It in no wise implies cancellation of orders, priority directions, and requests, whatever their form, having been entirely disconnected from the placing of orders; their sole purpose and function being to define the relative importance of orders when placed. Furthermore, the full force and effect of the directions prior to that date are retained and preserved for the protection and benefit of those who have respected and observed them.

The effect of the cancellation will be to divert to civilian needs on an equable basis vast quantities of materials in the obtaining of which the military program of the nation had prior claim.

Applications for priority certificates may still be made, but will be granted only when the need is urgent and where it is clearly in the public interest. Nevertheless, the priorities division, under the new order, not only recognizes the paramount needs of the Navy, Emergency Fleet Corporation, railroads, telegraph, and telephone companies, but urges the industries of the country, without resort to priority assistance, to speed up the production and delivery of orders for the repairing of public utilities, manufacture of farm implements, and equipment for the production and distribution of food, petroleum, and natural gas pipe lines, and other facilities; and the operation, repair, maintenance, or expansion of mines, coke-oven plants, or reduction plants, smelteries, and furnaces employed in the production of fuels, metals, and metal products.

The order further eliminates completely Preference List No. 2, issued by the priorities division for the guidance of all governmental agencies and others interested in the production and supply of fuel and electric energy, the supply of labor, and the supply of transportation. From time to time, however, the priorities division will promulgate such rulings and make such suggestions and requests in connection with priorities in the production and supply of fuel, electric energy, labor, and transportation as changing conditions may require.

All outstanding licenses for the importation of chrome ore, except those covering shipments from Cuba, Canada, and Brazil, have been revoked by the War Trade Board as to shipments from abroad after Nov. 11, 1918. Hereafter, no licenses will be issued for the importation of chrome ore, except licenses covering shipments from Cuba, Canada, and Brazil.

## John D. Ryan Resigns

In tendering his resignation as Second Assistant Secretary of War and Director of Air Service, announced on Nov. 22, John D. Ryan made the following statement in his letter to Secretary Baker:

I feel strongly that, now the war is over, my duty lies in the line of my former work. Labor and industry of the country must be quickly adjusted from a war to a peace basis, and the copper production is one of the most vital to the country's welfare. I believe I can do much in helping to bring about stable conditions, and that I should take up the work immediately.

In his reply, the Secretary of War said:

Realizing the very great importance of the production and distribution of copper in the reëstablishment of our national civilian industry, and your own intimate relation to this great business, I reluctantly acquiesce in your desire to return to it and to terminate your relations as Second Assistant Secretary of War and Director of Air Service.

Last May President Wilson called upon Mr. Ryan, president of the Anaconda Copper Mining Co., to take charge of aircraft production. Resigning his private connections, Mr. Ryan became Director of Aircraft Production and chairman of the Aircraft Board. Three months later he was appointed to the positions just resigned, in which he had complete charge of aëronautics. Improvement under his administration was commented upon by Charles E. Hughes, in his report on aircraft production.

## The November Meeting of the New York Section of the A. I. M. E.

The New York Section of the American Institute of Mining Engineers on Wednesday evening, Nov. 20, held a joint meeting with the American Institute of Electrical Engineers, the American Society of Civil Engineers, and the American Society of Mechanical Engineers, in the auditorium of the Engineering Societies Building, 29 West 39th St., New York. It had been announced that J. Leonard Replogle, director of steel supplies of the United States War Industries Board, would address the meeting on "The Demand for Steel and the Conservation of Steel." Pressure of official business in Washington prevented Mr. Replogle's attendance, and Albert C. Ritchie, counsel for the War Industries Board, addressed the meeting. Owing to the end of European hostilities and the cancellation of war orders—especially by many subcontractors—Mr. Ritchie changed the topic slightly and spoke on "The Demand for Steel and the Maintenance of Production." He said in part:

"During the first half of 1918, 17,000,000 tons of steel was produced, and it was estimated that the requirements of the second half would be 21,000,000 tons. The total produced under normal conditions in six months' time would have been 4,000,000 tons less than was then required for war purposes alone.

"We now have an annual capacity of producing 45 million tons of steel, and apparently no ready market to absorb this production. The War Industries Board will continue to give help and supervise steel production until conditions readjust themselves. The removal of the present limitation for the use of steel in non-essential industries, and renewed activity in building construction, will consume a large amount. The only priority retained will be for Army and Navy requirements both here and abroad."

Capt. P. E. Dulieux, of the French High Commission, said that at the beginning of the war Germany was very short of steel and needed it for war purposes. For this reason she grabbed the iron mines and steel plants in Belgium and northern France.

In 1913 France produced five million tons of pig iron and also imported some from Spain and Algiers. The German invasion effectually destroyed over 80% of the iron-producing capacity, so that during the war, to advance supplies for the troops, railroads in other parts of France had to be torn up and taken to the front. These must now be replaced. The total requirements of France are about eight million tons, which must be supplied by the United States and England, and new equipment is likewise required for the reconstruction of the French steel mills. With Alsace and Lorraine in their possession, and by means of combinations of the steel-producing interests similar in form to the United States Steel Corporation, France will become a competitor of the other countries in the production of steel and within a few years will be in a position to meet possible German competition in neutral countries.

## Société Minerais et Metaux

The Société Minerais et Metaux, with a capital of 10,000,000 francs, was organized (August, 1917), at the suggestion of the French Ministry of Commerce and Industry, and has for its principal objects: (1) The dealing in ores, metallurgical products, and metals; (2) establishment of close relations with the mineral and metallurgical industries of the Allied countries, free from any Germanic influence; (3) development in France of the mining and metallurgical industries.

The company is a coöperative organization of metal producers, its object being to keep them in contact with the producers of the world and fully informed as to the statistical data of the mining and metallurgical industries.

This company comprises among its shareholders 26 French mining or metallurgical companies representing interests in France, Spain, Mexico, Algeria, Tunis, Serbia, Chile, Bolivia, Italy, and Russia. Its directors are eminent in the mining, metallurgical, banking, and industrial circles of France.

The Société is now selling lead for all purposes to the French and British governments. It purposes developing this trade; and, being in a particularly favorable position to know in detail the metal necessities in France, to act as agent for the purchase and sale of ores and metals. This association of French producers represents today an output of about 200,000 tons of lead, 40,000 tons of copper, and 50,000 tons of zinc.

The Société expects to institute research work on a large scale and to organize laboratories for this purpose. It is its intention to compete on all points with the German organizations having similar objects which existed in Europe before the war.

The directors of the company are: MM. G. Teissier; R. G. Levy; E. Paraf; A. Vincent; W. d'Eichthal; F. Robellaz, and F. Ledoux. The mining and metallurgical companies that are participating are the following: Société Minière & Métallurgique de Penarroya; Société d'Affinage de Métaux; Compagnie des Mines d'Ain-

Barber; Association Minière; Sté des Mines de Zinc d'Ain-Arko; Compagnie du Boléo; Compagnie française des Mines de Bor; Corocoro United Copper Mines, Ltd.; Sté des Mines de Fedj-el-Adoum; Société des Mines de Zinc de Guergour; Compagnie des Mines de Huaron; Société Minière du Kanguet; Comptoir Lyon Alemand; Compagnies des Minerais de fer Magnétique de Mokta-el-Hadid; Société Anonyme des Mines de Malfidano; Compagnie des Mines d'Ouasta et de Mesloula; Société des Mines de Parzan; Compagnie Industrielle du Platine; Sté Anonyme des Mines & Fonderies de Pontgibaud; Sté des Mines d'Antimoine de Rochetréjoux; Sté des Anciens Etablissement Sopwith; Sté française d'études et d'entreprises; Sté des Mines du Djebel-Ressas; Sté Anonyme française du Djebel-Hallouf; Société Anonyme des Mines & Usines de Peyebrune; Compagnie La Cruz.

## Australian Metal Production

MELBOURNE CORRESPONDENCE

The conclusion of negotiations for the purchase of the surplus copper production till the end of the present year, which really means the yield from ore secured to the end of September, occasioned a feeling of relief on the part of Australian producers, but the uncertainty will again be manifested in the near future, although a general air of optimism is apparent. The value of the Australian output at present prices is approximately £5,000,000 per annum.

As previously reported, the exportable output of zinc concentrates has been sold to the imperial authorities for the period of the war and 10 years afterward. This covers 300,000 tons of concentrates annually.

The Australian production of lead amounts to about 175,000 tons per annum, and the exportable output to the end of 1918 has been sold to the British Ministry of Munitions, with the exception of lead for the markets of the East. As with zinc and copper, large accumulations of lead are awaiting shipment, and this fact makes the extension of the present agreement more difficult.

The formation of the Tin Producers' Association on the same lines as the zinc and copper associations has been approved. An embargo has been placed on the exportation of tin ores and concentrates, and in future all locally produced tin ore and concentrates will be smelted in Australia.

The Wallaroo and Moonta mines have produced, in the last half century and more, over 300,000 tons of fine copper, and although operations are now being carried on at varying depths to 3000 ft., the company has still a good lease of life. At Moonta, although large sums have been spent in prospecting, no new discoveries have been made, and work is now confined to the extraction of ore in the upper levels of the mine. The Wallaroo mines now yield the bulk of the ore. The ore raised at Wallaroo during the first half of 1918 averaged 3.95% copper, whereas the Moonta quota averages only 2.7%. After preliminary treatment and concentration, the tonnages from the two properties sent to the smelting works were respectively 29,586 tons, averaging 8.69%, and 4396 tons, averaging 13.91%. In addition, 404 tons of precipitate, averaging 68.81%, was produced at Moonta. The smelting works treated 35,371 tons of ore, concentrate, and precipitate, producing 3,804 tons of refined copper. The refinery also treated 864 tons of blister from Mount Cuthbert mine, North Queensland.

The Waihi-Paeroa Gold Extraction Co., of New Zealand, which erected a modern plant in 1911 for the treatment of the tailings and silt washed down the Ohinemuri River from the Waihi and Karangahake batteries, has decided to go into liquidation. Nearly £80,000 was spent on plant and equipment. The yield of gold from the treatment of 922,000 tons to the end of 1916 was valued at £279,375, but only £18,750 has been distributed among shareholders.

## Shipping Australian Metals

SYDNEY CORRESPONDENCE

Australia pays part of her debts by the export of lead, copper, tin, and zinc. Local consumption is insignificant. Recently published figures of metal exports for the last two years show that the dearth of ships has caused stocks to accumulate. In the year ended June 30, 1917, about 38,000 tons of copper was shipped, and in the year ended June 30, 1918, only 29,000 tons. Assuming the annual output to be 40,000 tons, this would leave a stock of about 13,000 tons of June 30, 1918. A few shipments have been made since June last, but not enough to keep pace with the production since that date. It seems likely that by the end of the year the stocks will be still greater. The quantity is not large according to American ideas, but it is about 33% of the whole output of the commonwealth. The lead stocks are larger, for, though lead has had the preference for export on copper and zinc, the production has been quadruple that of copper. In 1917-18 only about 120,000 tons was lifted, leaving at least 40,000 tons in stock.

