The Engineering and Mining Journal

VOLUME 97 MARCH 14, 1914 NUMBER 11

Witherbee-Sherman No. 4 Magnetic Separator

By J. S. Pellett*

SYNOPSIS—This latest concentrating plant at Mineville makes a 64% product from a 30% ore. Three-part separation, preliminary roughing, close sizing and fine crushing are followed.

Witherbee, Sherman & Co., Inc., Mineville, N. Y., now has four magnetic concentrating plants in operation on the magnetite deposits occurring in the district. The newest of these is the No. 4, which treats the "New Bed" ore from the recently reopened Barton Hill mines. This mill has been in operation since October, 1912.

Mill Looking Southeast from Barton Hill with Covered Track from Mine. Note Housed Conveyor to Shipping Bins on Right

The Barton Hill or "New Bed" ore, is the leanest ore treated at Mineville, carrying from 30% to 36% iron, with about 0.1%phosphorus. From it a concentrate is produced carrying from 64% to 65% iron and about 0.025% phosphorus. The mill was designed to handle 80 tons per hr. of 35% crude ore. It is situated about 600 ft. from the mouth of the Barton Hill tunnel, with which it is connected by an extension of the underground electric haulage system. The building is of steel construction covered with galvanized corrugated iron. The north end, which contains the crushing department, is 36 ft. wide and consists of nine bays, each 12 ft. 6 in. long.

*931 Cumberland St., Lebanon, Penn.

The separating department is built in five bays, each 17 ft. 9 in. long. The first and second floors, which house the rolls and magnetic separators, are 66 ft. wide for a height of 39 ft. Above this height the building is 26 ft. wide for a total height of 75 ft. This upper portion contains the sized-ore storage bin and the screens.

Storage System

To secure continuous and flexible operation, storage bins are provided between each department as far as possible. Crude ore is stored in a bin built of timber, placed at the north end of the mill nearest to the mine. Ore is dumped from the mine cars directly into this bin, which has a capacity of about 150 tons and provides sufficient storage to insure a steady feed to the mill. Crushed crude ore, ready for separation, is stored in a reinforced-concrete tank of 1000 tons capacity placed between the crushing and separating departments. In the regular operation of the mill this tank is bypassed.

By using it, however, either the crushing or separating department of the mill may be operated independently for some time. Bins of about 30 tons' capacity each are provided in the separating department for sized ore before it is sent to the magnetic separators. Concentrates

ready for shipment are stored in a reinforced-concrete bin of 600 tons' capacity. This bin, 50 ft. long, is built over a set of standard railroad scales provided with a loading beam.

Ore and General Treatment

The ore occurs in narrow layers of practically pure magnetite alternating with layers of lean ore and of rock. As it comes to the mill, it consists of clean magnetite, lean free-milling ore, quartz rock carrying very finely disseminated grains of magnetite, clean quartz rock and a hornblende gneiss. The iron in the gneiss is nonmagnetic and is not recovered.

The general principles upon which the treatment of this ore is based are: (1) Dry magnetic separation; (2) fine crushing; (3) the elimination from the mill of clean concentrates and tailings in as large sizes and as early in the process as possible.

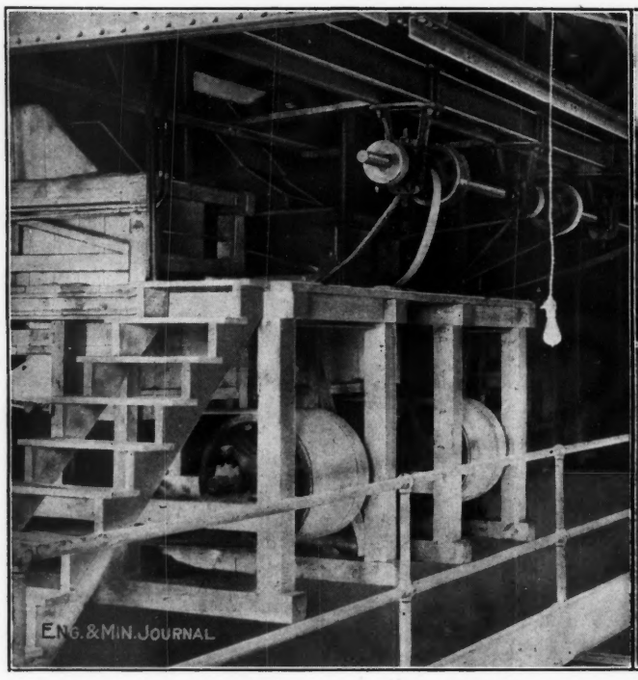
ing commences, and only the sized middlings product is fed to the rolls.

(3) Excess separator and roll capacity is aimed at.

These principles are well established in mills treating other kinds of ore, but have not before found as extensive application in the concentration of magnetic iron ore. This is probably due to the fact that heretofore richer ores only have been concentrated, together with the fact that the magnetic separator will do relatively good work on unsized material.

Crushing Department

Crude ore is brought to the mill in trains of from 15 to 20 two-ton cars hauled by electric locomotives. The ore is weighed, three cars at a time, on track scales, and dumped into the crude-ore pocket, from which it is drawn through a side gate to a shaking feeder supplying the primary crusher. This primary crusher is a 24x36-in.



East Side of Separator Floor, Pulley-Type Separator in Foreground

East Side of Roll Floor, Showing Bins

Fine crushing is carried to 20 mesh, but only where necessary to free the magnetite from the waste. The pieces of rich magnetite require little, if any, crushing beyond what they receive in the crushing department. The quartz rock is extremely hard on roll shells. As there is a large amount of this material it is necessary to discard it as soon as possible.

To carry out the system of separation the following principles are carried further in this mill than in any other mill at present treating this class of ore:

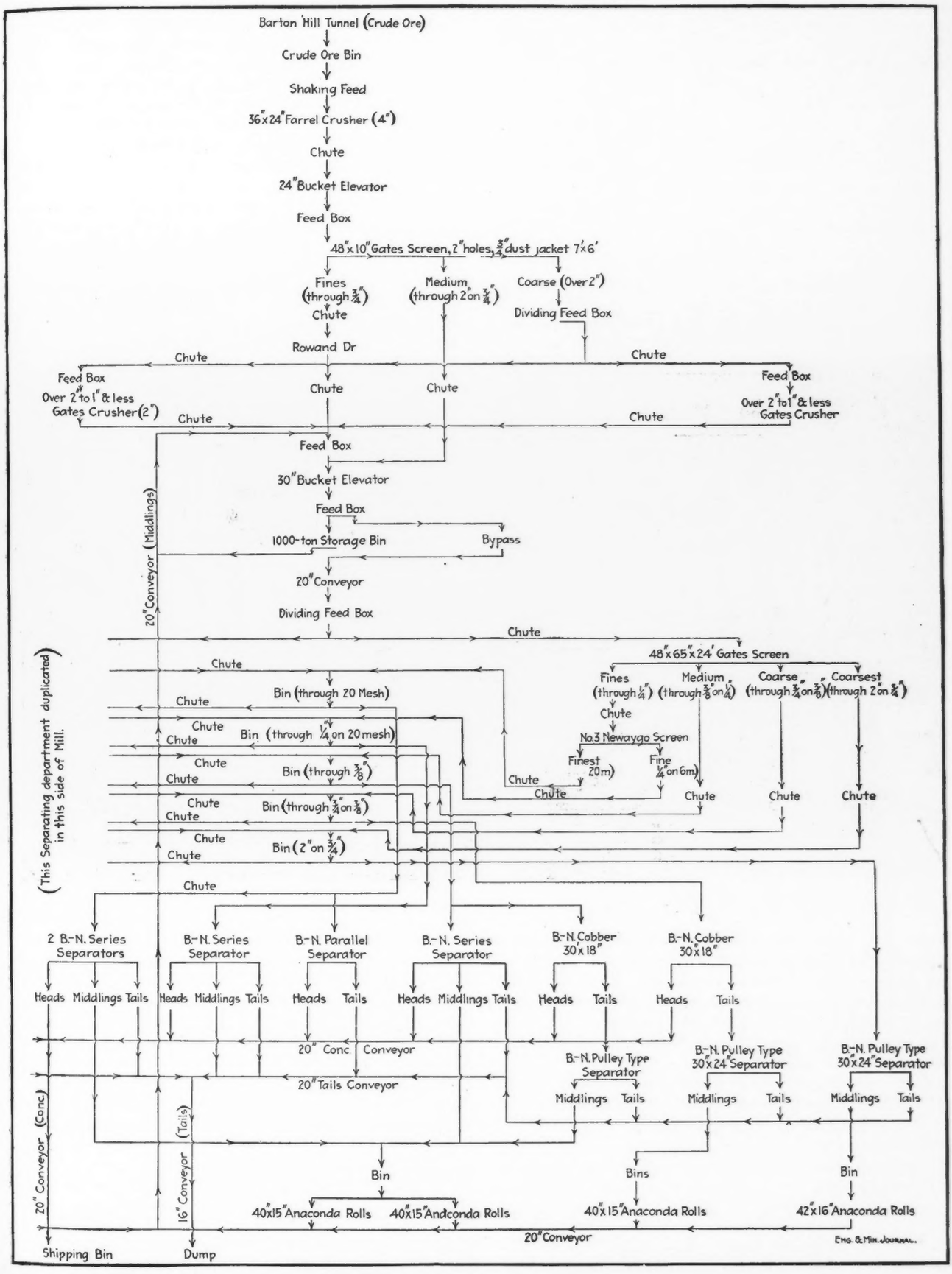
(1) Close sizing before separation. This permits feeding sized material to separators and rolls, securing both closer work and greater capacity than is possible with machines treating unsized material.

(2) In general a three-part separation is made on each size of crude, giving a tailing, a concentrate and a middling product on each size. In this way clean magnetite is delivered to the concentrates without unnecessary crushing, clean rock goes to the tailings before fine crush-

Blake type machine set to crush to 3½ in. One man is required to feed the crusher, controlling the feed by means of an air-hoisted bin gate and tight and loose pulleys on the eccentric shaft of the shaking feeder.

All material from the primary crusher flows by chute to No. 1 elevator. This elevator is 82 ft. center to center, with 24-in. buckets on a 26-in. eight-ply rubber elevator belt. The head pulley is 42 in. diameter, and the bucket speed is 180 ft. per min. No. 1 elevator delivers to the crushing-department trommel, which is situated on the top floor of the crushing department. This trommel delivers three sizes of products. A size through ¾ in. carrying practically all the moisture, goes to the drier. A size through 2 in. and on ¾ in. goes through a chute to No. 2 elevator and thence to the separating department. What rests on 2 in. goes to the secondary crushers for further crushing.

The drier is a Rowand tower type. It contains drying sections of cast-iron baffle bars, over which the falling



FLOW SHEET OF THE WITHERBEE-SHERMAN NO. 4 MAGNETIC SEPARATING PLANT

stream is deflected and retarded as it falls through the ascending hot gases and air from the furnace. The furnace is equipped to burn No. 2 buckwheat coal under forced draft. A 40-ft. 20-in. diameter stack is used.

Two No. 5K Gates gyratory crushers reduce the 2-in. ore size from the screen to 1½-in., delivering to No. 2 elevator. No. 2 elevator is similar to No. 1, being of the same size and practically the same height. It receives all ore from the crushing department ready for separation as well as recrushed middlings from the separating department and delivers it to the separating department or to the 1000-ton central storage bin.

Separating Department

The separating department is divided into two sides, either of which may be run independently of the other. This end of the mill has five floors. The highest is the screen floor; following in order below are the bin floor, separator floor, conveyor floor and roll floor or fine-crushing department. Crushed crude ore either from the crushing department direct, or from the central storage bin, is received from the head of No. 2 elevator on a 20-in. belt conveyor, which delivers through a dividing box to the separating department screens.

These screens are punched plate trommels 27 ft. over all in length. The main screen surface is 4 ft. in diameter by 24 ft. long, of ¼-in. plate with ¾-in. holes. The jacket is 6 ft. in diameter by 16 ft. long. Eight feet of the jacket has ¼-in. perforations and 8 ft. has ⅜-in. perforations.

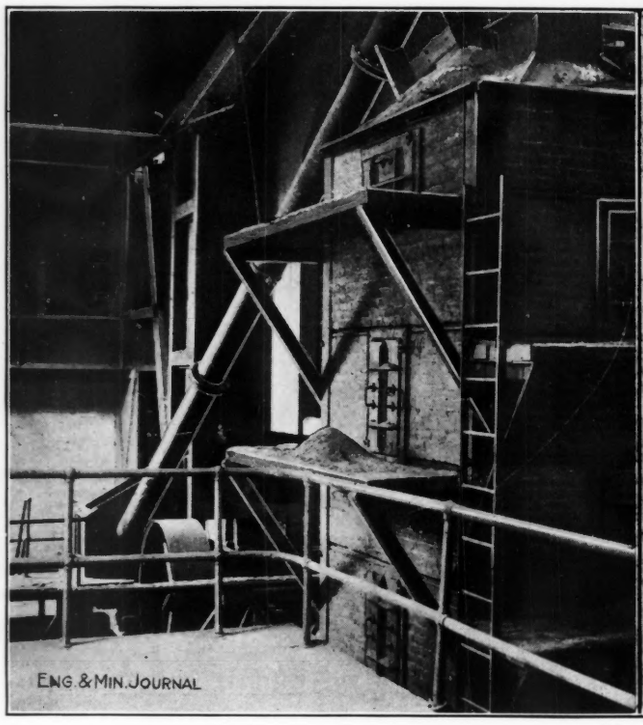
These screens make four sizes of material, through 2-in. on ¾-in., through ¾-in. on ⅜-in., through ⅜-in. on ¼-in., and through ¼-in. Each of these sizes, with the exception of that through ¼-in., falls directly to storage bins under the screens. The size through ¼-in. passes over two No. 3 Newaygo screens, which make two sizes, through 20-mesh and through ¼-in. on 20-mesh.

Sized material is drawn through side gates in the bins and flows by gravity to the hoppers of the magnetic separators on the floor below.

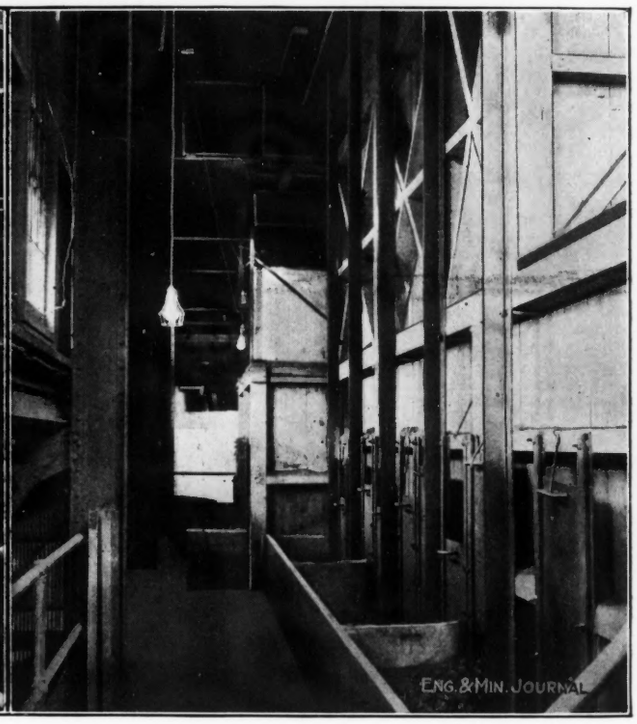
All magnetic separators are Ball-Norton machines. They are located on one floor, evenly divided between the two sides of the mill. Each size of ore is treated on machines best adapted to handle it as follows:

The size through 20-mesh is treated on four double-belt parallel separators, two on each side of the mill. Each machine consists of two belt separators placed one above the other, and operating in parallel. These machines make concentrates and tails but no middlings, as at 20-mesh size there is not enough combined material to pay for further crushing. The size through ¼-in. on 20-mesh is treated on six double-belt, series separators. These machines consist of two belt-type separators, one above the other. The top machine delivers clean concentrates with a current of about six amperes at 128 volts. The bottom machine carries nine amperes on stronger magnets and treats the rejected material from the top machine, making middlings and tailings. The size through ⅜-in. and ¼-in. is handled by two units, each consisting of a single-drum separator or "cobber" placed above a pulley-type separator. The combination of these two machines results in a three-part separation. The drum-type separator carries eight amperes and delivers clean concentrates, while the pulley-type separator carries 25 amp. and delivers tailings and middlings.

The size through ¾-in. on ⅜-in. is handled by the same number and type of machines as the previous size. The size through 2-in. on ¾-in. was formerly handled in a manner exactly similar to the two previous sizes. However, it was found that the amount of clean magnetite reaching this size was so small that it did not pay to run it over the drum machines. These were removed to an-



Top of Rowand Tower Drier



Bin Floor, Newaygo Separator in Background

other mill. The 2-in. size material now goes directly to the pulley-type machine where it is separated into tailings and middlings.

The finished products, concentrates and tailings are carried from the mill by a system of belt conveyors. Two conveyors on the center line of the mill collect the products. The tailings are carried back and delivered to a cross-conveyor, which in turn delivers to the tailing-shipping bin by a 16-in. stacking conveyor. Concentrates are carried forward in the mill and delivered to a 20-in. belt conveyor carried on wooden bents to the concentrate-shipping bin.

Recrushing

There are eight sets of rolls for recrushing, all placed on the ground floor of the separating department. Each side of the mill has one set of 42x16-in. and three sets of 40x15-in. Anaconda type rolls. The sized middling products from the separators are fed to the rolls by chutes. Products from the rolls are delivered to 20-in. belt conveyors placed in cellars underneath, which deliver by means of two short cross-conveyors, to a 20-in. conveyor running under the central storage bin and delivering to No. 2 elevator. This conveyor receives crushed crude ore from the central storage bin, as well as recrushed middlings to be delivered back into the system.

Power and Transmission Machinery

The mill is driven by four 150-hp. induction motors provided with starting resistances and controllers, which enable them to start the mill with elevators, belts and screens fully loaded. They may be operated in either direction and at a slow speed for a short period of time for running on belts, backing up blocked elevators, etc.

Power is taken from the company's 3300-volt line and stepped down to 440 volts. A 75-kw. motor-generator set furnishes 125 volts direct current for the magnets and for lighting.

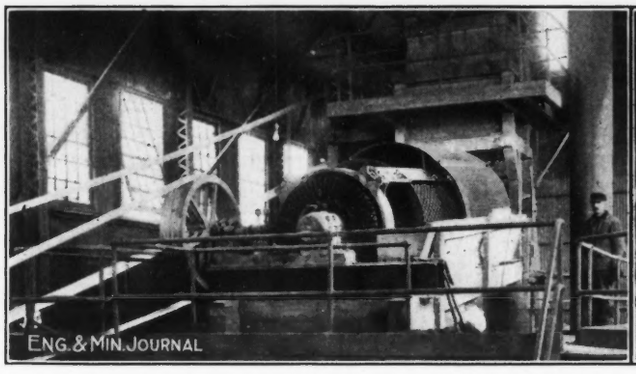
All technical apparatus is placed in dust-tight motor rooms.

Operating

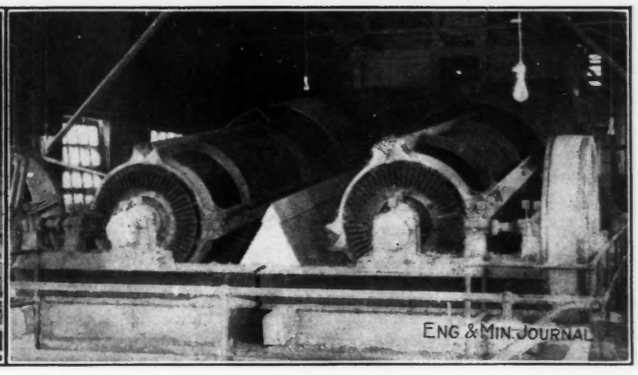
The mill is operated on two nine-hour shifts per day and treats 500 tons per shift. The actual capacity is about 85 tons per hr. when running on 30% ore. When running on richer ore the capacity is greater, due to the smaller proportion of middlings returned for retreatment.

Each shift of 14 men is made up as follows: One foreman, one feeder, two oilers, one motorman, one man on roll floor, two men on separators, one man on bin floor, one man on screens, one man on picking, one man on conveyors, one cleaner, one loader. The loaders clean and repair cars as well as load and weigh. Both of these men work on the day shift.

Crude ore, concentrates, and tailings are sampled and analyzed each day. Concentrates average 64% iron and 0.025% phosphorus; tailings, 5.5% to 6% iron, and crude ore from 30% to 35% iron. In August, 1913, the mill produced 9471 tons concentrates from 21,155 tons of crude ore at a cost of $0.228 per ton of crude. The recovery varies with the percentage of the various products. The figures show a theoretical recovery of 88.5% from 30% ore, 6% tails and 64% concentrates. With a 35% crude ore and the same tails and concentrates the recovery is 91.4%. With a 40% crude ore it would be 94.1 per cent.



Crushing Department Trommel and Head of No. 1 Elevator



Trommels of Separating Department. Drier Stack in Background

A Medieval Precursor of Oil Flotation

By Henry Briggs*

We are so likely to consider the separation of minerals by means of oil as one of the latest developments in ore dressing that it was with something of a shock I happened to find that such a process was in use before the discovery of America.

The process in question was devised by artists for separating ultramarine from lapis lazuli, and it is quite possible that it is still being employed for such small quantities of natural ultramarine as are now needed. An ordinary specimens of lapis lazuli contains, in association with the vivid blue ultramarine (lazurite), a variable proportion of other minerals (sodalite, haüynite, calcite and other spars) whose colors are light shades of blue, green and grey. When this mixture of minerals is crushed, the fine powder has little value as a pigment, being of an extremely pale blue. It appears, however, to have been used in little better than this crude state for illuminated manuscripts down to the end of the twelfth century, since it is only occasionally that one comes across a manuscript of that early period in which the ultramarine is of the vivid

*Heriot-Watt College, Edinburgh, Scotland.

color which we now associate with the name. Suddenly, however, in the thirteenth century, the ultramarines used for illuminated manuscripts underwent a remarkable improvement, and from a little after that time we begin to get recipes for the preparation of ultramarine from lapis lazuli—a preparation which involves a concentration of the blue mineral. One of the earliest recipes for this separation is to be found in a manuscript of Jehan le Begue preserved in the Bibliothèque Royale, at Paris, and translated into English by Mrs. Merrifield ("Ancient Practice of Painting," Vol. 1, London, 1849, pp. 96, *et seq.*) Le Begue wrote in 1431; but as he states that he received one of the recipes at Venice in May, 1410, we may take it that the recipes in question probably date back into the fourteenth century, while the circumstantial evidence to be gathered from illustrated manuscripts goes to show that the process was known in the thirteenth century. On the other hand, it was not known to Theophilus and therefore must have been discovered after his time, the twelfth century.

Besides the manuscript of le Begue, there are several others of contemporary or later date, giving the same or similar recipes; and among these is that of an Italian, Cennino Cennini, who wrote a treatise on colors and art early in the fifteenth century, and who gives a detailed description of the method of concentrating ultramarine.

Anticipating Use of Grease in Diamond Recovery

The interesting point about this method is that the blue is separated from the lighter-colored minerals by taking advantage of the fact that oil, or oily matter, adheres to some minerals in preference to others. Although not a "flotation" process, it appears to be based on the same principle as the oil-flotation process of Elmore, and would seem still more nearly allied to the mode of separating diamonds by the agency of grease, as it is practised in South Africa.

The following recipe for making good ultramarine is taken from Mrs. Merrifield's translation of le Begue's manuscript:

To Make Ultramarine Azure—Take 3 lb. of lapis lazuli, and pound finely in a copper mortar, and afterward sift it with a sieve such as perfumers use when they sift their perfumes after having pounded them. Then take 3 lb. of turpentine and put into a glazed earthen saucer, and place it on the hot ashes. Then put into it a little olive oil, and when you see that it begins to boil take it from the fire, and immediately put in the powdered lapis lazuli, little by little, stirring it well with a stick, so that the turpentine may be well incorporated with the said powder. Then keep the saucer, with the pastille thus made, for three days, and the longer it stands the better. Afterward take another large saucer, and put the pastille into it, and take some clean tepid water, and pour over the pastille as much as would fill a small saucer of the size of the saucer in which the pastille was kept, and wash the pastille well with your hands in the water, and then strain the water through the cloth; and having strained the water from the pastille in that manner three times, keep it in another larger saucer, for in it you will have the flower of the azure. Also pour water again over the pastille in quantity about three saucers' full, pouring it over three times, one saucer full at a time, and do as you did before, and you will have good azure but not so perfect as the first. Also pour water on the pastille a third time, and do as you did before, and you will then have another azure, yet not so perfect as the first or the second.

According to other descriptions of the separation, still other materials were sometimes added to the lapis lazuli; but the essential point seems to have been the addition of oil, wax and resin to the powdered mineral. The old manufacturers all agree in treating the "pastille" in warm water, and most of them recommend stirring it for some time until it becomes thoroughly soft in order to give the "azure" a good chance of falling away.

I have made the experiment and find it a surprisingly successful method of obtaining highly concentrated ultramarine. My mixture was of powdered lapis lazuli, beeswax, common resin and linseed oil. In warm water this becomes soft, and by kneading it with the hands the water soon becomes colored with the ultramarine which exudes from the mass. There seems no doubt that the method is one depending on the greater affinity of the oil, rendered thicker by the sticky resin and wax, for the colorless minerals than for the ultramarine. One can understand the preference of the oil for the pyrite crystals which are commonly found in lapis lazuli; but it is not so evident why there should be such a difference between the ultramarine and its other impurities, seeing that several of them are similar in composition to lazurite, and that all of them are of a class rejected by the oil in the Elmore process. The main fact is, however, that the separation is practicable.

A certain amount of the paler minerals is to be found with the concentrated ultramarine; and it is worth mentioning that even with the best modern natural ultramarine a microscopic examination reveals the presence of a small amount of a transparent crystalline substance.

Cennino Cennini, among others, recommends the treatment of the pastille in warm "lye" instead of in warm water. This lye was made by stirring wood ashes in water, and in this case probably lime was also added to the water. In this way a weak solution of the alkaline hydrates would be obtained; and I find that a slight alkalinity in the water does indeed help the separation.

Some of these ancient attempts at technical writing are exceedingly quaint. In le Begue's manuscript, for instance, there appears an alternative recipe for the separation, which is more complicated than that given above, and involves the careful preparation of the oil before adding it to the pastille. The olive oil has to be thickened, so the recipe says, by turpentine (larch resin; not oil of turpentine), varnish and incense. The oil and turpentine are first to be boiled together "for so long as it would take you to say a *Paternoster* and an *Ave Maria.*" Then the incense is added, and the mixture boiled "for so long as it would take to say the *Miserere mei Deus* twice." Cennino Cennini also has his human touches. He recommends his readers, when they have obtained the concentrated ultramarine, to "put it into a skin or purse and rejoice in it." He affirms further: "You must know also that it is rather the art of maidens than of men to make it, because they remain continually in the house and are more patient and their hands are more delicate. But beware of old women!"

Radium Ore Prices

According to a dispatch to the New York *Times*, the following price schedule for radium ores has been put into effect in Denver:

2% U_3O_8—$2 per lb. of uranium oxide.
3% U_3O_8—$3 per lb. of uranium oxide.
20-30%—$3.25 to $3.50 per lb. of oxide.
50-70%—$4.25 per lb. of uranium oxide.

Cuban Mineral Exports in 1912 were: Iron ore, 1,250,642 tons; copper ore, 71,801 tons; gold ore, 58 tons, worth $158,817; asphalt, 8823 tons.

Thomson's Work on the Nature of the Atom

By Harry C. Jones*

SYNOPSIS—Physicists early recognized that the atom could not be indivisible. Description of the experiments by which Thomson proved that the hydrogen atom was composed of about 1770 parts, electrons, and that all matter is probably composed of electricity. From this conception, we can get our first ideas of what intrinsic energy is, and why chemical reactions can give out light, heat, etc.

One of the chief aims of these papers is to point out the cause of all chemical reactions, and how chemical reactions and chemical equilibrium can be affected by changing the conditions to which they are subjected. These conditions include temperature, pressure, moisture, etc. We shall see that all of these have to do with energy relations, and especially with that form of energy which we call intrinsic.

What do we mean by intrinsic energy? It is obvious that we mean something within the atom, intrinsic to it; to distinguish this form of energy from those forms extrinsic to the atom. But it will be recognized that this is after all little more than words. To call the energy that exists within the atom intrinsic, to distinguish it from all those forms of energy which are external to the atom, is one thing, and to form any physical conception of intrinsic energy—to show what we mean by the term—is an entirely different thing.

Twenty years ago we had no physical conception of what was meant by intrinsic energy. This was due to the erroneous conception of the nature of the atom held by chemists for a century. The atom was supposed to be an ultimate unit, individual, not made up of parts, and from which nothing else could be obtained than the element in question.

It was difficult, not to say impossible, to see how such an atom could contain any known form of energy. Not being made up of parts, it could not contain any kinetic energy within itself, since there was nothing to move.

Although for a whole century we could not form any conception of intrinsic energy, we knew that it existed; and knew, further, that it existed in enormous quantities. When we burned coal, large amounts of heat were set free; when we caused hydrogen and oxygen to unite, still larger amounts of heat were liberated, and in general, whenever a chemical reaction took place there was either a liberation or an absorption of heat, and usually heat was liberated. We knew that this heat came from some form of energy within the atom, from that form which we called intrinsic energy. Intrinsic energy was, then, a fact; but a fact of which we had no explanation, of which we could form no physical conception.

Older Conception of the Atom Erroneous

While chemists held the above conception of the atom for so long a time, still many of them realized that it did not account for many of the facts which it was meant to explain. This was realized with special clearness by certain physicists, and in the following way:

When the temperature of any given gas is raised, the amount of heat required to produce any given rise in the temperature of a given quantity of the gas, depends upon whether the gas is heated at constant pressure allowing the volume to expand, or at constant volume allowing the pressure to increase. In the former case, with pressure constant, the amount of heat required to produce a given rise in temperature, is always greater than in the latter case where the volume is kept constant. The reason for this is obvious. When pressure is kept constant and volume increases, there is external work done in overcoming the superincumbent pressure, in pushing back the atmosphere to allow the volume of the gas to increase. A part of the heat that is added to an expanding gas is thus consumed in doing external work, and does not raise the temperature of the gas.

The amount of heat that is required to raise the temperature of a gram of a gas at constant pressure one degree, is known as the specific heat of the gas at constant pressure, while the amount of heat required to raise the temperature of a gram of the gas one degree at constant volume, is known as the specific heat of the gas at constant volume.

Relation between the Specific Heats of a Gas

The relation between the two specific heats of a gas is the important point in the present connection. It is easily deduced from the kinetic theory of gases, that when the ratio between the specific heat of a gas at constant pressure and the specific heat at constant volume is $1\frac{2}{3}$; it shows that the molecule of the gas is monatomic, i.e., the molecule contains one atom.

The ratio between the two specific heats for mercury vapor has long been known to be $1\frac{2}{3}$; we must therefore conclude, as was done, that the molecule of mercury in the form of vapor contains only one atom.

It was, however, a well known fact that the spectrum of mercury is complex. Mercury has many well defined emission lines, when the light which it emits is examined spectroscopically by means of a grating. This means that mercury sets up light vibrations of a large number of different wave lengths at the same times.

How could a molecule containing only one atom and that atom an ultimate unit, indivisible, not made up of parts, set up simultaneously a large number of vibrations having different wave lengths? It obviously could not, and yet the facts of spectrum analysis remain.

The physicists saw first the impossibility of reconciling the physical facts with the conception of a monatomic atom, defining the atom as the chemists had done. They therefore either refused to accept the ratio between the two specific heats as proving monatomicity of the molecule, or refused to accept the chemical definition of the atom.

*Professor of Physical Chemistry, Johns Hopkins University, Baltimore, Md.

Note—This is the first of a new series of papers by Dr. Jones. The next, on thermochemistry, will appear in the "Journal" of Mar. 21, 1914.

Chemical Atom Not Simple

Most of them accepted the latter alternative, and refused to believe that the chemical atom is a simple unit. I have heard Rowland say, based on his knowledge of the facts of spectroscopy, that the simplest atom must be at least as complex as a piano, otherwise it could not set up simultaneously as many light waves of different wave lengths, as it did.

It was one thing to show that the chemical atom is not the simple unit that chemists had supposed it to be. It was an entirely different thing to show theoretically and experimentally in what its complexity consisted. This was left for Sir J. J. Thomson.

Work of Thomson on the Atom

What is the chemical atom? Is it simple or complex? If complex, in what does its complexity consist? How does the atom of one element differ from the atom of another element? Is there any relation between the atoms of the different elementary substances, and if so, what are these relations? Such are some of the questions which Thomson raised and answered. His answer, as we shall see, gives us the first physical conception of what is meant by intrinsic energy, and intrinsic is that manifestation of energy which is transformed into other forms in chemical reactions, and which cause all chemical reactions. This is the reason why Thomson's work on the nature of the atom is taken up in some detail in the present connection. We must know the meaning of intrinsic energy before we can understand the real significance of chemical reactions, and Thomson's work is fundamental and essential to our understanding of intrinsic energy.

Discharge of Electricity through Gases

Thomson began his investigations by studying the discharge of electricity through dilute gases, that is, through high-vacuum tubes. He studied the so called cathode discharge. He determined the ratio of the charge e, carried by the cathode particle, to the mass m of the particle in the following manner. He allowed a bundle of the cathode rays to pass from the cathode through the perforated anode, and fall on the end of the glass vacuum tube opposite the cathode. When this whole system was suitably placed in a magnetic field, the bundle of cathode rays was deflected in one direction and fell on the wall of the tube in a different position from what it did when there was no magnetic field imposed. The cathode rays were, as we say, deflected, and the magnitude of the deflection could easily be measured.

When the whole system was placed in an electrostatic field, the cathode rays were again deflected; but this time in a direction which was exactly opposite to that in which they were deflected when in a magnetic field. Here, again, the deflection could be readily measured. The strength of the magnetic field, on the one hand, and the electrostatic field on the other, could be determined. The strengths of both of these fields could be varied at will. When they were so chosen that the deflection produced by the one was exactly equal and opposite to that produced by the other, it was a very simple matter to calculate the ratio of the charge to the mass for any given cathode particle[1].

[1]Anyone wishing further details in reference to the solution of this problem, can see my "Electrical Nature of Matter and Radioactivity." Second edition (D. Van Nostrand Co., New York).

Constant Ratio of Charge to Mass of the Cathode Particle

Thomson soon brought out this very remarkable fact, that the ratio $\frac{e}{m}$ is a constant, independent of the nature of the gas through which the discharge takes place. It does not matter whether we have in the discharge tube dilute oxygen, hydrogen, nitrogen, carbon dioxide, nitric oxide, or what gas, the ratio $\frac{e}{m}$ is always a constant, and is equal to 10^7. A dilute gas, of course, means one under low pressure.

Thomson showed that there was, then, split off from all gases, something which had a constant ratio of the charge carried by the particle, to the mass of the particle. What does this mean?

