

## Methods of Stopping at Cripple Creek

The Economy of Supporting Stopes by Stulls or by Ore-filling Depends upon the Value of the Ore

BY G. E. WOLCOTT\*

The Cripple Creek district presents almost every aspect of ore occurrence to be found in Western metal mining with the exception of deposits adapted to steam-shovel work. A complete exposition of the mining methods would, therefore, give a fairly complete account of Western mining practice in general. This article aims to present, in detail, only the most common methods in use, with some references to others of less importance.

### OCCURRENCE OF OREBODIES

In the great majority of cases the Cripple Creek orebodies occur in comparatively narrow veins, generally nearly vertical, with sound wall rock and vein material which is seldom dangerous for overhead stopping. Flat veins are not of common enough occurrence to have developed any particular method of attack. Wide veins, presenting dangerous ground for overhead work, have been encountered, but, as a rule, the ground will stand well, even in some cases, in veins up to 100 ft. wide.

The machines in common use are the  $2\frac{1}{4}$ -in. one-man piston drills, mounted generally upon a stopping bar or, in wide veins, upon a drifting column or tripod. Of late years the piston machines have found a serious competitor in the air-hammer stopping drills and have been replaced by them in many cases.

### METHODS OF STOPPING

The methods of stopping exemplified in the district may be divided primarily, for the purpose of discussion, into overhead, breast and underhand methods with their combinations and variations. Of the several methods the first is by far the most common and is becoming of more importance with the general introduction of air-hammer drills because these are more readily adapted to this method of attack. Breast stopping is not in very general use, but has been largely employed at one or two of the larger producers, among them the Portland.

### UNDERHAND STOPPING

This is of comparatively little importance, being limited mostly to surface deposits and irregular stopes such as illustrated in Fig. 1. In this case a drift has

been run on a lower level, beneath an ore shoot which has been worked above but has failed to find ore on the level. A raise is then started toward the orebody above, but fails to strike pay-rock until a short distance below the next level. In such a case underhand stopping is usually employed, breaking beginning at the points  $A_1 A$  and proceeding irregularly toward  $B_1 B$ ,  $C_1 C$ , etc., until the ore limit is reached. The broken rock is allowed to fall down the raise into the chute on the next level. In case the orebody extends to a considerable distance either side of the raise and some distance below the upper level, an intermediate drift is usually run at the lower ore limit and some method of overhead stopping is employed.

Another case where underhand stopping is used is in wide deposits extending to the surface. The Homestake mine presents the best example of this form of mining. It is sometimes referred to as a caving system, but in fact it is not, as no ore is caved systematically. Fig. 2 illustrates the method and needs but little explanation. Raises are run from the first level to the surface at considerable distances apart and breaking begins at the top of the raises as in the case described above.

The ground here is soft and broken and machines are not used except in driving the raises. The ore at  $A$ , which will not run into the chutes by gravity, is left to be taken out from the next level. This is probably the cheapest mining method employed in any mine in the district but is, of course, not applicable in many cases.

### OVERHEAD STOPPING

The lower portions of Figs. 3, 4, and 5 illustrate three different methods of starting overhead stopes, all of which have been more or less used. That shown in Fig. 3 is by far the most common and is used at most of the larger mines. Drifting and cutting out are carried on the full length and width of the orebody and then back stopping is carried up to about 15 ft. above the track level. Timbers and chutes are then placed in position, stulls being used for orebodies up to 8 or 10 ft. in width, and square sets for those wider. Chutes are

placed at intervals of from 10 to 20 ft., usually about 16 ft. Holes are left for manways wherever desired but preferably at either end so as to facilitate ventilation.

The method illustrated in Fig. 4 is especially adapted for wide stopes and is, I believe, entitled to more recognition than it has so far received. In this case the use of square sets is entirely dispensed with, the timber being limited to the chutes and manways. The drift is first run the usual width, 5 to 7 ft., and raises are started at the points where the chutes and manways are to be. These drifts are then expanded to the full width and length of the orebody and connected with each other above. This method not only saves the expense of putting in the square sets, but also saves the expense of taking them out as is done in the filled stope system, when stopping up from the next level. The Portland mine uses a square-set system which allows all of the ore beneath the level to be stoped out without removing the square sets.

The third method illustrated is seldom used and, as far as I can see, has nothing to recommend it. The idea in raising the lagging between the chutes is to allow all of the ore to run into them by gravity. It is much preferable, it would seem, to allow the space between the chutes to fill up with broken ore as the lagging here must be protected or made extremely heavy to prevent breakage. The advantage gained when the stope is cleaned out is more than offset by the additional cost of timbering and by the additional height of back stopping necessary which must, of course, be mucked up from the level.