Zinc concentrates are, of course, increasing greatly in amount, and no figures can now be given of these stocks. Production of zinc concentrates is bound up with the production of Broken Hill lead concentrates, and though not all of the current zinc sands are concentrated at present, stocks still grow.

The programme of shipbuilding laid out for Australia is a fine one, and there seems every prospect of its being carried out well. The 60-odd ships being built in Australia and in America for the commonwealth, will not be able to help much before the end of next year, though some of the American-built ships are arriving monthly. There is, of course, far more other weight to lift than metals. Wheat alone is said to be over five million tons today—without the harvest due early in 1919—and there are vast quantities of wool, meat, and other produce waiting shipment. Australia's pre-war annual clearance of approximately 11 million shipping tons just about sufficed for production, and now the annual clearances are rather less than half this amount. Suggestions have been made to use such ships as are available for the shorter sea route to San Francisco or Vancouver. Though this might shift a larger amount from Australia than by taking the ships to England, it would impose a heavy burden on the railways of the United States and Canada.

So far as the lead- and copper-producing interests are concerned, the establishment of the "Associations" dealing with the outputs as a whole, has been of the greatest benefit. In no other way would such excellent business with the Imperial Government have been made possible.

# Editorials

## The Prospect for the Metals

WE HAVE previously expressed the opinion that eventually there is going to be a great demand for the metals for reconstruction purposes, for the replenishing of the depleted stocks of goods for ordinary commercial purposes, and for new construction for the institution of industrial economies, such as a more general use of water-power, etc. But before that is to be expected we regard it as inevitable that there will be a period of readjustment, during which there will be lower prices. Such markets as have been free to do so, especially zinc and antimony, and even tin, in spite of its restrictions, have already been reflecting this. However, there is considerable reason to expect irregular conditions, and while most metals may go down, some may hold at their present levels and others may even rise. Thus the demand for silver for financial purposes may perhaps maintain its present price, while the acute shortage of platinum may not inconceivably result in a rise in its market when it becomes quite free. But nobody entertains any such expectation with regard to iron, copper, lead and zinc.

The continuance of control of these metals (which never has been more than partial in the case of zinc) by the War Industries Board gives rise to some misunderstanding as to just what it means. That body did not, for example, ever fix the price for copper in the sense that it guaranteed it for a certain period. It fixed a maximum above which sellers might not go. The hanging of the price at that maximum meant that at no time was there enough copper to satisfy the demand, and persons desiring copper had to be rationed. If there had been at any time more than enough copper, the price would have receded from the stipulated maximum price, just as high-grade zinc declined below the maximum price of 12c. that was fixed for it.

Now, the War Industries Board in making a new agreement with the copper producers whereby the latter promise to maintain production and not to reduce wages, the board reaffirming the price of 26c., does not say that it will maintain that price, which it could do only by buying all the copper that was offered to it, but apparently means only that it will not resell any copper over which it has control at less than that price, and sanctions the producers' concertedly asking that price and getting it if they can; whereupon the producers acted accordingly, i.e. unitedly agreed to demand and hold out for 26c. This is, of course, directly in line with the oft-repeated efforts of large producers in the past to starve consumers into paying what they, the producers, would like to have. The solution of such a policy will be now, as heretofore, whether the producers prefer to have money or own unsold copper, or how long and to what extent it may be advisable to lug accumulations of copper.

It will be perceived immediately that the agreement exacted by the War Industries Board that the producers shall maintain production does not match at all with the price program. Washington, however, seems to be in mortal terror in facing any readjustment of labor, either as to employment or rates of wages, and therefore passes the buck to the producers, who will pass it on to the primary manufacturers, who will pass it on to the secondaries, who will pass it on to the consumers. But while the War Industries Board institutes this policy, the Railway Administration, which is a large consumer, says that it will not pay present prices for anything, including copper, except labor. We do not think that the copper producers are under any illusions as to the outcome. They can see the time near at hand when stocks of refined will begin to pile up, besides the stocks of crude that they have already; with three months of high-cost production of the mines on the road to them; with a maintenance of high-cost production; and with no buyers in sight. Their real attitude toward the maintenance of the *status quo*, including an officially sanctioned asking price, is doubtless that it affords a breathing spell, during which everybody will have a chance to see more clearly what ought to be done next.

We have previously expressed the opinion that even if there had been no war the world's consumption of copper would naturally have been as large as it was in 1918. This would have been so if the old rule that copper consumption about doubles every 10 years had held good. We look forward to a great demand for copper after the period of readjustment, but it will not begin with the price for the metal at the present nominal level. Any idea of a prolonged maintenance of that level is simply preposterous.

The situations in steel and lead are not dissimilar to what exists with respect to copper. The steel producers are perhaps better sold ahead than producers of either copper or lead. The lead producers are more disposed to face the facts than are the copper producers and make reductions in price, acting concertedly, with allocation of orders, until such time as free competition may be restored. Here again a determining factor will be the quantity of unsold stock they will be willing to carry. Another important consideration in the lead situation is that the mines are probably less able to maintain production than are the copper mines, more serious inroads upon their developed resources having been made.

Zinc has conditions peculiar to itself. It is the only one of the major metals that has had a free market during the whole period that the United States was at war, and is the only one that has had an accumulation of marketable product in producers' hands. The industry stands immensely overbuilt as to smelting capacity and overdeveloped as to mining and milling capacity, with the prospect that plant to the value of many millions, into which was put much of the profit of 1915-17, will have to be written off. Even the

diminished production of 1918 has had to be absorbed to a considerable extent by foreign consumption, for the supply of which British and Japanese competition is increasing (with the prospect that Belgian will ere long be resumed), while of the domestic a large proportion has been for brass-making for ammunition that will be summarily suspended. At the same time the industry experiences internal competition from mining districts possessing rich ore and metallurgical districts enjoying favorable conditions that are bound to be influential factors. It is true that labor conditions, both in zinc mining and in zinc distilling, have been almost intolerable, and during 1918 the price for the metal has been most of the time below what was reasonably regarded as the equivalent of 5c. spelter before the war. But that did not prevent the market last spring from going down to 6¾c., reckoned as equivalent to 3¾c. before the war. Of one thing we may be fairly certain, which is that a further decline in the price for zinc will be followed by prompt closings of mines and works, with the simple explanation of "*non possumus*," and it is not unlikely that we shall see the earliest readjustment in this industry, which is not to imply that it will be painless.

In copper especially there will be new international conditions. We are going to be confronted by collective buying from abroad. In Great Britain there has already been formed a big metals company, while in France an association has been organized. These will be met by an American selling corporation or association, in which producers will unite under the permission of the Webb law. The conducting of international business among such powers, and the reactions upon domestic business, will without doubt develop highly interesting things. In the meanwhile, there are no buyers, either foreign or domestic, and there is a general reluctance among politicians to admit that industrial business cannot be resumed at the price scales of a war basis, in which cost did not enter so much into the calculations as exigency. But whatever be the reluctance on the part of anybody, or whatever desire there may be to compel the public to pay the piper, it will be the force of circumstances that will drive.

## The Retirement of Mr. McAdoo

MR. McADOO this week added another to his bag of offices, when he was appointed a member of the Reconstruction Board. Mr. McAdoo's capacity for office holding was exciting the admiration of the world, when on Nov. 22 his resignation was announced, to the great surprise of everybody. The real reason for his relinquishment of his great powers is a mystery. Mr. McAdoo has done things for which he has been properly criticized, but those have been greatly outweighed by the things that he has done well. He has been an efficient executive and a useful public servant in a time of crisis.

Mr. McAdoo, who was a lawyer by education and training, first became generally known as the promoter of the company that built the tunnels under the North River. The tunnels were completed and put in operation, but the enterprise was not successful financially. Entering upon the administration of the Treasury Department, well-informed people were doubtful as to the wisdom of the choice. However, Mr. McAdoo, without being a great Secretary of the Treasury, formulating great financial principles, has nevertheless been a sound and able one in a period of great emergency, and especially has he proved himself to be a great executive. The country owes him a wealth of gratitude for his opposition to the ruinous plans of the ignorant Mr. Kitchin, if for nothing else. It will be fortunate if the President selects a successor to Mr. McAdoo who will be as good as he.

The departure of Mr. McAdoo will become a matter of greater regret if it prove true, as has been suggested, that the mystery in his case is his opposition to governmental appropriation of the railways and telegraphs, to which the Administration is said to be committed.

## Ventilation of Metal Mines

AIR is such an invisible substance, and is so apparently able to take care of itself, that it is not surprising that the metal miner should undertake its regulation last among the common demands that press upon his attention. The air in a heading or stope must often reach a condition that prevents a candle from burning before steps are taken to better the ventilation. Even under these conditions acetylene lamps have been used because they would operate where candles would not. Only under the most extreme circumstances would ventilating pipe and blowers be installed. Too much reliance has been placed upon the efficacy of ventilation produced by the exhaust from air drills. Happily, this condition is rapidly passing.

Mr. Mitke's article in this issue is a good one. It reviews the field in a way that will be appreciated by mining engineers and operators. We concur in his opinion that a quantity standard is the most practicable. Under coal-mining conditions a quality standard is probably best, but there is little need in the majority of metal mines to undertake the regular analysis of the air in the mine, although abnormal conditions may necessitate this procedure at times.

The "good working atmosphere" that Mr. Mitke defines—a temperature of 78°, a relative humidity of 80%, a velocity of 125 ft. per min. and 350 cu.ft. per minute per man—can usually be readily attained. Mechanical ventilation is necessary for proper control, and this point has been thoroughly discussed. We agree, also, with the necessity for the working out of the ventilation problem for the mine as a whole, both for developing and for stoping. The insistence upon the standardization of small ventilating equipment is a good point. The relative merits of metal and canvas air pipes are discussed.

After all, improvements in underground conditions must find a measure upon the cost accounts. The test of time as well as the operating results secured under a "good working atmosphere" have been applied to Mr. Mitke's work and show in no uncertain manner that attention to ventilation pays. Mine ventilation, held in such casual estimation in many instances, has an important significance in operating economy when subjected to painstaking engineering investigation and followed up by an adequate installation.

## The Postal and Telegraphic Service

MR. McADOO, as Director General of the American Railway Express Co., this week ordered an increase in express rates, and thus added something to the cost of living. Mr. Burleson, as Postmaster General and Administrator of the telegraphs, announced a reduction in the rates on telegraphic night messages, which was supposed to win plaudits from the public as something contributing to reduction in the cost of living. However, Mr. Burleson's announcement had a string to it in the form of the proviso that night messages at the reduced rate are to be delivered by letter carriers. If anybody wants the usual delivery, that the telegraph companies heretofore have afforded, he must pay the full "fast rate" on his message. For practical purposes, in business affairs, this is equivalent to an abolition of the night rate, for nobody having in mind what happens to letters in Mr. Burleson's mail service is going to take chances on that kind of delivery. Thus Mr. Burleson, instead of contributing toward a reduction in the cost of living, is in all probability adding, like Mr. McAdoo, his quota of increase. It used to be "The public be damned." Now it is "The public be humbugged."