The simplest interpretation would be, that the electrical discharge was splitting off from the molecules of all gases a common constituent, and this common constituent always had, of course, the same mass and carried the same charge. There is, however, another possible interpretation of this result. The cathode particles split off from the different gases had different masses, and the charges carried by these different cathode particles might vary in such a way as to keep the ratio $\frac{e}{m}$ for the different particles constant. From what we know of electrical charges, namely, that they exist only in whole units, this assumption is highly improbable. It is, however, a possibility, and since the alternative that we are splitting off a common constituent from different elementary substances is so revolutionary, is so at variance with everything known at the time Thomson did his work, we must prove it directly before it could be accepted. We must show that the mass of the cathode particle is constant, before we can accept the conclusion that we are obtaining a common constituent from all elements. This is exactly what Thomson did, and in the following manner:

Mass of Cathode Particles Constant

The fact to start with is, that $\frac{e}{m}$ is constant for the different gases; if it could be shown that e is constant for the different cathode particles coming from the different elementary gases, this would show that m was constant for these same particles, since the ratio $\frac{e}{m}$ is constant. This is exactly what Thomson did.

How did he determine the magnitude of the charge carried by the cathode particles? This obviously could not be done directly, but was done by the following indirect method. We can readily pass electricity through a gas containing some cathode particles or gaseous ions, as they are termed, and measure the amount of electricity passed; in a word, determine the conductivity of the gas. This amount of electricity is carried from the one pole to the other by the charged parts. If we knew how many of these charged parts or carriers took part in the conductivity, we would know how much electricity was carried by each part, since it is quite certain that every charged part carries the same amount of electricity. We would only have to divide the total amount of electricity carried from the one pole to the other, by the number of carriers, to

show the amount carried by one charged part. This is the value of e/m in question.

Charge Carried by the Cathode Particle

But how can we determine the number of charged parts present in any given gas? We obviously cannot do this directly. We must resort here to some indirect method, and the following one was used by Thomson.

He made use of the following principle. When a gas containing some ions and water vapor was suddenly expanded, some of the water vapor present condensed as a mist or fog. Thomson showed that at the center of every fog particle there is one and only one charged particle, provided the condensation was effected in the proper manner. The question of determining the number of charged parts, cathode particles, or ions, as they are termed, then, resolved itself into determining the number of droplets of water or fog particles formed under the above named conditions. But how could this be done? Obviously not directly; here, again, an indirect method was used.

If we could determine the size of the fog particles, and the total amount of water precipitated as fog, we could determine the number of fog particles by simply dividing the latter by the former. This was done. Stokes had shown that the rate at which a fog particle settles to the bottom of the containing vessel is a simple, known function of the size of the fog particle. Knowing the rate at which the fog settles, which is determined by observing the distance it has fallen in the flask in a given time, we know at once the size of the droplet of water. Collecting the water after all the fog has settled, we know the total amount of water precipitated. Dividing the total amount of water precipitated by the size of the droplet, we know the number of droplets or fog particles present. Since this is equal to the number of charged parts present in the gas, we know the number of charged parts or cathode particles present in the gas.

Having determined the conductivity of the gas, or the total amount of electricity carried by all the charged particles present, and knowing the number of these particles, we know the amount of charge carried by one particle, which is the quantity desired. This experiment of Thomson, all things considered, is one of the most ingenious in the whole field of experimental science.

The result is that the charge carried by a single cathode particle is determined with a fair degree of accuracy.

Charge Carried by the Hydrogen Ion in Solution

Let us turn now to the hydrogen ion in solution. It is a comparatively simple matter to determine the ratio of the charge to the mass of the hydrogen ion in a solution of an acid which always contains hydrogen ions. We can pass a known amount of electricity through a solution of an acid and collect the hydrogen which separates at the cathode. We know approximately the number of atoms present in a given volume of a gas. We know, therefore, the magnitude of the charge carried by, say one hydrogen ion in solution; and we know its mass by knowing the number in a given volume and the weight of a given volume of hydrogen. The ratio $\frac{e}{m}$ for the hydrogen ion in solution is 10^4. $\frac{e}{m}$ for the cathode particle, it will be remembered, was 10^7.

Charge Carried by the Cathode Particle Same as That Carried by the Hydrogen Ion

It was found that the charge carried by the cathode particle is the same as that carried by the hydrogen ion in solution. This being true, and since $\frac{e}{m}$ for the cathode particle is 10^7 and $\frac{e}{m}$ for the hydrogen ion in solution is 10^4, it follows that the mass of the cathode particle is one one-thousandth that of the hydrogen ion in solution.

Having shown that e for cathode particles from all gases is the same, and that $\frac{e}{m}$ is the same; it follows that the mass of all cathode particles is the same, and this mass, from what has just been given, is one-thousandth the mass of the hydrogen ion as atom.

Having shown that l for cathode particles from all gases is the same, and that $\frac{e}{m}$ is the same; it follows that the mass of all cathode particles is the same, and this mass, from what has just been given, is one-thousandth the mass of the hydrogen ion or atom.

There is thus split off from all elementary gases a common constituent, the cathode particle, and this has a mass which is one-thousandth the mass of the hydrogen atom.[1] This particle, which was known to contain electricity, to carry an electrical charge, and which was supposed to contain some form of matter, since it had both mass and inertia, the supposed criteria of matter, Thomson called the "corpuscle."

What Is the Corpuscle?

The question is, what is the corpuscle? Not, what does it seem to be? Is it both matter and energy; or is it only matter, or is it only energy? These are the questions.

It is known to contain electrical energy because it carries the current. It is, as we say, charged. It was supposed to contain matter because it had mass and inertia. Are mass and inertia criteria of the existence of matter? This is the fundamental question in the present connection.

Lorentz had shown that an isolated electrical charge, moving through a medium such as the ether, itself has mass and inertia. The question then is, how much mass and inertia does it have? How much of the mass and inertia of the corpuscles are due to the electrical charge present, and how much to the supposed matter?

This question Thomson was able to answer, and in the following manner: If all of the mass and inertia of the corpuscle are due to the moving electrical charge that is present, then, as the velocity of the corpuscle increases, its mass ought to increase. On the assumption that all of the mass of the corpuscle is due to the charge, Thomson calculated how much the mass o fthe corpuscle ought to increase for a given increase in its velocity. He then tested the results of his calculation by experiment.

Radium sends off a number of kinds of radiation; among these are the beta radiations. These are nothing

[1] More recent and accurate determinations have shown that the mass of the corpuscle is $\frac{1}{1770}$ of that of the hydrogen atom.

but rapidly moving cathode particles or corpuscles. The point is that the different beta particles shot off by radium, are shot off at different velocities, and these different velocities have all been measured with reasonable accuracy. The masses of these beta particles moving with the different velocities have all been determined. It was, therefore, only necessary for Thomson to compare the results of his calculations with those of measurements upon the beta rays of radium. The results of calculation agreed with those of measurement to within the limits of experimental error. This made it highly probable, indeed practically certain, that the assumption underlying Thomson's calculation was correct, that the mass and inertia of the corpuscle are entirely of electrical origin. In a word, all of the properties of the corpuscle can be accounted for as due to the electrical charge that is present, and since we know things only by their properties, there is not the slightest reason for assuming that the corpuscle contains anything but the electrical charge, but electricity. This ultimate unit of matter which is obtained from all the elements is, then, not matter at all, but energy, and electrical energy at that.

Hitherto we have supposed that we had two entities, matter and energy, but now we know that we have only one, and that is energy.

Ultimate Unit of "Matter" Is Energy[1]

The question now arises, why did we ever suppose that there were two entities? We knew that energy existed, why did we suppose that matter existed? Ostwald pointed out a number of years ago that the conception of matter was a pure creation of the intellect. It never had any foundation in fact. There was never the slightest reason to believe that it existed. It was created by the imagination simply to have something to which to attach energy. We could not then think of energy in the abstract, and imagined the existence of a something or entity to which the energy was attached, and called this something matter.

The ultimate unit of all matter is then the negative electrical charge or *electron*. Where are the positive charges in the atom corresponding to these negative charges, since it is a fundamental principle that we cannot have negative charges without a corresponding amount of positive electricity? The positive electrons corresponding to the negative electrons have not yet been isolated. The positive electricity has not yet been proved to be heterogeneous, and we therefore say that it is distributed homogeneously throughout the atom. The negative electrons are then distributed through a field of uniform positive electrification, and this constitutes the atom.

The Atom in Terms of the Electron Theory

We can now see what the chemical atom is in terms of the electron theory. It is made up of a very large number of electrons, or negative charges of electricity, moving with very high velocities in more or less definite orbits, in a field of uniform positive electrification. The ideal as to the number of electrons within any given atom has undergone change from time to time. Thomson earlier supposed that the number of electrons in the simpler atom, hydrogen, was about 1770. The number in any other atom was the atomic weight of the atom in question, in terms of hydrogen as the unit, multiplied by 1770. Thus, the mercury atom, with an atomic weight of about 200, would contain about 350,000 electrons.

Number of Electrons in the Atom

Later, Thomson seems inclined to the view that there are much smaller numbers of electrons within the atom since he can obtain direct evidence of only a small number of electrons within any given atom. Other physicists, however, are of the opinion that the earlier view of Thomson was the more nearly correct. The presence of only a few electrons within any given atom can be demonstrated directly, since only a few are in such a condition that their presence can be detected by the now existing physical methods. Most of the electrons within any atom, forming its kernel, are in such a stable condition that they cannot be detected directly. There is a strong tendency at present to accept this latter view, and this is the one we shall adopt.

How is this large number of electrons arranged to build up the atom? Thomson has solved this problem in a number of cases in two dimensions, i.e., for a section cut through the atom. He has shown that the electrons are arranged in concentric circles, in a perfectly definite order, and move in perfectly definite orbits. The spaces occupied by the electrons, as compared with the interelectronic spaces, are almost infinitesimal. The relations of the electrons to the interelectronic spaces is that of the planets in the solar system to the interplanetary spaces. The result is that the electrons have ample spaces in which to move within the atom without flying off from it.

Meaning of Intrinsic Energy

We can now see what is meant by intrinsic energy, and the object of what precedes in this chapter is to bring out this very point. We have seen what the atom is in terms of Thomson's work. We have seen to what Thomson has led us, and what is far more important, how he has led us by brilliant experimentation and irresistible logic.

The atom is made up of a large number of parts, with small masses to be sure, but moving with enormous velocities. Anything that has mass and velocity has kinetic energy. Although the mass of the electron is so small, yet its velocity is very great. The kinetic energy of a moving body is given by the expression $\frac{1}{2} MV_2$; where M is the mass and V the velocity. If the mass is small and the velocity great, we have a large amount of kinetic energy, since the velocity enters into the equation as the second power.

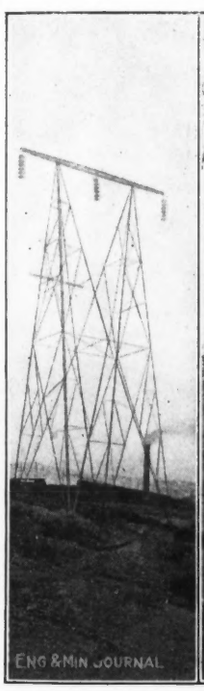
There is every reason today to believe that the intrinsic energy of an atom is essentially the kinetic energy of the moving electrons within the atom. Thus, we can form, and form for the first time, a physical conception of what is meant by intrinsic energy. This is fundamental to a rational discussion of the thermal, electrical and optical changes which manifest themselves when chemical reactions take place. The heat energy, electrical energy and light energy that appear in chemical reactions, come from a part of the intrinsic energy of the systems reacting from that part of the intrinsic energy that disappears. We must, then, know the meaning of intrinsic energy, in order to understand the effect of temperance, pressure, electrical action, etc., on chemical reactions and chemical equilibrium.

[1] "Zeit. phys. Chem.," XVIII, 305 (1895).

Butte, Anaconda & Pacific Electrification

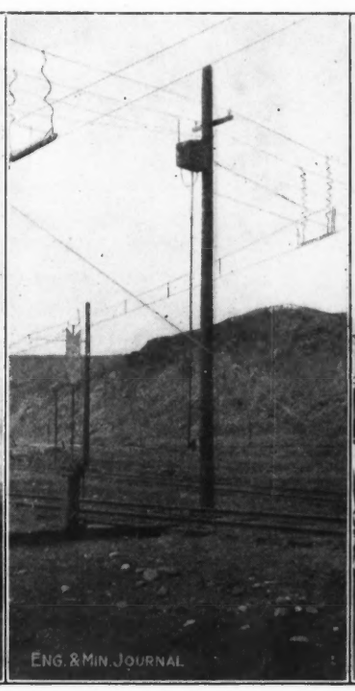
SYNOPSIS—First American road electrified solely from motives of economy. Territory, traffic and method of handling, power supply, rectification, overhead construction and feeding system described. Types of locomotives.

The Butte, Anaconda & Pacific Ry. is, in many ways, the most remarkable example of steam-road electrification in this country. Besides being the first 2400-volt direct-current road, it is also credited with being the first steam road, operating both freight and passenger schedules, to electrify its lines purely for reasons of economy, previous steam-railway electrifications having been made because of peremptory factors, such as terminal and tunnel operation or rapid suburban service.



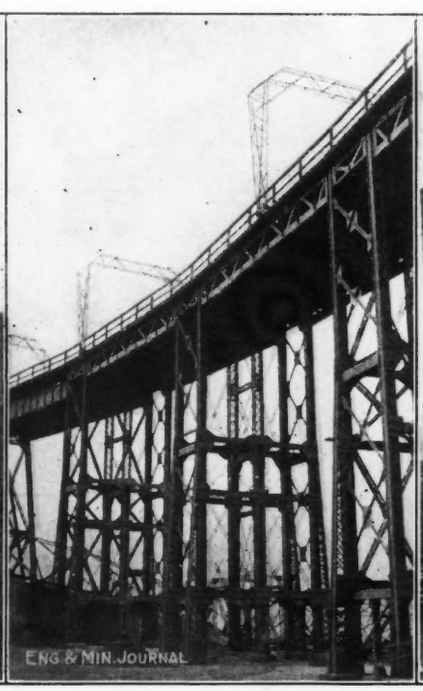
TRANSMISSION TOWER

100,000-volt line, Great Falls to Butte



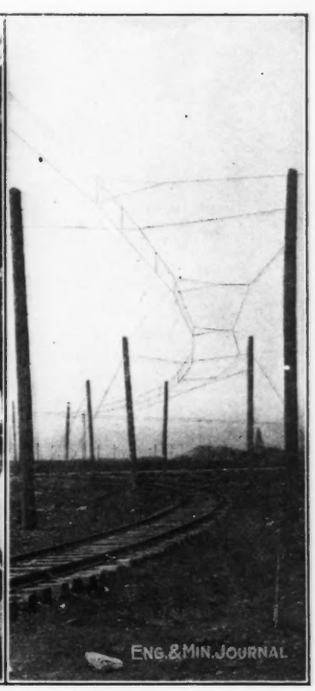
INSULATED SECTION

Intersection of a city 600-volt trolley line and the 2400-volt line.



TRESTLE

Steel bridge construction employed at Washoe Smelting Plant, Anaconda.



SINGLE TRACK

Method of supporting wire on curve

The first electric locomotives were put in service May 28, 1913, hauling ore cars between the East Anaconda yards and the smelting plant. During the first seven months of service, they made approximately 201,000 miles and hauled about 2,365,000 tons of ore. The steam-locomotive crews, engineers and firemen easily acquired proficiency in handling the electric locomotives; two or three days' instructions from a competent electrical man being ordinarily sufficient. The change from steam to electric haulage was made without any change in the personnel of the train crews and without any delays or alterations in the schedule.

The electrified lines of the system extend from the Butte Hill yard to the smelting plant, a distance of 32 miles. There are numerous sidings, yards, and smelter tracks that have been equipped with overhead wires, making a total of about 95 miles on a single-track basis. The system is essentially an ore-hauling road. From the Butte mines, the ore trains are lowered down the mountain a distance of 4½ miles to the Rocker yards, a few miles west of Butte. At this point, new main-line trains are made up for transportation to the Anaconda plant. The division extends through a mountainous country for about 20 miles. At East Anaconda, the main-line trains are broken up and hauled up Smelter Hill to the stock bins, where each car is run over the scales and weighed. The east-bound freight traffic consists of returning empty cars to mines and the transportation of copper ingots to the Butte yards, whence it is shipped over other roads to refineries.

Between Butte and Anaconda there is considerable local traffic, both passenger and freight. Butte, with the surrounding country, has a population of about 65,000, and Anaconda has about 10,000. At Butte, the system connects with the Great Northern, the Northern Pacific and the Chicago, Milwaukee & Puget Sound; and at Silver Bow, about six miles from the city, with the Oregon Short Line.

The maximum curvature on the system, 20°, occurs on the Butte Hill line. On this part of the road, there is an average curvature of 6° to 10°. The locomotives are designed with sufficient flexibility to take a curve of 31° at slow speed.

Note—From material furnished by the General Electric Co.

The freight traffic amounts to more than 5,000,000 tons per year. This material is handled in steel ore cars weighing about 18 tons and having a capacity of 50 tons each. Trains of 30 loaded cars weighing 2000 tons are made up at the Butte Hill yards and hauled by two-unit locomotives to the Rocker yards, where 4000-ton trains are made up for the main line. At the East Anaconda yards, the trains are again broken up and 1400-ton trains are sent up Smelter Hill to the ore bins. Shifting and spotting cars, at the plants and in the sorting yards, are done by single locomotive units. The customary train makeup for both east- and west-bound traffic is shown in the accompanying table.

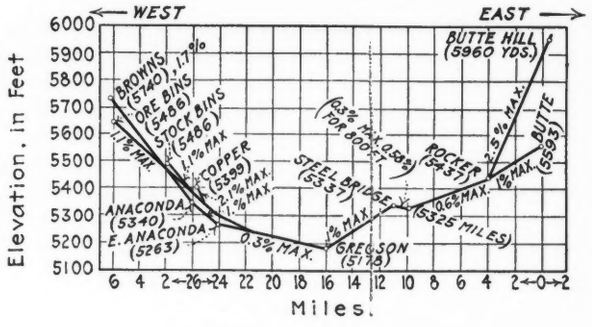
DATA ON FREIGHT-TRAIN HANDLING

	West Bound			East Bound		
	Butte Hill Line	Main Line	Smelter Hill	Smelter Hill	Main Line	Butte Hill Line
Trailing load in tons	2000	4000	1400	1000	1260	650
Number of cars	30	60	20	55	70	35
Number of 80-ton locomotives per train	2	2	2	2	2	2
Approx. grade against load	2.5%	0.3%	1.1%	1.1%	1%	2.5%
Approx. speed on level tangent track, miles per hour	....	21	....	....	25	....
Approx. speed on max. grade	12	16	16	20	16	16
Average trolley voltage	2200	2200	2200	2200	2200	2200
Length of run in miles	4.6	20.1	7	7	20.1	4.6

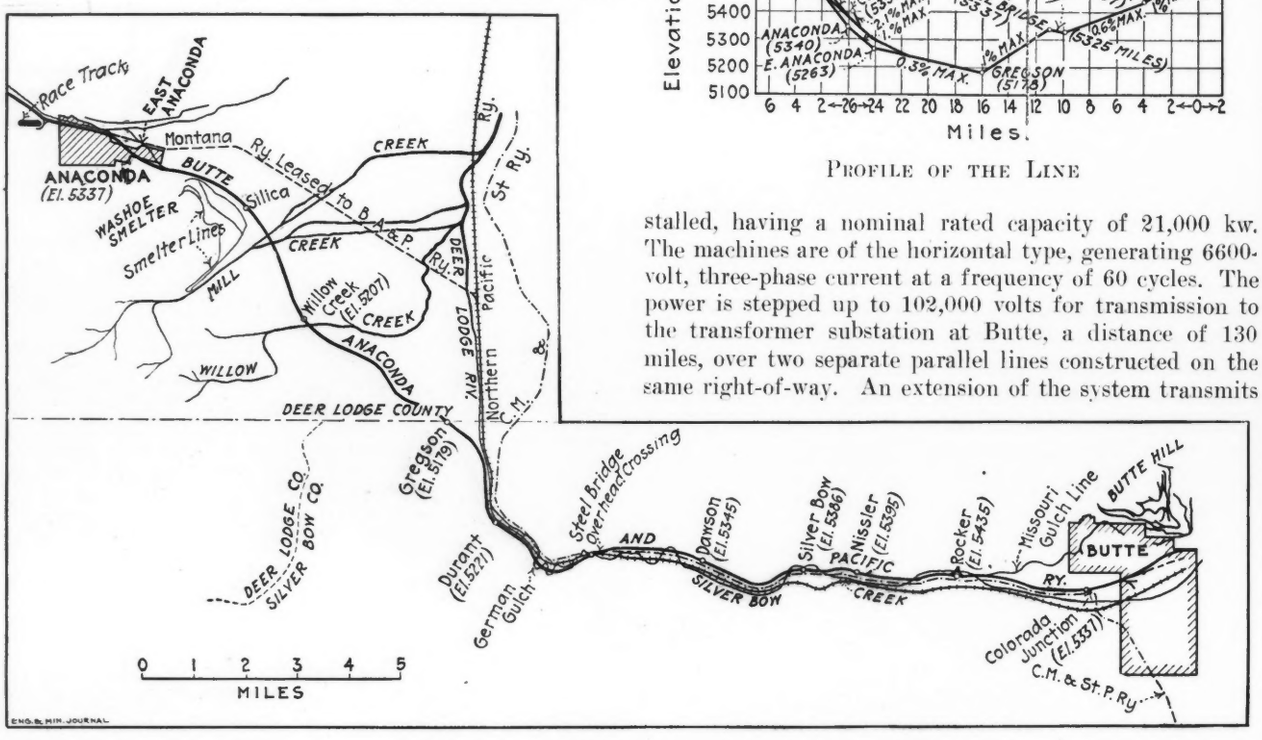
Eight passenger trains per day are operated between Butte and Anaconda, four in each direction. The main-line trains were first hauled by electric locomotives on Oct. 1, 1913, and promptly demonstrated their ability to make better time than was possible with steam engines. Single locomotives are used, hauling trains of from three to five passenger and baggage cars.

Power Supply

Energy for the operation of electric trains is purchased from the Great Falls Power Co. The generating plant is located at Great Falls, Mont., on the Missouri River, and has for some time been supplying electric power for the operation of the mines and smelting plants at Butte and Anaconda. Six hydro-electric units are installed, having a nominal rated capacity of 21,000 kw. The machines are of the horizontal type, generating 6600-volt, three-phase current at a frequency of 60 cycles. The power is stepped up to 102,000 volts for transmission to the transformer substation at Butte, a distance of 130 miles, over two separate parallel lines constructed on the same right-of-way. An extension of the system transmits power at 60,000 volts to a second transformer station at Anaconda, 26 miles farther on.



Profile of the Line



Map of the Electrified System

The Butte station forms the center of the extensive power system operated by the Montana Power Co. Besides the Great Falls 102,000-volt transmission lines, there are several 60,000-volt transmissions terminating at this point, which form a part of the Montana company's system. These lines bring in power from the Hauser Lake, Cañon Ferry, Madison and Big Hole plants. At the Butte substation, this power is stepped down to 2400 volts, and all of the lines tied in on the alternating-current bus. Ample protection is, therefore, afforded against interruption of service.

It is an interesting fact that the railway load was taken on without any increase in the high-tension transmission facilities. It is estimated that the additional load from this source is approximately 20% of the railway, industrial and lighting load furnished by the street railways, mines, and plants at Butte and Anaconda.

Railway Substations

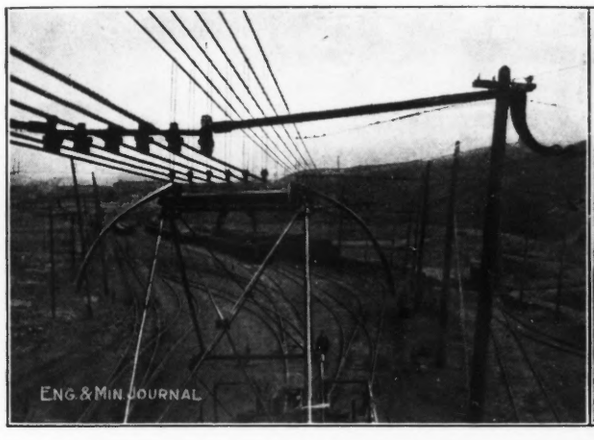
The two existing substations at Butte and Anaconda were used to house the 2400-volt motor-generators required for operating the electric trains, so that no additional buildings were constructed for the purpose. Power

is furnished by two 1000-kw., three-unit motor-generator sets in each sub-station, taking power from the 2400-volt alternating-current busses. These units operate continuously 24 hr. per day, seven days of the week. Each set consists of a three-phase, 60-cycle, 1450-kv.-a., 720-r.p.m. synchronous motor, direct-connected to two 500-kw., 1200-volt generators, arranged to operate in series for 2400 volts.

Excitation for the two generating units in each substation is obtained from two induction-motor-driven sets, rated 50 kw. each at 125 volts. One set is used for supplying current to the synchronous-motor fields and is controlled by the automatic voltage regulator. The second unit supplies current to the separately excited fields of the direct-current generators.

and cross-span construction are used as required by the local conditions. There is a large amount of special work on account of the many yards and sidings, and in one case 12 tracks are spanned. The cross-span construction used at this point is supported by a third pole between the eighth and ninth tracks.

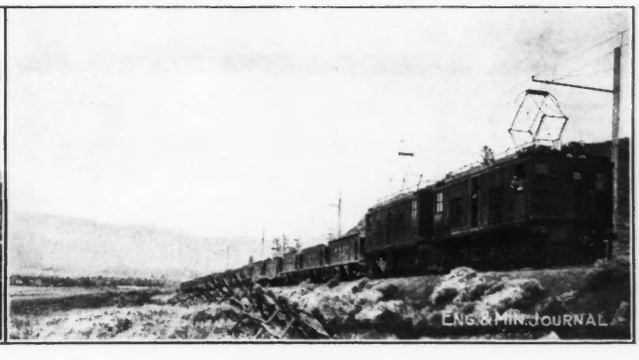
The section breakers were designed for the 2400-volt service, and at six points insulated crossings are necessary at the intersection of the 2400-volt trolley with the 600-volt trolley of the city system. On the main line a simple section insulator is used. This consists of paralleling the two trolley wires from the ends of each section at a suitable distance for insulation so that the pantograph bridges the two circuits for a short distance, thus avoiding interruption of the power supply to the locomotive. The construction in the yards and sidings is simplified by paralleling the trolley from the side tracks for a short distance along the main line. This avoids the use of switch plates or similar devices. At some of these junction points the pantograph engages as many as six trolley wires.



Pantograph Engaging Six Trolley Wires

Single Locomotive and Passenger Train at Butte

Eight-Track Tangent in the Butte Yards



Two-Unit Electric Locomotive Hauling Ore Train

The 2400-volt switchboards for controlling these sets are the first direct-current boards to be constructed for this high voltage. In general, they are similar to the standard 600-volt types with increased insulation and special provision for interrupting the 2400-volt current. The circuit-breakers and switches are also arranged for remote control, and all apparatus on the panels is provided with ample insulation to insure safety to operators.

Overhead Construction

The overhead construction for this system was especially designed to give the flexibility necessary for satisfactory operation of the pantograph trolleys used on the locomotives. The 0000 grooved copper trolley used over all tracks is supported by an 11-point catenary suspension from a stranded steel messenger cable. Both side-bracket

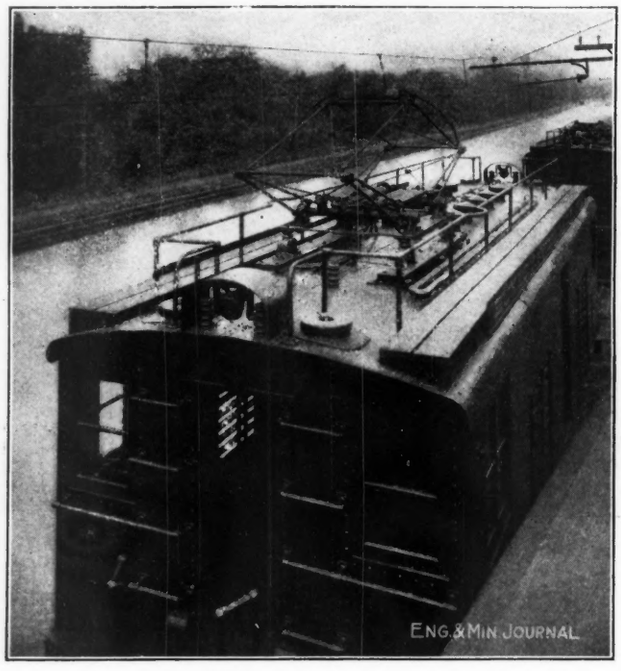
Feeders

The trolley wire is reinforced between the substations with two 500,000-c.m. bare copper cables tapped to the trolley at intervals of 1000 ft. A 0000 negative return wire is also installed between Rocker and East Anaconda. This wire is carried on the trolley poles and is connected to the cross-bonds at intervals of 1000 ft. The rails are connected by 0000 bonds at every joint. The substations are normally connected by these feeders, allowing

an interchange of current, and in emergency either station can supply current to the entire system.

Locomotives

The locomotive equipment used consists of 17 80-ton units, 15 for the freight and two for passenger service. The freight locomotives are geared for slow speed and are operated in pairs for the main-line service. The maximum free-running speed is 35 miles per hour. The two passenger locomotives are of the same construction as the freight units, but are geared for a maximum free-running speed of 55 miles per hour. A speed of 45 miles is made



One of the Locomotives

with three passenger coaches on straight, level track. These locomotives are of the articulated double-truck type with all the weight on the drivers. The motors are of the General Electric, 229-A, commutating-pole type, wound for 1200 volts and insulated for 2400 volts. This motor was designed for locomotive service and is provided with forced ventilation. The double-unit, 160-ton locomotive is capable of giving a continuous sustained output of 2100 hp. The motors are connected to the driving wheels by twin gears.

The principal data and dimensions applying to the locomotives are the following:

Length inside of knuckles	37 ft. 4 in.
Length over cab	31 ft.
Height over cab	12 ft. 10 in.
Height with trolley down	15 ft. 6 in.
Width over all	10 ft.
Total wheel base	26 ft.
Rigid wheel base	8 ft. 8 in.
Track gage	4 ft. 8½ in.
Total weight	160,000 lb.
Weight per axle	40,000 lb.
Wheels, steel tired	46 in.
Journals	6x13 in.
Gears, forged rims, freight locomotives	87 teeth
Gears, forged rims, passenger locomotives	80 teeth
Pinions, forged, freight locomotives	18 teeth
Pinions, forged, passenger locomotives	25 teeth
Tractive effort at 30% coefficient	48,000 lb.
Tractive effort at one hour rating	30,000 lb.
Tractive effort at continuous rating	25,000 lb.

The control equipment is Sprague-General Electric, Type M, Multiple-unit, operating the four motors in series and in series-parallel. Two 1200-volt motors are permanently connected in series. The controller provides ten steps in series and nine in series-parallel. The transition between series and series-parallel is effected without opening the motor circuit, and there is no appreciable reduction in tractive effort during the change. The transfer of circuits at this point is made by a special change-over switch, which is operated electro-pneumatically. Current is collected by overhead roller pantographs, pneumatically operated and controlled from either engineer's compartment by an air valve.

The locomotives have been maintained by the regular shop force with the assistance of one man experienced in electrical apparatus.

Electric Air-Heating System

All of the passenger and baggage cars now used between Butte and Anaconda will be heated as well as lighted by electricity as soon as the equipment can be installed.

Chronology of Mining for February, 1913

Feb. 1—New Mogul mill, at Terry, S. D., started operations—Chino Copper Co. discharged all minors in its employ.

Feb. 2—Three miners killed in cave-in at North Uno mine of Oliver Iron Mining Co., near Hibbing, Minn.

Feb. 4—Billinghurst's administration in Peru overthrown.

Feb. 5—Miner killed at the Original mine, at Butte, Mont., by falling down a chute.

Feb. 9—Congressional investigation of strike in Lake Superior copper country begun.

Feb. 10—Congressional investigation of Colorado coalfields strike begun.

Feb. 12—Chinese government granted important oil concession to Standard Oil Co.

Feb. 13—Miner drowned in the Osceola mine, Webb City, Mo.—Miner killed by falling piece of timber in the North Lake mine of the Cleveland-Cliffs Iron Co., near Ishpeming, Mich.

Feb. 15—Three mine guards and a deputy sheriff found guilty of manslaughter for killing a man at the height of the Lake Superior copper strike.

Feb. 16—Two miners killed by fall of ground in the Maas mine, at Negaunee, Mich.

Feb. 17—Miner killed by fall down a chute in the Leonard mine, at Butte, Mont.

Feb. 20—Man killed by falling rock in lime quarry of Anaconda Copper Mining Co., near Anaconda, Mont. —Two miners killed by cave-in in Southern Cross mine, near Georgetown, Mont.

Feb. 23—Man died from injuries from falling rock in the Vindicator mine, at Victor, Colo.

Feb. 24—Strike of miners in Southern coal fields of France.

Feb. 26—Two miners killed by cave-in at the Alpena mine of the Oliver Mining Co., near Virginia, Minn.

Feb. 26—Miner killed by caving bank at the Genoa openpit mine, near Gilbert, Minn.

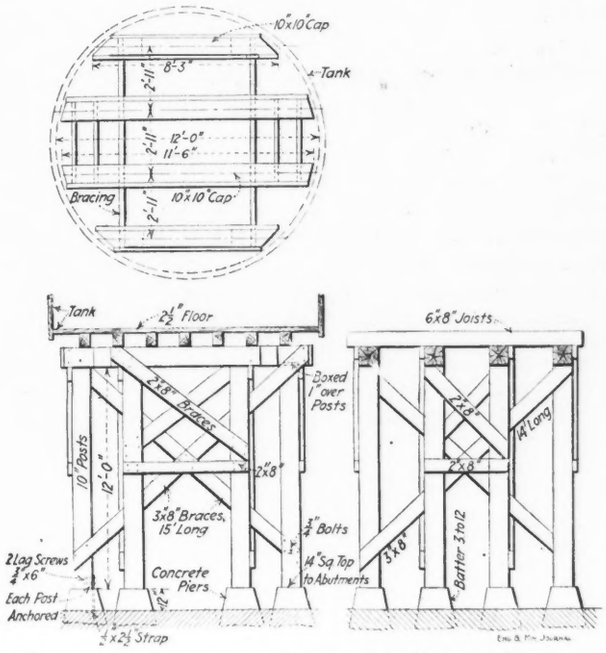
Spelter Production in Japan—According to a British Consular report the Osaka company is producing 250 tons of spelter per month and expects to make a production of 4500 tons in 1914. The Mitsui company is soon to begin zinc smelting at Miike, where it will make use of the cheap coal available there, importing the zinc ore from Hida and Kamioka.