### TIMBER VS. FILLED STOPES

From this point on the overhead stopping methods naturally divide themselves into two main types: (1) Timbered stopes; (2) filled stopes. I will first describe the two in detail and then compare the relative economy of each.

Either method may be preceded by driving raises to the next level as shown in the upper portion of Fig. 3. This not only affords better ventilation but also facilitates the handling of steel, timbers, machines, etc. Raising is of more importance with the increase in

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size of the stope, as with its longer life more is saved in the handling of material to offset the cost of the raise. Manways are made either of cribbing or with stulls and lagings as in Figs. 3, 4, and stulls and lagings as in Figs. 3, 4, and 5.

TIMBERED STOPE

In timbered stopes manways are sometimes omitted entirely and the miners reach the back by means of stulls and lagging left at convenient points. In stulled stopes the breaking of ore often proceeds rather irregularly, the machine man being allowed to set up his drill at the most convenient point. Some system should, however, be followed to obtain economical results and that shown in Fig. 4 is probably as good as any.

Stulls are placed so as to allow from 5 to 7 ft. between the lagging and back and stoping proceeds either from one end toward the other or from some point near the middle toward each end. As shown in Fig. 4, lagging is placed from A to A in sufficient quantity to give a place to work upon and stoping proceeds from C toward D. The breast at C is carried at an average height of about 4 ft., this being about the depth of round with a 2 1/4-in. piston machine. From this it follows that if stulls are placed to

have gradually been developed into a machine in which the depth of hole is practically limited by the length of steel that can be used. The permanent stulls are seldom placed at intervals of less than 7 to 8 ft. vertically and 5 to 7 ft. horizontally. I have no accurate data as to the average cost of stulls, placed in position in this method of stoping, but I believe that for a stope, averaging from 6 to 8 ft. in width, \$2.50 per stull is a low estimate. This figure will be used later in comparing the stulled and filled stope methods.

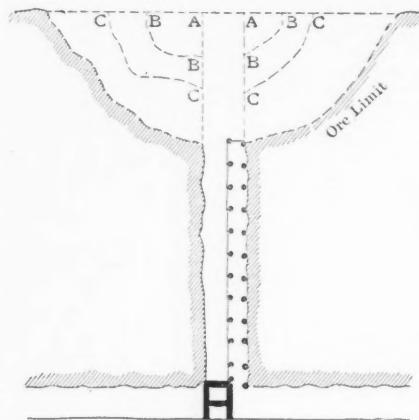


FIG. 1

ground and is not shot upon, lighter timber is used and it is not placed as carefully as when stulled stopes are run. The cost is probably not more than one-third that of stulling the same stope. The timber may even be omitted entirely. Stopes are run, by this method, as much as 100 ft. across and when coming up under the next level the square sets are removed and the ground upon which they rest is blasted out. If the method of starting the stope, shown in Fig. 4, has been used on the upper level there is little timber to remove and the stope is simply carried up a little farther to remove the ore left above the level. Of course this method of stoping destroys the level through this particular stope.

USING WASTE FILLING

The method of stoping with waste filling is shown in Fig. 5. In this case the chutes must be carried up to the top of the broken muck. The ore is first shot down upon planks laid tightly upon the waste filling and is then roughly hand-sorted, the ore being thrown into the chutes and the waste serving to fill up the stope. As the rock, broken in the stope will not, in this district, average more than about one-fifth ore, enough waste is, of course, available to serve as