It was a shock to every thoughtful citizen to hear last week that Mr. Burleson had taken over the cable companies, and that at a time when the war was practically, if not technically, over, and there was no conceivable reason why such a seizure should then be made. Mr. Burleson's reasons, as stated by himself, are in no wise convincing. To the plain citizen it looks like a step to take into governmental hands the last of the public services while there was still a right to do so, regardless of whether that right conformed to the spirit of the law or not. The cable service has heretofore been efficient and satisfactory. We shudder to think what Mr. Burleson will make of it. For what purpose does he wish to demoralize the postal, telegraph, telephone, and cable services? Do the people want poor service instead of good?

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Thursday, Nov. 21, will go down in history as the day upon which the German fleet sailed toward the Firth of Forth between two long lines of British warships to surrender. Events follow one another with rapidity in these days, but the far-reaching significance of the event strikes home to every thoughtful person. There was no cheering, nor outward sign of elation from the British. The greatness of the sacrifice on the part of the British, the grimness of this grim war, left no room for the customary outbursts of feeling. The fangs of the snake have been drawn. It cannot strike again.

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Accident prevention pays. A proper record of accidents, a careful and consistent study of this record, together with the fullest use of the deductions made, is urged by D. E. Charlton in an excellent article in another part of this issue. Mr. Charlton speaks from experience and touches upon some of the vital points in practical accident prevention. Keeping records is, after all, only a means to an end. Unless there is a definite decrease in accidents, such records serve only to satisfy statisticians. Keeping the workers in close touch with safety progress is recognized by superintendents and managers as necessary. Education is, as Mr. Charlton says, the solution of the safety problem, but it must have its beginnings in the thorough understanding of underground conditions by the miners and other workers, as well as by those in direct charge of mining operations.

## BY THE WAY

Those who with a love of nature combine a passion for statistics will find a recent bulletin of the U. S. Geological Survey on gems and precious stones a source of innocent pleasure. They will learn that quartz, for instance, masquerades under 200 different names, all of them English. Garnet is a poor second, with only 54. Opal, corundum and feldspar follow, their aliases ranging in number from 46 to 35; and spinel, beryl, topaz, and half a dozen others smell just as sweet by any one of a dozen or two different monakers.

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"For the sin ye do by two and two ye must pay for one by one" wasn't intended, of course, by the eminent bard who wrote the verse, to apply to the Democratic Administration, says David Lawrence in the *Evening Post;* but that is just about how Secretary Houston of the Department of Agriculture must have felt when the editors of twoscore farm and agricultural publications whom he had asked to coöperate with him in telling the farmer what must be done in the reconstruction period bluntly confessed that the operation of the Postal Zone law was hampering and stifling them.

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Sir John Pettus, who wrote on assaying back in the seventeenth century, evidently had his bad moments. He had probably just let the cupels freeze, or done something similar, when he set down his ideas on litharge. Says he: "This word is written littarge, and by some lithargy; and that signifies the public office of devotions, litturgy, and the sleepy disease, lethargy. And I wish that the plenty of our littarge or lithargy may raise up our litturgical devotions to be delivered in all times from our wealth and from the lethargical or sleepy hours of death."

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The efforts of the Unevida company to recover from the Carson River in Nevada the gold and silver lost in the old Comstock days bring to mind another of Dan De Quille's sketches of those times. During the first few years on the Comstock, millions of dollars was lost in the tailings. After freshets in the canyon the miners used to go out and collect amalgam by digging it out of crevices in the rocks. Having retorted this, they would make rings of it by melting the bullion and pouring it in a mold cut in an adobe or piece of brick. These rings weighed an ounce or more, and of nights, when going into town to have a good time with the "boys," the men would slip three or four of them upon the fingers of their right hands, for use in lieu of brass knuckles.

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Of the two men in Government positions who have had most to do with the personal comfort of our citizens since we entered the war, one has come out with greatly increased popularity and the other with less than none, says the *Boston News Bureau.* A few days

ago a prominent bank president was speaking approvingly of Mr. Hoover's methods of handling problems. Where his rulings affected corporations, their officials soon got to realize that if there was any seeming hardship to their business, it was only necessary to have an interview with the head of the Food Administration to have the difficulties cleared away or perhaps to become convinced that the order was necessary for the winning of the war. "He's no bull in a china shop," said the bank president to me. "Now, I'm talking about Hoover—not Garfield. I didn't say a word about Garfield," he added cheerfully.

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Mining litigation in the early days was attended with other dangers than those of losing the suit. When the case of the Ophir Company *vs.* McCall *et al.*, popularly known as the "Middle Lead Boys," was called at Genoa, Nev., in the Carson Valley, in 1860, three or four hundred men, armed to the teeth, were present. This according to Eliot Lord in Monograph 4, U. S. Geological Survey. The room was crowded with excited partisans, and an unguarded expression might at any moment bring on a collision which would cover the floor with bleeding bodies. The lawyers engaged in the suit, being fully aware of the disposition of their respective supporters, exercised a judicious caution in discussing the merits of the rival claims, and they were markedly courteous in their personal allusions, as well as in the examination of the witnesses, while their show of deference for the rulings of the court was extremely flattering to the presiding judge. In the face of this prevailing harmony, the jury appeared unnaturally obdurate in persistently refusing to agree upon a verdict.

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J. V. N. Dorr sends us the following extract from a letter from Capt. E. R. Graham, 309th Engineers, formerly manager of the Mogul mine, in the Black Hills, and one of his old boys: "I drew a rock-quarrying job about eight miles out of the city and three miles out of the main camp, and I am having the time of my life. This place is what I call 'Miners' Heaven.' Can you imagine having all the men you want and not having to worry about costs? I have about 30 men to do the supervising and mechanical work, and 130 German prisoners assigned as laborers. There have been about six officers on this job in the last six months, and they were sharpening their steel by finishing it on the emery wheel. This will give you a fairly good idea of how the place was run. I have a good bunch of men with me, but only two have had mining experience. The rest are willing, and I never saw a bunch take hold more quickly. Everybody is glad to get a rest from the continuous drilling. As I understand, we are to get out rock for about 60 miles of road. The tonnage we will get out will depend on the transportation furnished."

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The efforts of mining communities to raise their quota in the recent drive recall Mark Twain's account of a similar campaign made in Virginia City, Nev., during the Civil War, while he was city editor of the *Territorial Enterprise*. It runs:

The news came over the wires that money was wanted for the relief of wounded sailors and soldiers languishing in the Eastern hospitals. Right on the heels of it came word that San Francisco had responded superbly before the telegram was half a day old. Virginia rose as one man. A committee was hurriedly organized, and its chairman mounted a vacant cart in C Street and tried to make the clamorous multitude understand that if the town would only wait an hour, an office would be ready, books opened, and the commission prepared to receive contributions. His voice was drowned and his information lost in a ceaseless roar of cheers, and demands that the money be received now—they swore they would not wait. Men plowed their way through the throng and rained gold coin into the cart and scurried away for more. Hands clutching money were thrust aloft out of the jam by men who hoped this eloquent appeal would cleave a road their strugglings could not open. The very Chinamen and Indians caught the excitement and dashed their half-dollars into the cart without knowing what it was all about. It was the wildest mob Virginia had ever seen, and when it dispersed, it had not a penny in its pocket. To use its own phraseology, it came there "flush" and went away "busted."

We wonder how these old Comstockers would have responded to the appeal for the 27th Engineers.

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## 27th Engineers in Argonne Drive

We have been thinking about a Christmas present for the boys of the 27th. Colonel Perry has written us that they crave sweet chocolate, and of course cigarettes and tobacco are always wanted. We took up the matter of getting a supply of chocolate and found a good deal of difficulty in obtaining any. We finally secured an option on 4000 lb. In the meantime we were taking up the matter of shipment. Just when we got the news that we could get the chocolate we heard from Washington that the Transport Service would not take anything for shipment for anybody; also that there was an ample supply of chocolate and cigarettes in France, and that the best thing to do is to send over the money and let the officers buy the supplies over there. So we are sending $2500 for the Christmas present.

Company A, we are informed, has been actively engaged for the last few months in various sectors and has done extremely creditable work. It played an important part in the recent drive in the Argonne region in constructing and rebuilding bridges for the advance. The health of the company, in general, is excellent and the men are all in good spirits. The full strength of the regiment, according to the latest records of Washington, is 42 officers and 1615 men.

It is not too late to subscribe to the Comfort Fund. The regiment has done its part, but ours is not yet finished. Friends are urged to send their gifts in promptly.

HOW THE COMFORT FUND STANDS

| | |
|---|---|
| Previously acknowledged | $18,492.77 |
| C. M. Eye | 10.00 |
| C. A. Burdick | 5.00 |
| Mining and Metals Section, National Safety Council | 125.00 |
| John Herman | 10.00 |
| Lane Pearl | 5.00 |
| W. L. Gibson | 5.00 |
| C. M. Fenton | 10.00 |
| Charles Le Vasseur, monthly | 5.00 |
| B. N. Jackson | 10.00 |
| H. A. Johann | 10.00 |
| Mrs. A. B. Emery, Messina, Transvaal | 10.50 |
| A. C. Stoddard | 5.00 |
| Robert E. Tally | 25.00 |
| Nelson P. Hulst | 20.00 |
| Lawrence Addicks | 20.00 |
| R. R. Boyd | 25.00 |
| E. R. Varela | 5.00 |
| W. J. Olcott | 25.00 |
| J. E. Clennell | 10.00 |
| C. M. Eye (monthly) | 10.00 |
| Al. H. Hoffman | 10.00 |
| Total | $18,853.27 |

**Make your checks payable to W. R. Ingalls, treasurer of the Association of the 27th Engineers. Because of the work involved in administering the Comfort Fund, contributions are acknowledged only by publication in the *Journal*.**

## Personal

**Have You Contributed to the Association of the 27th Engineers?**

**Albert G. Wolf** examined mining property near Imlay, Nevada, recently.

**A. Charles Meagher,** of the Butters staff, Chile, is returning to the United States.

**James S. Douglas** has returned to France to resume his work as director of the American Red Cross stores.

**Emmet D. Boyle,** Governor of Nevada, and **Whitman Symmes,** of Virginia City, Nev., are in New York.

**Charles A. Chase** is in Telluride on professional business in connection with the Liberty Bell Gold Mining Company.

**W. H. Seamon** has been made manager of the Richmond Basin group of claims, seven miles north of Globe, Arizona.

**Robert R. Hedley,** mining engineer, is developing a mining property at Stump Lake, Nicola mining division, British Columbia.

**Arthur Curtiss James** and **William Church Osborne,** of the Phelps-Dodge Corporation, have been inspecting the company's properties in the Southwest.

**Arthur J. Bensusan,** superintendent at the mines of the Ouro Preto Gold Mines of Brazil, Ltd., at Passagem, Minas Geraes, Brazil, is now in New York.

**Charles T. Sokup,** who has been connected with the Bureau of Aircraft Production for the United States Government, is now with Ford, Bacon & Davis, of New York.