Details of Practical Mining

Substructure of Wooden Water Tank

By William Wallace*

A necessary adjunct to every iron-range boiler plant is the water tank. The flat topography usually eliminates the possibility of setting the tank on high ground to gain head, and for that reason it is usually put near the boiler house. The latest tanks are of the elliptical-bottom steel



Posts, Stringers and Bracing to Carry Wooden Tank

type, raised to considerable height on a steel structure, the wooden tanks supported on a wooden substructure in the manner of railway tanks are still common. Such a substructure of standard type is illustrated herewith. It is built of sawed timber set on concrete piers and usually painted. The tank supported in this case is 12x12 ft.

⁂

The Automatically Rotating Stoper

A stoping drill of the self rotating type was recently tested at the Mt. Hope mine (M. M. S. A. *Bull.* No. 68). This drill is equipped with a rifle bar similar to that used in a position drill, and is operated by means of the usual spring and pawls. The rifle bar rotates the hammer, the front head socket, and the socket nut in which the drill is placed. The drill has the usual telescope feed. The diameter of the cylinders is 2 in. as against the 1¾ in. diameter of the ordinary hammer drill. The drill weighs 101 lb., 22 lb. more than the usual hammer drill. The average depth drilled per day by an ordinary miner amounted to 58.85 ft.; the average actual time the drill was in operation during the 8-hr. shift was 3.7 hours, the remainder of the shift being consumed in making minor adjustments on the drill. The drilling rate per minute was 3.3 in., and the average depth of hole was 6 ft. No special effort was made toward a good showing with this drill, and it was used in ordinary mining work. A nonrotating hammer drill operated in the same ground by an equally competent drill-runner averaged 42 ft. per drill-shift. With the self-rotating drill, it was found necessary to use a 16-point bit to start the hole, followed by a six-point bit, instead of the usual four-point. The difficulties experienced in using the drill were: (1) Starting the hole was difficult; (2) the drill cannot be used in loose ground, as it strikes such a heavy blow that it shatters and jars down too much of the back; (3) the drill is too heavy, as at present constructed, and one man cannot operate it on other than vertical holes.

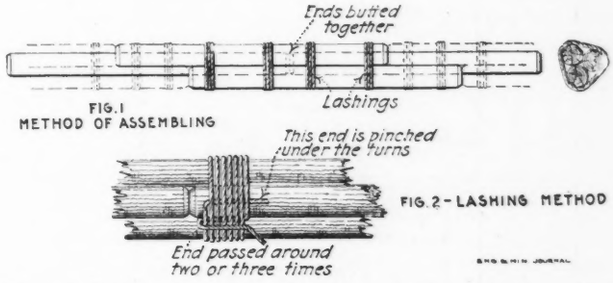
If this, or some other, type of rotating drill can be perfected, it should help to counteract the dislike felt by the individual miner for the hammer drill, as the principal objection is that rotating it is very hard work.

⁂

A Built-up Gin Pole

By A. Livingstone Oke*

It frequently happens, where timber is scarce, that a gin pole or other long timber is required larger than any single stick on hand. A method of building one from short lengths of either round or square timber is exhibited herewith.



Three Round Timbers Lashed together for a Gin Pole

The poles are laid up in threes, the ends overlapping, as shown in Fig. 1, with a lashing on both sides of each joint; the number of turns of rope used depends on whether the pole has to sustain merely a thrust, as in a gin pole, or is to be employed for work in which it will be subjected to bending stresses. In the latter case, both the strength of the ropes, the number of turns and the tightness with which they are put on, must all be increased. If the poles available are all of the same length,

*Mining engineer, New York.

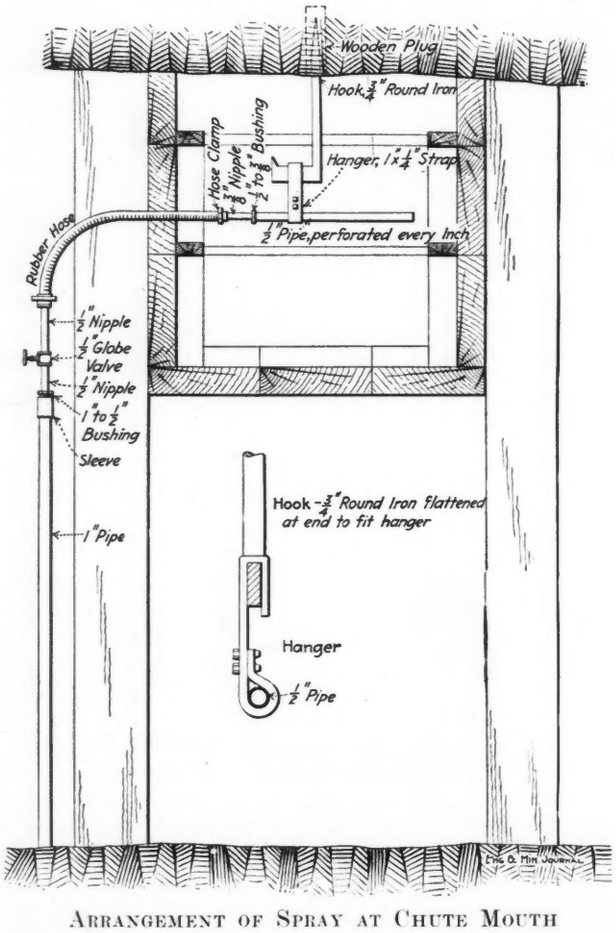
*Mining engineer, Penzance, Cornwall, Eng.

but of different diameters, some care must be used in matching the sizes at different points in the length of the built-up pole, keeping the stouter ones together and gradually tapering to the smaller end. Poles may also be built with more than three members, but this number is the more satisfactory, when possible, as it makes a three-point support inside and prevents transverse movement.

Fig. 2 shows the proper method of lashing; several turns of small rope are to be preferred to fewer turns of a larger rope. One end of the rope is pinched under the turns and finally the free end taken around these by passing through several times, as shown, and the whole drawn up tight. To tighten the lashing further, short lengths of smaller rope may be passed around the turns on the other two sides as well and drawn as taut as possible.

Removable Chute-Spray

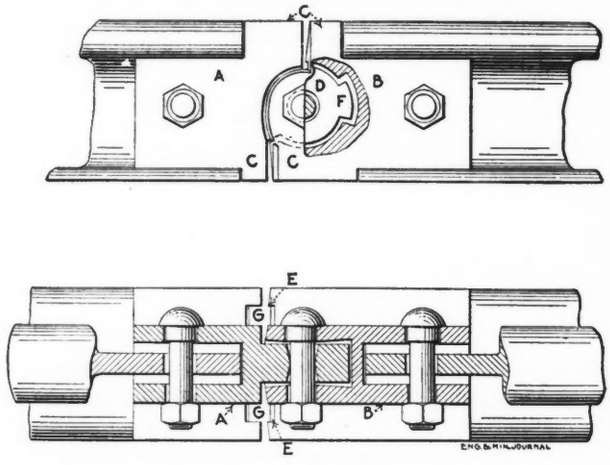
A recent act of the Nevada legislature made it compulsory to put sprinkling devices on all underground ore chutes where dry and dusty ore is handled. In the accompanying illustration is shown a convenient form of spray in use at the Mason Valley mine for laying the dust when loading cars. All stoping is done by the shrinkage method and as large boulders are unavoidably covered in the stopes, frequent blasting at the chute mouths is necessary; the spray was designed to meet this condition. Water is piped into the mine through a 1-in. main, and a 1-in. pipe is brought up beside each chute to a height of 4 ft. To this pipe, by suitable fittings, as shown, is connected a ½-in. globe valve; a ½-in. rubber hose; and then the spray proper. The spray consists of a 2-ft. length of ½-in. pipe, plugged at one end and perforated by small holes, placed in a row and at 1-in. spaces. To the spray pipe is bolted the hanger. This is a piece of 1x¼-in. iron, bent to fit the hook. The hook is made of a short length of ¾-in. round iron, one end bent at right angles and flattened, the other end pointed and driven into a wood plug in a drill hole in the roof of the drift. The flat hook and the fit of the hanger prevent the spray from swinging, so that the water is always thrown in the right direction. This spraying device is simply and cheaply constructed; the water can be easily regulated by the carman and is always directed to the right spot; the spray can be swung to one side when it is necessary to blast the chute, and the hook, the only part liable to injury by blasting, can be easily replaced.



Arrangement of Spray at Chute Mouth

Flexible Joint for Steam-Shovel Track

A new rail joint for use on steam-shovel tracks in moving up, and designed to eliminate some of the difficulties found in the use of joints of the older type, is here illustrated. An ordinary strap joint will not permit lateral deflection of the 6-ft. track lengths used for moving up, unless they are so loosely connected as to make the track insecure, and vertical swinging is prevented by the heads and flanges of the rails. The new joint is intended to permit horizontal and vertical deflection, and if desired, vertical without horizontal.



Assembled Members of Track Connection for Steam Shovels

The joint as described in the *Canal Record*, Jan. 7, 1914, was invented by Peter J. Thull, of Culebra (U. S. Patent 1,072,273). It consists of two parts *A* and *B*, held to the rail and to each other by three bolts. Each part has top and bottom lugs *C*, which take the place of the ends of the rail head and base, where these are cut away. The part *A* has a tongue *D* projecting into a socket in *B*. The sides of the socket in *B* are beveled, as shown, and also the ends of the lug portion as at *E*. The end of the tongue from *A* is a circular arc with a projection *F*, and the back of the socket in *B* corresponds to this shape, the projection *F* having a certain amount of play. The bolt hole through the tongue is also beveled. In this

way a certain amount of vertical and lateral rotation is possible around the bolt. When only vertical motion is desired, a spike may be inserted in the matched notches *G*, cut in the bottom lugs, and the joint locked against lateral swinging.

A successful trial of this joint led to an order for 22 to equip 10 shovels. They are reported by the resident engineer to give excellent satisfaction, after several months' use. They are particularly advantageous when track is laid on a soft bottom or under water. Their effect is to make the rail almost continuous. They are also valuable in slide areas where the shovel must be sometimes backed out rapidly without putting the back track in proper shape.

Small Economical Electric Hoist

An electric hoisting installation involving unusual features is described in the *Transactions* of the Mining Institute of Scotland, Vol. XXXVI, Part 1. Direct current

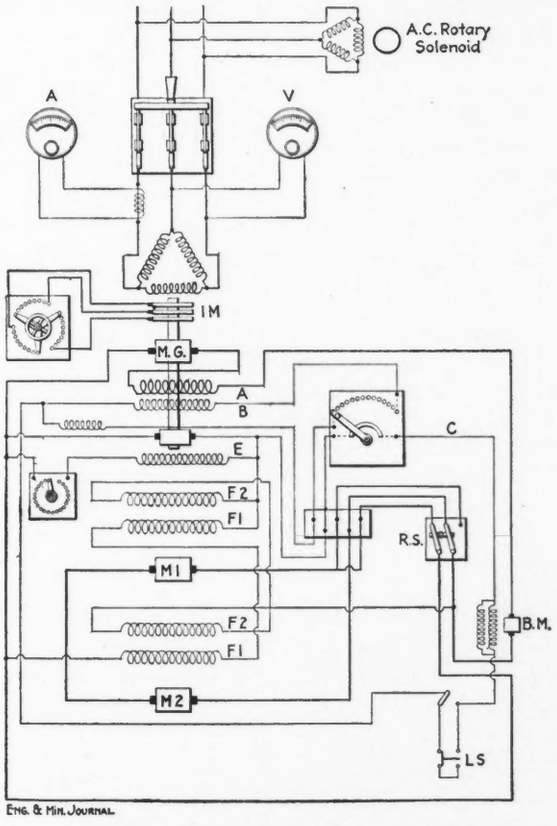


FIG. 1. DIAGRAM OF CONNECTIONS

is employed, rectified from a 400-volt alternating current by a 135-hp. motor generator. The system of windings provides that no more current is drawn during acceleration than during full speed running and no heavy flywheel is used. Two 52½-hp. hoisting motors are used, the division into two units being intended as a safeguard against shutdowns. An 8:1 gear transmits the power to the hoisting drum. The drum is of the spiro-conical pattern, the rope winds for three turns on the small diameter of 5 ft., rises rapidly in three spiral turns to the large diameter of 10 ft., and completes its winding on a cylinder of this diameter.

The safeguards on the hoist are four in number: (1) An electromagnetic brake comes into operation at the end of every trip the moment the controller cuts off the current to the hoist, and remains in operation until current is again introduced. In addition, limit-switches are fixed on the indicator pillar and come into operation to cut off the power and apply the brake if the cage should be hoisted too high. (2) On the indicator column are mechanical trips which, after the limit-switches are tripped, apply the mechanical brake by the release of a heavy weight. (3) This weight is also released by a solenoid connected direct to the supply mains. This solenoid comes into operation if the current supply fails. (4) The mechanical brake is operated by means of a cramp at the hoistman's foot.

The controller is so constructed that if the handle be put straight to the "full on" position, the driving motors will still accelerate gradually to maximum speed, owing to the system of winding.

The electrical connections are best shown in Fig. 1. The motor-generator set consists of an induction motor *I M*, which drives a main generator *M G* and a small exciter *E*, the three machines being mounted on one bedplate and designed to run at 750 r.p.m. The motor will develop 135 b.hp. continuously, with a rise in temperature not exceeding 75° F. It is provided with a wound rotor and controlled by a three-phase starting switch with metallic resistances. The main generator has two field windings, *A* carrying the main current and *B* a shunt winding supplied with current from the exciter. These windings are in opposition, the flux being proportional to the difference in the two field strengths. The series winding *A* limits the maximum demand from the supply mains during the period of acceleration by allowing a heavy current to pass to the main motors at low voltage only. The values of these two windings are fixed to suit the local conditions. The controller *C* consists of a regulating resistance for varying the field strength of the winding *B*, its value being such that with the controller in the "off" position the generator fields are neutralized, and zero voltage results. With all the regulating resistance cut out, i.e., when the controller is in the "full on" position, and with the full load passing through the winding *A*, the generator gives its maximum voltage. If for any reason the load should exceed the maximum for which the plant is designed, any increase in the armature current would automatically weaken the generator field and so lower its voltage; the current would, therefore, remain practically constant and the speed of the main motors vary in proportion to the load. The main driving motors *M*1 and *M*2 are each provided with two field windings *F*1 and *F*2. *F*1 of motor *M*1 is in series with *F*1 of motor *M*2, both being excited at constant voltage. The two fields *F*2 are also connected in series, one terminal being connected to the common supply from the exciter, and the other connected between the main generator and motors; they, therefore, vary with the generator voltage, and are so connected, that the main generator giving zero voltage they have the full exciter voltage applied to them. This voltage diminishes as that of the main generator increases, until, with the latter at its maximum voltage, these fields are neutral. Both fields are wound in the same direction, and, therefore, give a heavy flux when the motor is standing. The object of these windings is, first, to give to the motors a heavy starting torque, and, secondly, to cause the motors to regenerate as the motor-generator voltage is

decreased in the operation of switching off the controller. The strong field and heavy armature-current make it possible to accelerate the cages rapidly and economically. At retardation the regeneration gives all the braking effect required to bring the cages to rest rapidly and without shock; it is found unnecessary to use the main brakes, except when changing cages or in emergency. While this regeneration in itself constitutes an efficient safety device against running away, an electrically controlled brake is also provided for this purpose. This consists of a small motor *BM* operating auxiliary brake blocks through pinion and quadrant, the brake being held on normally by a spring. The motor armature is connected in series with

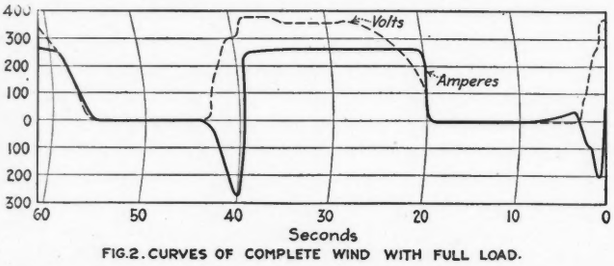


FIG. 2. CURVES OF COMPLETE WIND WITH FULL LOAD.

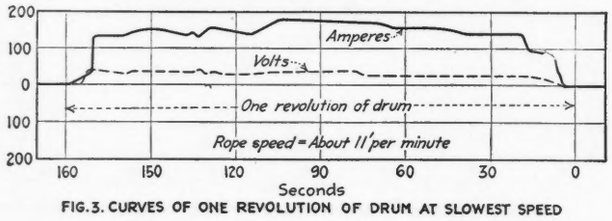


FIG. 3. CURVES OF ONE REVOLUTION OF DRUM AT SLOWEST SPEED

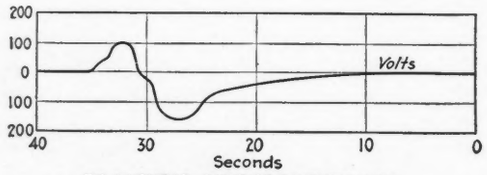


FIG. 4. VOLTAGE CURVE OF COMPLETE WIND WITH MOTOR GENERATOR STANDING.

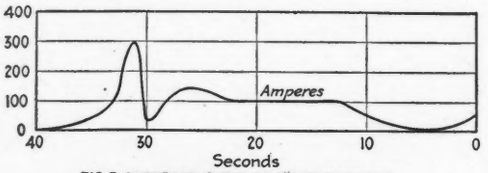


FIG. 5. AMPERAGE CURVE OF COMPLETE WIND WITH MOTOR GENERATOR STANDING

Eng. & Min. Journal

the main driving motor by a shunt field connected across the exciter. This motor is connected between the main generator and the reversing switch *RS*, so that the current flows in one direction. Should, however, the main driving motors take charge, the current would be reversed; the armature would then revolve in the opposite direction, and allow the brake to come on. Any interruption in the field circuit of this brake motor would obviously cause the brake to be applied; the circuit to this field is made through the limit switches *LS*, which, as stated, are fixed to the depth indicator. The field of the main generator is also completed through these limit switches, and in the event of an overwind, one or other of them is tripped, thus opening the circuit and causing the brake motor to be de-energized and the main generator to lose its field.

At present, hoisting takes place from a depth of 456 ft., with a stop at 408 ft. and another at 258 ft. below the surface. Over a certain period, 33,200 tons was hoisted with a current consumption of 26,438 units, or 0.893 units per ton, costing, at 1.5c. per unit, 1.3394c. per ton. This includes every trip made during the period under review. Three special tests were made, each of an hour's duration, when the full load was run from the 456-ft. level only, and these resulted in an average current consumption per ton of 0.591 units. The difference of 0.391 units is the power required for stopping and starting at intermediate levels and for hoisting men and supplies. The time taken to hoist 2075 lb. from the 456-ft. level, is 24 sec., and with 10 sec. allowed for discharging, the hoist running continuously would raise 806 tons in eight hours. The cost of upkeep from May, 1912, to May, 1913, was as follows: Oils, $12.30; brushes, $4.90; fuel for heating, $24.10; waste, $6.30; total, $47.60. The only labor is a hoistman for each shift on which men are underground.

Fig. 2 shows the voltage and the amperage curves for one complete trip with full load from a depth of 456 ft. Fig. 3 shows the curves for one revolution of the drum at its lowest speed. The minimum speed of the cage is about 11 ft. per min., which gives ample opportunity for examining the shaft. Figs. 4 and 5 illustrate the curves taken for a full run of 456 ft. with the motor-generator standing. These interesting diagrams are the result of an experiment. The electromagnetic brake was disconnected, and a pair of empty cars were put on the cage at the surface, the cage at the bottom being empty. The mechanical brake was released, and the top cage allowed to descend and raise the other cage slowly at first, but with increasing speed as it ran. When the loaded cage was still some distance from the bottom, it came gradually to a stop. During the time that the cages were in motion, power was generated by the main motors, and the power in turn set the motor-generator in motion, with the result that when the cages stopped the motor-generator was able to supply sufficient current back to the main motors to enable the trip to be completed. In the event of the power supply from the mains being cut off, this means could be adopted for drawing the men, if a heavier load were placed on the descending cage.

Pipe Fitting and Fittings

A correspondent in *Power*, Jan. 27, 1913, asks how many engineers know that pipe over 12 in. in diameter is measured on the outside; that but five standard thread sizes are used for all sizes of pipe from the smallest to the 12-in.; that large pipe lengths are not made for threading when ¼ in. thick or less, as the threads would cut too deep.

Valves, he says, may leak because pipe-line strains have warped the valve seat, or because a wrench was used on the wrong end of the valve when it was screwed in place. Always use the wrench on the end of the valve being screwed on the pipe. When running large pipe, each length should be supported independently of the rest of the line and should rest on roller brackets. The weight of a pipe line should never be carried by a valve, as a large valve seat may be warped by the strain.

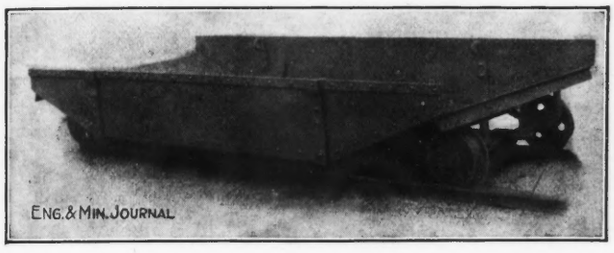
Always line up the lengths in a pipe line before bolting together. Neglect of this will cause leaky joints when the strain of holding the pipe in line comes on the bolts, gaskets and flanges.

Details of Metallurgical Practice

Ash Car in C. & H. Power Plant

One way in which the efficiency of power-house operation can be increased is to provide means for handling ashes directly from ashpits without having to rake them out and then shovel them into a car or wheelbarrow.

The Calumet & Hecla Mining Co. has been making extensive improvements in its power plant, says *Power,* Feb. 10, 1914. The car shown in the accompanying illustration was designed so that it could be run underneath the boiler grates to catch the ashes as they drop from the grate. When the car is full, it can be pulled out and run outside the boiler house to the ash dump or lifted by a crane and dumped into a standard-gage car for removal. The car was built by the Orenstein-Arthur Koppel Co., Koppel,



ASH CAR AT CALUMET & HECLA BOILER HOUSE

Penn. The body of the car is made of $\frac{3}{16}$-in. plate, heavily reinforced to prevent warping by the heat. The wheels are cast steel with roller-bearing hubs. It is built exceptionally low, with a height of only 24 in.; the gage is 36 in.; length, 12 ft.; width, 5 ft. 5½ in.; capacity, about 95 cu.ft. The use of these cars has greatly reduced the boiler-room labor.

Ledoux Chloridizing Patent

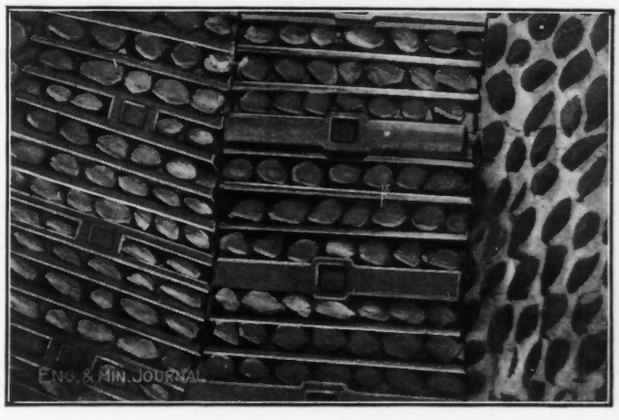
Augustus D. Ledoux, of 15 William St., New York, has been granted a patent (U. S. No. 1,082,599, Dec. 30, 1913) for a continuous process of chloridizing ores by means of the reaction heat of the salt and the ore; after the reaction has once been started by extraneous heat, the process is said to be self-sustaining, and no more extraneous fuel is used.

The process is considered to be especially applicable to ores containing copper and silver and a small amount of sulphur. According to the patentee, the heat required to bring about the reaction is from 250° to 275° C., whereas the heat of reaction is much greater than this, between 500° and 600° C. It is expected that by regulating the amount of air and conserving the heat of reaction, the process can be made continuous. The reaction heat may be conserved by passing the gases, free from impurities in the fuel ordinarily used, through the furnace again, or may be otherwise utilized. Almost any type of furnace may be used, but a modified McDougal type is suggested. The patentee, who is an importer of pyrites, states that the process is particularly applicable to the treatment of the residues resulting from the roasting of copper-bearing ores, such as pyrites. We understand that experiments are also being made with a view of adapting the process for use in connection with the leaching of certain copper ores.

Miami Lining for Hardinge Mills

After experimenting with a large number of different types of linings, the Miami Copper Co. is now using in its Hardinge mills ribbed cast-iron lining in the cylindrical part of the mill, and in the first portion of the conical discharge end; pebbles embedded in neat cement are used for the remaining portion of the discharge cone and also for the cone at the feed end of the mill.

In the JOURNAL of Jan. 10, p. 59, J. Parke Channing referred to the various linings that had been tried at Miami as follows: "A patented manganese-steel lining was given a thorough trial in three mills. It consisted of flat plates with ribs or lifting bars running longitudinally. This proved unsatisfactory on account of the increase in power required, poor grinding, and excessive wear of plates. The flat cast-iron lining was also tried without success. It appeared that a rough lining is absolutely necessary for the best results."

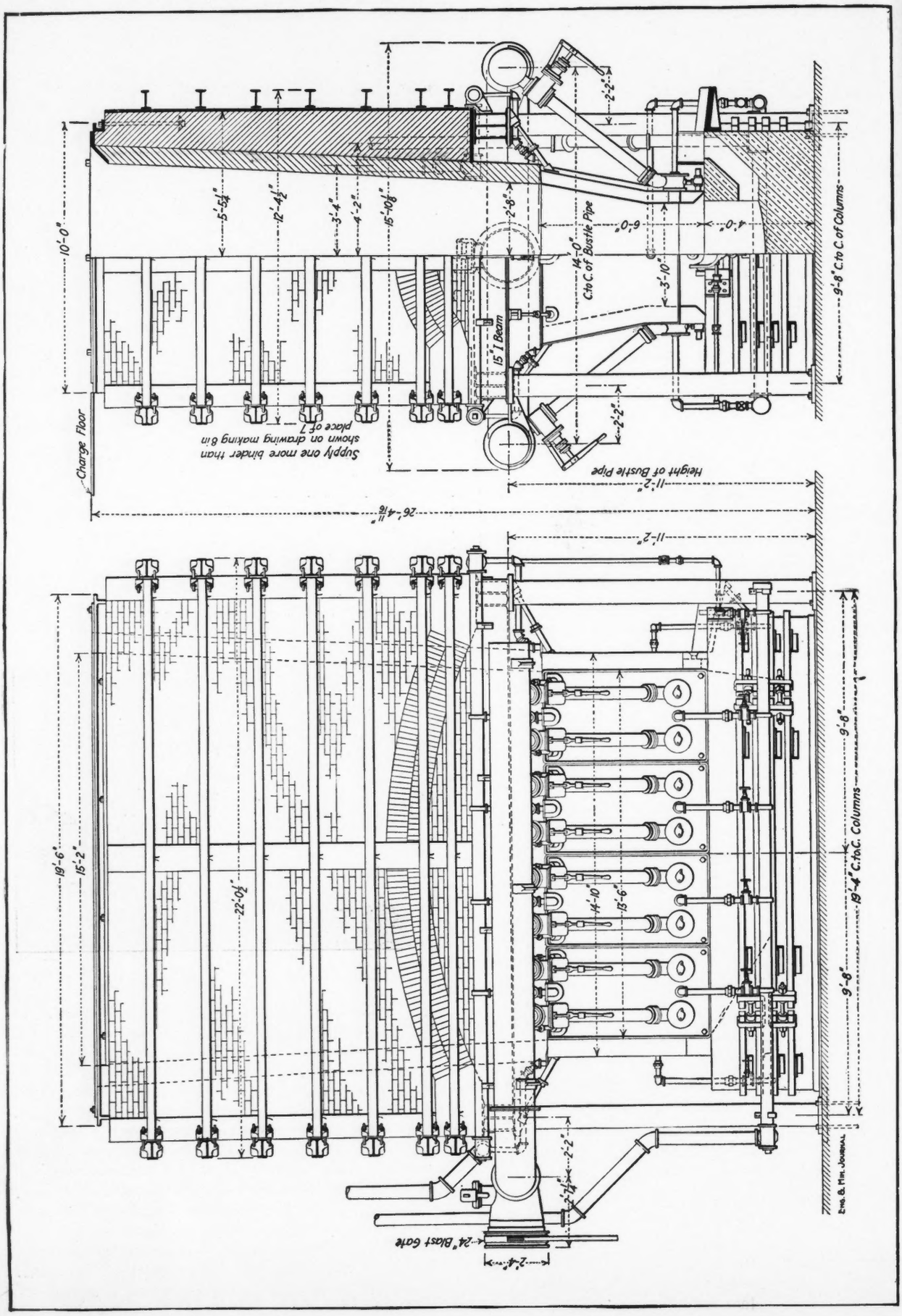


MIAMI LINING FOR HARDINGE MILLS

An all-pebble-and-cement lining[1] was also tried, but better results were obtained on the Miami ore with the lining illustrated in the accompanying picture. One mill so lined has run four months, and an examination of the lining indicated a life of at least two months more. This is a much longer life than the Belgian silex linings gave.

An important feature of the cast-iron ribbed lining in the cylindrical portion of the Hardinge mill as used at Miami is the lifter bar which is shown in the accompanying engraving. It has been found that this lifter bar, which projects about 2½ in. above the ribs of the cast-iron lining, has a beneficial effect in the grinding and also an important effect in the protecting of the cast-iron ribbed lining, the lifter bars taking much of the wear.

[1] "Eng. and Min. Journ., Nov. 15, 1913.



THE 46x162-IN. SILVER-LEAD SMELTING FURNACE OF THE CIA. MINERA DE PEÑOLES AT MAPIMI, DURANGO, MEXICO

The lifter bars last about three months and are then replaced, but give to the cast-iron ribbed lining a life of about nine months.

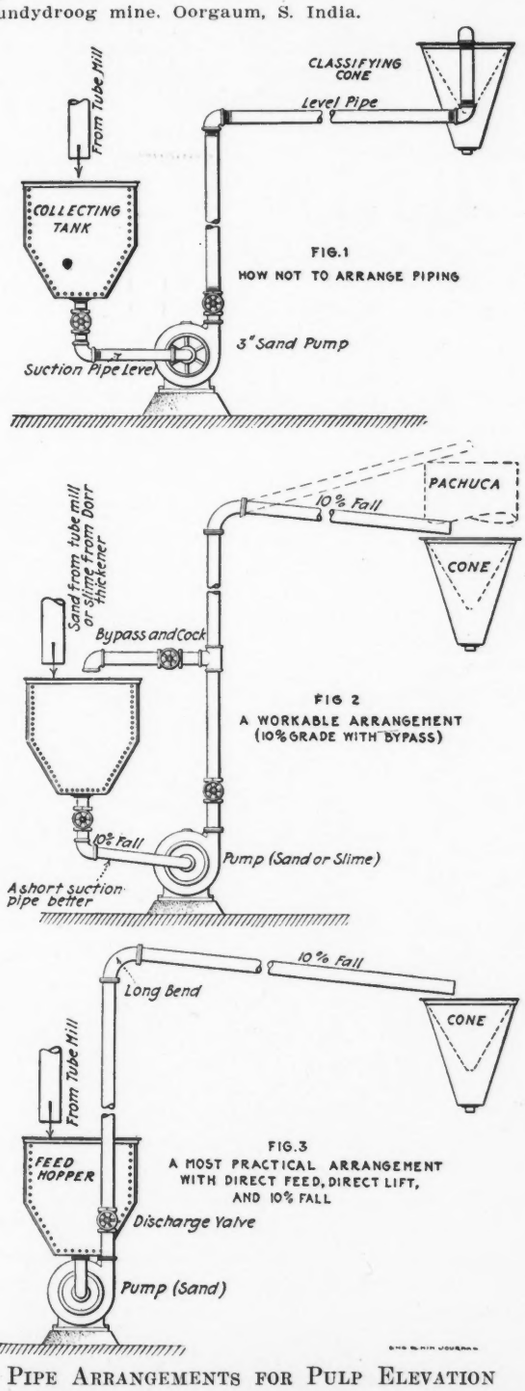
Pipe Arrangement for Sand and Slime Pumps

By H. E. West*

For the elevation of a sandy slime, centrifugal pumps are difficult to maintain in efficiency and constant operation. Without a suitable pipe arrangement, continuous elevation of the pulp is impossible. This feature is well illustrated in the three sketches.

In Fig. 1 we have a pipe arrangement that is impossible of satisfactory operation. In the first place, the collecting tank, taking a tube-mill product, on being permitted partially to fill, eventually will block the pipe. Then again, for lack of fall, the suction pipe easily chokes. On any attempt to throttle the delivery, the flat suction and delivery pipes will build up and fill solidly. Again, the broken lift is inadvisable. Altogether, this is a bad arrangement.

*Nundydroog mine, Oorgaum, S. India.



Pipe Arrangements for Pulp Elevation

Arrangement in Fig. 2 is better. There we have a 10% fall in both suction and delivery pipes, and a bypass to insure the suction running full, although permitting of regulation on the delivery to the classifier, thus making the discharge continuous, an important factor in classification. The lift is direct and unbroken, also a consideration in power consumption.

At Fig. 3 is a still better arrangement. Here the collecting tank is dispensed with, as both unnecessary and unsatisfactory, as it is liable to build up with sand and block the pump. The feed is direct into the hopper of the pump and is directly elevated, dispensing with both tank and suction pipe. There is no bypass, nor need for same. The lift is direct and with a 10% fall to the cone.

For a slime pump elevating pulp from a Dorr thickener to a Pachuca tank, the second is a good arrangement, since the discharge from a thickener is not necessarily continuous. The inclined portion of the delivery can be upward to the Pachuca so as to minimize height in the vertical pipe. Too much care cannot be given the installation of centrifugal pumps handling a sandy product. Fall in the suction is as important as in the discharge pipe. Throttling is effected either by the delivery valve, or better, by the bypass, keeping the delivery and suction valves wide open. Power remains approximately the same, irrespective of quantity in the pumps under review. These are two 3-in. pumps, sand and slime, with 4-in. pipes, lifting the sand pulp (sp.gr. 1.2) from tube mill to classifier through a vertical height of 33 ft., and the slime pump lifting slime (sp.gr. 1.36) through a vertical height of 44 ft. The pumps together take from 19 to 22 amp. at 440 volts, with a power factor of probably 85 per cent.

A Typical Silver-Lead Smelting Furnace

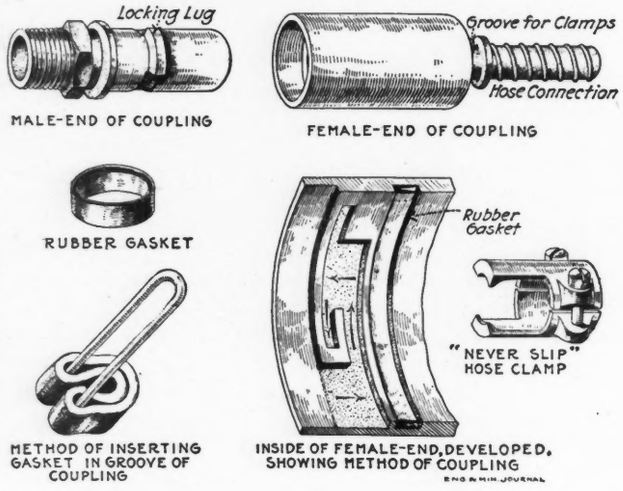
The general drawing reproduced on p. 568, shows a typical modern silver-lead furnace as developed at the smelting works of the Compañia Minera de Peñoles in Mapimi, Durango, Mexico. This furnace was designed in 1905 by H. S. Mulliken, smelter superintendent, and Alexander Carstens, master mechanic. The furnace was built by the Denver Engineering Works Co., Denver, Colo., which lately completed the seventh consecutive furnace for the Peñoles company. Some slight changes have since been made in the details of the blast pipes and tuyeres but the general features remain as shown, and are interesting as representing the practice of one of the most progressive companies in Mexico. The property is more or less isolated and the company has had to depend on its own initiative to a great extent in the development of its processes and equipment.