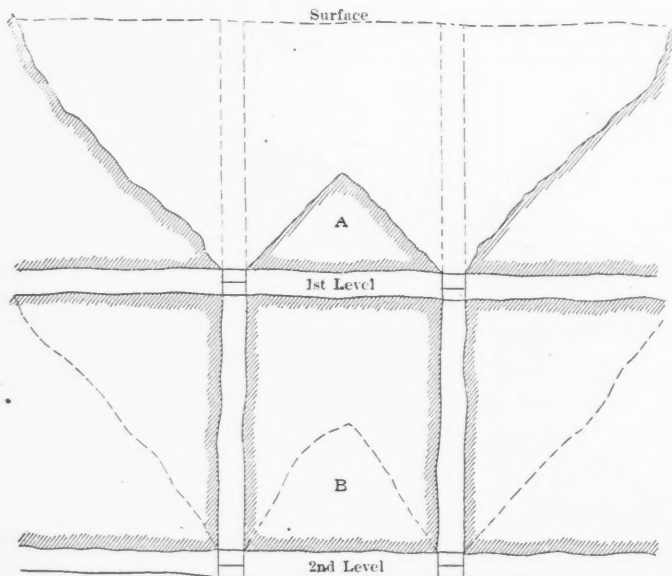


FIG. 2

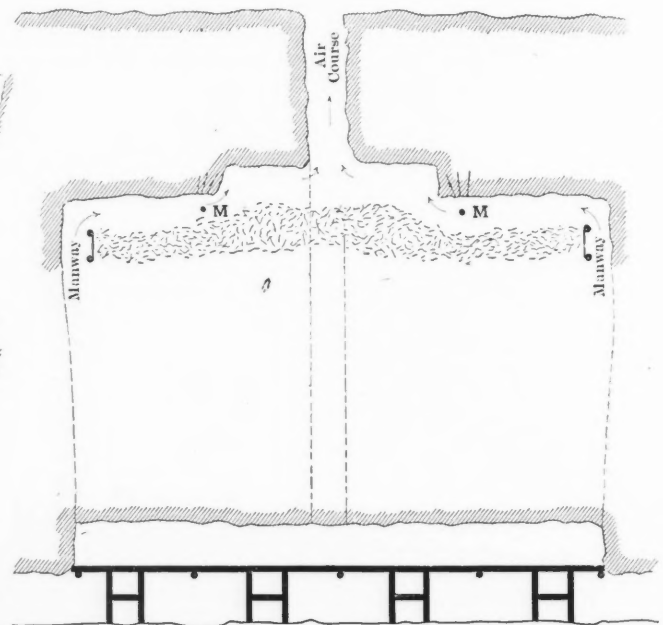


FIG. 3

follow each cut taken across the stope, they will be placed at a vertical distance apart of only 4 ft. This is overcome either by leaving a portion of the broken rock upon the lagging, to bring the machine man up to the back for another cut, or by placing temporary sprags to work upon. If air-hammer drills are used a deeper cut is practicable for, while these machines were originally used mostly for block-holing and narrow stopes, they

FILLED STOPE

Stopes may be filled either with waste, as in Fig. 5, or with ore as in Fig. 3. The latter needs little explanation. The broken rock is simply left in the stope in sufficient quantity to bring the machine man to the proper working distance from the back. After the stope is completed to the next level the ore is withdrawn and timber is placed in the stope as the ore descends. As this timber is only to hold the

filling. It will readily be seen that the handling of material in the stopes will be an important item of expense and will probably offset any advantages the method may have. Complete sorting cannot, of course, be done as the waste rock will not ordinarily adjust itself to the filling space and, furthermore, the light is too poor to admit of a fine distinction between ore and waste, so the method is not much used.

COMPARISON OF COSTS

In the Cripple Creek district stulls and the filled stope system, with ore filling, are both extensively used, and I will now give, as near as possible, a comparison of the relative economy of the two methods.

Assume for example a stope 100 ft. in length and of an average width of 6 ft., and suppose that, in the stulled stope, the stulls are to be placed 8 ft. apart vertically and 7 ft. horizontally. Two manways are supposed to occupy 5 ft. at each end of the stope and the timbers above the level are taken as 8 ft. above the track. In the filled stope system the filling will extend to about 6 ft. below the next level. This will give an ore filling of 86x90x6 ft. or 46,440 cu.ft., supposing it to be 100 ft. between levels. The average amount held in the stope during its life will be one-half of this or 23,220 cu. ft., and as one-fifth of this is ore at 20 cu.ft. to the ton, there will be 232 tons

of ore and less with a higher grade so that in a high-grade stope the difference may even be in favor of the stulled stope.

With the filled stope the output can be much more readily increased than with the stulled stopes and the amount of ore broken for each machine will be greater. However, there will be left in the stope, after breaking is completed, a large amount of muck which must still be withdrawn before the ore is all marketed. The total time before the ore is all removed will be approximately the same for both methods.

CONCLUSION

The conclusion arrived at, therefore, would seem to be in favor of the filled stope by an amount equal to the difference in cost of timbering. From the miner's standpoint the filled stope has the advantage also. If manways are carried at both ends much better ventilation

and clay. Metalliferous mining plays a small part in providing employment in the British Isles. Copper, lead and zinc ores are the only ones considered of sufficient importance to have columns to themselves in the Government tabular reports of each county. Tin ore goes in among "other minerals."