**Forest Rutherford,** consulting metallurgical engineer, has returned to New York from Colorado, where he has been making interesting mill tests on ores of the Breckenridge district.

**J. C. Agnew,** formerly superintendent of the Mahoning Ore and Steel Co., Hibbing, Minn., has been appointed assistant manager of the Midvale Steel and Ordnance Co., of Pennsylvania.

**M. H. McLean,** for several years general manager of the Morenci branch of the Phelps Dodge Corporation, has resigned and will reside in California. **Joseph P. Hodgson** will be his successor.

**S. W. Cohen,** formerly general manager, Crown Reserve Mining Co., Ltd., Ontario, Canada, has been appointed general manager of the Dominion Reduction Co., Ltd., succeeding the late **E. L. Steindler.**

**Harry J. Wolf** was in Colorado Springs several days last week in connection with metallurgical tests conducted at the Portland mills for the Buffalo Hunter Mining, Milling and Development Company.

**Capt. Percy E. Barbour** has been relieved from duty at the Engineer Officers' Training School, Camp Humphreys, Va., and has been assigned to the 150th Engineers, Camp Shelby, Mississippi.

**H. E. Eye,** manager of the Sasco, Ariz., plant of the American Smelting and Refining Co., has been given charge of the company's smeltery at Hayden, Ariz. He will be succeeded by **R. B. Green** at Sasco.

**Fletcher G. Downs,** assistant manager of the Ely-Copperfield Associates, at West Fairlee, Vt., expects to be in New York early in December, as the company is suspending its milling operations for the winter.

**Major A. S. Dwight,** who was detached from the 11th Engineers to do metallurgical work at Marseilles, is now detailed upon metallurgical reclamation work. **Captain Stehli,** formerly of the 11th Engineers, is acting as his assistant.

**Scott Leavitt,** of the U. S. Department of Labor, arrived recently in Butte, Mont., from Washington, D. C., for the purpose of investigating labor conditions in the mines, with a special view of inquiring into the rustling card system.

**W. S. Valentine,** president of the New York & Honduras Rosario Mining Co., was recently elected chairman of the board of directors. This office was created by changing the by-laws for the purpose. **William A. Prendergast,** former controller of the City of New York, was elected president.

**William Malcolm Corse,** manager of the Titanium Bronze Co., Inc., Niagara Falls, N. Y., arrived in New York recently and registered at the American Institute of Mining Engineers. Others who registered were: **Toner Antisell,** Washington, D. C.; **W. H. Staver,** Ciudade de Bomfim, Bahia, Brazil; and **Benjamin F. Tibby,** of Salt Lake City, Utah.

**Capt. C. E. Kilmer,** of Toronto, a graduate of Toronto University, who had considerable mining experience in the United States and Sweden previous to his enlistment, has been engaged as consulting engineer for the Bellevue Mining Co., which is preparing to develop several claims at Hole River in the Rice Lake district, Manitoba.

**W. L. Honnold,** director of the Commission for Relief in Belgium, is leaving for France on the S. S. "Rochambeau," Nov. 30, and will represent the Guaranty Trust Co. in reconstruction matters calling for financial coöperation. He will continue as a member of the advisory committee of the Commission for Relief in Belgium. His address will be with the Guaranty Trust Co., 1 and 3 Rue des Italiens, Paris.

## Obituary

**Charles A. Wheeler,** assistant assayer at the Consolidated Mining and Smelting Co.'s electrolytic zinc plant, Trail, B. C., died of pneumonia Nov. 1.

**Oscar Frederick Ambur,** mine representative at the Consolidated Mining and Smelting Co.'s smeltery at Trail, B. C., died of Spanish influenza recently, aged 42 years.

**O. T. Storrs,** of Cripple Creek, Colo., died recently of pneumonia, following influenza. Mr. Storrs was 41 years old. His wife, who was stricken at about the same time, also succumbed.

**Robert Milton Green,** manager of the Butte & Great Falls Mining Co., Butte, Mont., died of influenza-pneumonia Nov. 12, aged 32 years. He was also manager of the Butte Copper Czar Mining Co. of Butte.

**R. James,** who was employed at the smelting works at Trail B. C., before enlisting for military service overseas, was killed in action in France on Sept. 27. He was 25 years old, and was a graduate of Cambridge University, England.

**Bruce White,** president of the Noonday Mines Co., Sandon, B. C., died of pneumonia Nov. 15 at Nelson, B. C. He was a pioneer of the province and one of the discoverers of Slocan Star mine, now operated by the Silversmith Mines, Ltd. Mr. White was a member of the Northwest Mining Association.

**O. C. Schaeffer,** chemical engineer with the Chemical Products Co., Denver, Colo., died Nov. 14 of pneumonia, following influenza, at the Red Cross hospital, Dolores, Colo. He was formerly associated with the Du Pont Powder Co. and the U. S. Bureau of Mines. While in the employ of the Government he designed the National Radium Institute plant, at Denver.

**Pierre de Peyster Ricketts,** for 32 years connected with the teaching staff of the School of Mines of Columbia University, until his retirement in 1900, died Nov. 20, at his home in New York. He was born in Brooklyn 70 years ago, the son of George Richard Ashe Ricketts and Catherine Adriana de Peyster Greene; was graduated from the School of Mines, Columbia, in 1871, and received his degree of Ph.D. five years later. He was an assistant in the School of Mines for a number of years prior to 1885, when he was appointed professor of assaying, and in 1893 was made professor of analytical chemistry and assaying, retiring in 1900 to become the head of the firm of Ricketts & Banks, assayers, chemists, and consulting mining engineers. In 1876 Dr. Ricketts published a textbook, "Notes on Assaying," which was one of the first American works on the subject and found extensive use among the colleges throughout the United States. He was at one time president of the Society of the Older Graduates of Columbia, and was always prominent in alumni affairs and popular with graduates, young and old, for his even disposition and his love of his university. He was a member of the Columbia University, Union League, Chemists' and Barnard Clubs, the Century and Down Town Associations, the American Association for the Advancement of Science, New York Academy of Sciences, American Institute of Mining Engineers, and American Chemical Society. Dr. Ricketts (who is not to be confused with Dr. Louis D. Ricketts) was one of the old type of consulting mining engineers, which has now, like the old type prospector, all but disappeared. As a member of the firm of Ricketts & Banks, which for many years enjoyed a high reputation as assayers, chemists, ore samplers, and ore testers, Dr. P. deP. Ricketts was quite successful. He was less so in his ventures afield as an advisory engineer and as an engineering promoter. Not many years ago the old firm of Ricketts & Banks was dissolved, its successor being Ricketts & Co., Inc., John H. Banks retiring to do consulting engineering work on his own account.

## Industrial News

**Ohio Brass Co.** has removed its New York office from 30 Church St. to 1781 Hudson Terminal Bldg., 50 Church St., New York. The telephone numbers remain the same, 2495 and 2496 Cortlandt.

**Walter C. Mack** has been elected president of the Hoover Steel Ball Co., Ann Arbor, Mich., succeeding L. J. Hoover, founder of the company, who died a few weeks ago. F. A. Stivers is the new vice president; M. J. Fritz, treasurer and H. D. Runciman, secretary and general manager.

**Fairbanks, Morse & Co.,** of Chicago, announces the appointment of R. H. Morse as vice-president and general manager of purchasing and traffic; C. W. Pank, general director of sales, as vice-president in charge of sales of all factory products; W. S. Hovey, general manager at Beloit, Wis., as vice-president in charge of general manufacturing; W. E. Miller, formerly first vice-president, as vice-president and treasurer, and F. M. Boughey, formerly treasurer, as secretary and controller.

**Dwight P. Robinson and Co., Inc.,** constructing and consulting engineers, have opened offices in New York. Dwight P. Robinson, a former partner of Stone & Webster, is in charge of the construction and engineering business. Associated with him will be R. M. Henderson, in charge of construction; C. W. E. Clarke, mechanical engineer; R. A. Philip and D. L. Galusha, electrical engineers, and M. E. Thomas, structural engineer, together with the nucleus of a strong purchasing, accounting and field construction organization. All of the members of the company have for many years been engaged in large undertakings under Mr. Robinson's direction.

## Trade Catalogs

**"V. V." Fittings and Safety Switches.** V. V. Fittings Co., Philadelphia. Catalog No. 21; Nov. 1, 1918; 8½ x 11; pp. 127; illustrated. This catalog includes a pictorial index as well as descriptions and prices of the many types of conduit fittings and switches, with attachments.

**Pyrometers.** Wilson-Maeulen Co., 781 E. 142nd St., New York. Catalog No. 12; 8 x 10½; pp. 24; illustrated. A catalog descriptive of pyrometers, with an inserted wall-card giving the melting points of the elements and a table for Centigrade-Fahrenheit conversion. There is a cartoon on the reverse side of the card.

**Manual of Oxy-Acetylene Cutting and Welding.** Victor Oxy-Acetylene Equipment Co., 884-886 Folsom St., San Francisco, Calif.; 6 x 9¼; pp. 37; illustrated; price, 50c. The manual gives a brief description of the practical application of oxy-acetylene welding and cutting of metals, and has been prepared especially for the man who has had little or no previous experience.

## 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.

**Aluminum Alloy** and Process of Making. Levi S. Gardner, Detroit, Mich. (U. S. No. 1,280,706; Oct. 8, 1918.)

**Drill, Core.** Richard A. Conkling and William Richard Guiberson, Tulsa, Okla. (U. S. No. 1,281,140; Oct. 8, 1918.)

**Excavation**—Combined Trench Machine and Open-Ditch Excavator. James C. French, Kenosha, Wis., assignor to Frederick C. Austin, Chicago, Ill. (U. S. No. 1,280,701; Oct. 8, 1918.)

**Gold,** Disintegrating Apparatus for Use in Recovery of. Eduard Maria Rombouts, Amsterdam, Netherlands. (U. S. No. 1,281,073; Oct. 8, 1918.)

**Gold-Panner.** John A. Kimber, Atlanta, Ga. (U. S. No. 1,280,766; Oct. 8, 1918.)

**Hoisting-Machine.** Edward D. Hooker, New York, N. Y., assignor to Gillis & Geoghegan, New York, N. Y. (U. S. No. 1,280,007; Oct. 8, 1918.)

# Editorial Correspondence

### DENVER, COLO.—Nov. 21

**A Community Sampler** to be established by the mining men of Boulder County is the subject of serious consideration by interested citizens. The Boulder Commercial Association and the Boulder County branch of the Colorado Metal Mining Association have passed resolutions endorsing a proposal to organize a local company to take over and run the sampler formerly operated by the Chamberlain Ore Co. Among the prominent mine operators concerned are John R. Wolf, L. E. Girard, L. A. Ewing, Timothy O'Connor, Louis Herman, W. F. Bleecker, H. A. Frey, J. W. Pherson and Lloyd Buchanan. These men believe that such a sampler, operated by a local stock company, would more than pay operating expenses, to say nothing of accomplishing the more important object of accommodating the small producer and lessee. It is proposed that a company with a capital of $25,000 be organized for the purpose. Several local business men have expressed their willingness to support the scheme financially.