The low position of the water-supply pipe—around the crucible—will doubtless attract the attention of lead metallurgists.

Mining & Metallurgical Machinery

New Hose Coupling--The Neverleak

An excellent air-hose coupling of new and unusual design is now put on the market by the Cleveland Rock Drill Co. Its chief charaeteristies are that it is quiek acting, needs no wreneh and is always tight. It ean be used between the drill and the hose, or between the hose and the pipe, or to conneet two lengths of hose. Being the result of a good deal of study and experiment, it is guaranteed against leakage by its makers.



THE COUPLING, CLAMP AND GASKET

It consists of two brass pieees held together by a bayonet loek. A lug on one part is arranged to aet between guides on the inside of the other in such a manner that the two parts can be separated only by a combination of motions that could not occur accidentally. Connection is made by inserting the lug pieee in the other, turning it as neeessary until it can be pushed in between the güides, and giving it a half turn to the right, a pull out and a short turn to either left or right. This is quiekly and easily performed and the unloeking is equally simple. The gasket is of peculiar design, as shown, with a U-shaped eross-section. It is inserted in such a manner that when the air is turned on, the pressure forees the lips apart, one against each part of the coupling and the gasket is perfeetly tight at all pressures. The gasket is easily inserted with a bent wire, as shown, whenever it needs to be replaeed. Being caught in a groove, it cannot slip out and be lost.

For use with the coupling, the hose elamp illustrated is recommended. Two lugs on the end engage the groove back of the flange on the hose end of the coupling and eliminate any danger that the hose may blow off. These clamps are made in ½-, ¾- and 1-in. sizes.

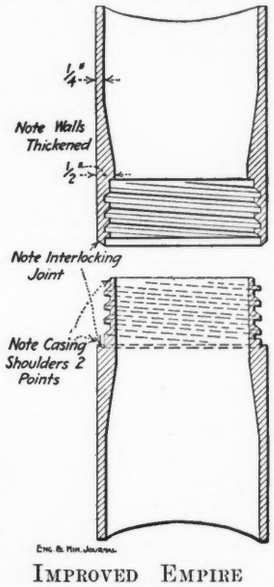
The couplings are made in 12 sizes and types and any male end can be interchanged with any female end, whether designed for hose or pipe connection. The possible conneetions for both hose and pipe vary from ½ in. to 1 in.

Incidental advantages elaimed are, that there are only three parts, ineluding the gasket, that there are no threads to get broken, that the outside is smooth without projeetions to eatch when the hose is dragged around, that the long bearing between the two parts insures a long life, that the air passage is unobstrueted.

Quoted priees, f.o.b., Cleveland, subjeet to 45% discount are: ½-in. and ¾-in. male ends, $0.90 each; ½-in. and ¾-in. female ends, $1.10; 1-in. male ends, $1.30; 1-in. female ends, $1.50; these prices applying whether the pieee is for hose or pipe conneetion.

New Empire Drill Casing

Improvements have been made, from time to time, in the casing used with the Empire prospecting drill, and the weak or troublesome features have been gradually eliminated. Reeently, the casing has been improved by increasing the thickness of the walls from $\frac{3}{16}$ to ¼ in., and strengthening the thread by whieh the casing is connected. Any easing used for prospecting drilling should be of extremely high quality on account of its being withdrawn and used over again in each sueeessive hole. The casing for the Empire drill must not only fill the above requirements but must also stand the strain due to rotation. In the Empire method, developed by the New York Engineering Co., of 2 Rector St., New York, the casing is rotated by a lever 12 ft. long and generally by horsepower; the pull exerted by a horse at the end of this lever may put a heavy strain on the easing joints, espeeially when the easing is in sticky elay or in quicksand.



IMPROVED EMPIRE DRILL CASING

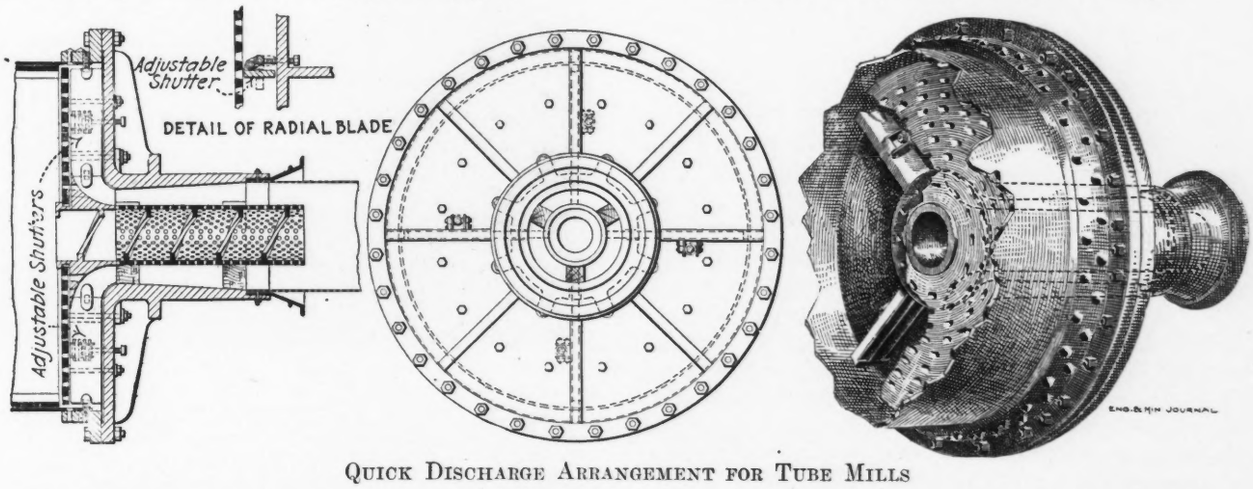
Earlier methods of making this casing consisted of using standard 4-in. wrought-iron pipe and inserting a piece of Shelby cold-drawn seamless tubing at the end. This pieee was riveted to the pipe and was also provided with a heavy shoulder at the joints; the thread was then cut direetly on the inserted end pieee of seamless tubing. This pieee would sometimes beeome loose, due to the fact that the rivets would wear with the constant jarring in driving. It was finally decided to use ¼-in. cold-drawn seamless tubing for the entire casing. The National Tube Co.'s seamless-tubing department has succeeded in making this tubing with the last four inehes upset to ½ in. thickness, without producing an abrupt

shoulder on which the drill tools might catch. Sufficient material is thus provided for the special "resistance" thread on the casing, at the same time keeping the total weight of a 5-ft. section down to 60 lb.

It will be noted from the illustration that the male thread shows a square shoulder on the lower side, and a square face with a bevel backing on the upper side. The square shoulder on the under side is absolutely necessary in order to prevent the joints from telescoping when the severe turning strain is put upon them. The sloping face on the upper side is to reinforce or "back" the thread and prevent shearing. The outer edge of the female is chamfered at the end, as is also the outside shoulder of the male, so that these two form an interlocking joint that will not telescope in driving or rotating. The threads are coarse, three to the inch, and no trouble is experienced from cross-threading. With ordinary drive pipe, having outside couplings, the projecting shoulder may catch on a boulder and make the withdrawal of the pipe difficult. The new Empire casing is flush on the outside when joined, and there is consequently nothing to obstruct the sinking or pulling of the casing; made of seamless-steel tubing, with this heavy reinforced thread, the casing is now practically indestructible.

Quick Discharge for Tube Mills

Improvement of fine-grinding devices is one of the principal items of interest before the metallurgical profession at present. Discussion of the points of merit of tube mills, conical mills, grinding pans, etc., is animated, each type claiming its devotees. In view of this great interest, any appliance which has shown a tendency to improve results is worthy of study. Such a device is the adjustable quick discharge for tube mills, originated and marketed by Chalmers & Williams, Chicago, Ill.

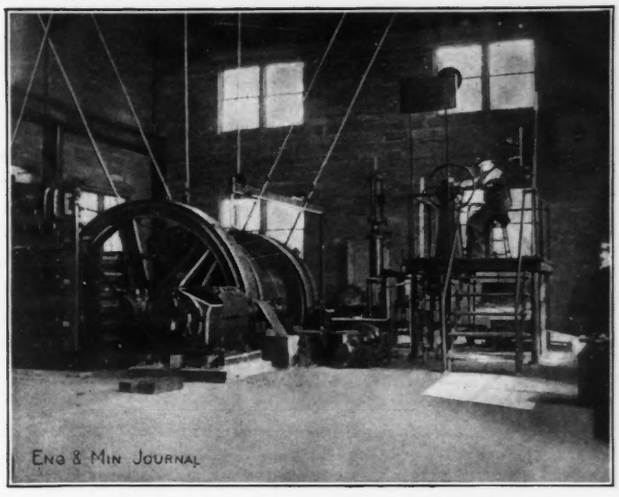


QUICK DISCHARGE ARRANGEMENT FOR TUBE MILLS

Essentially this device consists of a perforated plate, which is interposed between the end of the tube mill and the body of the mill. Between the perforated plate and the end of the mill are radial blades, used as practical elevators. The blades are arranged on hinges, as shown in detail in the drawing, so that by changing their inclination with respect to the tube-mill end, the space between the perforated plate and the mill end may be more or less closed and the amount of pulp elevated may be greater or less. It is claimed that the device increases the capacity of a tube mill by 10%, involving less power consumption per ton of material ground and a saving in pebble and lining consumption. Shorter tubes can be used to perform the required duty. The theory is that the material does not remain indefinitely in the mill, but is promptly discharged and can be classified, the oversize being returned to the mill for further grinding. The essential point is that work is not wasted on material already fine enough; therein is the economy.

Two-Motor Single-Gear Hoist

The accompanying illustration shows an electric hoist built by the Denver Engineering Works, and embodying some unusual features. The hoist has a single drum, capable of exerting a 20,000-lb. rope pull. It hauls a 50-ton load up a 6000-ft. slope with a grade of 19% at



METHOD OF APPLYING MOTOR TO HOIST

10 miles per hour. The drum is driven through a single-reduction, 16:1, herringbone gear, by two 175-hp. 500-volt 600 r.p.m. direct-current motors. The novel feature of the design is the application of two motors to the one spur. The motor pinions mesh on opposite sides of the spur. By this means, the advantage of the series parallel control system is obtained and one gear is saved, while this gear can be made narrower and thus cheaper, inasmuch as the strength of a pinion-spur combination is limited by the strength of the pinion.

Canadian Mining Institute

By Frederick Hobart*

SYNOPSIS—A current report of the proceedings of the sixteenth annual meeting of the Institute, which was a successful and interesting occasion. Many valuable papers were presented and discussed, and measures adopted to increase the usefulness of the Institute.

The sixteenth annual meeting of the Canadian Mining Institute began in the Ritz-Carlton Hotel, in Montreal, at 10:30 a.m., on Mar. 4. The number of members present at the opening session was rather small, owing to delays caused to incoming trains by the storm of the previous day, but at the afternoon session and the later meetings, there was a large attendance.

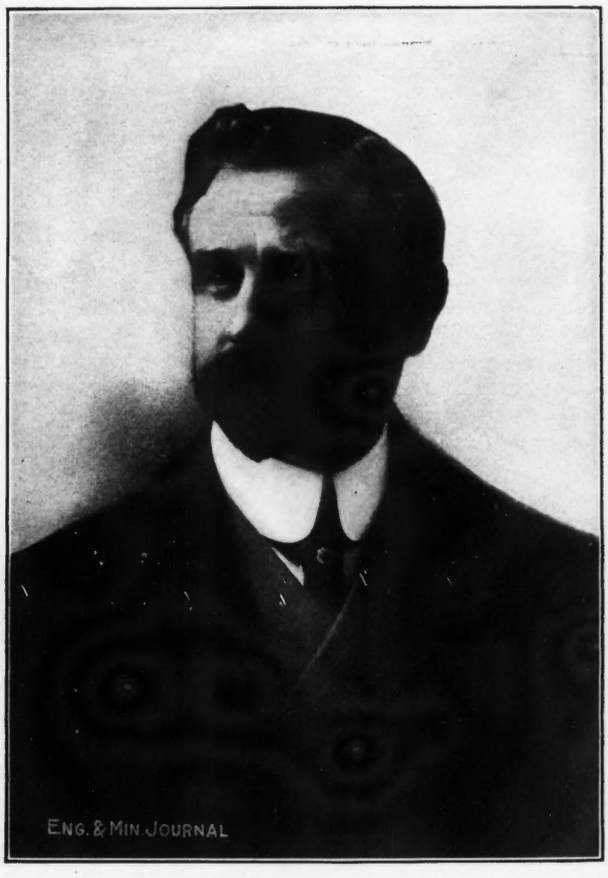
The opening session was in part a business meeting. The report of the council for the year was accepted as printed, having been published in the *Transactions* for January. The report showed a total of 1029 members, a reduction of six from the previous year. This was due, however, to a falling off in the number of associated student members at McGill and Kingston, the regular membership showing an increase of 46 during the year. The total receipts, including cash at the opening of the year, were $18,575, and the expenditures, $12,907; the balance being $5668. The report explained the condition of the society, and the increase in the library. It also referred at some length to the meeting of the International Geological Congress, in Canada, in August last, and its successful results. While the Institute was not officially responsible for the arrangements and conduct of the meeting, the organizing and executive committees of the congress were composed almost entirely of prominent members and offices of the Institute who gave their time and effort to the work.

The Council further reported that eight papers were submitted by student members in competition for the prizes offered annually by the Institute. On the recommendation of the judges—David H. Browne, J. M. Gordon and the Secretary—the Council awarded the President's gold medal and the first prize of $25 to C. W. Greenland, of the School of Mining, Kingston, for his admirable thesis entitled, "On the Origin and Structure of the Carbonaceous Schists of the Lake of the Woods." The second prize of $20 was awarded to P. P. Bailey, of McGill University, Montreal, for his paper on "The Moyie Sills." The paper by C. S. Parsons, of the School of Mining, Kingston, on "The Iron Ore Washing Plant of the Canada Iron Corporation, Ltd.," and that by E. E. Billington, of McGill University, on "The Weathering of Coal," were awarded honorable mention.

Announcement was then made of the election of officers for the ensuing year. There was no contest and those chosen were as follows: President, G. G. S. Lindsey, Toronto; Vice-Presidents, Charles Fergie, Montreal; W. F. Sutton, Victoria, B. C.; Arthur A. Cole, Cobalt, Ont., to fill the vacancy caused by the election of Mr. Lindsey to the presidency. Councillors, D. B. Dowling, Ottawa; Norman R. Fisher, Cobalt, Ont.; John E. Hardman, W. S. Johnson, J. W. Pyke, Montreal; J. J. Penhale, Sherbrooke, P. Q.; M. E. Purcell, Rossland, B. C.; C. E. Smith, Toronto; P. A. Robbins, Porcupine, Ont.; O. E. S. Whiteside, Coleman, Alberta.

Dr. Alfred E. Barlow, the retiring president, then delivered his annual address in which he referred at length to the progress of the mining industry during the year. to the excellent condition of the Institute, to the various endeavors made to forward the mining and metallurgical interests of the country and to the prominent part taken in the Geological Congress.

Mr. Dresser announced the receipt that morning of news of the death of Hon. Charles R. Devlin, Minister of Mines, of Quebec, and a committee was appointed to take suitable action. The secretary was directed to send a telegram to Dr. F. H. Hatch, President of the British Institution of Mining & Metallurgy, to see if it would be possible for him to stop in Montreal on his way to Europe. but he was unable to do so.



G. G. S. Lindsey

The new president of the Canadian Mining Institute is a resident of Toronto and is a prominent lawyer, holding the rank of king's counsel in the Dominion courts. He is a high authority on mining law. He has also been actively engaged in mining operations, having been for several years past managing director of the Crow's Nest Pass Coal Co., from which position he recently retired.

John McLeish, chief statistician of the Department of Mines, then presented his report on the mineral industry in Canada, of 1913, a summary of which will be found

*Associate editor, "Engineering and Mining Journal."

on another page. Reports from the various provinces were then presented by Thomas W. Gibson for Ontario, by Dr. Bancroft, for Quebec, by W F. Robertson, for British Columbia.

A proposed change in the bylaws providing for a nominating committee was briefly discussed, and was finally laid on the table, leaving the old bylaw unchanged.

The Afternoon Session

At the afternoon session, papers on "Sampling of Cobalt Ores," by C. St. G. Campbell, Cobalt, and on "Milling Practice in Cobalt," by Fraser D. Reid, of Cobalt, were read and discussed. Both papers gave interesting accounts of the milling of the lower grade ores of the camp. A paper on practice at the Nipissing mill was read by title. Prof. George A. Guess, of Toronto, then read an interesting paper on pyritic smelting, which was based chiefly on observations at the works of the Tennessee Copper Co. This was followed by an address from Dr. Edward D. Peters, of Harvard University, who went at length into the various methods of smelting ores. He took, as his special topic, the reverberatory furnace and called attention to the fact that this furnace had been adopted in the first place by the Swansea smelters, while the German metallurgists adhered persistently to the blast furnace. Dr. Peters gave the economic and historic reasons for this preference and traced the development of the reverberatory to its present size and efficiency. The address was practically a brief treatise, not only on the reverberatory furnace, but on the best methods of utilizing heat in metallurgical operations.

The Evening Session

The evening session was devoted to two illustrated papers. The first was on "Safety in Coal Mines," by Austin King, chief inspector of mines for the H. C. Frick Coke Co. He showed a large number of slides illustrating the right and wrong way of working, and the measures adopted by his company to avoid accident and loss of life. The paper was a very interesting one, and gave an excellent idea of the inside workings of a bituminous coal mine.

The second illustrated lecture was by Howard W. Du Bois, of Philadelphia, on "Hydraulic Mining." It illustrated the methods adopted in California and British Columbia, together with the construction of sluices, and gave some analysis of the expenses necessary in operating a hydraulic mine, and of the extreme cheapness of operation which can be obtained under favorable conditions, the first of which is an abundant supply of water. One of the plants shown in British Columbia used a total of 60,000,000 gal. of water daily, when in full operation, and this was given as an instance of the consumption.

The Thursday Sessions

Thursday morning was devoted to an inspection of the tunnel which the Canadian Northern Railway is constructing under Mount Royal to secure an entrance into the City of Montreal. Two parties were formed, one starting from the southern entrance and walking two miles through the tunnel, while the second party was taken in cars from the northern entrance, the two meeting at the point where the headings have recently come together. The main work now being done in the tunnel is the benching out and enlargement of the bore to its full size. This excursion was particularly interesting to the geologists as the tunnel workings have thrown some light on disputed points about the geology of Mount Royal, and its existence as a detached mountain mass rising abruptly from the general level of the Laurentian plain. Doctor Bancroft, of the Geological Survey, is engaged in a careful study of these questions and expects shortly to make a detailed report on what the tunnel has revealed. The excursion was thoroughly appreciated.

At the afternoon session, S. P. Brown, of Montreal, the engineer in charge of the work, read in summary, a very interesting paper on the "Methods of Excavation Adopted in the Mount Royal Tunnel," deseribing the machinery used and the different methods.

At the conclusion of this paper, Eugene Coste brought up the question of the iron ores of Canada. The iron industry of Canada, he said, as shown by the reports submitted the previous day, was now dependent very largely upon the use of imported ores from the Lake Superior country, although there were abundant deposits which only needed exploration and development to bring them into use. He thought that special instructions should be given to the Geological Survey to assist in this work, and that the Government might take other measures. Mr. Coste was supported by Mr. Dresser, Mr. Denis, and Mr. Dulieux. Finally, a resolution was adopted providing for the appointment of a committee to consider this question and to urge upon the government the advantage of taking some action.

Mr. Dresser for the committee appointed on the previous day, presented suitable resolutions of regret for the late Charles R. Devlin, Minister of Mines, of Quebec, which were passed.

Resolutions were also adopted, thanking Hon. Louis Coderre, Dominion Minister of Mines, for the interest he had taken in safety work in the mines and the prizes he had offered for efficiency in first-aid work.

J. M. Forbes, of Montreal, then read a carefully prepared paper on "Factors Influencing the Cost of Power for Mining Purposes," which was briefly discussed. F. B. Gilbreth, of New York, read a paper on "Scientific Management," which was chiefly laudation of the Taylor method of studying and regulating methods of working. This was illustrated by lantern-slides but did not seem to attract special favor.

The Smoking Concert

In the evening, the serious proceedings were interrupted for the time by a smoking concert, which was very largely attended. The proceedings were in charge of John J. Penhale. The Institute began by resolving itself into a university convocation, and with great solemnity, Mr. Penhale, as chancellor, proceeded to confer appropriate degrees upon various members. Each degree was accompanied by an inscribed address, especially intended to fit the victim's case. Those included were John E. Hardman, K. B. J. G. F., or as it was explained in his certificate, "Knocker, but Jolly Good Fellow;" Dr. H. E. Haultain, G. A. G. (Grand Assaulter of Geologists); Dr. Bancroft, of McGill, G. S. B. (Grand Stone Buster); Eugene Coste, V. S. (Volcanic Secretionist); J. B. Tyrrell, A. R. O. C. (Artistic Romancer of Canada); and Dr. Alfred E. Barlow, R. I. P., this being intended to mean "Rather Interesting President," and not having any reference to his prospective retirement from office.

Dr. F. D. Adams presented a remarkable series of views, which attracted close attention and general applause. They represented the adventures of one of the excursion parties of the Geological Congress, whose members were so absorbed in the pursuit of knowledge, that they neglected to stop at Vancouver and kept right on to China. How they made most remarkable discoveries in that country, including some wonderful geological occurrences, some enormously valuable gold placers, and even some prehistoric, but still living animals, was well told in this series of pictures and in Dr. Adams' running comments.

The University exercises were followed by several interesting plays by members of the Institute, in which various prominent members were caricatured. These included a discovery of the North Pole, the flight from Cobalt of the infant Darling and her recovery, and several others. The fun was kept up until midnight and was generally voted to be the most enjoyable occasion of the kind in the history of the Institute.

Friday Sessions

At the Friday morning session, Dr. H. M. Payne, of New York, made an address an efficiency engineering applied to mines and quarries, in which he demonstrated the futility of going into extreme refinements, efficiency engineering being really applied common sense.

Arthus A. Cole presented a number of lantern slides showing veins in different mines in Cobalt. Some of these were really extraordinary examples of views taken underground, and gave a striking idea of the conditions in the mines there.

W. McA. Johnson, of Hartford, Conn., then read a paper on "The Commercial Aspect of Electric Zinc Smelting," in which he described the progress made with his electric furnace, and especially a recent test run for the recovery of zinc in that furnace. His paper was closely followed and attracted a great deal of interest. It was discussed by W. R. Ingalls and Professor Stansfield, Mr. Ingalls giving an account of the work which had been done with the electric furnace in Sweden and Norway, and expressing some doubt as to whether commercial success had yet been reached, whatever might be the possibilities of the future.

This was followed by a paper on "Recent Metallurgical Improvements," by Prof. A. Stansfield, of Montreal, in which he referred to the various changes and improvements in metallurgy since the beginning of the present century, taking a special notice of iron and steel.

Howard W. DuBois made a short address on the use of various materials for sluiceway linings in hydraulic mining, with special reference to the use of high-carbon steel plates where the wear was greatest. Some discussion followed this paper.

Friday Afternoon Session

A considerable part of the afternoon session was devoted to an address by Gardner F. Williams, who was present by special invitation of the Institute, and who presented and described a large number of lantern slides, showing and illustrating the diamond mines of South Africa. Mr. Williams' long experience in those mines as manager for the De Beers Co., enabled him to give a most interesting account of the work there.

Following his address, C. A. Ablett, of Montreal, read a rather technical paper on "Electric Driving of Winding Engines." D. B. Dowling briefly summarized the great work published by the Geological Congress on the coal resources of the world, giving a general idea of its contents and also showing in lantern slides some of the diagrams prepared for the work. Some of these diagrams and maps presented geological facts which are rather unfamiliar to the average student. Thus it would appear that the largest area of anthracite in the world is probably to be found in North China, and the Asiatic coal resources are apparently very large. In Canada, the greatest quantity of available coal is in Alberta.

The following papers, which had been on the program, were read by title. "The Valuation of Mines," by J. D. Kendall; "Cobalt and Its Alloys," by H. T. Kalmus; "The Chisana Goldfield," by D. D. Cairnes, Ottawa; "Recent Improvements in Cyanidation," by Herbert A. Megraw, of New York; "Ore Dressing Improvements," by Prof. Robert H. Richards, of Boston; "Notes on Mine Sampling," by Victor G. Hills, Denver, Colo.; "Mining and Milling Practice at the Alaska-Treadwell," by H. C. Meek, South Porcupine, Ont.; "Asbestos Resources of the Thetford Area," by W. J. Woolsey, Thetford Mines, P. Q.

This concluded the business part of the session which was marked by the excellent character of the papers and the close attention paid to them. The only regret was that the time of the meeting was so closely occupied that there was hardly sufficient time for discussion.

The Annual Dinner

The meeting was brought to an end by the annual dinner at the Ritz-Carlton Hotel, which was largely attended and which was one of the most successful occasions in the history of the Institute. After the usual opening ceremonies, when the time for speeches came, Dr. A. E. Barlow, the retiring President, expressed his gratification at the support which he had received from the Council and members during his two years' tenure of office. He referred to the growing importance of the Institute, the improvement of the number and quality of its membership, and was confident that even greater progress would be made under his successor. He called upon Col. Penhale to assume the duties of toastmaster.

Col. Penhale referred briefly to the regretted absence of Hon. Louis Coderre on account of illness. Mr. Coderre had sent the Hon. Martin Burrill, Minister of Agriculture, as his representative. He also expressed the hope that the Government would realize that the importance of the mining industry demanded the creation of a separate department with a minister who would give his whole time to its direction. He referred to the death of Mr. Devlin, Minister of Mines of Quebec, and observed that a worthy and capable successor could be found in George R. Smith, ex-president of the Institute, and member of the Legislative Council, of Quebec. Col. Samuel Hughes, Dominion Minister of Militia, then made a brief and excellent address. Hon. Martin Burrill, Minister of Agriculture, made a long address in which he referred to the progress of mining and at much length drew a parallel between agriculture and mining, and expressed his opinion that both should be encouraged by the Government. Senator Bostock, of British Columbia, an old friend of the Institute, made an address in which he re-

ferred to the revival of interest in mining in his provinee, and to the great progress which it had recently made.

President-elect G. G. S. Lindsey then made an address, expressing his confidence in the progress of the Institute and asking for the coöperation of the members in making the coming year a prosperous and successful one. He also expressed his hope that the year would see some needed improvements in mining laws and was confident that they would receive fair treatment from the present government.

Bradley Stoughton, Secretary of the American Institute of Mining Engineers, spoke briefly, conveying the good will of that Society to the Canadian Institute.

John E. Hardman spoke briefly, but strongly, of the necessity of paying greater attention to the study and practice of metallurgy in order that Canada should be enabled to treat its own ores more fully and to become an exporter of the finished product rather than of ores or semifinished material. Instruction in metallurgy he considered to be one of the most important points required.

A humorous and reminiscent talk from Mr. Mellish, of Nova Scotia, closed the formal proceedings of the sixteenth annual meeting.

After the formal adjournment, however, the post-prandial exercises were kept up in an informal way after the old-time manner of the Institute to an early hour, under the guidance of Col. Hay, Mr. Browne, and the Duke of Argyle; but no formal report can cover the spirit of these closing proceedings, which will be long remembered by those who took part in them.

Much credit was due the Montreal local committee for the smooth working of all the arrangements for the meeting. The ladies who attended were well taken care of, and handsomely entertained by the Ladies' Committee, headed by Mrs. Hill and Mrs. Burlow.

Public-Land Leasing Laws

The so called Administration bills, governing the development of Western resources, have been introduced in both houses of Congress. These bills are intended to make available the coal, oil, phosphate and potash deposits of the West for immediate development. They provide for leasing under conditions intended to guard against monopoly and to insure full development. As to oil lands, the Government will issue permits giving exclusive rights of exploration in areas of 2560 acres for a period of two years, during which time 2000 ft. of drilling must be done. If oil is discovered, the explorer is entitled to one-fourth of the land in fee, the rest to remain with the Government and be subject to lease in small tracts upon a royalty basis. Under lease or patent, no drilling can take place within 200 ft. of the outer boundaries of the tract held, and precautionary regulations are provided against waste of oil or the entrance of waters into the oil sands or oil-bearing strata.

The coal lands, which are in great part classified, are to be sold as at present in small blocks, but provision is made for leasing them, no holding to exceed 2560 acres. For strictly local and domestic needs, limited permits may be granted for tracts not to exceed ten acres for a period of ten years. The provisions against monopolization are stringent. For instance, no person or association is permitted an interest as a stockholder or otherwise in more than one lease, and severe penalties are provided against the sale or transfer of any interest in any lease to anyone holding an interest in any other lease.

The manner of granting leases is to be regulated by the Secretary of the Interior, and the royalties paid are to be based upon the amount of the product. To insure against speculative holding, a small annual rental per acre is charged.

Similar provisions adapted to the different conditions existing cover the phosphate and potash lands.

The royalties resulting from this development will be applied in the first place to the reclamation fund, and be used for the development of irrigation projects in the arid and semi-arid states. After being once so used, 50% of the proceeds upon return to the Federal treasury will be granted to the states for school and development purposes.

Capt. Joseph Sellwood

Capt. Joseph Sellwood died at his residence, Duluth, Minn., on Feb. 24, 1914, of Bright's disease and other complications. He was one of the best known mining capitalists in the Lake Superior iron district. Born in Cornwall, England, Dec. 5, 1846, his only education was secured in grade schools in Cornwall, prior to the age of 13. He worked in the Cornwall mines until the age of 19, when he came to America. In 1870, at the age of 24, he settled in the iron country around Ishpeming, Mich., working as a miner. Soon he began taking contracts for the extraction of ore, and in a few years he was operating the New York and the Cleveland mines, which latter is now being operated by the Cleveland-Cliffs Iron Co. In 1885, he was commissioned to open the Colby mine, located where the town of Bessemer, Mich., now stands. The next year he opened the Brotherton mine, on the Gogebic Range, of which he later became one-fourth owner, and which was later turned to the Lackawanna Steel Company.

In 1888, Captain Sellwood removed to Duluth, and became interested in opening the Chandler mine on the Vermilion Range, at Ely, Minn. In 1892, he became vice-president and manager for the Minnesota Iron Co., and in 1898, he became manager of all the American Steel & Wire Co.'s holdings in the Lake Superior district. In 1902, when these holdings were turned to the Steel Corporation, Mr. Sellwood devoted his time to securing interests on the youthful but vigorous Mesabi Range, being associated with the Cherry Valley Iron Co., Pickands, Mather & Co., Salem Iron Co. and Wheeling Steel & Iron Co. In this time he secured control of, or a substantial interest in, the following mines: Longyear, Leetonia, Croxton, La Rue, Cyprus, Adriatic, Pearce, Morow and Cass. These were all later leased to various operating companies except the Cyprus, in which he owned a half interest and assisted in the operation, together with Pickands, Mather & Company.

At the time of his death he was interested in 12 producing mines and was president of three banks, including the City National of Duluth. He personally owned the 8-story home of the last named institution. He also owned large interests in the ore-carrying trade, both lake and rail. His son, Richard M. Sellwood, has assumed active charge of the estate.

J. Parke Channing, who was an intimate friend of the deceased, contributes the following:

There are two Cornishmen who have left their marks upon mining in the Lake Superior district: One, John Daniell, in the copper country, and the other, Joseph Sellwood, in the iron country. Neither of these men had any technical training, but they had that natural inborn capacity for developing original ideas and carrying them to a successful conclusion which no school can give a man.

To Mr. Sellwood are due three marked innovations in the mining of iron ore on the Lake Superior ranges. When he took hold of the Colby mine, in the Gogebic Range, in 1885, he found the so called south vein of the mine running into the side of a hill. He thereupon drove into the hill, as low as possible, a tunnel of sufficient size to hold the standard railway cars which hauled the ore to Ashland. At every 60 ft., or about two car lengths, raises were put up to the surface. The surface was stripped, and the ore down to the level of the tunnel back was milled into the cars at an extremely low cost. This was probably the first use of the so called milling system on Lake Superior. It was afterward developed extensively in some of the Mesabi mines, where the ore, however, was milled into smaller cars, trammed to a central shaft and hoisted in the usual manner.

When he got hold of the Brotherton mine, he put John Pengilly in charge of it, and he and Mr. Pengilly introduced what was then known as the North-of-England caving system. This was the first subdrift caving that was ever done in a methodical manner in a Lake Superior iron mine.

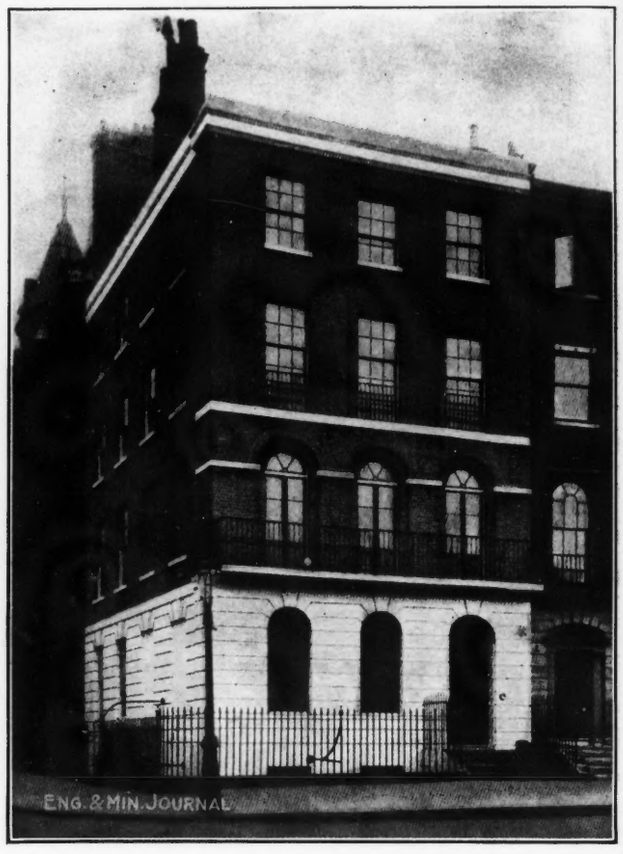
At the Colby mine, during the winter of 1886-87, the ore from the mine was dumped, as is usual in Lake Superior iron mines, upon a stock pile, but much to the surprise and mystification of everyone, instead of the stock-pile bottom being built up to the level of the tops of the railway cars, it was simply laid on the level ground. One day in May, 1887, there was great excitement in the town of Bessemer, and the news came down the hill that "Joe Sellwood was loading his stock pile with a steam shovel into the railway cars at the rate of a car in three minutes." The town was nearly emptied by people going up the hill to see this marvelous innovation, and in one day the whole complexion of handling stock piles was changed. The minimum cost of about 8c. a ton for loading by means of men and wheelbarrows was reduced to about 3c. a ton for the steam shovel. This was the first time that iron ore in Lake Superior was ever handled with a steam shovel.