**A Japanese Delegation** of six members of the Tokio Chamber of Commerce is visiting Denver and other commercial and mining centers of Colorado. This commission desires to promote coöperation between American chambers of commerce and the numerous similar bodies in Japan, with the view of improving the commercial relations of the two countries. The party includes R. Yamshina, vice-president of the Tokio Chamber of Commerce and head of the commission; S. Sheba, secretary of the Tokio Chamber of Commerce; also S. Teraba, H. Yoshida, S. Okuno and I. Sugahari. The commission was entertained at luncheon by the Denver Civic and Commercial Association. After leaving Denver it visited Colorado Springs, whence it will proceed eastward to New York, and thence to Europe. South America will be visited on the return to Japan. The chief object of the commission is to bring about close coöperation between America and Japan in the development of the commercial and mining resources of China and Siberia.

### SPOKANE—Nov. 21

**The Spokane Stock Exchange** resumed its sessions on Nov. 19 after being suspended six weeks because of influenza. Much greater interest is displayed by investors than when the exchange closed.

**Northwest Mining Men** are waiting for a settlement of the war-tax problem. Many of the larger mines of the Cœur d'Alene region have been accumulating surpluses, and in the meantime passing dividends or reducing them because of the uncertainty of Government requirements. The hope is expressed on all sides that a settlement will be quickly made.

**The Northwest Mining Association** will hold its tenth annual convention Feb. 10 to 16 inclusive, in the association's club rooms adjoining the Hotel Spokane. "If the Government forestry department and the Indian Department will be more friendly to prospectors," says Frank C. Bailey, secretary, "there will be extensive exploration of comparatively untried districts." The territory to be represented at the convention includes the four Pacific Northwest states, British Columbia, and Alaska.

### WALLACE, IDAHO—Nov. 21

**Early Construction of the Pine Creek Railroad** by the Oregon-Washington R. R. and Navigation Co. is hoped for since the return of ex-Senator George Turner, of Spokane, from Washington and New York, where he again urged upon Director General McAdoo and Judge R. S. Lovett, chairman of the executive board, the necessity for building this nine-mile branch. Senator Turner is president of the Constitution Mining and Milling Co., which has a mine and mill at the end of the proposed branch. He reports that he has assurance that the road will be completed at an early date. The fact that repairs have been undertaken on the two-mile stretch built last year, and later washed out, indicates that new construction is about to begin.

**The Sweeney Mill**, which came into the possession of the Bunker Hill & Sullivan company through the settlement of litigation between that company and the Federal Mining and Smelting Co., is being remodeled for custom work and for treating ore from ground owned by the Bunker Hill that is being worked by lessees. Along with the mill, the Bunker Hill company became owner of the tailings accumulated during the 20 years that the Federal company was operating the Last Chance mine. These are being carefully sampled, and results indicate that a good profit may be made.

### BUTTE, MONT.—Nov. 22

**Manganese Producers** of Philipsburg district received orders to discontinue shipment of ore amounting to about 10,000 tons monthly soon after the signing of the armistice. Considerable gloom has been cast over this section in consequence, as much money had been invested in bringing local properties to a paying basis, in response to the war demand. One company has a contract good until April, but others are not so fortunate. A protective tariff against foreign ore is hoped for, though opposition of steel interests is expected. All but 400 men are now idle of the 1200 employed in the manganese mines at the time of the slump.

### SALT LAKE CITY—Nov. 21

**Manganese Producers and Buyers in Utah** were directed by telegraph by their Eastern connections, from Nov. 15 to 19, to ship no more manganese ores until further notice. No definite reasons have been given or received here, but it is understood locally that the Eastern market is oversupplied.

**The Mines Amendment** to the Constitution of the State of Utah, which was carried at the elections on Nov. 5, was passed principally through the activity of the state administration headed by Governor Simon Bamberger, and by the organized efforts of the superintendents, professors, and teachers of the public schools. The amendment was defeated in Salt Lake, Summit, Tooele and Carbon counties. The mining communities all voted against it by the largest majorities. The state officials now seem to be more or less in perplexity as to how the measure can be made operative, as there is a probability that it conflicts with the other constitutional provisions. The attitude of the state administration is that legislation will be necessary to make the amendment operative, and there is a doubt as to whether it can be made to apply to 1919 taxes. Complete returns from the election in regard to the amendment will not be received before Nov. 25.

### JOPLIN, MO.—Nov. 23

**Growing Discontent Over High Royalty Charges** in the Oklahoma section of the Joplin district may result in a campaign to bring relief soon. Speculation in leases when the Oklahoma part of the district was first opened, three years ago, resulted in the repeated turning of tracts, and with each sale the seller reserved a royalty percentage. Some mining companies thus have paid as high as 50% royalty, and the average probably is around 25%. In the older part of the district, royalty charges rarely went over 15%, and more frequently were 10%. Oklahoma producers, confronted with present unsatisfactory ore market conditions, are recalling this fact now. Many are being forced to close, whereas if they had a reasonable royalty charge, they could continue to operate and make a small profit. Original land owners would gladly alleviate the situation if they could, but the royalty charge is distributed to so many different persons in most cases that relief will be a hard problem.

**Borrowing Money on Zinc Ore** up to 90% of average value will be started in the Joplin district on Dec. 1. The Oklahoma Warehouse Association has given official notice to producers to this effect. In striking an average for making loans, the average price of ore for the preceding six months will be used to arrive at the basis. Notes will be issued, using the warehouse receipts as collateral on two, four or six months' time, to be taken up at the option of the borrower. The Picher warehouse is only one-third completed, and contracts have been let for the construction of warehouses at Douthat and Tar River. It is the plan of the association to build narrow-gage railroads from the principal mines to the storage bins to eliminate teaming. The association believes that the new plan will result in stabilizing the zinc ore market.

### CLEVELAND, OHIO—Nov. 10

**The Ore-Shipping Season** will be practically over at the end of this week, making the earliest closing of Lake shipments in several years, according to "Iron Age." Boats are now taking their last cargoes, and many will return to Duluth for storage cargoes of grain which will be brought down to Lake Erie ports before navigation closes. The Pittsburgh Steamship Co. will load no boats after Saturday, and it is expected that the number of cargoes sent by other shippers after that date will not exceed 25. Total Lake shipments will probably fall slightly below last year.. Sales made for delivery during the season of 1918, these including ore sold to merchant furnaces and ore requisitioned by consumers interested in ore properties, amounted to 61,900,000 tons as of Nov. 1, and ore delivered on that date amounted to 56,000,000 tons, leaving a balance due of 5,900,000 tons. Shipments that were deferred until next season are not included in these figures.

### VICTORIA, B. C.—Nov. 21

**Need of an Iron and Steel Industry** is again being agitated in this province. A plant of this sort, previously referred to, is in operation at Irondale, Wash., under direction of the Pacific Coast Steel Co., at which pig iron has been produced for some time. When the furnaces were first blown in, it was for the specific purpose of using a large quantity of Chinese iron ore which had been accumulated by the former operators and left untreated when the plant closed down. With a satisfactory output and good prices, however, the company decided to continue, if possible, after its stock of imported ore was exhausted. A source of supply, therefore, was sought and has been found, it is thought, in British Columbia. The large deposit of bog iron, near Mons, on the line of the Pacific Great Eastern Ry., proved suitable to mix with the magnetites of Texada Island, where the limestone needed was also available. As production has not been great up to the present, the success of the project cannot be said to have been demonstrated. Of the amount of bog iron contracted for, 5000-odd tons, 1000 tons has been delivered and has been used with steel scrappings as well as with some magnetite. In all tests the pig iron produced has proved suitable for foundry work, although possibly not up to standard for steel manufacture. The company is said to be confident, nevertheless, that with the raw material referred to, an output of good pig can be continued. It is also purposed, if successful, either to enlarge the present plant or to build a new one closer to the source of supply.

### TORONTO, ONT.—Nov. 23

**Mine Managers in Southern Ontario** have received requests from the government to employ all the labor they can, owing to the release of men from the munition industry. A large influx of unemployed to mining camps is looked for, and will be welcomed by operators. The present shortage of labor at Porcupine is estimated at about 50%, and at Cobalt 10%. The latter is expected to be speedily made up, and provided no serious change occurs in the situation the gold mines will probably have their full complement of workers before spring.

**Improved Transportation Facilities** will be asked of the provincial government by the mine operators of northern Ontario. Important projects for road construction, which were necessarily postponed until the close of the war, are being brought forward involving the expenditure of several hundred thousand dollars. It will probably require $100,000 to place the Elk Lake-Gowganda road in good condition; about $40,000 to macadamize the road from Swastika to Kirkland Lake, and at least $25,000 to construct the road from Boston Creek Station to the east boundary of Pacand Township. Kirkland Lake operators claim that the importance of that camp justifies their asking the government for a large outlay to provide a suitable highway, the present road being in bad condition.

# The Mining News

### ALASKA

NORTH MIDAS COPPER (Strelna)—Treating 10 to 20 tons per day and securing better than 95% recovery. Gold and silver ores only being mined; copper deposits to be worked later.

### ARIZONA

#### Pinal County

MAGMA CHIEF (Superior)—Sombrero Butte claims in Copper Creek district, 20 miles south of Hayden, purchased. Property idle for several years owing to litigation. Development will be under direction of Charles A. Kumke, who will move to Hayden.

PICKET POST GOLD (Superior)—Hoist, compressor, and other sinking equipment sold to Magma Chief Copper Co. and will be moved to Sombrero Butte property in Copper Creek district.

### ARKANSAS

#### Independence County

LOYALTY (Cushman)—Will start construction of small washing plant soon. Company operating 40-acre manganese tract.

#### Marion County

PARADIS (Dodd City)—Salina Mining Co. plans 150-ton mill. Will push development work.

OHIO (Yellville)—Mill completed; constructon time, 90 days. Three headings developed in mine sufficient to keep plant running full time.

### COLORADO

#### Boulder County

ALICE (Jamestown)—Taken over by W. G. Chesebro to be operated for fluorspar. Earl Nelson is superintendent. Company will open up deposits for leasing. Three leases in operation, namely, Tower Bros.' lease on tunnel level, which is shipping regularly, and two surface deposits being developed by M. Milhise and L. A. Markt.

#### Clear Creek County

COUNTY SAMPLER organized by operators in Clear Creek County. North American Sampler, in Idaho Springs, being remodeled to be used by new organization. W. E. Passmore will be superintendent. New sampler will replace Chamberlain sampler recently shut down.

#### Dolores County

BLACKHAWK (Rico)—Now worked under lease by Marmatite Mining and Leasing Co., Salt Lake City, which has also leased Silver Swan property.

#### Gilpin County

TWO FORTY (Central City)—Group in Russell district bought by Pilgrim Gold, Silver, and Copper Mining and Milling Co. Will add new compressor.

#### Lake County

DOWN TOWN (Leadville)—Will retimber Coronado shaft. Steam plant replaced with electric hoist.

#### San Miguel County

INFLUENZA EPIDEMIC responsible for 52 deaths in Telluride during last 20 days. Appears under control, only two deaths being reported during last week.