The success of steam shovels in handling the soft Gogebic ores and the hard Marquette ores was such a revelation that when the Mesabi Range was opened, it was self-evident that the proper way to work the mines was to strip them and mine them with steam shovels.

Mr. Sellwood had a generous heart, and several of today's successful mining engineers are indebted to him for aid and advice extended to them twenty-five years ago. He was a man who would probably have succeeded in almost any business, for at the time of his death, not only was he interested in mining, but also in real estate, in banking, and in several commercial enterprises. But the thing that will always keep green his memory was his insistence that the proper way to mine the iron ore-bodies of Lake Superior was either by the use of the caving system, or, where possible, by the steam shovel.

New Home of the I. M. M.

The house of the Institution of Mining and Metallurgy was formally opened on Jan. 13, the twenty-second anniversary of the foundation of the Institute, by the Lord Mayor of London, assisted by the Sheriff, according to I. M. M. Bull. 113. The house, which is situated at No. 1 Finsbury Circus, E. C., and the exterior of which is shown herewith, is arranged as follows: In basement,



NEW HEADQUARTERS OF THE INSTITUTION OF MINING AND METALLURGY

smoking lounge, strong rooms, etc.; on ground floor, secretary's room, general offices, etc.; on first floor, council chamber and reading room; on second floor, library; on third floor, writing rooms, etc.; on fourth floor, housekeeper's apartments.

Ontario's Mining Death Rate, 1912

There were 32 men killed in Ontario mines during 1912. This does not include metallurgical works. The death rate per 1000 was 3.36, according to the Annual Report of the Bureau of Mines. It is not stated whether this rate is based on employment figures reduced to 300 days of work or not. Including metallurgical works and quarries, the rate was 2.84 per 1000. This latter figure compares favorably with an average of 3.22 over 12 years, a maximum of 5.11 in 1908 and a minimum of 1.79 in 1903. Divided by causes, 7.4% of the fatalities were due to falls of ground; 25% to shaft accidents; 21.9% to explosives; 18.7% were surface accidents and 25% are classed as miscellaneous.

The Hoover Dinner

The dinner of the Mining & Metallurgical Society of America, at which the first gold medal of the Society was presented to Herbert C. Hoover and Lou Henry Hoover, his wife, took place at the Biltmore Hotel, in New York, on Mar. 9. It was a noteworthy event, attended by just 100 persons, including members and their guests. The presence of ladies added much brilliancy to the occasion and was highly appropriate in view of the fact that one of the recipients of the Society's medal was a woman.

The method adopted by the Mining & Metallurgical Society in awarding its medal is rather unusual and results in an honor which must be especially prized by reason of its spontaneousness. In brief, one of the first steps is a vote by the whole membership of the Society as to whom it considers honor especially to be due. Of course, such a procedure is possible only in a society relatively small in number, with a well developed system for the conduction of letter ballots. The council of the Society first selects a subject, within the limits of which the award of its next medal is to be made. The subject selected for the medal of 1914 was "Distinguished contributions to the literature of mining." The members of the Society express their individual ideas as to who deserves especial recognition in that subject, a direct primary being conducted so to speak. The medal committee makes two nominations out of the names suggested by the membership and the council of the Society votes upon those nominees. The expression of opinion by the membership, last fall, showed a large majority in favor of the Hoovers, and their election by the council was all but unanimous.

THE M. M. S. A. MEDAL

H. C. Hoover has not been a prolific contributor to the literature of mining, but his contributions have been of the highest value. He has contributed to the engineering periodicals, the past volumes of the JOURNAL comprising many of his papers; has published a wonderfully concise, yet wonderfully comprehensive treatise on "The Principles of Mining"; and last of all made a translation of Agricola's "De Re Metallica." Regarding our own appreciation of that work, we shall repeat parts of an editorial in the JOURNAL, following its publication:

> The appearance of Hoover's Agricola, which has long been talked about, deserves more than the ordinary book review, being an event of some importance, not merely because of the intrinsic value of the work, but especially we think as the work crowning the professional career of a distinguished engineer, who in becoming also a successful financier has not forgotten his professional ideals and duties. We know those envied engineers who have developed financial instincts and created a following among capitalists and investors and thereby become successful promoters. Most of them, unfortunately, degenerate into mere money-makers and upon their retirement from activity nothing more to say of them can be called to mind than that they were rich. Mr. Hoover has been as successful commercially as any of them and his operations have been of broader scope geographically than any of them (which probably has contributed to his great breadth of vision), but amid his multifold activities he has always preserved enthusiastic attention to strictly professional studies. What other mining financier or engineer-operator could have given us "Principles of Mining," or even would have taken the trouble to try?
>
> The first great treatise on mining and metallurgy was "De Re Metallica," by Georgius Agricola, otherwise Georg Bauer, written in Latin and published in 1556. Most of us have known from our school days of the existence of such a book, have seen it in the college libraries and examined its quaint engravings. Although there have been translations from the Latin, most of us have been ignorant of the text, and as we are informed these translations have been made by scholars without mining knowledge. Some years ago, Mr. Hoover conceived the idea of making a translation into English, and although the work proved to be more than he contemplated, he stuck to it. In this he was steadily assisted by Mrs. Hoover, who is an accomplished Latin scholar, and who appears as joint translator of the work. With this happy combination of knowledge of the language of the original and knowledge of the subject, conditions were inimitable. Would that the story of the work, of its difficulties, snares and pitfalls, side-diversions and revelations, could be told as it has been to their friends!
>
> We shall not attempt a full description of the product as it lies before us. It is a bulky, quarto volume, bound in vellum, of the size and appearance of the original, but much thicker. The type-face is similar to that of the original, the engravings are the same. The dedication is to Dr. John C. Branner, a testimonial of which he may well be proud. The entire production is an example of the best in the printer's art.
>
> Realizing that no publisher could afford to bring out this work in the way desired with any hope of reimbursement from its sale, Mr. Hoover, a unique Maecenas giving both of his brain and his purse, has himself brought it out, a merely nominal charge per volume being made to exclude inconsequential requests for it and yet put it readily within the means of all who really desire to have it.
>
> We have reserved to the last the explanation of the increased thickness of the volume, to which we have previously referred. This is due to the copious and extensive notes that Mr. Hoover has added to it. These will, to modern minds, be perhaps the most interesting parts of the work; they will be found to come pretty near to constituting a history of mining. To this subject Mr. Hoover has for many years devoted great attention. His researches in connection with his translation of Agricola have increased his knowledge of it to the profound. Upon it he may rightfully be pronounced to be the world's greatest authority.

In all of Mr. Hoover's literary work, Mrs. Hoover has been an important collaborator. In the preparation of his "Principles of Mining," she revised the manuscript, read the proofs and saw the work through the press, remaining in New York for that purpose after Mr. Hoover had been called away. In the translation of Agricola, her collaboration was more important. She accompanied Mr. Hoover in his travels of investigation, joined in his studies of the history of mining, and bore the brunt of the translation of corrupt, mediæval Latin into fluent and accurate English.

The dinner committee prepared a unique souvenir of the occasion, a pamphlet comprising reproductions of some of the engravings in Agricola, with captions applying these to the professional work and experiences of the Hoovers. Some of these are reproduced herewith. The

antique type and spelling contributed the right flavor. The souvenir also contained an engraving of the medal, reproduced herewith. The design was greatly admired. The idea is knowledge, typified as a beautiful woman

A—Twig. B—Trench.

Ye Hooveres Jumppe ye Antiguas of ye Anciente Manne Akgricola

holding a miner's light, breaking through the barrier rock of Ignorance.

Prof. J. F. Kemp, president of the Mining and Metallurgical Society, presided at the dinner. The speaking after dinner was limited in a very gratifying way and was unusual in character. Sidney J. Jennings responded to the toast of "The Ladies." Thomas B. Stearns, of Denver, Colo., spoke for "The West," and conveyed the felici-

A, C—*Vena dilatata* crossing a *vena profunda*. B—*Vena profunda*. D, E—*Vena dilatata* which junctions with a *vena profunda*. F—*Vena profunda*. G—*Vena dilatata*. H, I—Its dividrd parts. K—*Vena profunda* which divides the *vena dilatata*.

Ye Hoovere Prepareth ye Way for ye Appex Dispute at ye Lawe of ye Lande

tations of the members and professional men in that great region.

Mr. Jennings said that he felt much like a man who had been asked, during the days of the rebuilding of the Grand Central station, when it was almost impossible to find one's way about, "where was track 19?" "There are four-and-a-half million inhabitants in Manhattan, why do you want to pick on me?" But having relieved his mind of this, he launched into a most beautiful speech, on "woman as the sharer of our joys, the bearer of our sorrows and, in these days, our comrade in our work," which would require *verbatim* quotation to do it justice.

Among the hits specially enjoyed were some of Thomas B. Stearns'. He spoke of mining law in the United States being 5% enactment and 95% judicial decision, of which Colorado had furnished 90%, and that there seemed to have been an especially tangled and twisted mass of veins through Colorado to enable the lawyers to take full advantage of the apex law. However, no matter how bad matters were in Colorado, they might take comfort from

A—Wood. B—Bricks. C—Pans. D—Furnace. E—Crucible. F—Pipe. G—Dipping-pot.

Ye Hooveres Menne Roaste and Smelte ye Hyghgrade

the fact that other places could be as bad. Virginia City, for instance, was a place of "Ophirs, gophers and loafers. Arizona was a land of more cows and less milk,

A—Ampullar arrangrd in the vrssels. B—An ampulla standing upright betwren iron eods. C—Ampullae placed in tne sand which is containrd in a box, tne spouts of which erach from the opeecula into ampullae placrd under them. D—Ampullar likewise placrd in sand which is contained in a box, of which the spout peom the opeecula extends crosswise into ampullae placed undee them. E—Othee ampullae eeceiving the distilled *aqua* and liekwise aeranged in sand contained in the lowee boxes. F—Ieon teipod, in which the ampulla is usually placed when theee are not many particles of gold to ee paeted from the silver. G—Vessel.

Ye Hooveres Menne Refine ye Golde and ye Silver. Ye Hoovere, Himselfe, Weigheth ye Bullion. Ye Hoovere Will Later Putte ye Bullion in ye Bank for ye Other Hoovere to Spende

less moisture overhead and more underground, and where one could see farther and see less than in any other state."

Professor Kemp then spoke of Agricola, of our previous imperfect acquaintance with his work, and of the several attempts to translate it that had been made and had failed. "The difficulty of the past," said Professor Kemp, "was largely because of the fact that the book had been written in a decadent mediæval Latin, and that the author had been obliged to invent technical terms

for which there were no Latin equivalents." Mr. and Mrs. Hoover were able to utilize their combined knowledge of geology, mining, metallurgy and Latin in the translation. "Their book is more than a translation," said Professor Kemp. "With its copious and comprehensive footnotes their work has been made practically a history of geology, mining and metallurgy down to the time of the beginning of the modern sciences." Professor Kemp concluded by presenting the medal of the Society to Mr. and Mrs. Hoover. Mr. Hoover responded with a highly interesting, absorbing talk, in which he traced the antiquity of the mining industry and touched upon some of the lighter points in the practice of the art as exhibited in the writings of the Greeks and Romans and in the Bible. This will be published later in the bulletin of the Society.

Mr. Hoover spoke of the mining engineer always seeming to be willing to take an inferior position as compared with the parasitic professions of theology, law and war, yet unless war should be excepted, the metallurgist was the only profession having representation (in Vulcan) on Mt. Olympus. Among distinguished practitioners of metallurgy, he was sure Jeremiah was included, which doubtless accounted for his pessimistic frame of mind, since many of his similes could have only come from a man who had seen his own experiments go wrong.

Themistocles was a miner, and it was due to the silver miners of Laurium that the Western world had been able to roll back the Eastern invasion at Salamis. Demosthenes was akin to the miner, as his first two extant orations were on mining law; Hannibal was a mining engineer, as was also his father, *multis cum aliis.*

It was somewhat to enhance the feelings of dignity of the members of this venerable profession that they had undertaken their translation of Agricola, whose work he felt was almost unrivalled among technical publications, in that it had remained the standard work for two centuries.

Flotation Litigation

LONDON CORRESPONDENCE

The decision in the case of the Ore Concentration Co. vs. the Sulphide Corporation, which was tried before the Privy Council last January for the second time, was rendered on Mar. 6, in favor of the Sulphide Corporation, Ltd.

Briefly, the history of this litigation was as follows:

The British Ore Concentration Co., Ltd., sued the Minerals Separation Co., Ltd., for infringement of patents. The Minerals Separation made the defense: (1) That the Ore Concentration Co.'s patents were invalid; (2) if they were valid, the Minerals Separation Co.'s process did not infringe them.

The case was fought out in England some years ago; the first court decided in favor of the Minerals Separation, the case was taken to the Appeal Court, where it was heard before Justice Fletcher Moulton (as he then was), who reversed the decision of the lower court and gave the case to the British Ore Concentration Co. A final appeal was made to the House of Lords, which decided in favor of the Minerals Separation Co., in November, 1909. This finished the case as far as the English patents were concerned.

The Australian patent specifications being, however, somewhat different from the English, the Ore Concentration Co. (1905), Ltd., sued the Sulphide Corporation for infringement of patents in their zinc-lead mill, at Broken Hill. The case was tried before the Australian first court three years ago, when the Sulphide Corporation got the verdict. The Ore Concentration Co. appealed direct to the Privy Council in London and the appeal was heard for the first time last autumn before three Lords of Appeal, namely Lords Fletcher Moulton, Shaw and Dunedin. Judgment was reserved and about the time it was expected the litigants were notified that the case would have to be tried again. No reason for this was given, but it is presumed that as Lord Fletcher Moulton had decided in favor of the British Ore Concentration Co. in the appeal court in England some years ago and Lord Shaw had decided in favor of the Minerals Separation Co. when the case came before the House of Lords, neither of these learned judges saw his way to reverse his previous decision even though, as mentioned above, the Australian patent specifications are somewhat different from the English.

Be this as it may, the fact remains that on the rehearing of the case in January, 1914, Lords Fletcher Moulton and Shaw dropped out and the case was heard before the Lord Chancellor and four other judges, including Lord Dunedin, who stayed in.

Large interests were involved, as the Ore Concentration Co. claims back royalties on each ton of the millions of tons already treated at Broken Hill by the Sulphide Corporation, and, had the Ore Concentration Co. won, the Sulphide Corporation would have had to work under license from it in Australia.

The Minerals Separation American Syndicate gave us the following at its office in New York, received by cable:

In the Privy Council this morning, Mar. 6, a decision was announced in favor of the Sulphide Corporation, Ltd., of Australia, licensees of Minerals Separation, Ltd., of London, affirming the judgment of the Supreme Court of Australia in the suit of Ore Concentration Co., Ltd., and the Australian Ore Concentration Syndicate, Ltd., on the Elmore patent for oil concentration of ore.

This decision follows a long argument before Lord Haldane, the Lord Chancellor, and Lords Dunedin, Parker, Sumner and Parmoor, and finally decides the controversy between the owners of the Elmore patent and Minerals Separation. Ltd., and its licensees exploiting the agitation-froth process of ore concentration.

Substantially the same issues were involved in a case between Ore Concentration Co., Ltd., and Minerals Separation, Ltd., which was decided in favor of Minerals Separation, Ltd., in the House of Lords about two years ago by the then Lord Chancellor, Lord Loreburn, and Lords Halsbury, Ashbourne, Atkinson and Shaw, but there was a difference between the Australian and British Elmore patents and also a difference in the available defenses which encouraged the owners of the Elmore patent to carry this last litigation to its final issue.

Itinerary of Mine Rescue Car

DENVER CAR NO. 2

Arrive	Leave	
Mar. 7	Mar. 12	Clarkdale, Ariz.
Mar. 13	Mar. 18	Wickenburg, Ariz.
Mar. 19	Mar. 24	Ray, Ariz.
Mar. 25	Mar. 31	Tucson, Ariz.
Apr. 1	Apr. 6	Bisbee, Ariz.
Apr. 7	Apr. 12	Clifton, Ariz.
Apr. 13	Apr. 18	Morenci, Ariz.
Apr. 19	Apr. 24	Globe, Ariz.
Apr. 24	Apr. 30	Miami, Ariz.
May 1	May 5	Santa Rita, N. M.

A Mountain at the Panama-Pacific Exposition

By Grant Wallace

One of the 11 great exhibition palaces which range in area from five to 10 acres, in the 635-acre exposition grounds by the Golden Gate, is the Palace of Mines and Metallurgy. In the center of this colossal building, under the dome which towers to a height of 160 ft., there is being constructed a mountain with a base of about 150x200 ft., which will be an epitome of all phases of the mineral industry of California. Its peak will be over 50 ft. high, and its slopes will be divided into quadrants, one facing each of the main entrances, and each section finished to represent one or more main divisions of the industry.

On one quarter will be represented the facsimile of an oil field, with wells, derricks and gushers, models of field storage, pipe lines, oil tanks, etc., many of them in actual operation. This unique exhibit will face and supplement the floor exhibits from all over the world, illustrating variations and details of oil equipment, besides an educational exhibit in oils.

A second quarter of the mountain will depict placer mining in all phases, from the crude pan and rocker of the Argonauts to a reproduction of La Grange mine of Trinity County, Calif., the largest hydraulic property in the world, with giants shown washing down the side of the mountain; and at the base, a working model of a dredge.

The copper-mining industry will occupy the third quadrant, with tunnels and various types of smelters. The fourth quadrant will represent in still greater detail all phases of the quartz-mining industry. Many quartz veins will be shown, one being prospected and another under full development, producing and fully equipped. A section of the mountain will be cut away on this side and a plate-glass front put in, behind which will be shown the various underground working details of tunnels, shafts, stopes, hoists, and the like. The mountain will also show details of the mining or production of gems, borax, magnesite, cement and other minerals. On account of its boldness, its unique features which condense the working details of California's mining industry in small compass, and its avoidance of wearisome duplication of exhibits, it is bound to attract the liveliest interest.

Model Oil and Gold Fields, Panama-Pacific Exposition

James B. Cooper

James B. Cooper, superintendent of smelting for the Calumet & Hecla Mining Co., died at Hubbell, Mich., Feb. 27. Eight months ago Mr. Cooper was taken ill and underwent a surgical operation at Chicago. The operation, however, confirmed the diagnosis that there was no hope of recovery. About six weeks ago Mr. Cooper went to Florida, but his condition became more serious and he returned to his home. Since then his decline was gradual.

Few men were better known throughout the district than Mr. Cooper. He was born in 1859 in Springwells, Mich., which is now a part of Detroit. He was a son of James R. and Mary E. (Jenks) Cooper. Mr. Cooper was educated in the public schools of Detroit, graduating from the high school of that city in 1877. His father had come to the copper country some time before to take the management of the old Detroit & Lake Superior Copper Co.'s Hancock smelting works, at Hancock, where the company did custom smelting.

On graduating at Detroit, Mr. Cooper took a position under his father in the smelting works. Remaining at the work for two years, he decided to increase his scientific education and put in the succeeding year at the University of Rochester, in New York State, returning then to his duties in the Hancock smelting plant, where he was foreman until 1888. In that year he was appointed foreman of the old Parrot plant at Bridgeport, Conn., a position he held for two years, returning to Houghton County to take the superintendency of the new Calumet

& Hecla works, at Grover, now Hubbell, where he has since resided. He succeeded the late M. B. Patch, when Patch went to Buffalo to build the Calumet & Hecla smelter there.

In his position as superintendent of the Calumet & Hecla plant, Mr. Cooper had much to do with giving Lake copper the reputation it bears. The loyalty of his men had much to do with his success. For many years he was a director and vice-president of the Houghton National Bank, holding that office up to the time of his death. Mr. Cooper was married in 1892 to Antoinette Senter, a daughter of the late John Senter, of East Houghton. Mrs. Cooper and eight children survive.

Mineral Production of Canada in 1913

The record of annual mineral production in Canada since 1886 shows the rapid growth of the industry.

MINERAL PRODUCTION IN CANADA SINCE 1886

Year	Value	Per Capita	Year	Value	Per Capita
1886	$10,221,255	$2.23	1900	$64,420,877	$12.04
1887	10,321,331	2.23	1901	65,797,911	12.16
1888	12,518,894	2.67	1902	63,231,836	11.36
1889	14,013,113	2.96	1903	61,740,513	10.83
1890	16,763,353	3.50	1904	60,082,771	10.27
1891	18,976,616	3.92	1905	69,078,999	11.49
1892	16,623,415	3.39	1906	79,286,697	12.81
1893	20,035,082	4.04	1907	86,865,202	13.75
1894	19,931,158	3.98	1908	85,557,101	13.16
1895	20,505,917	4.05	1909	91,831,441	13.70
1896	22,474,256	4.38	1910	106,823,623	14.93
1897	28,485,023	5.49	1911	103,220,994	14.42
1898	38,412,431	7.32	1912	135,048,296	18.27
1899	49,234,005	9.27	1913	144,031,047	18.57

The production of the more important metals and minerals is shown in the following tabulated statement in which the figures are given for the two years 1912 and 1913 in comparative form. The figures are in short tons:

Metallic	1912	1913
Copper, lb.	77,832,127	76,975,832
Gold, oz.	611,885	784,525
Pig iron, tons	1,014,587	1,128,967
Lead, lb.	35,763,476	37,662,703
Nickel, lb.	44,841,542	49,676,772
Silver, oz.	31,955,560	31,750,618
Less pig iron credited to imported ores, tons.	978,232	1,055,459
Non-metallic		
Asbestos and asbestic, tons	136,301	161,086
Coal, tons	14,512,829	15,115,089
Gypsum, tons	578,458	639,698
Natural gas, M. ft.	15,286,803	20,345,763
Petroleum, bbl.	243,336	22[illegible],080
Salt, tons	95,053	100,791
Cement, bbl.	7,132,732	8,658,922
Lime, bu.	8,475,839	7,671,381

The total estimated value of metallic products in 1913 is $81,671,404, from which is deducted $15,543,583 for pig iron made from imported ores, leaving a net value of $66,127,821. The value of clay products, stone and miscellaneous nonmetallic products, for which quantities are not given in the table, was $19,256,282, making up the total given in the first table.

In these comparisons Nova Scotia is given no credit on account of the large iron-smelting and steel-making industries at Sydney, New Glasgow, etc. The pig iron made here is entirely from imported ore and naturally is not credited as a Canadian mine output. The same remark applies to a large percentage of the pig-iron production in Ontario as well as to the production of aluminum in Quebec.

MINERAL PRODUCTION BY PROVINCES

	1912		1913	
	Value	Per Cent.	Value	Per Cent.
*Nova Scotia	$18,922,236	14.01	$19,305,545	13.40
New Brunswick	771,004	0.57	1,049,932	0.73
Quebec	11,656,998	8.63	13,303,649	9.24
Ontario	51,985,876	38.50	58,697,602	40.75
Manitoba	2,463,074	1.83	2,211,159	1.54
Saskatchewan	1,165,642	0.86	899,233	0.62
Alberta	12,073,589	8.94	13,844,622	9.61
British Columbia	30,076,635	22.27	28,529,081	19.81
Yukon	5,933,242	4.39	6,190,224	4.30
Dominion	$135,048,296	100.00	$144,031,047	100.00

*Includes a small production of lime from Prince Edward Island.

Note—Abstract from the report by John McLeish, chief of the Division of Mineral Resources and Statistics, Mines Branch, Department of Mines, Ottawa, Canada.

SMELTER PRODUCTION

Refined Products Produced and Metals Contained in Refined Smelter Products Exported	1912 Refined Products	1912 Metals Contained in Matte Blister, Base Bullion and Speiss	1913 Refined Products	1913 Metals Contained in Matte Blister, Base Bullion and Speiss
Gold, oz.	12,118	184,815	11,977	213,279
Silver, oz.	17,572,217	686,171	13,789,709	934,601
Lead (including secondary lead), lb.	35,893,190	.....	39,468,729	.....
Copper, lb.	.....	58,405,910	.....	59,245,722
Copper sulphate, lb.	87,110	.....	130,533	.....
Nickel, lb.	.....	44,841,542	.....	49,676,772
*Nickel and cobalt oxides, etc., lb.	349,054	.....	1,644,185	.....
White arsenic, lb.	4,090,768	.....	3,384,249	.....

*Nickel oxide, cobalt oxide and cobalt material, speiss, etc., not all completely refined.

Smelter products shipped out of Canada for refining were blister copper carrying gold and silver values, 15,270 tons, copper matte carrying gold and silver values, 5159 tons, and bessemer nickel-copper matte, carrying small gold and silver values as well as metals of the platinum group, 47,150 tons.

The gold production of 1913 compared with the production of the previous year shows an increase of $3,567,337. The Yukon placer production in 1913 is estimated at $5,835,554, as against $5,576,493 in 1912. The British Columbia production in 1913 was $6,136,900, of which the placer production as estimated by the Provincial mineralogist was $540,000. The main feature of the year was the large increase from the Porcupine district of Ontario.

The estimated production of silver in 1913 was 31,750,618 fine oz., a decrease of 204,942 oz. from 1912. Of the 1913 production 28,452,737 oz. were from Ontario, and 3,208,122 from British Columbia.

The Canadian production of copper is represented by the copper contents of smelter products, matte, blister copper, etc., together with the amount of copper contained in ores exported, estimated as recoverable. Quebec is credited with a production of 3,455,887 lb. Ontario's production was 25,884,836 lb., being mainly derived from the nickel-copper ores of the Sudbury district. British Columbia had an output of 45,791,579 lb. From the Yukon the Pueblo mine was the heaviest shipper.

The total smelter production of lead in 1913 was 39,468,729 lb., but this includes lead from American ores and lead contained in scrap, etc., resmelted, the recovery from Canadian ores being 37,662,703 lb. The shipments were practically all from British Columbia mines in 1913, though a small production is reported from Ontario and the Yukon. The amount of bounty paid during the 12 months ending December 31, 1913, on account of lead production was $57,956 in all.

The aggregate results of the operations on the nickel ores during the past four years were as follows, in tons of 2000 lb.:

	1910	1911	1912	1913
Ore mined	652,392	612,511	737,584	784,697
Ore smelted	628,947	610,834	725,065	823,403
Bessemer matte produced	35,033	32,607	41,925	47,150
Copper content of matte	9,630	8,966	11,116	12,938
Nickel content of matte	18,636	17,049	22,421	24,838

The estimated quantity of nickel contained in matte exported was 49,459,017 lb., of which 44,224,119 lb. went to the United States.

Iron Ore—The iron-ore shipments from Canadian mines during 1913 amounted to 307,634 short tons. Exports of iron ore from Canada during 1913 were recorded by the Customs Department as 126,124 tons. Imports of iron ore in 1913 were 1,942,325 tons.

Pig Iron—The total production of pig iron in Canadian blast furnaces in 1913 was 1,128,967 tons of 2000 lb. Of the total production of 1913, 23,696 tons were made with charcoal as fuel and 1,105,271 tons with coke.

The amount of coke used during the year was 1,417,148 tons, comprising 710,260 tons from Canadian coal and 706,888 tons of imported coke or coke made from imported coal. There were also used 2,206,191 bu. of charcoal. Limestone flux used amounted to 630,119 tons. The production of pig iron by provinces in 1912 and 1913 was: Nova Scotia, 480,068; Ontario, 648,899 tons. There was also a production in 1913 in electric furnaces of 8075 tons of ferro-alloys.

The output of asbestos in 1913 exceeded those of all previous years, the increase in sales over 1912 being 22.75%. The total output in 1913 was 132,564 tons, an increase of 29,805 tons, or 29%. The sales and shipments of asbestos fiber in 1913 were 136,951 tons. Stock on hand at Dec. 31, 1913, was reported as 20,786 tons.

The exports of coal in 1913 were 1,562,020 tons, valued at $3,961,351, a falling off of 565,113 tons, or over 26%. Imports of coal were 18,201,953 tons.

PRODUCTION OF COAL BY PROVINCES

Province	1911 Tons	1912 Tons	1913 Tons
Nova Scotia	7,004,420	7,783,888	7,972,727
British Columbia	2,542,532	3,208,997	2,714,449
Alberta	1,511,036	3,240,577	4,144,377
Saskatchewan	205,779	225,342	209,175
New Brunswick	55,781	44,780	70,311
Yukon Territory	2,840	9,245	4,050
Total	11,323,388	14,512,829	15,115,089

Coke—The total output of oven coke during 1913 was 1,517,133 tons of 2000 lb., made from 2,147,913 tons of coal, of which 1,598,912 tons were mined in Canada and 549,001 tons imported.

A bounty of 1½c. per imperial gallon is paid upon the production of crude petroleum. The total output of petroleum in 1913 was 228,080 bbl., or 7,982,798 gal., on which a bounty of $119,742 was paid.

Natural Gas—The production was approximately 20,435 million feet, of which 828 million feet was from New Brunswick; 12,487 million feet from Ontario, and 7030 million feet from Alberta.

Congressional Committee's Mine Inspection

Four members of the Congressional subcommittee, investigating strike conditions in the Lake Superior copper country, inspected the underground workings so much complained of by strikers. The party, shown in the photograph, went down three shafts of the Calumet & Hecla and saw working conditions on the conglomerate and amygdaloid lodes. They saw the one-man drill in operation and the method of handling rock from the stopes to the shaft. To understand the requirements of the occupations the Congressmen took up shovels and assisted in loading tram cars. This they found hard work, and only one, Representative Casey, of Pennsylvania, the miner-Congressman, succeeded in filling a car.

CONGRESSIONAL MINE INSPECTION COMMITTEE

From left to right, Capt. John Knox, general superintendent of the C. & H.; Representative Howell, of Utah; Chairman Taylor (Colorado); Captain Gibbons; Representative Switzer (Ohio); Casey (Pennsylvania), and a newspaperman.

The inspection extended to the 72nd level of the No. 5 and Red Jacket shafts on the conglomerate lode and deep mining was seen there under the most extraordinary circumstances. The investigators passed through high, hot stopes and cold, wet shafts, yet found ideal mining conditions. The Congressmen donned "digging clothes," overalls, jumper, oilskin hat and carbide lamp. An innovation, in the nature of white gloves, was sprung, which was not part of the regular outfit. Some of the miners in the group refused to don the gloves, claiming they had worked 15 years before, in the mines, without wearing them and they would not bring themselves to wearing "mits" at this time.

Editorials

The Copper Statistics for February

Our comment on the January statistics could be repeated with regard to the statistics of February, and nobody would know that they were a month old. Again we had phenomenonally large exports, relatively small domestic deliveries, and relatively small production, with the net result of a decrease in the stocks, contrary to general expectations. The small production is again in line with our forecast of some time back, reflecting the reduced rate of output of the mines, with which the refiners have finally fallen into step. The large exports undoubtedly represented to some extent the further shipment of copper abroad on consignment. The small domestic deliveries indicate that American brass-makers, wire-drawers, and sheet-rollers had not experienced any material improvement in their business up to the end of February, and had no courage to enter into contracts to cover future requirements.

Fettling Reverberatory Furnaces

Many changes in reverberatory-furnace practice have been made in the last decade, most of them due to the increased length of furnace and the adoption of liquid fuel. One change, of which little has been said, is in no way connected with either of these two factors in the reverberatory's return to favor. Ten years ago, quartz was almost exclusively used for protecting the furnace sides, and many works went to considerable expense to secure the finest quality obtainable, envying Montana plants their Dillon quartz. As in the case of converter linings, quartz has in many places been gradually supplanted by ore.

In the Southwest, pure quartz is difficult to obtain, most of the siliceous rocks containing more or less alumina. As pure silica could not be obtained, it occurred to the metallurgists that it would be as well to use high-silica ores. This led to difficulties in the way of slag loss, as any unsmelted oxidized ore that floated off in skimming usually carried away whatever metals it contained. This has been obviated by the use of "siliceous" sulphide ore with the advantage that, even though the siliceous skeleton should pass out through the skimming door, the sulphides containing the copper and precious metals would to a large extent melt out and enter the matte bath. One plant, which was having trouble with "siliceous floaters" when using fettling containing 80% silica, increased the tonnage of its furnaces more than 30% by fettling with siliceous copper-sulphide ore; quartz is still used near the throat, but for fettling the sides, this plant uses an ore averaging 14% S, 5% Cu, and 22% SiO_2. A decade ago, such a proposal would have been branded as metallurgical heresy. However, the "reformation" has extended even further. Another Southwestern plant is fettling with cold converter slag. With the improved methods of fettling through the roof, more cold material can be placed on the furnace sides with much less cooling of the interior than was possible when fettling was thrown through the open doors with shovels.

The Constitution of Matter

The new conceptions of the ultimate constitution of matter are so revolutionary that it has seemed worth while again to have the foremost American exponent of physical chemistry set forth the late advances in chemistry. As a consequence, Dr. H. C. Jones, of John Hopkins University, begins in this number a series of three papers on physical-chemical subjects.

When we were young, and knew without doubt that the molecule was composed of two or three ultimate parts, called atoms, we listened complacently to the statement that "science progresses in a straight line, philosophy around in a circle, or at best along a helical spiral." Now that we are older, and believe that the simplest atom has nearly 1800 parts, we find that perhaps the helix is expressive of science as well.

We believe, with the alchemists, that the so called elements are fundamentally the same. Whether we will transmute one to another remains to be seen; we follow the alchemists in attempting it.

Were one of the Greek philosophers, Thales of Miletus, for instance, to stroll into a modern assembly of physicists and chemists, the language would be more troublesome than the ideas. He would hear the physical chemist remarking cheerfully that there is no matter, for that which we call matter is only energy, and Thales would remark, "plagiarist." The disciples of relativity, the ultra modern physicists, would tell him that space and time are one, and Thales would sigh to think of his boyish debates.

But whether we travel in a right line, or a circle, or a spiral, or whether we be disposed to accept the new views or not, Doctor Jones' expositions are invariably interesting, and, as the modern school sees it, invariably exact.

Wastes and Savings

We hear from our conservationist friends a good deal respecting the wastes that the country experiences in losses that are avoidable, to more or less degree. We have been aware for many years of the $250,000,000 annual fire loss, and more recently it has been dinned into our ears that the nation loses hundreds of millions annually in avoidable accidents to life and limb, unsanitary conditions of living, depredations by rats and mice, wastage of manure by farmers, the mischief of tramps, etc. So far as we know, no one has ever undertaken to foot-up these estimates, but we surmise that they would easily come to the $5,000,000,000 mark, which Sir George Paish reckons as the annual saving of the American people. Nor shall we include the $1,000,000,000 that Mr.