#### Teller County

INDEX (Cripple Creek)—Four carloads shipped during October by El Paso Extension Company. Crosscutting on 1200 level to prospect ground under oreshoot opened in 900-level winze. Al. Campbell is superintendent.

STRATTON ESTATE (Victor)—Several mine dumps of Stratton-Cripple Creek Mine and Development Co. being worked by lessees. Pike's Peak dump has been leased to McLeod & Kessey; Callie dump to Richardson and associates, of Cripple Creek, and Badger Boy dump to McDonald and associates.

UNITED GOLD MINES (Victor)—During October lessees shipped 40 cars, or 1290 tons, of ore having average value of $20 a ton, to Golden Cycle plant at Colorado City. Trail mine on Bull Hill was largest producer, shipping 37 cars, of which 33 were from Anderson & Benkelman lease, operated through Dexter shaft, and four from Wilson lease, operated through Trail tunnel. Three cars of milling ore shipped by W. P. H. Leasing Co. Development work continued in Deadwood mine.

### IDAHO

#### Shoshone County

NABOB (Beeler)—Hauling ore six miles to railroad. Only property active on Pine Creek.

ANCHOR (Murray)—Compressor being installed and electric power line being extended to reach it. Control owned by Michael Melley, of Murray.

### MICHIGAN

#### Copper District

BUREAU OF MINES has established temporary headquarters for the Lake Superior district at the Michigan College of Mines, Houghton, pending the completion of the Bureau of Mines station at Ironwood. Byron O. Pickard is in charge.

### NEVADA

#### Humboldt County

NEVADA-SULPHUR (Sulphur)—Mine two miles east of Sulphur producing sulphur from crude ore by screening and treating in steam-heated retorts. Recovery low because of total loss of fines. Production limited by shortage of men.

ARIZONA (Unionville)—Fifty-ton flotation plant under construction by Sunset Mining and Development Co. to be ready Jan. 1. E. S. Van Dyck, manager.

BUSH (Unionville)—Unionville Mining Co. grading for mill. J. A. Spiker, of Salt Lake City, president.

RYEPATCH (Unionville) — Installing leaching tanks to treat tailings dump.

#### Nye County

TONOPAH DISTRICT ore production for week ended Nov. 16 was 6312 tons, of estimated gross milling value of $107,287. Producers were: Tonopah Belmont, 1854 tons; Tonopah Extension, 2304; West End, 1037; Jim Butler, 136; Montana, 108; Tonopah Divide, 252; MacNamara, 400; Rescue, 129; North Star, 54; and miscellaneous, 38.

ORIZABA (Orizaba)—Will abandon old steam surface plant and install distillate or gasoline plant. Controlled by Charles S. Sprague. J. K. Turner, engineer in charge.

GOLDFIELD MINING (Tonopah)—Preparing to sink working shaft. Twenty-five horsepower gasoline hoist installed, and new headframe, blacksmith shop and bunk houses built. Marion Arnold, manager. Company owns seven claims.

TONOPAH BELMONT (Tonopah) — Milled 9968 dry tons in October; produced 1,185.478 oz. gold bullion and 116,378.44 oz. silver bullion.

### NEW MEXICO

#### Grant County

REPUBLIC (Hanover)—Shipping crude zinc ore running 45% Zn at rate of 12 cars per month. New shaft started about 500 ft. south of present hoisting shaft.

UNITED STATES COPPER (Hanover)—Sinking shaft on Philadelphia group with three shifts per day. Much water encountered. Expect to begin work on Hardscrabble group in Pinos Altos district in near future.

CARLYSLE (Steeple Rock)—Mill treating 40 tons per eight-hour shift. Lead-copper-silver concentrates shipped to El Paso. Zinc-copper concentrates being stored for future treatment. George H. Utter is manager.

MOUNT ROYAL (Duncan, Ariz.) — Harold C. E. Spence and associates erecting cyanide plant. Property five miles from Steeple Rock.

### SOUTH DAKOTA

#### Lawrence County

CUTTING (Deadwood)—Will sink two-compartment shaft to 500 ft. Shaft house and compressor house being erected; to install new electric hoist and compressor.

ECHO (Deadwood)—New shaft down 100 ft. and will go to 300 ft. Development shows body of lead-silver ore.

### UTAH

#### Juab County

TINTIC SHIPMENTS for the week ended Nov. 8 were 142 cars, by 19 shippers. The Dragon Consolidated, Chief and Iron Blossom were the largest shippers, sending out 23, 21, and 19 cars respectively. Shipments the week previous totalled 150 cars. Influenza has been bad among the miners, but is abating. Shipments for the week ended Nov. 15 were 126 cars by 16 shippers. Tintic Standard was the heaviest shipper, with 24 cars, or about 1000 tons.

#### Salt Lake County

UTAH METAL AND TUNNEL (Salt Lake City)—Dispute with Utah Consolidated over apex rights understood to have been settled amicably; latter said to have acquired these rights for consideration.

UTAH ORE SAMPLING (Salt Lake City)—Cars released at Murray during week ended Nov. 13 included 30 from Utah, 21 from Nevada, 3 from Idaho and 4 from California. Sixty cars were sampled and released by sampler at Silver City.

#### Summit County

PARK CITY SHIPMENTS for week ended Nov. 15 were 2,396,100 lb., which is less than normal, due principally to labor shortage, influenza, and winter weather. There were six shippers.

ONTARIO-SILVER (Park City)—Shipments for week ended Nov. 15 were 966,200 lb., or 483 tons. The 600-level tunnel being used by Ontario for ore hauling, and by Ontario lease, old Daly, New Quincy and Daly West to reach their respective ground.

#### Utah County

AMERICAN FORK CANYON has first snow and freezing weather. Mines still operating are Old Miller, Mineral Flat, Belorophon, South Park, Bog Iron Lease, Pacific, and Globe.

BELOROPHON (American Fork)—Mill closed for season, but development to be continued through winter. Another car of concentrates being hauled.

### CANADA

#### British Columbia

SILVER STANDARD (New Hazleton)—Concentrator has begun operations. Property owned by Foley, Welch & Stewart.

QUEEN (Sheep Creek)—This group and the Vancouver, Kootenay Belle and Alexander consolidated by A. W. McCune, of Salt Lake City. New mill said to be planned.

#### Ontario

BIG DIPPER (Barrie Township)—Property comprising 1404 acres in Frontenac County sold by sheriff on Nov. 20 for $2000 to E. P. Huntington, of Potter County, Penn., formerly manager.

OCTOBER SHIPMENTS over Temiskaming & Ontario Ry. were: Buffalo, 495 tons (2000 lb.); Coniagas, 42; Dominion Reduction, 77; Hudson Bay, 32; La Rose, 70; McKinley-Darragh, 364; Mining Corporation, 251; National, 68; Nipissing, 289; O'Brien, 61; Penn Canadian, 33; and Trethewey, 43. Total, 2365 tons, of which Deloro Smelting and Refining Co. received 1014 tons; Coniagas Reduction Co., 119; Metals Chemical Co., 762; and A. S. & R., Perth Amboy, 470.

### MEXICO

#### Sonora

SAHUARIPA TUNGSTEN—Twenty-ton concentrator lately completed at mine, 60 miles below Sahuaripa.

LAS CHISPAS (Arizpe)—Property has resumed operations.

NORTH TIGRE (Douglas)—Leasing company following several stringers from lower tunnel. New mill will be driven by electric power from Copper Queen works at Douglas by extension of Tigre transmisson line.

# The Market Report

SILVER AND STERLING EXCHANGE

| Nov. | Sterling Exchange | Silver New York, Cents | Silver London, Pence | Nov. | Sterling Exchange | Silver New York, Cents | Silver London, Pence |
|---|---|---|---|---|---|---|---|
| 21 | 4.7600 | 101⅛ | 48⅛ | 25 | 4.7570 | 101⅛ | 48⅛ |
| 22 | 4.7575 | 101⅛ | 48⅛ | 26 | 4.7575 | 101⅛ | 48⅛ |
| 23 | 4.7575 | 101⅛ | 48⅛ | 27 | 4.7550 | 101⅛ | 48⅛ |

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

| Nov. | Copper Electrolytic | Tin Spot. | Lead N. Y. | Lead St. L. | Zinc St. L. |
|---|---|---|---|---|---|
| 21 | *26 | † | 8.05 | 7.75 | 7.75@7.85 |
| 22 | *26 | † | 8.05 | 7.75 | 7.90@8.00 |
| 23 | *26 | † | 8.05 | 7.75 | 8@8⅛ |
| 25 | *26 | † | 8.05 | 7.75 | 8@8⅛ |
| 26 | *26 | † | 8.05 | 7.75 | 8.10@8.15 |
| 27 | *26 | † | 8.05 | 7.75 | 8.10@8.15 |

*Price fixed by agreement between American copper producers and the U. S. Government, according to official statement for publication on Friday, September 21, 1917, and July 2, 1918.

† No market.

The above quotations (except as to copper, the price for which has been fixed by agreement between American copper producers and the U. S. Government, wherein there is no free market) 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.

We quote electrolytic cathodes at 0.05 to 0.10c below the price of wirebars, cakes and ingots.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

LONDON

| Nov. | Copper Standard Spot | Copper Standard 3 M. | Copper Electrolytic | Tin Spot. | Tin 3 M. | Lead Spot | Lead 3 M. | Zinc Spot |
|---|---|---|---|---|---|---|---|---|
| 21 | 122 | 122 | 137 | 325 | 305 | 29½ | 28½ | 54 |
| 22 | 122 | 122 | 137 | 320 | 300 | 29½ | 28½ | 54 |
| 23 | ... | ... | ... | ... | ... | ... | ... | ... |
| 25 | 122 | 122 | 137 | 320 | 300 | 29½ | 28½ | 54 |
| 26 | 122 | 122 | 137 | 310 | 290 | 29½ | 28½ | 54 |
| 27 | 122 | 122 | 137 | 310 | 290 | 29½ | 28½ | 54 |

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at $4.7515: £29½ = 6.2576c.; £54 = 11.4545c.; £110 = 23.3333c.; £125 = 26.5151c.; £260 = 55.1513c.; £280 = 59.3937c.; £300 = 63.6362c. Variations, £1 = 0.2121205c.

## Metal Markets

**NEW YORK—Nov. 27, 1918**

This week was again conspicuous by the general absence of business in copper and lead. There was small business in antimony, tin, and zinc, without there being any radical changes in price.

**Copper**—Producers received no inquiries from any quarter. Manufacturers intimated that they could not pass on the 26c. price to consumers, for the reason that the latter would not pay it. On the other hand, producers received numerous cancellations of private contracts on the alleged ground that governmental contracts for which the copper was to be used had been cancelled. Producers refused to accept such cancellations. The attempt to make them came from manufacturers who are new to the business and who do not appreciate the ethics of the copper business established by immemorial custom. In this business contracts have always been contracts, and arbitrary cancellations have previously been unheard of. Sellers and buyers have both lived up to the letter of their agreements, no matter how unpleasant it might be to do so.

While the major market is sealed by agreement between the War Industries Board and the producers, and by agreement among the producers themselves, there is developing a sort of a minor market similar to the "gutter market" in Wall Street in the fall of 1914. Casting copper has been offered and sold in carloads at 24@23c., and was offered today at 23@23⅛c. Scrap copper, for conversion into casting, is offered in quantities aggregating thousands of tons from all parts of the country upon almost any terms that a buyer will pay. Virgin copper has been offered for resale by consumers who had overbought. As to the last, such offerings are contrary to the standard contract entered into between producers and the buyers from them, wherein it is stipulated that "all the copper hereby sold will be used by the buyer, and that the buyer will not sell or otherwise dispose of, or attempt to sell or otherwise dispose of, any of said copper."

Meetings have been held among the producers to consider the organization of an export selling company or association. There have also been conferences respecting the labor situation.

John D. Ryan, having resigned as Assistant Secretary of War, has been elected a member of the board of directors of the Anaconda Copper Mining Company.

**Copper Sheets**—The base price of copper sheets is 35⅛c. per lb. Copper wire is quoted at 28⅛c. per lb. f.o.b. mill, carload lots.

**Tin**—A good deal of tin of various grades is being offered for resale by consumers who found themselves oversupplied. This business is permitted by the War Industries Board. On Saturday last a 25-ton lot of electrolytic tin was sold at 70c. Tin of 99% grade was offered on Nov. 26 at 69c., with 68c. bid. About the same ideas continue today.

The London quotation for tin on Nov. 18 was £327 for spot and £315 for 3 months; on Nov. 20, £327 for spot and £317 for 3 months.

**Lead**—At the request of the War Industries Board, the Lead Committee will continue the allocation of business until the end of this year. Prices at New York and St. Louis are maintained at unchanged figures, which apply to orders that are being filled. Producers are not getting any new orders, and, on the contrary, are receiving a good many cancellations, which are not accepted if it can be helped. Here is somewhat the same situation as exists with respect to copper.

Washington reports that the armistice came at a very fortunate time, from the Government standpoint, insofar as the lead situation is concerned. A buying contract had just expired, and the Army is making no more contracts, but the Navy is still buying. Only very small stocks are being carried by either of these departments.

**Zinc**—After a day of further weakness, resulting from a notice of Government cancellation, the market rallied on the conjecture that there might be some mistake about the notice, with the thought that it might not therefore be safe to sell prompt supplies supposedly released. Moreover, there developed a small inquiry, aggregating perhaps 1000 tons, from galvanizers, which resulted in some business for which there was sharp competition. On Nov. 25, a governmental communication was received, rescinding the notice to cease production, which was said to have been unauthorized, and producers were directed to await specific instructions from Washington. This strengthened the market a little more, but there is no feeling of confidence in the situation. This is reflected by the fact that while prompt and December spelter are around 8⅛c., January and forward is freely offered at 7⅞c. However, at present there is neither desire to buy nor pressure to sell, and quotations are more nominal than representative of business. In the meanwhile, stocks are presumably piling up in the hands of the Government, which will not be shown in the statistics, and export shipments are being deferred on the ground that shipping facilities are required for foodstuffs. Foreign governments do not intimate anything about cancellation of contracts, but, nevertheless, it is not unlikely that a good deal of the spelter that is being deferred will never go forward.

**Zinc Sheets**—Unchanged at $15 per 100 lb., less usual trade discounts and extras as per list of February 4.

## Other Metals

**Aluminum**—Unchanged at 33c. per lb., but the situation as to supplies is a good deal easier.

**Antimony**—At the close of last week, we quoted spot at 7⅞c., with the market irregular and uncertain. There followed a sharp rally, and on Friday and Saturday carload lots of 25 gross tons each were sold at 8⅜c. On Tuesday and Wednesday carload business was done at 8⅛c. We quote the market at 8⅛c. at the close. November-December shipments from the Orient were offered at 8⅛c., duty paid, New York.

**Bismuth**—Metal of the highest purity for pharmaceutical use is quoted at $3.50 per lb. for wholesale lots—500 lb. and over.

**Cadmium**—Quoted at $1.50@1.75 per pound.

**Nickel**—Market quotation: Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

**Quicksilver**—We quote New York at $125. There was some inquiry, but not much business done. San Francisco reports, by telegraph, "no quotation, market unsteady." Washington reports that at the meeting on Nov. 21 between producers and the price-fixing committee there was no apparent necessity for fixing maximum prices. Particular emphasis was laid upon the fact that agreements now existing between the producers and the non-ferrous metals section are not to be affected by the action taken at the meeting with the price-fixing committee.

## Silver and Platinum

**Silver**—Market remains unchanged. The latest advices from London are to the effect that though the Indian Treasury is in a much stronger position as regards its reserve of silver, there is at present no sign of a reduced demand for rupees. Shipments to London for week ended Nov. 23 were 307,000 ounces.

Crop prospects in India are so poor that the government has prohibited the export of foodstuffs, a fact which the London "Bankers' Magazine" thinks may have some bearing on the price of silver, and which may cause some withdrawals of the metal from India's secret hoards.

Mexican dollars at New York: Nov. 21, 77⅛; Nov. 22, 77⅛; Nov. 23, 77⅛; Nov. 25, 77⅛; Nov. 26, 77⅛; Nov. 27, 77⅛.

**Platinum**—Unchanged as to price, which will be maintained officially at $105 until Dec. 1. Upon that date all restrictions will be removed and there will be a free market.

## Zinc and Lead Ore Markets

**Joplin, Mo., Nov. 23**—Blende, per ton, high, $76.90; basis 60% zinc, premium, $75; Class B, $65@60; Prime Western, schedule, $52.27; outside the schedule, $47.50@45; calamine, basis 40% zinc, $40@38. Average selling prices: blende, $53.05; calamine, $39.51, all zinc ores, $49.76.

Lead, high, $104.90; basis 80% lead, $100; average selling price, all grades of lead, $103.07.

Shipments the week: Blende, 7658; calamine, 510; lead, 1318 tons. Value, all ores the week, $562,310.

Of the 4700 tons purchased this week, about 3000 tons was sold on schedule price. At least two buyers report approximately 1700 tons purchased on a basis of $47.50 to $45, cutting to the latter price yesterday, and are still taking all offerings late tonight.

The Zinc Institute committee is working tirelessly to strengthen sellers to hold for schedule price.

**Platteville, Wis., Nov. 23.**—Blende, basis 60% zinc, highest settlement price reported for week and year to date, $76.90; base price for premium grade, $75; base price for high-lead blende declined to $47.50 per ton. Lead ore, basis 80% lead, $96 per ton. Shipments reported for the week were 1981 tons blende, 40 tons galena, and 395 tons sulphur ore. For the year to date the totals are 113,723 tons blende, 7341 tons galena, and 38,989 tons sulphur ore. During the week 2560 tons blende was shipped to separating plants.

## Other Ores

**Chrome Ore**—No business and no market. Consumers are reported to have all the ore on hand that they can possibly use between now and early next year. The chrome-ore producers are conferring today with Secretary Lane in order to obtain relief from the serious predicaments into which the sudden termination of the war precipitated them.

**Manganese Ore**—No business and no market. Consumers overstocked. Shipments of ore from Butte and other districts have been discontinued.

**Molybdenum Ore**—Negotiations are said to be proceeding for some of this ore. It will be interesting to see what price is made. In the meanwhile, there are reports of private business done at figures far below $1.

**Tungsten Ore**—The producers, importers, smelters, and consumers of tungsten ore held a meeting in New York on Nov. 25 to consider the situation in their industry, and appointed a committee, representing each element in the business, to recommend to the Government what steps might advisably be taken to prevent too sudden a readjustment of price. At the meeting it became immediately apparent that there are widely divergent and conflicting interests and views. American producers, who say that no one of them can operate successfully under present conditions, if they do not receive more than $20 per unit for their product, and speculators and manufacturers who are long of supplies bought at high figures would like to see a maintenance of prices, even at the expense of restrictive measures. Other manufacturers and consumers generally would prefer to see nature take its course. It was clear that there are large supplies of ore, ferrotungsten, tungsten powder, and tungsten steel.

In the meanwhile there has been no market, for nobody has been willing to buy. There are plenty who would sell if they could and would make sharp concessions. Prices like $18, $17, and so on down, are intimated. Foreign ore of 65% grade and excellent quality has been freely offered for shipment at $15 per unit per long ton. These figures are merely indicative and are not given as quotations, for at present there is no way of telling what the real market is, or would be.

## Other Minerals

**Pyrites**—Whether the embargo on Spanish pyrites will be suspended between now and Jan. 1 has not been definitely settled. Spanish pyrites is quoted, subject to the raising of the embargo, at 17c. on the basis of 10s. ocean freight, buyers to pay war risk and insurance.

## Iron Trade Review

**PITTSBURGH—Nov. 26**

At this writing, more than a fortnight after the signing of the armistice, there have been scarcely any cancellations of either war or peace orders on which work was actually being done, though nearly all contracts for war material that will not be needed, and on which work had not been begun, have been canceled. The Government, which is presumably fortified with information, regards it as essential that there be no serious interruption to the country's industrial activity on account of a menace for which the only recognized term is Bolshevism.

There is criticism of the Government's policy to continue work on contracts by those who desire to see wage reductions. The great majority of steel manufacturers do not wish wage reductions in their industry unless as a sequel to lower costs of living, and feel that with immigration shut off for more than four years, and emigration of the foreign born in prospect rather than immigration, it is going to be difficult to find an adequate supply of labor, as the American born do not naturally gravitate to employment at coke works, blast furnaces and steel mills. The future of steel prices hinges largely upon these considerations, including the great question whether the permanent and stable basis for iron and steel prices that must come some time is to be reached merely by a gradual decline or by a sharp recession or slump and then a recovery. The latter would be the natural course, according to steel market history.

Though only a week or two ago it was regarded as a foregone conclusion that the War Industries Board would continue to set prices for some time, it is now an even chance whether it will do so even for the first quarter of the new year. An awkward feature of the situation is the desire of the Railroad Administration to buy as cheaply as possible, and this runs counter to the desire of the War Industries Board to let the market down gradually.

All the steel mills are running as well as they can, having plenty of orders for the immediate future at least. With the removal of practically all restrictions upon the production and consumption of steel, a demand has quickly arisen from jobbers, automobile builders, and a few other classes of buyers, for steel that they can turn over at once, the question of price practically not entering. There is absolutely no interest in forward deliveries. The so-called investment buyers, in particular, will probably not be in mood to consider purchases for some time.

Operations are interfered with by shortage of coke, due to the influenza epidemic and the peace celebration, which was prolonged in the Connellsville region. In the past few days the Carnegie Steel Co. has banked five blast furnaces by reason of shortage of Connellsville coke, produced by mine-labor shortage rather than oven-labor shortage. The company has blown out one stack at Farrell for rebuilding. Of its 59 furnaces, four are out of blast, five banked and 50 producing. The company's steel-ingot output last week was 94% of capacity, but, through shortage of pig iron, this week's steel output is likely to be a few points less.