Brandeis once told the railway managers that they ought to save, inasmuch as he neglected to tell them just how to do it and they have not been able to find out, although they have come into dire straits to make both ends meet.

However, it is encouraging to the cheerful optimist and economist that the inroads upon the nation's income by the devouring automobile and the time-wastrels of the labor unions may be repaired, or be even more than made good by checking the inroads of the rat, the tramp and the microbe. Anyway, it is a great relief to have the conservationists conversationizing about the savings that may be made in consumption instead of hurling epithets at the producers as of yore. It would be even more gratifying if the producers could now and then be given due credit for what they have indeed accomplished. In truth they are apt to be rather inferior as conversationists and the telling of important things really done by someone else often fails to interest the reformer.

Yet we may see in many achievements of the scientist, engineer and manufacturer results that in actual saving stand up very favorably alongside of some of the big savings that might be made, but are found so difficult practically to manage. Thus, such a thing as the Gayley invention of the dry-air blast in the smelting of iron is estimated to save the American people from $15,000,000 to $29,000,000 per year. But more spectacular by far is Doctor Whitney's estimate that the tungsten lamp saves $240,000,000 per year (we infer that he refers to the world's saving in this case). Reflection on the credit side of the nation's ledger as thus exemplified gives courage that may be needed after too long a poring over the debit page may have led to the feeling that everything is going to the dogs.

Canadian Iron Ores

At the recent convention of the Canadian Mining Institute, resolutions were passed and a committee appointed to see if the government would not aid, through the Geological Survey or other agencies, in the exploration of the iron-ore deposits of the western part of Ontario. The motive for this action are readily explained. That the growing iron industry of Canada should draw its supplies from Canadian mines appears natural and desirable. So far, though there are indications of the existence of extensive iron-ore deposits, little has been done in the way of development, outside of the Helen mine on the Michipicoten, and of Moose Mountain. In the East also there are large partly known reserves, not including the titaniferous ores of Quebec, which have not been developed, or even explored.

While it is well from the Canadian point of view that the native ores should be developed, the situation at present is really a natural result of existing conditions. The proximity of a large supply of ores which can be delivered at low prices and small freight charges is the main, of not the only cause. It has operated in much the same way on the other side of the line. The development and exploitation of the abundant iron ores of New York, New Jersey and Pennsylvania have been held back by the rush of ores from Michigan and Minnesota, where every means had been provided for working on a gigantic scale and at the lowest possible cost. Lake ore have overshadowed everything else, and for a long time, even the possibility of avoiding their domination was not considered. The only alternative seemed to be the importation of ore from Cuba, just as some Canadian furnaces are getting their supplies from Newfoundland. In the last two or three years, however, the pendulum has swung the other way, and attention is now being paid to the iron-ore deposits of New York and to the further extension of the old mines of Pennsylvania and New Jersey, is a way which promises supplies for our eastern furnaces entirely apart from both Lake and imported ores.

Tube-Mill Tendencies

Much attention is being given now to the subject of tube-mill efficiencies, and the profession may look for some types which will be startling at the first glance. The movement toward shorter mills of greater diameter has been seriously started; some have been put into use, and some extreme models are being constructed. All this makes a machine which is essentially different, both in appearance and effect, from the long, narrow tubes which were first used for grinding. The use of shorter mills is being advocated by the most progressive metallurgists, an instance of recent occurrence being those installed at Cinco Minas, Jalisco, designed by the late Godfrey D. Doveton.

The principal reasons for the present tendency lie in the quest for greater efficiency. The mills of today deliver a much greater quantity of finished product for the power introduced than the mills of the older type, although it is to be remembered that the power required for operating the old-style tubes was, for a long time, absurdly over-estimated. Experiments dealing with the height of pebble load, dilution of pulp, method of discharge, and other details have added essentially to the exact information on the subject and enabled the practice of economies in plants already installed.

The conical mill is one of the developments of the principle of pebble milling, and seems to have secured a favorable reception in some quarters. A newer development makes use of a special quick discharge, designed to increase capacity by decreasing the amount of useless work done. One of the principal facts, however, that should be borne in mind by operators, is that different machines must be used to secure opposite results. If a granular product is required, a certain machine may be designed to give it, but if a purely slime product is sought, the means must be different.

The Mexican problem becomes more and more complex. Recent events along the border have destroyed whatever confidence that optimists may have had in the Constitutionalists and have reawakened the idea that after all the Administration made a mistake in not recognizing Huerta in the first place. Yet apparently that idea is not entertained in Washington. But if any plan of action be under consideration there, nothing of it has been revealed. One thing that is certain is that there is no sentiment in the United States away from the border in favor of intervention. In the meanwhile, the mining industry, outside of Sonora and a few places like Pachuca that have been undisturbed, is practically at a standstill.

BY THE WAY

According to Dr. Edward Weston, there are three stages to an invention. In the first, competitors say, "It's theoretically impossible." In the next, "It can't be done, mechanically." In the third, "We did it ourselves three years ago."

⁂

According to the *Pahasapa Quarterly,* when an inquisitive visitor underground asked the foreman, "who had made the best report on the property," the latter told him, "Pat O'Brien with a long fuse and 50 sticks of gelatin."

⁂

In the early days of pan amalgamation, the chemical processes involved were little understood, and rules of thumb were relied upon for results. According to a history of Nevada mining by George J. Young, when trouble was experienced, the imagination was frequently drawn upon for an explanation. Witness the remedy of one millman for flouring quicksilver: "The trouble arises from too great activity of the quicksilver, and therefore there should be introduced into the mass, opium as a sedative, in order to keep it quiet, to make it sleep and thus enable it to catch the precious metals."

⁂

The gusher, brought in about the middle of January, in the Panuco (Tampico) field, by the Cia. de Petroleo la Corona, is reported to have flowed at the rate of 188,000 bbl. per day during a 14-hr. test, after which the well was again throttled down to a flow of about 50,000 bbl. per day. Little waste ensued when this big well was brought in; three carloads of fittings were shipped by express from New York and the casing was anchored in place by a concrete block which is expected to prevent cutting and caving around the mouth of the well. This Dutch Shell gusher is apparently one of the world's greatest oil wells, though the short test is insufficient to demonstrate what the well would do over a long period. It will be recalled that the Pearsons' famous Portrero de Llano well, though throttled down at present, maintained a daily flow of 110,000 bbl. over a long period. The importance of the Mexican petroleum field, both as a producer and a disturber, is apparent.

⁂

Up to the passing of the Alaskan Railway bill by the two houses of Congress, there was in Alaska about as much love for the United States as there is south of the Rio Grande. Among the multitude of grievances, a wretched mail service to interior points has been particularly irritating. Some statements in a letter recently received in this office are pointed. The letter was written from Iditarod:

> You are possibly ignorant of the expeditious methods of Uncle Sam's mail service in Alaska. Up to the present, Oct. 30, my last copy of the "Journal" is Sept. 6, and the usual delivery of mail matter forwarded is about 30%. Some three years ago I discontinued all subscriptions to reading matter because it seemed impossible for the mail carriers in Alaska to get mail matter to its destination. What is more, Uncle Sam's pompous inspectors do not care and one meets with insults if one dares to question the service. I value the annual report of the American Mining Congress most highly, yet though duplicate copies have been mailed to my address, I have not received the 1911 and 1912 reports. To you people in the so called civilized world, these statements may seem a joke, or great exagerations, but they are neither; with us they are cold facts. The post office sees but one side of the Alaskan business, that it is on the wrong side of the ledger, and loses sight of the fact that the more slip-shod and unsatisfactory the manner in which a business is done, the less business there will be to do. It is an obvious fact that a prompt and certain mail service is the first essential in the development of the mining interests and of all other business in this country. Narrow indeed is the range of vision at Washington!

⁂

The Civil Service Commission announces an examination for assistant explosives engineer, on Apr. 8, 1914, to fill a vacancy in the Bureau of Mines, at a salary from $1620 to $2100 per year. The duties of this position will be to assist and participate in tests of explosives used in mining and quarrying, and in the demonstration of the use of these explosives in mining and quarrying operations. The duties will involve considerable field work and travel. Competitors will be examined in:

Subjects	Weights.
(1) Physics	20
(2) General chemistry	10
(3) Mining engineering	30
(4) Education and experience	40
Total	100

A training equivalent to that required for graduation in mining engineering from a school or university of recognized standing, and at least three years' actual experience with mines, or in the manufacture, testing and use of explosives, are requisites for consideration for this position. Applicants must have reached their twenty-first but not their fortieth birthday on the date of the examination. Persons who desire this examination should at once apply for Form 1312, assistant explosives engineer, No. 276, to the U. S. Civil Service Commission, Washington, D. C.

⁂

Besides running mines, smelting works and railways; and being an economist, sociologist and philosopher, Doctor Douglas finds time to be a historian. In his recently published "New England and New France" (Putnam), he essays the task, as persistently difficult as it is perennially fascinating, of drawing historical parallels, says a critic in the *Evening Post.* "In this instance, of course, the contrasts are more than the resemblances; and the chapters in which Doctor Douglas sets over against each other the history of New England colonies and of New France tell, for the most part, independent stories, and thereby bring out, in striking fashion, the fundamental difference between the two regions in almost everything that relates to political theory, economic establishment, and governmental control. One suspects that the author either knows his New France better than he knows New England, or else that he likes it better; at least, the accounts of French colonial development show a range of incident and thoroughness of treatment less observable in the sketches of New England experience. Most interesting and original are the chapters on the status and careers of women in New France and New England, the contrasted state of education and religion in the two regions, and the successes and failures of Catholic and Protestant missions. Here the author's really wide acquaintance with his subject shows itself at its best, and the material is effectively handled." Doctor Douglas was born and brought up in Quebec and has ever been loyal to his native province, whose history, life and affairs are close to his heart. This sympathy is naturally exhibited in his latest book.

PERSONALS

F. C. Alsdorf, of San Francisco, has been in Arizona the past two weeks examining mining properties.

H. W. Turner has changed his address to 207-210 Alaska Commercial Building, San Francisco, California.

Prof. H. S. Munroe, of Columbia University, who is in poor health, is going to the South to recuperate.

E. H. Taylor has been appointed mine superintendent of the Great Cobar Copper Mines, Ltd., and has started for Australia to take charge.

Edwin J. Collins has returned to Duluth from Deadwood, South Dakota, where he has been engaged in examination work for the past two weeks.

R. T. White, formerly manager of the Braden Copper Co. in Chile, is going to the Caucasus, South Russia, to take charge of a copper operation there.

Archibald Johnston, first vice-president of the Bethlehem Steel Co., has returned from China, where he has been for a number of years past on business matters for his company.

The following gentlemen have been elected to membership in the Mining & Metallurgical Society of America: Joseph E. Johnson, Jr., Robert Linton, William L. Saunders and Benjamin F. Tillson.

William Wuthenow, for several years assistant to Chairman John A. Topping, Republic Iron & Steel Co., New York, has been appointed general superintendent for the Western works of that company with offices at Chicago, succeeding Charles H. Burgess.

George S. Rollin has resigned his position with the Longyear Iron Co. and has opened an office at Crystal Falls, Mich., as mining engineer. He will keep in touch with mineral-land developments in the district and will superintend exploration and geological work.

Col. J. C. Maben, president of the Sloss-Sheffield Steel & Iron Co., has just returned from an extended trip to Europe. The location of the new coke ovens for the Sloss company is now under discussion, and Colonel Maben hopes to make a definite announcement shortly.

P. Eyermann, formerly of Dubois, Penn., and in the past few years engineer in charge of construction at the Witkowitzer Bergbau & Eisenhuetten Gewerkschaft, Witkowitz, Austria, has been appointed general superintendent of the new Austrian Steel Co., at Brüx, Bohemia.

John A. Savage, of Duluth, Minn., former general manager and a director of the Shenango Furnace Co., Pittsburgh, resigned Mar. 1. He and several associates have purchased mining properties in Minnesota, and will form a company to be known as John A. Savage & Co., dealers in iron-mining and ore-land business.

In commemoration of 40 years' continuous service at the University of Illinois, a banquet will be tendered Prof. Ira O. Baker, at the La Salle Hotel, Chicago, Tuesday evening, Mar. 17. About 400 are expected to be present. Professor Baker is the head of the civil-engineering department and is a member of the class of 1874, which was the first class of engineers to be graduated at Illinois.

E. J. Maney, of Duluth, Minn., formerly treasurer and director of the North Butte Mining Co., has resigned to become general superintendent of the Shenango Furnace Co. ore interests in the Lake Superior district, which position recently became vacant through the resignation of John A. Savage. Mr. Maney was also treasurer of the Greene Cananea Copper Co. Frederic Kennedy, now secretary, assumes the treasurership of the above named copper companies, and John H. McLean, general manager of the Oliver Iron Mining Co., fills the vacant directorship on the North Butte board. Mr. Maney was identified with the Cole interests in Duluth for a number of years, rising to his present position from a clerkship.

OBITUARY

Hon. Charles R. Devlin, Minister of Colonization & Mines for the Province of Quebec, died at Aylmer, Que., Mar. 1. He was born at Aylmer in 1858 and during his earlier life was engaged in journalism. He was elected to the Canadian Parliament in 1891 and was some years later appointed Canadian Commissioner to Ireland. In 1903 he was elected to the British House of Commons by the Nationalists of Galway. Returning to Canada he became a member of the Quebec administration in 1907 as Minister of Colonization & Mines, which office he continued to hold until his death.

Bernard Gilpin died at Baltimore Feb. 2, aged 58 years. He graduated from Yale and was connected with the Hayden geological expedition in the West. He then settled in Colorado where he was engaged in ranching and mining. Later he was sent by some investors to Japan to investigate mining conditions there. He was sent to Brazil several times, to Alaska, through all the mining district of California and frequently to Northern Mexico. He was directly connected for a time with mines near Parral, in the State of Chihuahua. He was a member of the University Club of Baltimore. He was married five years ago in Los Angeles, and in the following year became connected with the United States Fidelity & Guaranty Co. He is survived by his wife and his brothers.

Andrew Horatio Reeder died at Philadelphia, Feb. 26, aged 45 years. He was born at Easton, and was the eldest son of the late Gen. Frank Reeder. He was graduated at Lafayette College in 1890, and after some engineering service took charge of the H. C. Frick Coal & Coke Co., Uniontown, Penn. Subsequently he became a consulting engineer and in that capacity was employed by the Virginia Iron, Coal & Coke Co. in connection with improvements in its plant at Toms Creek, Va. His recommendations were so successful that he was made general superintendent of the plant. He was next general manager of the Crows Nest Pass Coal Co., in Canada. He then became general manager of the Stonega Coal & Coke Co. and allied interests at Big Stone Gap, Va., later becoming vice-president and general manager, holding this position at the time of his death. He leaves a widow and two children.

SOCIETIES

Mining and Metallurgical Society of America—A meeting of the New York Section will be held at the Engineers' Club, New York, on Thursday, Mar. 19, at 8 p.m., preceded by the usual informal dinner.

Old Freibergers in America—The next regular meeting of the Old Freibergers in America will be held on Wednesday, March 25, at 7:00 p.m., at the Hofbrau Haus, Broadway and 30th St., New York City. Special interest at this time is shown in the fact that Dr. Friedrich Kolbeck, Rektor of the Bergakademie, is expected to visit the United States to attend the Fiftieth Anniversary of the School of Mines of Columbia University, New York City, during the last part of May. The officers of the association are Dr. R. W. Raymond, President; Gardner F. Williams, Vice-President; and C. L. Bryden, 1701 Jefferson Ave., Scranton, Penn., Secretary. Much interest is being taken in the coming celebration of the 150th anniversary of the Royal School of Mines in Freiberg in 1916. A good sized party expects to go from this country.

University of Utah—Plans for the coöperative work between the University of Utah and the United States Bureau of Mines have been outlined as follows: Prof. D. A. Lyon at the expense of the Bureau of Mines will begin at once with the organization of the general metallurgical investigation, which the state of Utah purposes to conduct for the special treatment of low-grade ores, and as to safety and waste. He will continue to supervise the work until such time as a permanent director has been selected by the Bureau of Mines. The Bureau will pay the salary of whoever may be appointed by it, but the state will pay the traveling expenses in connection with the work, which he may do for the state. In the meantime, and until July 1, the Bureau of Mines will lend the services of R. M. Keeney to the state of Utah for the purpose of assisting in the investigation above referred to. The state of Utah is to pay the Bureau of Mines a sum equivalent to Mr. Keeney's salary for that period. Should the Bureau of Mines wish to do so it may have the privilege of making the headquarters for this district at the University of Utah. Mr. Keeney or a representative of the Bureau will probably remain in the district, with headquarters at the University, for the purpose of studying metallurgical problems in other states, the interests of which are more or less closely allied to those of Utah. In this way the representative of the Bureau will be able to assist with the Utah work and the work which is being done by the state will greatly assist the Bureau in the metallurgical work. The above plans have been approved by the board of regents of the University. The money which the state is to supply is to come from the metallurgical research fund already established.

Editorial Correspondence

SAN FRANCISCO—Mar. 5

The North California Mining Co.'s removal of its head offices from Oroville marks the close of the operations so far as related to the holding of large timber areas under mineral locations in California. When Lewis E. Aubury was state mineralogist the company and its manager, H. H. Yard, were attacked in the courts on complaint of the state mineralogist, charged with taking up timber lands under mineral locations. Aubury was not well supported in the fight, but subsequent action of the mining company seems to have proved the charges to be well grounded at least. More than 100,000 acres of these lands have within the last year been released to the U. S. Government, and the holdings of the North California Mining Co. are now reduced to about 1500 acres of patented mineral land. Aubury was repeatedly complained of during his administration of the mining bureau for devoting more time to matters of this sort than to the general and specific requirements of the bureau. But he was signally successful in his efforts in such matters and the bureau was the initial power that weeded out a number of fake promotion schemes. In one instance the trustees of the bureau refused payment of the full amount of earnings of a special examiner of the bureau, notwithstanding the bogus company was driven out of business by the investigation and a large number of investors saved from putting their money into a losing scheme.

DENVER—Mar. 5

Market Prices for Radium Ore have been reported by the daily press as having been established in Denver. According to this announcement, the authority for which is altogether doubtful, the quotations are based upon the units of U_3O_8 in the ore. It does not appear that there have been any Denver transactions in uranium ores except upon a basis of barter. At Placerville, the railroad shipping point for southwestern Colorado fields, there has been a somewhat unofficially established price of $80 per ton for 2% ore. This price checks with the above schedule, so far as it goes. As yet there appears to be no basis for the fixing of market prices in this state and the sellers and buyers merely bargain.

The Geology of the Front Range of the Rockies is a pertinent matter in view of the proposed boring of the so called Moffat tunnel. This tunnel, which will be driven by the City of Denver, is intended for both railroad and water-supply purposes. The commission in charge of the project secured from the state geologist, R. D. George, a report concerning the formations along the line of this bore. The report states the entire six miles will be precambrian complex of granite, gneiss and schist. These rocks are distinctly banded with an average strike that is approximately parallel to the crest of the divide or northeast. There are some strikes west of north. The prevailing dip is toward the west and ranges from 25 to 90°, the average probably being 55°. It is not probable that the tunnel will drain any of the numerous little lakes and marshes on James Peak. Small faults are common, and are both with and across the strikes of the rocks. Professor George does not expect this tunnel to disclose veins of commercial importance. No veins have ever been found along the line of this tunnel and none of the known strong veins in neighboring mining districts have strikes that will carry them into this territory. Fissures will be encountered and they will be chiefly of interest as channels for water, but the inflow of water is not likely to present a difficult problem.

"Gross Proceeds from Mining Operations" is a term that is provoking considerable comment these days. For a long time past, this expression has occupied the attention of many mining officials, but recently it has assumed publicity in court proceedings as well as in the discussions of the Colorado Metal Mining Association. The matter of the taxation of mining property has been difficult to handle and the various attempts to arrive at fair assessments have thus far proved failures. When legislation finally settled the matter by placing the assessment of taxes as a function of the actual proceeds from operation, it was assumed that equity had been established; but the law has been useless purely through the oversight of insufficiently defining its principal phrase. To obtain this definition, the treasurer of Teller County, Cripple Creek district, brought suit against the Casson Consolidated Gold Mining & Milling Co. The law then provided that mines should be taxed on a basis of one-fourth the gross proceeds, and the question has been in regard to what constitutes such return. The defendant company sought to prove that the charges for transportation and treatment should be deducted from the gross assay value of its output. The district court sustained this contention, but the state supreme court reversed this decision. However, upon a rehearing of the case, this higher court changed its opinions, using the following language: "Gross proceeds means the sum of money accruing from a sale of property; and, from items which the statement of owners must disclose, it is evident that the legislature, in directing the assessor to ascertain the gross proceeds of a mine, from such statement meant that he should determine the sum received by the owner for his ores." This decision is specially important at this time as it has a direct bearing upon a law passed by the last legislature increasing the assessment valuation of mines to "one-half of the gross proceeds plus all of the net proceeds." The constitutionality of this law is at stake and there is promise of much litigation.

BUTTE—Mar. 4

Work on the Thompson Falls Power Project continues because of the remarkably fine weather for this time of the year. The work has continued without interruption, and a night crew of men has been put on for the operation of machine drills and steam shovel. The Thompson Falls Power Co. is employing about 300 men on the work, and between 80 and 100 men are employed by the contractors, Boomer & Hughes, on the rock work. Eighty men are employed on the coffer-dam, excavating for the foundation work of the main dam. The excavation is from 400 to 500 ft. long and 100 ft. wide, all below the level of the river. Two large suction pumps, operated by electric motors, are used to handle the water that seeps into the excavation through the protecting dike. As the rock is drilled and blasted from the bottom of the river it is hoisted in buckets by steam derricks to the cliff above, where it is hauled away for track building.

To Reduce Mine Accidents to a minimum the Anaconda Copper Mining Co. is distributing to its employees a 10-page folder entitled suggestions to employees, the title page containing in large display type the words, "Safety First." Superintendent John Gillie, speaking of the purpose of the pamphlet, stated that the company is as much interested in avoiding mine accidents as are the miners themselves, and the folder is published to secure if possible closer attention on the part of miners and other employees, to the rules and regulations of the company for the purpose of avoiding these accidents. Attention is called to the fact that the company is attempting in every way possible to reduce accidents, and the coöperation of all employees in the good work is sought. To this end suggestions are made as to how best to avoid the common causes of accidents, such as: Never go to work under ground after drinking liquor; never travel through mine workings without sufficient light; never enter powder magazines with exposed light; always make sure that the back is properly timbered before working under it.

SALT LAKE CITY—Mar. 5

Heavier Crushing Machinery will be installed by the Ohio Copper Co. in its mill at Lark. This will be similar to that used by the Utah Copper, and is expected to bring the capacity from 2100 tons now being treated daily, to 3000 tons. With the present crushing equipment, it is difficult to treat some of the hard quartzite ore fast enough to keep the tables working up to capacity. The mill is equipped with three sections designed originally to treat 500 tons each, but which are treating 700 tons. By the changes now proposed, it is expected that each section will be able to treat 1000 tons.

The Old Grasselli Plant below Park City has been bought by John Pingree, president of the Merchants' Bank of Salt Lake, and other men of this city, and is to be remodeled and converted into a custom mill for the Park City district. The Grasselli plant is a well equipped dry-zinc concentrator, and was built to treat the Daly-Judge zinc middlings before this was done by the concentrator at the mine. It has a good power plant, railroad spur, etc., on the flats below Park City. The remodeled mill will be intended to handle those low-

grade siliceous ores of the district, which have been found difficult to concentrate without a large loss in the tailings, and which can hardly be shipped with profit. Crushing and roasting machinery, with leaching equipment, is to be added and a chlorination process used similar to that employed by the Mines Operating Co., at Park City, and the new Knight mill at Silver City. This consists essentially of roasting with salt, and a small amount of sulphides, leaching and precipitating on scrap iron and copper. The remodeled mill is to have a capacity of 300 tons, and a contract for ores from the American Flag mine has been made.

CALUMET—Mar. 7

The Federal Investigation of the copper-country strike was taken up last week with the mining companies' side of the controversy. James MacNaughton, general manager for the Calumet & Hecla Mining Co., was on the stand for nearly three days and told the situation to the smallest detail. His testimony covered the history of Michigan copper mining in its entirety, working conditions, temperatures, ventilation, etc., pertaining to underground work. He went into details regarding the housing of employees, aid and pension funds, welfare and charitable work and other features that the company has developed. He explained the contract system of mining and gave figures showing the average distance trammed and tons per man handled at the various mines of which he is in charge. The following list is interesting insofar that it has been maintained that the life of the copper-country miner was comparatively short. The Calumet & Hecla company has 403 employees who began work 15 years ago and have 31 sons at work; 427 employed from 20 to 25 years have 63 sons at work; 433 employed 25 to 30 years have 90 sons at work, and from 40 years and over, there are 111 with 57 sons at work. The Federation presented many individual dockets, intended to show the low scale of wages paid to the miners, and in rebuttal of this evidence, the companies showed what these different individuals earned for a long period and what class of work they had been doing. As an incident, the pay of W. J. Rickard, president of the Calumet local of the Western Federation of Miners, was offered. Rickard testified that he had worked 26 days in April, 1902, at the Osceola and received only $4.20, while as a matter of fact, taken from the company's payroll, he only worked two days for the Osceola for which he received $4.20 and then finished out the month of 21 days at the Kearsarge, receiving $47.25. He worked 15 months at the Tecumseh mine at an average of $3.79 per day. His highest wage was $132.49 for one month and he averaged $4.40 per day for the last 20 days he worked at the Tecumseh. Dolphis Little was another who testified that he only received 27c. for the month of February, 1911, at the Osceola. Little's record showed an average of $2.97 for the entire year of 1911, $3.86 per day for 1912, and from January to July, 1913, he averaged $6.77. Numerous other similar cases were cited. Several new men testified as to the conditions under which they were employed, knowing absolutely that a strike existed and that they were permitted to leave the train en route, that they were not restrained from leaving the bunk houses and did not have to work against their will. These were some of the points that the Federation witnesses tried to establish. Two members of the committee are holding a session at Calumet, looking into the Christmas Eve Italian Hall disaster. It is likely that another week will be required before the mining companies will complete their case.

MARQUETTE—Mar. 7

The Forcing of a Tonnage Tax on iron and copper mines, according to reports from the southern part of the state, where agriculture is a highly important industry, will depend on the results of an investigation to be made in the mining country by the legislative committee of the farmers' organization. It is averred that the Grange leaders have been so impressed by the volume of the protest against the proposed levy that they have decided upon a searching inquiry and this will be undertaken soon. Hearings will be held and the mining men will be asked to present their views. This procedure will be augmented by personal inspection of the mines. The legislative committee already has a tonnage tax bill ready for submission, but its members profess a desire to be fair in the matter, hence the proposed visit to the mining region. There is skepticism in mining circles as well as a suspicion that the proposed investigation merely is a strategic move. A criticism frequently aimed at the tonnage tax is that it contemplates sweeping legislation on a subject with which southern Michigan people have no familiarity. This criticism has carried much weight. Thus if the legislative committee of the Grange, already committed to the proposed law, went through the motions of an inquiry on the ground and then reported that the arguments of the mining men were outweighed by the arguments for the tax, it is obvious that the position of the proposed measure would be strengthened. It is not charged that this may be the motive for the forthcoming trip to the Lake Superior country, but there nevertheless is a lurking suspicion that the mines will not be accorded a fair and square deal. A tonnage tax would undoubtedly result in lower wages at some properties and a suspension of operations at others.

NEGAUNEE—Mar. 7

A Flow of Sand at the Maas Mine of the Cleveland-Cliffs Iron Co., on Marquette range, killed one man a few days ago, and five fellow workers narrowly escaped a similar fate. The sand broke through from the surface at a point midway between the Maas and the Negaunee mine of the same corporation and spread rapidly like water. It poured along the first level for a distance of several hundred feet and when the flow ceased it had formed a bed four to five feet in thickness. Part of the stream had run into a sublevel, 60 ft. farther down, and it was in this working that the ill-fated miner lost his life. Six men were in the sublevel. At the risk of his own life, a miner had shouted a warning that the sand was running and the men had rushed to the first level in an attempt to escape. Exit by that channel was impossible by that time and the men hurried down the ladder they had just ascended. The man killed was knocked from the ladder by sand and was smothered to death in the material into which he was plunged. The flow ceased soon afterward. The five survivors were safe in the sublevel, but were entombed. The mine officials rescued them with the aid of a raft. Ore hoisting was stopped and with the men working 8-hr. shifts the work of removing the sand was started.

JOPLIN—Mar. 7

Mine Inspection in Missouri is at last approaching a better basis both from the standpoint of efficiency and organization; this is attested by the men engaged as miners as well as by the operators. This last week brought an announcement from the board of inspection that from now on a personal campaign through weekly or monthly lectures to miners on personal safety and rules to prevent injury to fellow workmen would be undertaken by the various inspectors. According to Inspector I. L. Burch, of the Joplin district, many of the accidents to the zinc miners come from carelessness on the part of the miners themselves and he believes that an educational campaign to point out the personal responsibility of the miner both for himself and for his fellow workmen should be helpful in accident prevention. With that end in view the lectures will be undertaken at once. It is the plan of the inspectors to do much of this work personally but they will have the assistance of those operators who are struggling to better conditions in the field.

TORONTO—Mar. 7

A Bounty on All Iron Ore mined and shipped from mines in Canada is asked by the Ontario Associated Boards of Trade in a resolution adopted for presentation to the Dominion government. They also ask that a commission be appointed by the government to investigate and report on conditions. On account of the low-grade of Canadian iron ores, iron mining in Canada has shown a substantial falling off, as practically all Canadian ores have to be beneficiated before they can be shipped. This resolution has been advanced with the idea of stimulating iron-ore mining throughout the Dominion. In the event of favorable action being taken by the government, it is altogether probable that this bounty will vary according to the ores which would have to be treated. Northern Ontario in particular, has exceedingly large deposits of magnetite which have to be concentrated before becoming commercially available. There are also exceedingly large deposits of pyrrhotite which it is believed could be roasted to give a resulting product running between 62 and 64% in iron and carrying less than $\frac{1}{10}$ of 1% in sulphur. In addition, there are large deposits of low-grade hematites and banded hematites and magnetites for which different processes would have to be used. Practically all the iron ore used in Canadian blast furnaces is imported and the idea is to pay a bounty on Canadian ores which would put them in a position to compete with those of United States.

Following the issue of an order-in-council at Ottawa, assigning 30 mining claims on Clark and Armstrong Islands in the Hudson Bay to the Ungava Miners and Traders, Limited, the company will send another expedition north in the course of the next few months. It is understood that iron ore of good quality in beds varying from 7 to 15 ft. in thickness, has been opened up and should these beds prove persistent. the two islands are estimated to contain 465,000,000 tons of iron ore.

The Mining News

ALABAMA

Etowah County

A COÖPERATIVE SOIL-PIPE COMPANY is to be formed at Gadsden, with capital of $60,000, in 600 shares of $100 each; $25,000 will be paid in and be used to build plant, which will be at East Gadsden. Output will be 15 tons daily at start; 300 shares are reserved for white employees to be paid for by deducting 25% from weekly wages. Robert Campbell will have charge of planning and erection of plant.

ALASKA

ALASKA UNITED (Douglas)—January production, Ready Bullion Claim, 18,958 tons of ore yielded $40,329, or $2.18 per ton; $13,504 net profit; 700 Claim, 18,081 tons yielded $27,447, or $1.53 per ton, $247 loss.

ARIZONA

Gila County

ARIZONA COMMERCIAL (Globe)—Work is soon to be resumed on twelfth level as control of water through bailing and pumping is being rapidly achieved. Crosscutting on 1300 and 1400 levels continues. A small flow of water was recently encountered in latter, indicating proximity of main vein, and it is expected that lode will be cut with firing of next round. On 1200 water is fed into bailer through a pipe which is hung clear of shaft at completion of each filling. Neglect to swing this pipe clear Feb. 24 was direct cause of serious accident which occurred when descending cage, on which were the foreman and night boss, struck projecting pipe, resulting in injury to both men.

Pinal County

MAGMA (Superior)—Intention now is to build an aërial tram from Superior to Miami, Ray or a point on the desert to which a spur will be laid from main line of Southern Pacific. Which of these lines is most likely to be built Magma management asserts to be wholly problematical, its final choice of route for tramway depending upon several conditions of which most important are encouragement by county officials of the two counties in which lines are being surveyed and terms and length of contracts company will be able to secure from the three different smelters, International Smelting & Refining Co.'s plant now building at Miami, El Paso and Hayden. Line to Miami would be 15 miles long, that out on desert would be 10 miles long, one to Ray would be longest. Contemplated line's importance is best understood from fact that present rate paid for freight haul from Superior to railway at Florence is $10 per ton, and that cost of delivering it by an aërial tram to Miami, for instance, would be $1 per ton. Line will not only carry Magma's output but that of entire Pioneer district and incoming supplies, and do so for half present freight rate. Estimates from steel companies have been secured. Line to Miami probably would cost from $200,000 to $400,000, according to size of towers, weight of equipment and general details of equipment.

CALIFORNIA

Amador County

HARDENBERG (Jackson)—R. E. Cranston, consulting engineer for Breitung & Co., together with R. H. Elliott and Alexander Wise, have completed an examination of this mine. New orebody developed last year on 1000-ft. level was thoroughly sampled as well as the workings on 850 level. Mine which was operated steadily last year has new modern equipment throughout.

Butte County

CLAY DEPOSITS AT OROVILLE have been examined recently by T. M. Moore, of Cleveland, Ohio, president of American Clay Co. Options are said to have been taken on deposits on Robert Campbell ranch. There are several clay deposits in vicinity of Oroville possible of commercial development.

SECOND DIAMOND FROM CHEROKEE GRAVEL MINE, at Cherokee, found this year was found by Thomas Riley who was mining for gold. It is said by jewelers at Oroville to be worth about $100. U. S. Diamond Mining Co. began organization and development of property about two years ago, but no extensive work has been done.

Calaveras County

COFFEE MILL (San Andreas)—Joseph King and others have purchased this gravel mine and other claims at Chili Gulch. Development will be carried on through old Bob Paul tunnel which will be reopened.

Eldorado County

DAVIDSON (Eldorado)—Mine is being reopened, it is said, by a French company. There is a 300-ft. shaft, sunk about 40 years ago, when mine was one of Mother Lode producers.

Mariposa County

MT. GAINES (Mariposa)—It is reported that mine is to be reopened. It was formerly one of the good producers on southerly end of Mother Lode. It was purchased in 1912 by A. R. Mains, of Los Angeles, but little work is said to have been done since.

Plumas County

CLAYBANK (La Porte)—Development in tunnel is progressing and a new shaft will be sunk on Buckley ranch. Channel is southern extension of Bellevue channel which is being worked by John Thomas.

PLUMAS EUREKA (Johnsville)—It is again reported that this mine is to be reopened by Eastern men. It was one of the earliest and largest producers in northern California and is believed to contain undeveloped orebodies at depth.

COLORADO

Boulder County

ROGERS NO. 2 (Boulder)—Kinsey & Crisman recently shipped one lot of uranium ore assaying 43.2% U_3O_8 and another lot running 24.4%.

Clear Creek County

ALBRO (Idaho Springs)—Hauling of 100 tons stocked during road blockade has started.