**Pig Iron**—There is a little insistent demand for pig iron, particularly in steel making, but only for small lots for almost immediate shipment. Full Government limits are readily obtained: Bessemer, $35.22; basic, $33; No. 2 foundry, $34; malleable, $34.50; forge, $33, f.o.b. furnace freight from the Valleys to Pittsburgh being $1.40 and from six detached furnaces somewhat less.

**Steel**—Odd lots of unfinished steel, chiefly odds and ends of various sizes and analyses, are beginning to develop. There are no offerings for production to specification. The market remains at Government limits: Billets, $47.50; sheet bars and small billets, $51; slabs, $50; rods, $57.

**Ferroalloys**—The market is absolutely stagnant on ferromanganese and spiegeleisen, consumers showing no disposition to buy, and price cuts would not tempt them, so that prices remain nominal at former figures, $250, delivered, for 70% ferromanganese and $75 f.o.b. furnace, for 16% spiegeleisen.

## Coke

**Coke**—Coke production in the Connellsville region decreased even last week, when the output was estimated at about 30% under the former rate. Production at byproduct plants is only fairly well maintained. Furnaces are short of coke, but not to the extent to be expected from the curtailment in output, and a resumption of the former rate of production would probably result in cut prices from the Government limit. Furnaces regard the coke price as relatively the highest of all the Government limits, and, moreover, are not pleased with the way coke matters went during the war, and they are likely to seek lower prices by every means possible. The market remains quotable at Government limits: Furnace, $6; foundry, 72-hour selected, $7; crushed, over ½-in., $7.30; clean screenings, over ½-in., $5.50, per net ton at ovens, Connellsville region.

## STOCK QUOTATIONS

| N. Y. EXCH.† | Nov. 26 |
|---|---|
| Alaska Gold M. | 3⅛ |
| Alaska Juneau | 2 |
| Am.Sm.&Ref.,com. | 83⅛ |
| Am. Sm. & Ref., pf. | 107 |
| Am. Sm. Sec., pf., A. | 93 |
| Am. Zinc | 13 |
| Am. Zinc, pf. | 41 |
| Anaconda | 65⅛ |
| Batopilas Min. | 1¼ |
| Bethlehem Steel | 62 |
| Butte & Superior | 20⅛ |
| Butte Cop. & Zinc | 8 |
| Cerro de Pasco | 33⅛ |
| Chile Cop. | 19⅛ |
| Chino | 38⅛ |
| Colo.Fuel & Iron | 36 |
| Crucible Steel | 56 |
| Crucible Steel, pf. | 89⅛ |
| Dome Mines | 12¼ |
| Federal M. & S. | 11 |
| Federal M. & S., pf. | 38⅛ |
| Great Nor., ore ctf. | 33⅛ |
| Greene Cananea | 46⅛ |
| Gulf States Steel | 66½ |
| Homestake | 90 |
| Inspiration Con | 48⅛ |
| International Nickel | 31⅛ |
| Kennecott | 35½ |
| Lackawanna Steel | 71 |
| Mexican Petrol. | 161⅛ |
| Miami Copper | 25⅛ |
| Nat'l Lead, com | 63 |
| National Lead, pf. | 103 |
| Nev. Consol. | 18⅛ |
| Ontario Min. | 7 |
| Ray Con | 21⅛ |
| Republic I.&S., com. | 76⅛ |
| Republic I. & S., pf. | 99⅛ |
| Sloss-Sheffield | 45⅛ |
| Tennessee C. & C. | 14⅛ |
| U. S. Steel, com. | 100 |
| U. S. Steel, pf. | 111½ |
| Utah Copper | 79 |
| Va. Iron C. & C. | 59 |

| BOSTON CURB* | Nov. 26 |
|---|---|
| Alaska Mines Corp. | ‡.12 |
| Boston Ely | .80 |
| Boston & Mont. | .48 |
| Butte & Lon'n Dev. | .15 |
| Calaveras | .75 |
| Chief Con. | 3⅛ |
| Contact | .05 |
| Corbin | .25 |
| Cortez | .15 |
| Crown Reserve | .20 |
| Crystal Cop. | .39 |
| Eagle & Blue Bell | 2⅛ |
| First Nat. Cop. | 2⅛ |
| Houghton Copper | .40 |
| Intermountain | ‡.05 |
| Iron Blossom | .55 |
| Iron Cap | 16⅛ |
| Majestic | .26 |
| Mexican Metals | .27 |
| Mines of America | 1⅛ |
| Mojave Tungsten | .07 |
| Nat. Zinc & Lead | .11 |
| Nevada-Douglas | .39 |
| New Baltic | .90 |
| New Cornelia | 16⅛ |
| Oneco | .20 |
| Pacific Mines | ‡.35 |
| Rex Cons. | .05 |
| Yukon Gold | 1 |

| SAN FRAN.* | Nov. 25 |
|---|---|
| Alta | .03 |
| Andes | .04 |
| Best & Belcher | .02 |
| Caledonia | .02 |
| Challenge Con. | .03 |
| Confidence | .10 |
| Con. Virginia | .10 |
| Gould & Curry | .01 |
| Hale & Norcross | .02 |
| Jacket-Cr. Pt. | ‡.03 |
| Mexican | .05 |
| Occidental | .40 |
| Ophir | .04 |
| Overman | .01 |
| Savage | ‡.02 |
| Sierra Nevada | .01 |
| Union Con. | .12 |
| Utah Con. | .01 |
| Belmont | 3.00 |
| Jim Butler | .41 |
| MacNamara | .24 |
| Midway | .13 |
| Mont.-Tonopah | .13 |
| North Star | .06 |
| Rescue Eula | .08 |
| West End Con. | 1.20 |
| Atlanta | .06 |
| Booth | .07 |
| Comb. Frac. | ‡.02 |
| Florence | .11 |
| Jumbo Extension | .11 |
| Kewanas | .05 |
| Nevada Hills | .02 |
| Nevada Packard | .32 |
| Round Mountain | .19 |
| Silver Pick | .04 |
| White Caps | .15 |

| COLO. SPRINGS* | Nov. 25 |
|---|---|
| Cresson Con. | 5.00 |
| Doctor Jack Pot | .04 |
| Elkton Con. | .06 |
| El Paso | .14 |
| Gold Sovereign | ‡.02 |
| Golden Cycle | 1.76 |
| Granite | .17 |
| Isabella | .06 |
| Mary McKinney | .08 |
| Portland | 1.03 |
| United Gold M. | .15 |
| Vindicator | .39 |

| BOSTON EXCH.† | Nov. 26 |
|---|---|
| Adventure | ‡.60 |
| Ahmeek | 77 |
| Algomah | .30 |
| Allouez | 47 |
| Ariz. Com. | 13⅛ |
| Arnold | ‡.20 |
| Bingham Mines | 9 |
| Bonanza | .20 |
| Butte-Balaklava | ‡.35 |
| Calumet & Ariz. | 66 |
| Calumet & Hecla | 452 |
| Centennial | ‡13⅛ |
| Copper Range | 45⅛ |
| Daly West | ⅛ |
| Davis-Daly | 4⅛ |
| East Butte | 10⅛ |
| Franklin | 4¼ |
| Granby | ‡79 |
| Hancock | 7 |
| Hedley | ‡12 |
| Helvetia | ‡.20 |
| Indiana | ‡.60 |
| Isle Royale | 26 |
| Keweenaw | ‡1 |
| Lake | 5⅛ |
| La Salle | ‡3 |
| Mason Valley | 3⅞ |
| Mass | ‡5 |
| Mayflower | 3 |
| Michigan | ‡3⅛ |
| Mohawk | ‡57 |
| New Arcadian | 1⅛ |
| New Idria | ‡13 |
| North Butte | 12⅛ |
| North Lake | ‡.40 |
| Ojibway | 1 |
| Old Dominion | 40 |
| Osceola | ‡57 |
| Quincy | 67⅛ |
| St. Mary's M. L. | 43⅛ |
| Santa Fe | ‡.50 |
| Seneca | 13 |
| Shannon | 3⅛ |
| Shattuck-Ariz. | ‡16⅛ |
| So. Lake | ‡1⅛ |
| So. Utah | .11 |
| Superior | 6 |
| Superior & Bost. | 3⅛ |
| Trinity | 3 |
| Tuolumne | .77 |
| U. S. Smelting | 46 |
| U. S. Smelt'g, pf. | 45⅛ |
| Utah Apex | 3⅛ |
| Utah Con. | 8⅛ |
| Utah Metal | 2⅛ |
| Victoria | 2⅛ |
| Winona | .75 |
| Wolverine | 20⅛ |
| Wyandot | ‡.50 |

| N. Y. CURB† | Nov. 26 |
|---|---|
| Big Ledge | 1⅛ |
| Butte & N. Y. | .50 |
| Butte Detroit | .03 |
| Caledonia | .35 |
| Calumet & Jerome | .50 |
| Can. Cop. Corpn. | 2 |
| Carlisle | ‡2 |
| Cashboy | .06 |
| Con. Ariz. Sm. | 1⅛ |
| Con. Coppermines | 5⅛ |
| Emma Con. | ‡.03 |
| Goldfield Con. | .22 |
| Goldfield Merger | .04 |
| Greenmonster | ‡⅛ |
| Hecla Min. | 5 |
| Howe Sound | 4⅛ |
| Jerome Verde | ‡.50 |
| Louisiana | ‡⅛ |
| Magma | 29 |
| Marsh | .03 |
| McKinley-Dar-Sa. | 48 |
| Milford | ‡.75 |
| Mother Lode | .35 |
| Nixon Nevada | .33 |
| Ohio Cop. | ‡ |
| Rawley | ‡2 |
| Ray Hercules | 3⅛ |
| Richmond | ‡.56 |
| Rochester Mines | .31 |
| St. Joseph Lead | 14 |
| Standard S. L. | 1 |
| Stewart | .16 |
| Success | .10 |
| Tonopah | ‡3⅛ |
| Tonopah Ex. | 1⅛ |
| Tribullion | ‡ |
| Troy Arizona | .10 |
| United Eastern | 4⅛ |
| United Verde Ext. | 35 |
| United Zinc | ‡ |
| Utica Mines | ‡.08 |

| TORONTO* | Nov. 26 |
|---|---|
| Adanac | .10 |
| Bailey | .03 |
| Beaver Con. | .38 |
| Cbambers Ferland | .10 |
| Coniagas | 3.00 |
| Hargraves | .02 |
| Kerr Lake | 5.75 |
| La Rose | .30 |
| Lake Shore | .90 |
| Min. Corp. of Can. | 2.50 |
| Nipissing | 8.37½ |
| Peterson Lake | .07 |
| Temiskaming | .32 |
| Wettlaufer-Lor. | .03 |
| Davidson | ‡.60 |
| Dome Exten. | .24 |
| Dome Lake | .12 |
| Hollinger | 6.12½ |
| McIntyre | 1.62 |
| Newray | .12 |
| Porcu. Crown | .23 |
| Teck-Hughes | .25 |
| Vipond | .20 |
| West Dome | .13 |

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