TOM TUCK (Idaho Springs)—Recent strike is producing well, shoot increasing both in grade and width.

JO REYNOLDS (Dumont)—R. B. Morton is developing new ground in this mine formerly owned by "Diamond Jo" Reynolds. Production will begin soon.

HOMESTAKE (Empire)—Lead-silver vein cut in crosscut adit, 700 ft. from portal. This was located five years ago during excitement of Camp Beshears.

LITTLE MATTIE (Idaho Springs)—Two lifts being sunk in shaft to open up levels below 800 ft. Concentrator is operating and good shipments of smelting ore are made.

NEW ERA (Freeland)—Calumet-Corbin Mining Co. has purchased this property. Benjamin F. Hall is manager. Reports by engineers show blockade reserves worth $250,000.

EMERALD GOLD MINING CO.—This company has been conducting exploratory work during past six months on mining property on Bard Creek. Development will begin soon.

Lake County

DENVER CITY and EMMET (Leadville)—These Fryer Hill mines are making good shipments of sulphide ore from 600-ft. levels. Deeper mining impossible until drainage is established.

YAK TUNNEL (Leadville)—Heavy ground is causing abandonment of part of bore and substitution of Moyer drainage lateral which is now being enlarged, wired and tracked. Heavy part is beyond branch to Cord winze. Cord mine keeps up regular production of sulphide ore. White Cap is shipping sulphides running well in lead and zinc.

Ouray County

REVENUE (Ouray)—It is rumored that these properties have been purchased by E. H. Platt, et al.

Park County

BUTTE (Alma)—Charles P. Aicher, manager, proposes to reopen this old mine along the London fault, in South Mosquito Gulch, this spring.

SWEET HOME (Alma)—Holliday & Peterson, lessees, have struck stringers of rich copper-silver ore, such as was mined years ago in this Buckskin Gulch property.

MASCOTTE TUNNEL (Alma)—Contractors Shuck Brothers are progressing slowly in driving this bore to intercept Orphan Boy-Phillips contact. Rock is hard, white quartzite and work is by hand.

COLORADO GOLD MINING & SMELTING CO. (Alma)—Bondholders of this company, owning several mining properties and smelting works, have started foreclosure proceedings and a reorganization with view to active operations.

San Juan County

TRILBY (Silverton)—Transformer that was carried down the mountain inside its house by a snowslide has been reset and mining has been resumed.

SUNNYSIDE (Eureka)—Loading terminal destroyed last November by fire and towers of aërial tramway destroyed by snowslides have been rebuilt and mine is running normally.

Summit County

ARCTIC (Breckenridge)—After breaking road 11 miles through deep snow, a carload of ore was hauled to town by sleds.

LUCKY (Breckenridge)—M. A. and S. B. Wright have shipped two carloads of heavy lead-silver ore to Leadville for smelting.

WELLINGTON (Breckenridge)—On fifth level, a shoot of sphalerite 8 ft. thick has been struck. Dry or magnetic separating mill has continued in operation throughout snow blockade and wet mill will be started as soon as railroad traffic resumes.

Teller County

INTERPRETATION OF LAW TAXING MINES that are producing was handed down by Supreme Court Feb. 2. According to this decision taxation is based upon half gross proceeds, after deducting transportation and reduction charges, and is recognized as a victory for mine operators.

ELKTON (Elkton)—Mine will be shut down for two weeks, while shaft is being retimbered.

PORTLAND (Victor)—A steam-electric station, to be built in Cripple Creek district, is projected.

DRAINAGE TUNNEL—Flow of water averaged 7500 gal. per min. in February, a little less than January flow.

EL PASO (Cripple Creek)—A dividend of $49,000, or 10c. per share, first since March, 1913, has been declared.

MAY B. (Victor)—Rankin Bros. have installed an electric hoist in adit to hoist from winze and are mining a 2-ft. vein of milling ore.

DANTE (Cripple Creek)—Gaylord mill is expected to resume operations Apr. 1, after a shut-down on account of repairs to crushers and screens.

IDAHO

Cœur d'Alene District

SNOWSTORM-MISSOULA (Mullan)—Purchase of controlling interest in Missoula Copper Co. by Snowstorm Mining Co. at a price said to be more than $300,000, was made last week. Properties are 1¾ miles apart. Several Missoula stockholders, representing more than 600,000 shares, pooled their holdings and transferred them to Snowstorm company for a price said to be approximately 50c. per share. Securities are to be held in escrow by Union Trust Co. until necessary details of sale have been arranged.

BUNKER HILL & SULLIVAN (Kellogg)—All trolley wires are being taken out of underground workings to eliminate danger to workmen. Company is making a feature of "safety first" policy. Electric-storage locomotives are being installed to haul ore, except in Kellogg tunnel. Three locomotives, weighing eight tons each, are in operation. Accident list has been materially reduced since adoption of new policy in regard to safety.

MICHIGAN

Iron

CHAPIN (Iron Mountain)—Cornish pump at this property was out of commission for several days because of a broken connecting pin. New pin weighed 1400 lb.

NEGAUNEE (Negaunee)—New high-pressure centrifugal pump which was recently started running at this property is working satisfactorily and other large electric pump, which was purchased some time ago, is on ground and will soon be in working order.

GARDNER (Gwinn)—Headframes for Gardner and Cyr shafts have been completed and steel sets are now being put in place. No mining is being done at present, as seals have not been groken at concrete at bottom. Shafts were sunk into ore a short distance several years ago and are concreted that far.

CHICAGO, MILWAUKEE & ST. PAUL RY. (Iron River)—This company has completed its line to Iron River and first trains were run last week. Branch line connects with main line at Channing and means a great saving in time to traveling public. St. Paul will go after its share of ore business, and it is stated that several companies have already closed contracts with road.

ZIMMERMAN (Iron River)—Order was received a few weeks ago to reopen this mine, but operations had been going on for only a few days when work was discontinued. This is only one of many Iron River properties in idleness. Monroe Iron Mining Co., operating Hiawatha, Chicagoan and Rogers, and Jones & Laughlin Co., operating Forbes, are only companies in district which are working with full forces. Other properties working are employing only small shifts.

CLEVELAND-CLIFFS IRON CO. (Ishpeming)—Company has been adding to its rescue apparatus at its four stations on Marquette range and will soon have five oxygen helmets at every station instead of three. Lung-motors will soon replace pulmotors, former being considered more effective and easier to handle underground. Stations are at Ishpeming, Negaunee, North Lake and Gwinn. Each mine has a trained rescue crew and first-aid crew, which are drilled every week by assistants of safety inspector.

MINNESOTA

Cuyuna Range

NEW TOWN OF WOODROW has been platted adjacent to Canadian-Cuyuna Ore Co.'s holdings, six miles east of Brainerd. Town, as well as mine, will be served by Northern Pacific Ry. Special permission as to naming of town was secured from President Wilson.

DULUTH-BRAINERD (Ironton)—Shaft is now down 102 ft. and still in wall rock. At 150 ft. a station will be cut, and a drift driven into ore.

CANADIAN-CUYUNA ORE CO. (Brainerd)—Shaft sinking was scheduled to begin Mar. 2. It will be a drop shaft. Temporary power equipment is ready.

ROWE (Riverton)—Despite extremely cold weather, 25 to 35° below zero, one steam shovel is kept at work, overburden being broken by blasting. This is only shovel now at work on range.

ADAMS (Oreland)—After several years of preparatory work, hoisting of ore has begun. Ore averaging around 58% iron is now being hoisted regularly. Mine is pumping 150 gal. of water daily.

BRAINERD DEVELOPMENT CO. (Brainerd)—Representatives of company have announced that Apr. 1 company will begin sinking a shaft on its property in Sec. 33, 47-29, near Iron Mountain shaft. This company is financed by Twin Cities men, and is capitalized at $100,000.

CUYUNA IRON & MANGANESE ORE CO. (Ironton)—Drilling continues to show considerable increases in tonnage. In addition, 25% manganese has been encountered in one hole. Manganese is not generally considered unless it occurs in fairly good-sized deposits of uniform content low in phosphorus. Company has not as yet given out for publication phosphorus content of its manganiferous ores.

Mesabi Range

OLIVER IRON MINING CO.—Company now has more than 50 independent drills working at various points on Mesabi range, displaying more activity than it has shown for a number of years past. This is locally construed to indicate that it is preparing to increase production from its other properties when Great Northern leases expire in 1915. Most of the drilling is merely check drilling, little of it being on hitherto unexplored areas.

Vermilion Range

SECTION THIRTY MINING CO. (Ely)—Winter's work has consisted largely of opening up deeper ore, and increasing number of working faces. Company plans to have 85,000 tons on stockpile when navigation opens.

MISSOURI—KANSAS—OKLAHOMA

Joplin District

NORTH ARKANSAS MINES SHIPPED SEVERAL CARS OF ORE last week; two cars sent out from Zinc, Ark., by Brown & Co., and one by J. T. Westrich, operating Virginia J.

DURSTON MINING CO. (Galena, Kan.)—This company, composed of Carthage, Mo., operators, is erecting 400-ton concentrator, moved from southeast Missouri lead fields.

SWARTZ LAND (Joplin, Mo.)—Several companies now operating successfully here. Joseph Dillon & Co. in good lead and zinc ore. B. W. Easley & Co. have 20-ft. face of blende.

FORTUNE TELLER (Granby, Mo.)—While sinking for lower deposit of silicate, rich run of zinc ore was found. Shaft entered mineral at 100-ft. level. Mine owned by Granby Mining & Smelting Co.

SITTING BULL (Thoms Station, Mo.)—New ore deposits being worked, furnishing ore for mill for indefinite period. Mine was first opened in camp and has produced 12,500 tons of zinc ore. Now working deeper level.

KAIL LAND (Klondike, Kan.)—Profitable lead mine being developed by Alexander Mining Co. Rich deposit, several feet thick, encountered at 90-ft. level. O. W. Sparks, of Galena, Kan., holds first lease, which is near Sparks' Yellow jacket.

MONTANA

Cascade County

POWER CITY OIL & NATURAL GAS CO.—At meeting of directors it was decided to begin drilling operations in territory west of Great Falls, north of Sun River, near its junction with Missouri. Both from a geological and economical standpoint outlook is bright for striking oil and gas. There is plenty of water available; machinery and supplies can be unloaded directly from railroad cars and electric light and power can easily be brought to drills. Guy Seguine with drillers from Kansas is in charge of operations.

BUTTE & PENSACOLA MINING CO. (Logging Creek)—This company, chiefly of Butte men, owns 20 claims, covering an area of 400 acres in district, 12 miles from Logging Creek, a station on the Neihart branch of Northern Pacific Ry. Lode which is at present being developed, has been traced on surface for three miles and is 20 to 65 ft. wide. Four other lodes are said to outcrop within area of company's property. Ore contains chiefly lead and silver. A shipment of 725 sacks of rich lead carbonates was recently made to East Helena smelting works from Excelsior claim. Properties are developed by a 1700-ft. tunnel which taps lodes 1400 ft. below surface.

Deer Lodge County

SOUTHERN CROSS (Georgetown)—A cave-in occurred Feb. 20 at this mine which was recently acquired by Anaconda Copper Mining Co. Cave-in threw much earth into a stope on 100-ft. level, burying two miners. Although several shifts of men are kept at work to rescue entombed men, they have not yet been reached and hopes of their being found alive have been abandoned.

Granite County

IN THE GARNET MINING DISTRICT renewed activity is reported. This old camp promises to assume some importance this summer. Nancy Hanks property, consisting of seven claims, is being operated by lessees who are working on Spokane, Cascade and Tiger claims. Colonel Peak is working eight men in Anderson mine. International mine, of Mitchell and Mussigbrod, is being developed by six lessees. McDermott Bros. have eight men on Shamrock. All mines named are shipping pay ore to Washoe smelting plant at Anaconda. Adams & Jennison have recently shipped a carload of ore from Dewey mine, netting $4000. On a property of Colonel Ritchie, in First Chance Gulch, a tributary of Bear Gulch, a new vein was struck recently. Some of the ore assayed $400 in gold.

Jefferson County

BASIN CONCENTRATOR—It is said that M. Atwater, formerly superintendent of the Butte & Superior mine, at Butte, has secured a five-year lease on 50,000 tons of tailings of this old mill, residue of ore milled in past from Butte Superior zinc mine. Tailings are to be treated in one of the mills, while another mill will probably be operated as a custom mill to treat ore from mines in district, principally Crystal mine, which is worked by Ray and Ruby and Columbia mines worked under lease by Dowling.

Madison County

THE GALENA MINE, LOCATED AT STERLING, 2½ miles west of Norris, on Pony branch of Northern Pacific Ry., was sold to a syndicate of Cleveland, Ohio, business men. New owners intend to build a modern mill. Mine has been developed by its former owner, P. V. Jackson and lessees have realized $200,000 from mining high-grade ores. There are four veins on property which outcrop on surface and may be traced for several thousand feet along strike.

EL ORO DREDGING (San Francisco, Calif.)—Preparations are being made to commence prospecting operations on a large area of placer ground near Twin Bridges, upon which company holds options. A drilling outfit has been ordered and as soon as it arrives work of drilling rows of holes across valley, from east to west, will be commenced. Maximum depth of drill hole will be 90 ft.

Silver Bow County

UNITED MINE WORKERS OF MONTANA have raised a fund of $4000 for striking miners in Michigan and this sum was forwarded Feb. 27.

BUTTE & ZENITH CITY (Nissler)—Unwatering of shaft which has been going on for several months has been completed and development work on 500 level will be resumed at once. This was suspended when a flow of water was encountered that could not be handled by pumps then in place. Work is carried on under direction of Superintendent Newton, of the Butte & Ballaklava, Duluth owners of Butte & Ballaklava being also interested in Butte & Zenith City.

NORTH BUTTE (Butte)—Granite Mountain shaft has been connected with Speculator workings on 2800-ft. level. Work of cutting stations and skip pockets on several levels in Granite Mountain shaft, is now under way, and as soon as connections are made with Speculator workings on these levels, which work should be completed in about three months, shaft will be in readiness to take place of Speculator shaft as ore-hoisting outlet. New dry house of steel, being erected near Granite Mountain shaft, is nearing completion.

BUTTE-BALLAKLAVA (Butte)—Ever since settlement of litigation with Anaconda Copper Mining Co., output from this property has been steadily increased until at present about 110 tons of ore are hoisted and shipped daily. This comes largely from 1400 level with some from 900, 1200 and 1600. On 1400 level, vein is 10 ft. wide. On 1600 level a crosscut is being driven which will be about 160 ft. long when it reaches vein. During February, in spite of four days' shutdown, total output amounted to 2350 tons. This is to be increased as soon as more men can conveniently be put to work.

BUTTE & GREAT FALLS (Butte)—Resumption of operations at this company's properties, four miles north of Butte, recently took place. Mines are being developed by a shaft which at a depth of 200 ft. opened up a vein 13 ft. wide, carrying gold, silver and copper. Shaft is to be sunk to a depth of 500 ft. at which level vein discovered at 200 level will be further developed. Mine is well equipped with a carpenter and blacksmith shop, engine and boiler house, a boarding house, and three bunk houses. All machinery will be electrically driven. At present work is carried on with a steam hoist.

BUTTE-DULUTH (Butte)—Captain Wolvin has returned from New York where he went, assumedly to close negotiations with the American Metal Co. by which latter was to take a block of bonds of Butte-Duluth. Wolvin refrained from making any definite statement further than to say that none of the negotiations have contemplated allowing control of Butte-Duluth to pass to any other than those who are now in control. According to reports of superintendent, February was a record breaker both as to amount of copper produced and cost of production. With improvements now under way a further reduction of cost will soon be realized.

BUTTE & BACORN (Butte)—F. W. Bacorn has brought suit against company and J. F. Finley to quiet title to a lease on following claims belonging to company: Fortunate, Little Chief, Belinda, Cyclone, Last Chance, Horseshoe Bend, Prince of Wales, Welland, Landore, Silver State, Treasure, Erie, Panama, Suez, Berlin, Montana State and part of the Dublin. Lease was executed to Bacon Dec. 23, 1913, and he complains that defendants now claim rights, title or interest to these premiscs adverse to his rights under lease. He asks to be declared sole owner of lease and be protected in his operations from interference by defendants.

ANACONDA COPPER MINING CO. (Butte)—A campaign has been started by this company to reduce accidents in its mines by distributing to all employees printed pamphlets in which are pointed out most common causes of such accidents as well as means of prevention. In these pamphlets attention is called to and suggestions made regarding crowding on cages, keeping a careful lookout for winzes, manways and other openings, trolley wires, lights, missed holes, defective timbering and explosives. As a further protection, company requests every employee to notify shift boss or foreman of any dangerous condition known to exist in any of the properties and to make such suggestions as will tend to prevent accidents and to increase safety.

NEVADA

Clark County

ANACONDA (Searchlight)—It is reported that this property 18 miles southeast of Searchlight in Newberry range, has been bonded by Rogers Bros. of Central City, Colo., for $25,000. Development work will begin at once.

ST. ANTHONY MINING CO. (Goodsprings)—This copper mine in Yellow Pine district has completed important improvements. A 900-ft. aërial tramway has been built to new ore bins on road to Jean. Headframe at shaft has been erected, and Fairbanks-Morse hoist and self-dumping skips installed. Good-grade oreshoot has been opened on 150-ft. level, and 25-ft. winze from this level is all in ore.

Elko County

ALPHA (Jarbidge)—New strike of 4-ft. vein of milling grade ore is reported.

SUCCESS (Jarbidge)—An option has been taken on this claim, It and American Man by Cincinnati men.
this shoot at depth.

ANTELOPE MINING CO. (Contact)—Three 40-ft. shafts have been sunk and 100-ft. tunnel driven in ore. Development work is being done in tunnel.

SEATTLE-CONTACT COPPER CO. (Contact)—Shipments of ore are being made via Rogerson. Ore is sorted and averages 20% copper. New 50-ft. winze has opened shoot of high-grade oxidized ore. A tunnel will be driven to cut

Esmeralda County

NANCY DONALDSON (Goldfield)—It is reported that this mine in Red Mountain section will resume operations.

GOLDFIELD-DOUBLE TRIANGLE (Goldfield)—A 16-hp. gasoline hoist has been installed at this property 25 miles east of Goldfield, in Cactus range. Other companies doing work in district are: Bailey, New Lincoln, Rocket, and Thompson.

SILVERFIELD MINING CO. (Millers)—This property in Monte Cristo range is being developed through 230-ft. shaft. Hoist has been installed. Crude oil will be used as it is more economical than gasoline.

Humboldt County

NEVADA SHORT LINE R.R., it is reported, will be extended six miles to Rochester.

GOLDBANKS QUICKSILVER CO. (Goldbanks)—Furnace will be started in March. A 40-hp. engine for compressor and 15-hp. engine for crusher have been installed. It is planned to add two 30-ton furnaces to plant by end of year.

Lyon County

BLUESTONE (Mason)—A smelter-test run of several cars, it is stated, will be mined at once.

HAMILTON & POLLARD MILL (Silver City)—Operations were resumed recently after several weeks' shutdown on account of bad weather.

TRUCKEE RIVER GENERAL ELECTRIC CO.—Company is building branch power line from Dayton to Douglas tailings reservoir below Sutro. Plant is being built to treat these tailings.

NEVADA-DOUGLAS (Ludwig)—It is stated that three new oreshoots have been discovered in Casting Copper ground by diamond drilling. Casting Copper and Ludwig mines are supplying all ore being shipped at present. Further tests on leaching process in Denver have resulted in reducing cost of precipitation.

EMPIRE-NEVADA (Yerington)—In addition to this group, Miami Copper Co. has bonded Dillon property and has obtained control of Alberta townsite, south of old smelting plant. Many claims have also been located on flat west of Walker river and in foot-hills. Satisfactory progress is being made in churn drilling.

Nye County

PRODUCTION OF TONOPAH MINES FOR JANUARY: Tonopah Belmont, 15,009 tons; Tonopah Mining, 12,255; Montana-Tonopah, 4874; Tonopah Extension, 4717; West End Consolidated, 4600; Jim Butler, 2365; MacNamara, 1823; Merger, 921; North Star, 443; Midway, 200; total, 47,207; total gross value, $896,933.

HALIFAX (Tonopah)—Work on 1200- and 1400-ft. levels has been resumed.

TONOPAH EXTENSION (Tonopah)—Capacity of mill will be increased at once to 200 tons per day.

EAST END DEVELOPMENT CO. (Tonopah)—New headframe is to be erected. As soon as this is done sinking in 75-ft. shaft will be continued.

CASH BOY (Tonopah)—Crosscutting south on 1300-ft. level is being done. It is expected that this will cut ore-bearing formation on its north dip from Tonopah Extension.

NORTH STAR (Tonopah)—Ore is being treated at MacNamara mill. This is coming from C. E. K. vein on 1050-ft. level. East drift on 1050-ft. level has cut 3 ft. of mill ore. Good-grade ore is being stoped above 1130-ft. level.

PIONEER CONSOLIDATED MINES CO. (Pioneer)—Development on recent strike of high-grade ore on 225-ft. level is giving satisfactory results. Shoot has widened from 4 in. at point of discovery to 2 and 6 ft. of low-grade vein matter.

CARRARA MARBLE CO. (Carrara)—Some development has been done on talc beds on company's property. One deposit, outcropping 10 to 20 ft. and for distance of 375 ft., composed of blue and white talc, may be of commercial value.

MUSHETT-WITTENBERG (Manhattan)—Operations at Manhattan are showing signs of recovery from results of phenomenal snowfall and cold weather of last two months. After several shut-downs from various causes, main one being impassable condition of wagon roads upon which ore to mill has to be hauled, mill is now getting its receiving ore bins filled, and will be dropping stamps steadily from now on.

COLORADO RIVER HYDRO-ELECTRIC CO. (Tonopah)—Site for power plant was located four years ago north of Boulder Cañon, near Colorado River. Original filings have been perfected, final surveys will be completed in near future, and construction will commence in September. First line will be built to Kingman, Ariz. Plant will develop 25,000 to 40,000 hp. at start and will be increased as necessary.

MARS CHALCEDONY QUARRY (Manhattan)—Experimental mill for shaping pebbles has begun operations. Rough pieces are revolved dry, in a cylinder for 30 min. This wears off rough corners and rounds pebbles. Less perfect ones are recharged with rough stones. Rounded pebbles are then screened and sized. Rock is obtained in open cut from 18-ft. face. Large pieces broken down are reduced by cobbing; this gives best results. Pebbles can be placed on market at less cost than can European, and are as durable. Larger mill is to be built in near future.

MANHATTAN DEXTER (Manhattan)—Unwatering of 600-ft. main working shaft of Mushett-Wittenberg lease on southern portion of Union claim has been only work attempted. Heavy wind and snow storm, which put electric-power line out of commission for a day about four weeks ago, necessitated drawing of electric-station pump from 400-ft. level. By time that sinker could be put to work and with steady bailing of shaft water had gained so that all drifts and crosscuts on 400 had filled. When storm moderated, and surface water commenced to drain to lower levels in mine, rate of increase was so strong, that even with largest sinking pump in camp operating, and with additional air lines connected with Big Four compressor, it was found impossible to reduce water back to 400 level, where triplex station pump is installed. At present a centrifugal pump is aiding sinker being installed on 200-ft. level. Shaft is being drained by two pumps and by bailing with skip at rate of 60 gal. per min. While draining work has been most expensive and also slow, drifts on 400-ft. level are showing above water. Station pump will soon be placed in operation. As soon as 400-ft. level is reached ore in hanging wall of north drift will be worked on, and a milling lot taken out in but a few days.

Storey County

SILVER HILL MINING CO. (Virginia City)—Directors have authorized construction of 50-ton mill and cyanide plant on property in Devils Gate district in lower Gold Cañon.

STURGIS MINES (Virginia City)—Water in Crown Point and Belcher incline is being lowered by Byron Jackson sinking pumps. Shaft is being repaired as water is lowered. When 1600-ft. level is recovered it will be thoroughly repaired and mining will be started. Ore will be treated at Yellow Jacket mill.

NEW HAMPSHIRE

Carroll County

BREITUNG MINES CORPORATION (11 Pine St., New York)—Option has been taken on Madison zinc-lead mine, 3½ miles from Mount Whittier station on the Boston & Maine R.R. Property comprises 50 acres. Lode is 20 ft. wide in an open cut 125 ft. long. Zinc and lead are found in equal amounts, with a little silver. As soon as snow thaws property will be diamond-drilled by Giles & Clark, 30 Church St., New York.

NEW MEXICO

Eddy County

CARLSBAD DRILLING COMPANIES have experienced a season of difficulties, but now rigs of Hartford company, Carlsbad Oil & Gas Co. and others are again in operation.

Grant County

BELL & WRIGHT (Pinos Altos)—Lessees' property in litigation at present, plaintiffs charging they are mining high-grade ore on their property 15 ft. across line.

EIGHTY-FIVE CO. (Lordsburg)—Company has ordered 450-hp. Diesel engine, a 200-kw. generator and a 1500-cu.ft. air compressor. Work has been commenced on a 790-ft. tunnel making a new entrance to mine as present portal is inadequate for handling of ore.

Socorro County

MAUD MINING CO. (Mogollon)—Contractors have just finished sinking new working shaft to a depth of 700 ft. Crosscuts and drifts are to be started.

BREITUNG MINES CORPORATION (11 Pine St., New York)—Development of Comet group of 12 claims in Mogollon district has been started under direction of A. H. G. Palmer at five faces, two in winzes, and three in adits. A 4-ft. vein of shipping ore is being developed in one adit.

OREGON

Baker County

POWDER RIVER DREDGING CO. (Sumpter)—A gold nugget worth $1500 was taken from workings of this company.

SUMPTER VALLEY RY. CO. (Sumpter)—Expense budget of road for 1914 will include $100,000 for improvements. Ore and concentrates form principal revenue.

Gilliam County

HIGHLAND GOLD MINE CO. (Rock Creek)—A permanent injunction was given Feb. 25, restraining company from polluting waters of Rock Creek and Maxwell Creek with tailings from mill. Decree is in answer to a suit brought by 39 farmers with land on these creeks. Decree states that court does not order mill closed but it does order that further pollution of streams shall cease.

Josephine County

R. H. BAILEY is developing a promising property near Galice; he has recently interested Portland capital in the mine.

ALTHOUSE PLACER MINE CO. (Althouse, via Grants Pass)—Three carloads of machinery for this mine have arrived at Grants Pass and are being hauled to property in old Kerby district.

ORIOLE (Galice)—Machinery at mine is in place and mill will be operating soon. Ore has been shipped to Tacoma smelters for years during development of this property, but as soon as mill is in operation all shipments will stop.

SOUTH DAKOTA

Lawrence County

HEIDELBERG (Two Bit)—Second shipment of ore is being made to Golden Reward cyanide mill at Deadwood.

MINNESOTA (Maitland)—Work of dewatering underground workings is completed and examination started. Favorable report will mean resumption by new management amply financed. Property is equipped with good hoisting and air-compressing plant and 150-ton cyanide mill.
extensive improvements.

UTAH

Beaver County

MONITOR (Milford)—A hoist is being installed at this property, near Moscow.

CAVE MINE (Milford)—Some new equipment is being installed following opening of new orebody recently by lessees.

RED WARRIOR (Milford)—Leasing system has been adopted, and leases in both upper and lower workings have been given to former employees, who are well acquainted with ground.

Juab County

CHIEF CONSOLIDATED (Eureka)—A new reservoir is being built to store water from melting snow, etc.; 10,000 cu.ft. of ground will be excavated.

TINTIC STANDARD (Eureka)—Winze below 1000 level is down 60 ft., and has been following 8 to 10 in. of solid galena.

EAGLE & BLUE BELL (Eureka)—Net earnings for 1913 were $147,198, as compared with $89,875 for year preceding.

Piute County

BEAVER MINES (Marysvale)—Ore carrying gold has been opened in this company's main tunnel, which is in 540 ft. Vein is up to 7 ft. between walls. There is a small amount of silver.

San Juan County

URANIUM MINING (Moab)—This company has been incorporated to operate carnotite claims at Kane Springs, 17 miles southwest of Moab, on road to Monticello. Capitalization is $100,000 in shares of $1 each. J. L. Wade, L. I. Taylor and David Taylor are chief owners. Same interests have been shipping ore carrying uranium and vanadium from claims near Thompsons, in Grand County, for last six months.

Summit County

FEBRUARY SHIPMENTS FROM PARK CITY totaled 6101 tons of crude ore and concentrates, as compared to 6742 tons during January. Shipments for week ended Feb. 21 amounted to 2,912,600 lb.; those for week ended Feb. 28, to 2,862,160 lb.

DALY (Park City)—Ore from 800- and 1200-ft. levels has recently been shipped; 25 men are working. Mine was closed down for a short time, owing to an accident to machinery.

SILVER KING CONSOLIDATED (Park City)—Annual report for 1913 shows $308,791 dividends paid. There is a cash balance of $384,858. All litigation has been settled, excepting a suit for partition of mining claims owned in common with Silver King Coalition Co., and a disagreement over attorneys' fees in litigation recently concluded. Sinking the shaft 500 ft. to the 1800 level cost $46,699, exclusive of timbers and supplies. From November, 1913, to Feb. 25, 1914, 3½ months, 2280 ft. of development was done. Of this 1537 ft. was in mineral ground, and 1326 tons of first-class ore, and 2100 tons of second-class was mined. Second-class carried 10 oz. silver and 5% lead. First-class averaged $41.34 per ton, and gave net smelter returns of $33.90. Gross production brought $44,951. Expenses during last 3½ months, including machinery and supplies, totaled $41,330.

WASHINGTON

Ferry County

REPUBLIC—Rathfon Reduction Works of Republic has taken this mine over and will reopen same. New owners intend to install a number of new improvements.

CHICAMUN—Little Michigan Co. will do extensive development work on this group of claims at Orient coming season. New machinery is now being installed. J. C. Argall of Spokane, is interested.

Okanogan County

JOHN MAQUAY—This property at Wanicut lake has been purchased by Henry Bahrs and a number of other West Virginia mining men. New machinery is being installed.

Stevens County

BIG B (Chewelah)—This company has been incorporated with capital of $1,250,000 to develop a property in Chewelah.

MAYFLOWER (Cheweiah)—Claims have been leased to Charles F. Soderling and others, of Spokane, who will drive a tunnel and do considerable other development work.

PEACOCK—R. A. Hutchinson, owner of this mine, has leased it to E. E. Alexander for 10 years. A concentrator will be built.

WISCONSIN

Grant County

WEST HILL (Platteville)—Company will build small mill on Stephens land just west of city limits.

BENTON-SHULLSBURG—W. J. Power and others, of Hibbing, Minn., have taken an option on this property in New Diggings Township.

LITTLE JACK (Platteville)—A company of Minneapolis men have resumed development work on Loomis land one mile west of Platteville.

WILSON—This company is overhauling its mill and mining plant preparatory to resuming operations at the old Preston Point property near Potosi.

SEGELKE LAND—H. E. Stephens has obtained a lease on this land just east and adjoining Homestead mine; drilling machines have been started to prospect ground and Homestead mine will be reopened.

CANADA

British Columbia

PLACER GOLD IN AMOS AND GOLD CREEKS, two small streams running into the Pacific about 40 miles south of Quatsino Sound, on Vancouver Island, has lately been discovered Pans running as high as 65c. were taken out and five men are now working on the claims under the direction of H. E. Neave. An old tunnel was found on one creek that had been driven about 30 ft. into gravel. Judging from trees that have grown at mouth of it since it was abandoned, it is thought to have been the work of Spaniards, as it appears to be several hundred years old.

GRANBY (Anyox)—Delay in starting operations at smelting plant is due to a leakage in rock-filled crib dam, and company will replace dam with one of cement if silt brought with spring floods is not sufficient to calk it. Plant is completed ready to operate.

Ontario

THREE NATIONS (South Porcupine)—It is stated that this company will raise sufficient money to finance further development of this property and to install a cyanide plant.

McINTYRE (Schumacher)—A crosscut is being driven south across lake from 600-ft. level of Pearl Lake shaft in order to open up lower levels of McIntyre and prospect ground underneath lake. At about 300 ft. from Pearl Lake shaft, crosscut penetrated 30 ft. of ore assaying $8 per ton.

MEXICO

Sonora

MINES CO. OF AMERICA—Dolores property idle. Preparations are being made to operate El Rayo; Creston Colorado and Butters property purchased last year are working. La Dura idle as railroad is not being operated.

COLOMBIA

MARQUETTE-MAGDALENA CO. (D. Gordon Smith, Topacio, via Caceri)—This Breitung Mines subsidiary is developing Topacio property of Robert Farley on Caceri Creek, a branch of the Nechi. Property includes Farley placer, but more attention is now being directed to development of lode mine in which five adits have been driven at different levels to open a 6-ft. vein. Work is at present being done on fifth level.

The Market Report

METAL MARKETS

NEW YORK—March 11

The metal markets have generally inclined to dullness during the past week, and prices have shown some declines.

Copper, Tin, Lead and Zinc

Copper—A somewhat larger volume of business is reported both for home trade and export, but it has been consummated at the expense of prices. It is noteworthy that the sales have been for early delivery. Stocks in the hands of consumers, on this side at least, appear to be depleted, and while thus far buyers have not had sufficient confidence to contract ahead for future delivery, the lower prices that have been current lately have proved attractive and have caused them to provide for their early wants. The demand was freely met by nearly all sellers. Asking prices have been nothing but a matter of form, something to begin from in talking business. During most of the week copper has been offered freely at 14¼c., delivered, usual terms, and in the last few days there have been concessions from that.

Quotations for Lake copper are but nominal, the old conditions continuing to prevail in this market.

The average of quotations of electrolytic for the week is 14.071 cents.

The London standard market has fluctuated within very narrow limits—around £64 for spot and £64 10s. for three months. It closes at £63 15s. for spot and £64 5s. for three months.

Base price of copper sheets is now 20c. per lb. for hot rolled and 21c. for cold rolled. The usual extras are charged and higher prices for small quantities. Copper wire is 15¾ @16c., carload lots at mill.

Exports of copper from New York for the week were 7052 long tons. Our special correspondent reports exports from Baltimore for the week at 3133 tons.

Imports of copper in Germany in January were 14,764 long tons; exports, 663 tons, leaving 14,101 tons as the net imports for the month.

Tin—The market is very dull and is characterized by an entire absence of demand. Efforts were made to stimulate trading by underquoting the importation price, without, however, much success. Consumers seem to be well covered, so far at least as their near-by wants are concerned, and no interest is, therefore, shown in spot material. As the level of prices is low, comparatively, a firmer tendency displayed for a few days by the London market would no doubt create a buying movement. The market closes steady at £173 10s. for spot and £175 7s. 6d. for three months, and about 37½c. for March tin here.

Messrs. Robertson and Bense report receipts of tin ore and concentrates at Hamburg, Germany, in January, at 1011 tons from Bolivia and 38 tons from South Africa; a total of 1049 tons.

Lead—A fair business has been done both in the East and in the West. Some tonnage sold at 3.90c., St. Louis.

The London market is unchanged, Spanish lead being quoted £20, and English lead 12s. 6d. higher.

Spelter—Somewhat more business has been placed this week, some considerable lots being reported sold at 5.12½c., St. Louis.

The London market is unchanged, good ordinaries being quoted £21 10s.; specials, 10s. higher.

Base price of zinc sheets is unchanged at $7.25 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

Nickel—Quotations for ordinary forms—shot, blocks, or plaquettes—are 40@45c. per lb., according to size of order and quality. Electrolytic nickel is 5c. per lb. higher.

Cadmium—German quotation is 750 marks per 100 kg.—equal to about 81c. per lb.—f.o.b. works in Silesia.

Magnesium—The current quotation for pure metal is $1.50 per lb. for lots of 100 lb. or over, at New York.

Other Metals

Aluminum—The market continues dull, with sales on a moderate scale only. Prices are unchanged, at 18½@19c. per lb. for No. 1 ingots, New York. The foreign market is also rather quiet, but steady.

Antimony—Business remains quiet, with a fair jobbing demand. Cookson's is quoted at 7.20@7.35c. per lb., and Hallett's at 7@7.15c.; while 6@6.15c. is named for Chinese, Hungarian and other outside brands.

Quicksilver—Business is good. New York quotations remain unchanged at $39 per flask of 75 lb. for large lots, and 54c. per lb. on small orders; San Francisco at $38.50 per flask for domestic orders. London price is £7 10s. per flask, with £7 quoted from second hands.

DAILY PRICES OF METALS

NEW YORK

Mar.	Sterling Exchange	Silver	Copper		Tin	Lead		Zinc	
			Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
5	4.8585	58⅛	14½ @15*	14.10 @14.15	38	4.00	3.87½ @3.90	5.25 @5.30	5.10 @5.15
6	4.8580	58¼	14½ @15*	14.05 @14.15	37⅞	4.00	3.87½ @3.92½	5.25 @5.30	5.10 @5.15
7	4.8575	58¼	14½ @15*	14.00 @14.10	37⅞	4.00	3.87½ @3.92½	5.25 @5.30	5.10 @5.15
9	4.8580	58¼	14½ @15*	14.00 @14.10	37⅞	4.00	3.87½ @3.92½	5.25 @5.30	5.10 @5.15
10	4.8580	58¼	14½ @15*	14.00 @14.10	37⅞	4.00	3.87½ @3.92½	5.25 @5.30	5.10 @5.15
11	4.8590	58¼	14½ @15*	14.00 @14.10	37⅞	4.00	3.87½ @3.92½	5.25 @5.27½	5.10 @5.12½

*Nominal.

The quotations herein given are our appraisal of the markets for copper, lead spelter and tin based on wholesale contracts; and represent, to the best of our judgment, the prevailing values of the metals specified as indicated by sales by producers and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.15c. apart. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. below that of electrolytic; of casting copper 0.15 to 0.25c. below. The quotations for lead represent wholesale transactions in the open market for good ordinary brands; the specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb., are: St. Louis-New York, 15½c.; St. Louis-Chicago,6c.; St. Louis-Pittsburgh, 12½c.; New York-Bremen or Rotterdam, 15c.; New York-Havre, 16@17½c.; New York-London, 16c.; New York-Hamburg, 18c.; New York-Trieste,22 c.

LONDON

Mar.	Silver	Copper				Tin		Lead		Zinc	
		Spot		3 Mos.	Best Sel'td	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
		£ per Ton	Cts. per Lb.								
5	27	64¼	13.96	64 11/16	69	174	176	19⅞	4.32	21½	4.67
6	26⅞	64¼	13.96	64⅛	69	172⅞	174⅞	20	4.35	21½	4.67
7	26⅞	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
9	26 13/16	64	13.90	64 1/16	69	171⅞	173⅛	20	4.35	21½	4.67
10	26 13/16	63 15/16	13.89	64⅛	68½	172⅛	174½	20	4.35	21½	4.67
11	26 13/16	63¾	13.85	64¼	68½	173½	175⅜	20	4.35	21½	4.67

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latte being subject to 3 per cent. discount. 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: £10 = 2.17½c.; £15 = 3.26c = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 0.21¾c.

Selenium—For large lots, 100 lb. or over, $3@3.25 per lb. is quoted; while $5 per lb. is paid for retail orders.

Exports from Baltimore for the week included 2926 lb. selenium to Hamburg.

Gold, Silver and Platinum

Gold—The price of gold on the open market in London, which had been in the previous week at a premium as high as ½d., receded this week to the normal figures, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. With the exception of £130,000 for India, all the gold arriving was taken for the Continent, chiefly for France.

Gold in the United States Mar. 2 is estimated by the Treasury Department as follows: Held by Treasury against gold certificates outstanding, $1,140,698,969; in Treasury current balance, $167,662,188; in banks and circulation, $611,907,591; total, $1,920,268,748, an increase of $3,455,192 during February.

Sales of gold bars from the New York Assay Office in February were $2,741,624. For the two months ended Feb. 28 the total sales were $5,479,803 in 1913, and $5,656,157 in 1914; an increase of $176,354 this year. Deliveries of gold for export were $14,066,382 for the two months.

The cable reports the production of gold in the Transvaal in February at 626,000 oz., making for the two months ended Feb. 28 a total of 1,277,000 oz., which is a decrease of 246,512 oz. from last year.

Platinum—The market abroad has been slightly speculative, but the movement has not been reflected here. Refined platinum is quoted at $43@44 per oz., while $46@49 per oz. is asked for hard metal.

Silver continues steady. The London demand is limited, and though supplies from this side are curtailed, more than 2,000,000 oz. per month, owing to the contraction of Mexican supplies, yet for the present the offerings seem to be enough to satisfy the commercial demands.

Shipments of silver from London to the East, Jan. 11 to Feb. 26, as reported by Messrs. Pixley & Abell:

	1913	1914	Changes
India	£1,247,900	£ 924,000	D. £ 323,900
China	95,000	40,000	D. 55,000
Total	£1,342,900	£ 964,000	D. £ 378,900

Exports for the week were about the heaviest reported this year, including £30,000 to Shanghai and £249,500 to India. The Continent of Europe continues to take a good amount of silver.

Coined silver in the United States is reported as follows by the Treasury Department: Standard dollars, $565,754,263; subsidiary coins, $179,530,024; total, $745,284,287. Of the standard dollars, $473,873,000 are held in Treasury against silver certificates outstanding.

Zinc and Lead Ore Markets

Joplin, Mo.—Mar. 7

Zinc blende sold at $44 for choice lots, the assay base ranging from $38 to $41.50, and the metal base from $37 to $40 per ton of 60% zinc. The calamine base price remains at $21@23 per ton of 40% zinc. The average of all grades is $39.86. Lead sold as high as $54, the base being still reported at $50 per ton of 80% metal content. The average of all grades is $50.12 per ton.

Weather conditions were very good throughout the week for the season and a strong average output was made. With the reduced price offerings this week followed a heavier buying movement largely for future delivery, the most active buying coming at the week-end.

SHIPMENTS WEEK ENDED MAR. 7

	Blende	Calamine	Lead	Value
Total this week..	10,079,430	481,680	1,958,910	$259,590
Total 10 weeks...	98,629,860	5,636,670	17,650,580	$2,521,305

Blende value, the week, $205,170; 10 weeks, $2,016,020.
Calamine value, the week, $5325; 10 weeks, $62,225.
Lead value, the week, $49,095; 10 weeks, $442,970.

PLATTEVILLE, WIS.—Mar. 7

The market dropped off a few points this last week, the base price for 60% ore being $41 per ton. A premium of $42 was paid. The base price for 80% lead ore was $50 per ton.

SHIPMENTS WEEK ENDED ,MAR. 7

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week	3,377,870	134,860	1,150,620
Year	28,005,480	1,002,720	9,915,990

Shipped during week to separating plants, 2,893,670 lb. zinc ore.

MONTANA ZINC ORES

The Butte & Superior Co. in February, 1914, produced 10,070 tons of concentrates, averaging 51¾% zinc.

IRON TRADE REVIEW

NEW YORK—March 11

While the iron and steel trades have been rather quiet, there is still a large volume of business, and a good degree of activity at the mills. Blast-furnace production increased notably in February, especially that of the steel companies, showing a disposition to prepare for better business.

A good deal has been said in the papers, especially those inclined to a high tariff, of a sale of pig iron by the Dominion Steel Co. to a Philadelphia firm. The quantity of this Cape Breton iron is 20,000 tons, which looks rather small when compared with the total production of iron last year. The price, delivered at Philadelphia, is not stated.

Traffic conditions are just recovering in the East from the bad blockade caused by the recent snowstorms and cold weather. Deliveries of material are still slow, but are much improved over the previous week. In the Central West the slow deliveries of coke and other material have mainly passed and conditions are normal again.

The closing of several large and important contracts for structural work is reported this week. Orders for the necessary steel will be placed soon.

The United States Steel Corporation reports its unfilled orders on Feb. 28 at 5,046,440 tons of material. This is an increase of 412,760 tons over the January report.

Pig-Iron Production in February showed an increase. The monthly reports of the furnaces, as collected by the "Iron Age," show that on Feb. 1, there were 214 coke and anthracite stacks in blast. Making allowance for the charcoal furnaces, the production of pig iron in the United States in February was 1,919,000 long tons; for the two months ended Feb. 28 it was 3,834,000 tons. Of this total, 2,591,560 tons, or 67.6% of the total, was made in furnaces owned and operated by steel companies.

The Steel Output of Germany in 1913 was 18,958,819 metric tons of ingots. The quantity of Thomas or basic bessemer steel was 10,629,697 tons, and basic openhearth, 7,339,314 tons. The total production in 1912 was 17,148,631 tons.

PITTSBURGH—Mar. 10

The Steel Corporation's report of unfilled tonnage at the close of February was unexpectedly favorable, showing an increase during February of 412,764 tons, or a larger increase than the 331,572 tons shown for January. The showing is the more remarkable in view of the fact that shipments were at a much heavier rate in February than in January. It is believed that an order for about 300,000 tons of plates from the Standard Oil Company figured in the February bookings.

The steel market is undeniably quiet. While the placing of contracts diminished early in February specifications against old contracts continued heavy during the major part of the month, but specifications have decreased in the past 10 days. While steel prices have not quotably declined they are hardly as firm as a fortnight ago and definite declines are expected early in April unless demand improves very materially. The mills are filled with specifications for about 30 days and are maintaining the same rate of operation as a fortnight ago, between 70 and 75% of capacity.

Sentiment in Pittsburgh steel circles has become depressed in the past week through the decrease in specifications received. While the disposition in most quarters is to attribute the decreased activity to the extreme cold weather which has pervaded nearly all consuming districts, there is an undertone of feeling that probably such an explanation is not altogether adequate.

The prospects as to railroad buying appear to be somewhat improved. There are reports that a fair volume of orders has been placed quietly and that there is a large volume of business in the form of requisitions which the railroads intend to place with a minimum of publicity, the effort to influence the Interstate Commerce Commission by a show of poverty being still very vigorously prosecuted.

Plates, bars and shapes are fairly steady at 1.20c., the Carnegie Steel Co. being practically alone in demanding 1.25c. As a result it is losing business to its competitors and it is probable that this month will end its abstention from ac-

tive pursuit of business, so that unless demand improves very considerably by Apr. 1 there will be a fresh period of price cutting.

Pig Iron—The basic pig-iron market is not over $13, Valley, some small sales having been made at not over this level, while there are rumors that 25c. less can be done, and it is even hinted that some recent buyers would dispose of a part of their purchases. The market has been openly quoted at $13.25 for two or three weeks but it is a question whether it ever was really established at that level. Bessemer is quiet and there is question whether the $14.25, Valley, quotation usually named could not be shaded on an interesting inquiry. Foundry iron is quiet, at $13.25@13.50, Valley.

Ferromanganese—The market is decidedly quiet. There are reports of cut-price material being offered, the regular quotation being $39, Baltimore, for prompt or forward, English or German.

Steel—There is no new demand for billets and sheet bars, and prices are not being tested. Shipments on sheet bar contracts are very good, as the sheet and tin mills are running at practically full capacity. There are rumors that some contracts made for billets delivered at eastern points are likely to be revised on account of low prices quoted on foreign material. The market remains quotable nominally at $21 for billets and $22 for sheet bars, for early delivery, with an advance of $1 for second quarter. Rods are $26@27, Pittsburgh.

Russian Pig-Iron Production in 1913 is reported at 4,660,000 metric tons, an increase of 610,000 tons over 1912. Deliveries of finished iron and steel from Russian works, so far as reported, were 2,435,900 tons, an increase of 580,480 tons over the preceding year.

IRON ORE

Nothing has been done yet as to the adjustment of prices for Lake Superior iron ore for the coming season. The season thus far seems to promise a late opening of navigation, and there is no hurry about supplies. Some furnaces have ore enough left over from last year to carry them for a time. Others are still in doubt about their requirements for the coming year. It will certainly be a month or more yet before the situation clears itself and the price question can be settled. Two Gogebic mines, the Newport and the Ashland, are reported to have made reservations.

COKE

Coke production is still on the increase, and the Connellsville "Courier" reported the total production last week at 313,870 short tons. Notwithstanding the bad weather shipments were large, 341,784 tons. The production of the Upper Connellsville and Greensburg districts for the week was 37,769 tons.

Connellsville Coke—A Shenango Valley merchant furnace interest has bought 7000 tons of furnace coke for March shipment at $2, ovens, and an eastern consumer is understood to have closed for about the same tonnage at this price. There is practically no interest in second quarter coke. Prompt furnace coke is a shade easier after the stiffness caused by the cold weather and is quotable at $1.90@2 at ovens.

Anthracite Shipments in February were 4,121,451 long tons, the lightest in many months, and 1,552,718 tons less than in February, 1912. For the two months ended Feb. 28 the shipments were 12,010,588 tons in 1913, and 9,297,183 in 1914; a decrease of 2,713,405 tons, or 22.6%, this year.

CHEMICALS

Arsenic—As noted last week, the larger buyers are now fairly well protected by contracts. The price is steady, being practically pegged at $3 per 100 lb. Buying is quiet.

Copper Sulphate—Sales are still rather slow, and the trade has not fully opened. Sulphate is firmly held, however, the prices remaining at $4.80 per 100 lb. for carload lots and $5.05 per 100 lb. for smaller parcels.

Nitrate of Soda—Dealers expect a good spring trade, and a firm market abroad is holding up prices. Quotations are 2.25c. per lb. for both spot and future positions.

Imports and Exports of Chemicals and raw materials in the United States, year ended Dec. 31:

	Imports		Exports	
Chemicals:	1912	1913	1912	1913
Arsenic, lb.	6,758,946	6,688,216	33,600	66,000
Copper sulphate, lb.	.....	.....	6,828,657	4,211,300
Bleach, lb.	74,235,256	61,605,077	400	13,200
Potash salts, lb.	42,072,827	47,041,478	583,913	1,002,277
Soda salts, lb.	11,609,950	11,176,463	431,407	534,470
Acetate of lime, lb.	.....	.....	76,562,803	74,055,648
Sulphur, tons	26,885	14,636	58,751	89,246
Ores, etc.:				
Pyrites, tons	964,478	848,674	.....	.....
Chrome ore, tons	53,929	65,180	.....	.....
Magnesite, tons	112,037	149,941	1,375	2,818
Fertilizers:				
Kainit, tons	511,994	465,850	.....	140
Manure salts, tons	171,208	223,292	.....	.....
Potash salts, tons	258,673	253,300	1,941	3,419
Nitrate of soda, tons	486,352	625,862	8,833	5,560
Sulph. ammonia, tons	53,163	58,728	150	.....
Phosphates, tons	.....	.....	1,106,420	1,366,508

Exports include reëxports of imported material of all kinds. Some phosphate is imported, but is not given separately in the returns.

COPPER SMELTER'S REPORTS

This table is compiled from reports received from the respective companies except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield then is reckoned at 97%. In computing the total American supply duplications are excluded.

	October	November	December	January	February
Alaska shipments	1,951,883	3,391,300	3,104,155	2,701,258	.....
Anaconda	18,400,000	25,250,000	25,100,000	24,400,000	21,300,000
Arizona, Ltd.	3,550,000	2,800,000	1,920,000	3,474,000	3,062,000
Copper Queen	8,292,929	7,115,991	9,033,459	8,796,358	6,987,366
Calumet & Ariz.	4,500,000	4,600,000	5,230,000	5,975,000	5,596,850
Chino	4,767,466	4,270,821	4,390,018	.....	.....
Detroit	1,861,878	1,922,352	2,021,034	1,590,681	1,814,214
East Butte	1,040,997	1,002,190	1,324,560	.....	.....
Giroux	156,084	250,000	197,649	143,411	.....
Mason Valley	1,052,000	1,174,000	1,372,000	944,000	.....
Mammoth	1,700,000	1,700,000	1,400,000	1,625,000	1,400,000
Nevada Con.	5,898,046	5,443,647	5,343,862	5,791,122	.....
Ohio	698,691	772,120	722,940	700,728	.....
Old Dominion	2,037,000	2,450,000	2,613,039	2,797,000	3,066,000
Ray	4,725,419	4,753,964	5,075,202	5,705,000	.....
Shannon	1,216,000	1,110,000	1,078,000	.....	904,000
South Utah	232,269	225,072	242,362	275,569	.....
Tennessee	1,392,162	1,666,753	1,700,000	1,474,890	.....
United Verde*	3,000,000	3,000,000	3,000,000	.....	.....
Utah Copper Co.	9,929,478	10,787,426	10,306,646	10,329,564	.....
Lake Superior*	5,500,000	6,600,000	5,600,000	7,400,000	8,500,000
Non-rep. mines*.	6,200,000	6,000,000	6,250,000	6,200,000	.....
Total prod.	88,102,302	96,285,636	97,024,926	.....	.....
Imp., bars, etc.	21,935,023	21,796,866	23,578,938	.....	.....
Total blister	110,037,325	118,082,502	120,603,864	.....	.....
Imp. ore & matte.	5,062,015	8,980,186	12,205,187	.....	.....
Total Amer.	115,099,340	127,062,688	132,809,053	.....	.....
Miami†	2,862,050	3,230,000	3,210,000	3,258,950	3,193,300
Shattuck-Arizona	993,224	995,429	1,050,781	1,276,636	.....
Brit. Col. Cos.:					
British Col. Cop.	688,581	655,637	.....	.....	.....
Granby	1,718,258	1,944,145	1,605,382	1,793,840	.....
Mexican Cos.:					
Boleo†	2,424,800	2,315,040	2,315,040	2,369,920	.....
Cananea	3,682,000	3,800,000	3,646,000	3,460,000	2,688,000
Moctezuma	3,178,136	3,517,800	3,139,613	3,024,556	2,642,543
Other Foreign:					
Braden, Chile	2,006,000	1,592,000	2,122,000	2,430,000	2,362,000
Cape Cop., S. Af.	712,320	649,600	683,200	519,680	.....
Kyshtim, Russia.	.....	.....	.....	.....	.....
Spassky, Russia.	983,360	904,960	900,480	902,720	.....
Exports from					
Chile	6,160,000	7,616,000	10,640,000	5,488,000	.....
Australia	7,728,000	11,200,000	6,720,000	,712,000	.....
Arrivals–Europe‡	18,040,960	9,107,840	13,787,200	8,599,360	.....

† Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.
‡ Does not include the arrivals from the United States, Australia or Chile.

STATISTICS OF COPPER

	United States			Visible Stocks.		
Month	U.S.Refin'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
Year, 1912	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
III '13.	136,251,849	76,585,471	77,699,306	122,302,890	81,244,800	203,547,690
IV.	135,353,402	78,158,837	85,894,727	104,269,270	87,180,800	191,450,070
V.	141,319,416	81,108,321	68,285,978	75,549,108	85,948,800	161,497,908
VI.	121,860,853	68,362,571	68,067,901	67,474,225	77,235,200	144,709,425
VII.	138,074,602	58,904,192	78,480,071	52,814,606	77,904,000	124,808,606
VIII.	131,632,362	73,649,801	73,263,469	53,594,945	66,420,480	120,015,385
IX.	131,401,229	66,836,897	73,085,275	38,314,037	63,716,800	102,030,837
X.	139,070,481	68,173,720	68,123,473	29,793,094	53,625,600	83,418,692
XI.	134,087,708	48,656,858	70,067,803	32,566,382	48,787,200	81,353,582
XII.	138,990,421	21,938,570	73,542,413	47,929,429	46,592,000	94,521,429
Yr., '13	1,622,450,829	767,261,760	869,062,784	.....	.....	.....
I, 1914.	131,770,274	47,956,955	87,955,501	91,438,867	53,916,800	145,355,667
II.	122,561,007	47,586,657	83,899,183	87,296,685	50,108,800	137,405,485
III.	.....	.....	.....	78,371,852	47,376,000	125,747,852

Note—Visible supplies in Europe do not include copper afloat.

Assessments

Company	Delinq.	Sale	Amt.
Alpine Galena, Utah	Mar. 6	Mar. 26	0.0015
Amador, Ida., postp'd	.....	Mar. 21	0.025
Andes, Nev	Mar. 6	Mar. 27	0.03
Atlas Wonder, Nev	Feb. 24	Mar. 18	0.005
Belmont, Ida	Feb. 28	Jan. 24	0.003
Buclimo, Calif	Feb. 24	Mar. 24	0.03
Butte & Yerington, Nev	Feb. 20	Mar. 20	0.005
C. & R., Ida., postp'd	.....	Mar. 24	0.005
Challenge, Nev	Feb. 25	Mar. 18	0.05
Crown Point, Nev	Mar. 2	Mar. 23	0.10
Exchequer, Nev	Mar. 4	Mar. 25	0.02
Galena King, Utah	Mar. 6	Mar. 26	0.0015
Gould & Curry, Nev	Mar. 10	Mar. 30	0.03
Grutil, Utah	Mar. 11	Mar. 28	0.002
Manhattan Cons., Nev	Feb. 19	Mar. 21	0.01
Moonlight, Ida	Jan. 24	Feb. 28	0.005
Monarch-Pittsburgh, Nev	Feb. 16	Mar. 16	0.01
Nabob, Ida	Feb. 23	Mar. 23	0.005
Nebo National, Utah	Mar. 10	Mar. 31	0.001
Ploche Coalition, Nev	Mar. 10	Mar. 30	0.05
Potosi Gold & Silver, Nev	Feb. 24	Mar. 20	0.01
Saltese Cons., Ida	Feb. 16	Mar. 16	0.002
Secret, Utah	Mar. 10	Mar. 30	.00125
Sierra Nevada, Nev	Mar. 2	Mar. 25	0.10
Sunset, Ida	Mar. 7	Mar. 28	0.0015
Tarbox, Ida., postp'd	.....	Mar. 28	0.002
Yankee Cons., Utah	Mar. 7	Mar. 23	0.02

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1912	1913	1914	1912	1913	1914
January	56.260	62.938	57.572	25.887	28.983	26.553
February	59.043	61.642	57.506	27.190	28.357	25.578
March	58.375	57.870	.....	26.875	26.669	.....
April	59.207	59.490	.....	28.284	27.416	.....
May	60.880	60.361	.....	28.038	27.825	.....
June	61.290	58.990	.....	28.215	27.199	.....
July	60.654	58.721	.....	27.919	27.074	.....
August	61.606	59.293	.....	28.375	27.335	.....
September	63.078	60.640	.....	29.088	27.986	.....
October	63 471	60.793	.....	29.299	28.083	.....
November	62.792	58.995	.....	29.012	27.263	.....
December	63.365	57.760	.....	29.320	26.720	.....
Year	60.835	59.791	.....	28.042	27.576	.....

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

COPPER

Month	New York				London Standard	
	Electrolytic		Lake			
	1913	1914	1913	1914	1913	1914
January	16.488	14.223	16.767	14.772	71.741	64.304
February	14.971	14.491	15.253	14.946	65.519	65.259
March	14.713	.....	14.930	.....	65.329	.....
April	15.291	.....	15.565	.....	68.111	.....
May	15.436	.....	15.738	.....	68.807	.....
June	14.672	.....	14.871	.....	67.140	.....
July	14.190	.....	14.563	.....	64.166	.....
August	15.400	.....	15.904	.....	69.200	.....
September	16.328	.....	16.799	.....	73.125	.....
October	16.337	.....	16.913	.....	73.383	.....
November	15.182	.....	16.022	.....	68.275	.....
December	14.224	.....	14.904	.....	65.223	.....
Year	15.269	.....	15.686	.....	68.335	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN

Month	New York		London	
	1913	1914	1913	1913
January	50.298	37.779	238.273	171.905
February	48.766	39.830	220.140	181.556
March	46.832	.....	213.615	.....
April	49.115	.....	224.159	.....
May	49.038	.....	224.143	.....
June	44.820	.....	207.208	.....
July	40.260	.....	183.511	.....
August	41.582	.....	188.731	.....
September	42.410	.....	193.074	.....
October	40.462	.....	184.837	.....
November	39.810	.....	180.869	.....
December	37.635	.....	171.786	.....
Av. year	44.252	.....	206.279	.....

New York in cents per pound; London in pound sterling per long ton.

LEAD

Month	New York		St. Louis		London	
	1913	1914	1913	1914	1913	1914
January	4.321	4.111	4.171	4.011	17.114	19.665
February	4.325	4.048	4.175	3.937	16.550	19.606
March	4.327	.....	4.177	.....	15.977	.....
April	4.381	.....	4.242	.....	17.597	.....
May	4.342	.....	4.226	.....	18.923	.....
June	4.325	.....	4.190	.....	20.226	.....
July	4.353	.....	4.223	.....	20.038	.....
August	4.624	.....	4.550	.....	20.406	.....
September	4.698	.....	4.579	.....	20.648	.....
October	4.402	.....	4.253	.....	20.302	.....
November	4.293	.....	4.146	.....	19.334	.....
December	4.047	.....	3.929	.....	17.798	.....
Year	4.370	.....	4.238	.....	18.743	.....

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

SPELTER

Month	New York		St. Louis		London	
	1913	1914	1913	1914	1913	1914
January	6.931	5.262	6.854	5.112	26.114	21.583
February	6.239	5.377	6.089	5.227	25.338	21.413
March	6.078	.....	5.926	.....	24.605	.....
April	5.641	.....	5.491	.....	25.313	.....
May	5.406	.....	5.256	.....	24.583	.....
June	5.124	.....	4.974	.....	22.143	.....
July	5.278	.....	5.128	.....	20.592	.....
August	5.658	.....	5.508	.....	20.706	.....
September	5.694	.....	5.444	.....	21.148	.....
October	5.340	.....	5.188	.....	20.614	.....
November	5.229	.....	5.083	.....	20.581	.....
December	5.156	.....	5.004	.....	21.214	.....
Year	5.648	.....	5.504	.....	22.746	.....

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

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1913	1914	1913	1914	1913	1914
January	$18.15	$14.94	$17.35	$13.23	$18.59	$13.90
February	18.15	15.06	17.22	14.12	18.13	14.09
March	18.15	.....	16.96	.....	17.53	.....
April	17.90	.....	16.71	.....	16.40	.....
May	17.68	.....	15.80	.....	15.40	.....
June	17.14	.....	15.40	.....	15.10	.....
July	16.31	.....	15.13	.....	14.74	.....
August	16.63	.....	15.00	.....	14.88	.....
September	16.65	.....	15.04	.....	14.93	.....
October	16.60	.....	14.61	.....	14.80	.....
November	16.03	.....	13.91	.....	14.40	.....
December	15.71	.....	13.71	.....	14.28	.....
Year	$17.09	.....	$15.57	.....	$15.77	.....

STOCK QUOTATIONS

COLO. SPRINGS Mar. 10

Name of Comp.	Bid.
Acacia	.02½
Cripple Cr'k Con	‡.007
C. K. & N	.07½
Doctor Jack Pot	.06
Elkton Con	.46½
El Paso	1.50
Findlay	‡.02
Gold Dollar	.02½
Gold Sovereign	‡.01½
Golden Cycle	‡1.50
Isabella	.09½
Jack Pot	.06
Jennie Sample	.04
Jerry Johnson	.03½
Lexington	.003
Old Gold	.01
Mary McKinney	.55
Pharmacist	.008
Portland	1.02
Vindicator	.88½

SALT LAKE Mar. 10

Name of Comp.	Bid.
Beck Tunnel	.05
Black Jack	.07
Cedar Talisman	.01
Colorado Mining	.10½
Crown Point	.01½
Daly-Judge	5.10
Gold Chain	.15
Grand Central	‡.56
Iron Blossom	1.17½
Little Bell	.15
Lower Mammoth	.01½
Mason Valley	2.00
May Day	.05½
Nevada Hills	.34
New York	‡.02
Prince Con	.17
Silver King Coal'n	3.35
Sioux Con	.02½
Uncle Sam	.05
Yankee	.04½

TORONTO Mar. 10

Name of Comp.	Bid.
Bailey	.09¾
Coniagas	8.00
Peterson Lake	.43
Right of Way	.03½
T. & Hudson Bay	75.00
Timiskaming	.19
Wettlaufer-Lor	.06
Big Dome	15.20
Crown Chartered	.00½
Dome Exten	.11½
Foley O'Brien	.20
Hollinger	13.35
Imperial	.01¼
Jupiter	.14
Pearl Lake	.08¾
Porcu. Gold	.13½
Preston E. D	.01¼
Rea	.15
Swastika	.04
West Dome	.14

SAN FRANCISCO Mar. 10

Name of Comp.	Bid.
Comstock Stocks	
Alta	.10
Belcher	.40
Best & Belcher	.05
Caledonia	.85
Challenge Con	.09
Chollar	.02
Confidence	.40
Con. Virginia	.23
Crown Point	.55
Gould & Curry	.04
Hale & Norcross	.06
Mexican	1.10
Occidental	.70
Ophir	.50
Overman	.25
Potosi	.02
Savage	.10
Sierra Nevada	.16
Union Con	.14
Yellow Jacket	.50
Misc. Nev. & Cal.	
Belmont	7.75
Jim Butler	.95
MacNamara	.08
Midway	.36
Mont.-Tonopah	.99
North Star	.37
West End Con	.92
Atlanta	.23
Booth	.05
C.O.D. Con	.04
Comb. Frac	.08
Jumbo Extension	.25
Pitts.-Silver Peak	.35
Round Mountain	.38
Sandstorm Kendall	.09
Silver Pick	.06
Argonaut	2.75
Bunker Hill	1.90
Central Eureka	.66
So. Eureka	‡1.75

N. Y. EXCH. Mar. 10

Name of Comp.	Clg.
Amalgamated	74⅜
Am.Sm.&Ref.,com	68⅜
Am. Sm. & Ref., pf.	102½
Am. Sm. Sec., pf. B.	82
Anaconda	35½
Batopilas Min	1
Bethlehem Steel, pf.	82
Chino	41⅛
Federal M. & S., pf.	35
Great Nor., ore., ctf	36⅛
Guggen. Exp	53⅛
Homestake	118
Inspiration Con	16⅛
Miami Copper	22⅛
Nat'l Lead, com	49⅛
National Lead, pf	106⅛
Nev. Consol	15⅜
Phelps Dodge	183
Pittsburg Coal, pf.	92½
Quicksilver, pf	2½
Ray Con	20⅞
Republic I&S, com.	25⅜
Republic I&S, pf.	90½
SlossSheffil'd, com	32⅛
Sloss Sheffield, pf.	91
Tennessee Copper	35
Utah Copper	53⅜
U. S. Steel, con	64⅜
U. S. Steel, pf	109⅜
Va. Car. Chem., pf.	105

BOSTON EXCH. Mar. 10

Name of Comp.	Clg.
Adventure	1½
Ahmeek	295
Alaska Gold M	21½
Algomah	1⅜
Allouez	40
Am. Zinc	18½
Ariz. Com., ctfs	5 5/16
Bonanza	.60
Boston & Corbin	‡.50
Butte & Balak	3
Calumet & Ariz	66⅜
Calumet & Hecla	420
Centennial	16½
Cliff	2½
Copper Range	37½
Daly West	2½
East Butte	1½
Franklin	5½
Granby	84½
Hancock	19
Hedley Gold	27
Helvetia	.45
Indiana	5
Island Cr'k, com	46½
Island Cr'k, pfd	86½
Isle Royale	20½
Keweenaw	4½
Lake	8⅜
La Salle	4⅜
Mass	2½
Michigan	1
Mohawk	43
New Arcadian	5½
New Idria Quick	‡3½
North Butte	28½
North Lake	1½
Ojibway	1⅜
Old Dominion	52½
Osceola	78
Quincy	62½
Shannon	6½
Shattuck-Ariz	27⅞
Superior	29½
Superior & Bost	2 5/16
Tamarack	39½
Trinity	4
Tuolumne	.63
U. S. Smelting	40
U. S. Smelt'g, pf.	47½
Utah Apex	2 1/16
Utah Con	10½
Victoria	1
Winona	4½
Wolverine	45
Wyandot	.90

N. Y. CURB Mar. 10

Name of Comp.	Clg.
Ariz. Belmont	‡.03½
Barnes King	‡1⅛
Beaver Con	.31
Big Four	.15
Boston Montana	6⅛
Braden Copper	7½
B. C. Copper	1⅛
Buffalo Mines	1⅛
Can. G. & S	.05
Caribou	.73
Con. Ariz. Sm	.50
Coppermines Cons	2 13/32
Davis-Daly	1 5/32
Diam'field-Daisy	.04
Ely Con	.04½
Florence	.60
Gold Hill Con	.48
Goldfield Con	1⅞
Greene Cananea	37
Greenwater	.07
Internat. S. & R	106
Kerr Lake	4 11/16
La Rose	1⅜
McKinley-Dar-Sa	1½
Mines of Am	2⅜
New Utah Bingham	.57
Nipissing Mines	6⅛
Ohio Copper	⅜
Oro	.13½
Puebla S. & R	2½
South Utah M&S	‡.25
Stand'd Oil of N.J.	414
Stand'd Silver Lead	1 13/16
Stewart	1½
Tonopah	7
Tonopah Ex	1 5/16
Tonopah Merger	.55
Tri-Bullion	⅛
Tularosa	.50
United Cop., pfd	‡3½
Yukon Gold	3

BOSTON CURB Mar. 10

Name of Comp.	Bid.
Bingham Mines	.04½
Boston Ely	.45
Butte & Lon'n Dev	.37
Cactus	.01⅜
Calaveras	1 1/16
Chief Cons	1
Corbin	.99
Cortez	.30
Crown Reserve	1 13/16
Eagle & Blue Bell	.96
First Nat. Cop	2 1/16
Houghton Copper	3
Majestic	.27
Mexican Metals	.22
Moneta Porc	‡.01
Nevada-Douglas	1
New Baltic	2½
Oneco	1⅛
Raven Copper	.18
Rhode Island Coal	‡.01
Smokey Dev	.75
So. Lake	5
S. W. Miami	1½
Tonopah Victor	.30
Trethewey	.23
United Verde Ext	.53

LONDON Feb. 27

Name of Comp.	Clg.
Camp Bird	£0 12s 0d
El Oro	0 14 6
Esperanza	0 18 9
Mexico Mines	5 2 6
Oroville	0 12 6
Santa Gert'dis	0 17 6
Stratton's	0 0 9
Tomboy	1 7 6

‡Last Quotation.