Re-opening California Hydraulic Mines

SPECIAL CORRESPONDENCE

Work is being started on the Indian Hill Hydraulic Mining Company's ground at Indian Hill on the North Yuba river, seven miles above Camptonville, California. Lumber is being taken in for the sluice boxes and a quantity of 26-in. pipe for the mile of pipe line that is to convey water from Indian and Humbug creeks

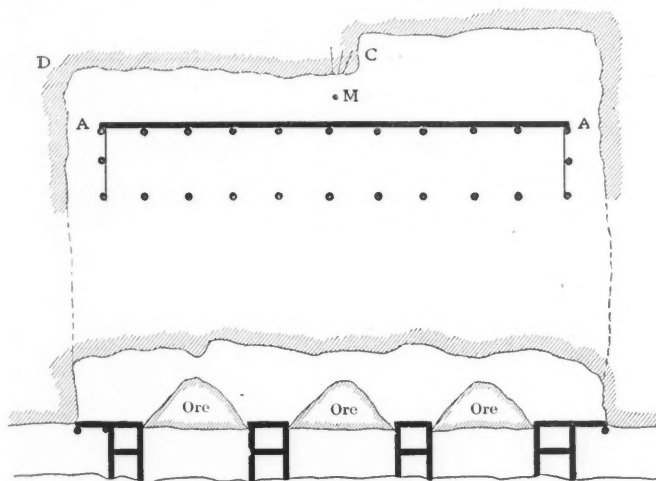


FIG. 4

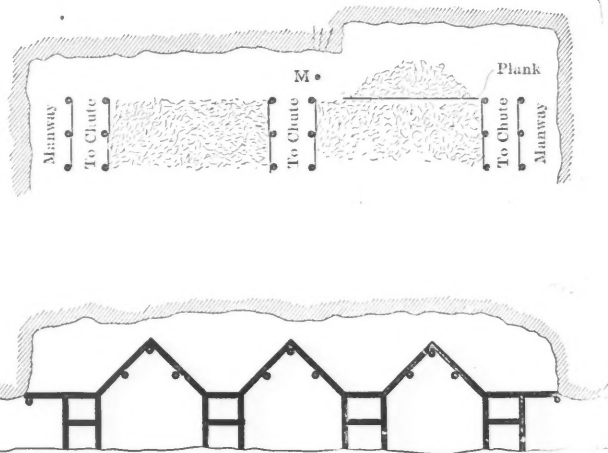


FIG. 5

of ore held in reserve during the life of the stope. At \$20 per ton net, this gives a value of \$4640 which may be considered as so much capital tied up. With two machines in the stope its life will be approximately 4.5 months. With the stulled stope there will be used, in excess of that required for the filled stope, about 143 stulls besides some lagging. The cost of the stulls will be figured at \$2.50 each, in place.

COMPARISON OF COST OF STULLED AND FILLED STOPES.

STULLED STOPE.	
143 stulls @ \$2.50.....	\$357.50
Lagging .....	10.00
Total .....	\$367.50
FILLED STOPE.	
Interest on \$4640 for 4.5 months at 6 per cent.....	\$104.40
Timber (1/3 of \$357.50).....	119.17
Total .....	\$223.57
Saving in filled stope.....	\$143.93

Looking at the matter from this standpoint there is a comparatively small difference in favor of the filled stope. The difference is greater with a lower grade

is obtained and the work is carried on much more easily and safely.

Mining Labor in the United Kingdom

SPECIAL CORRESPONDENCE

The total number of employees at the mines and quarries of the United Kingdom during 1906 was 1,004,092, of whom 785,748 were employed below ground in mines or inside quarries, and 218,344 were employed above ground at mines or outside quarries. These figures are a slight increase over those of 1905, which were 768,396 and 213,967 respectively. Coal-mining naturally accounted for the bulk of these figures. The number employed underground in coal mines was 709,545 and above ground 172,800. After coal the more important minerals were iron ore, limestone, granite and other igneous rocks, sandstones, oil shales, gravel and sand

to the claim has been delivered. The Indian Hill consists of nearly 300 acres along the old Bald Mountain channel, on which are located the famous Depot Hill claims just to the south, the Grizzly Hill claims a mile to the north and just across the river, and the Brandy City claims adjoining the Grizzly Hill. Three years ago the company acquired the original Indian Hill diggings, and more recently bought the Corelli and other adjoining claims, which in all give it a mile along the channel. The mine has one of the finest dumping and storage basins in the mountains, and the water rights belong to the company.

Preparations are now in progress for extensively working the Brandy City diggings, which, like those at Depot Hill, Indian Hill and Grizzly Hill, have been for years rated as among the richest in the State. The Brandy City company is running a bedrock tunnel that it will take a year or so to complete, and is building roads, bridges and making other expensive improvements.

# The Copper Belt of California—III

More Important Mines of the Copper Belt; Their History, Extent, Operations. Conditions in Belt and Prospects for Future Operations

BY HERBERT LANG\*

All of the early smelters erected in the Copper Belt were very small and crudely built, and in no case were their operations long continued. They have long since fallen into ruins, and in some cases are completely obliterated. The best preserved of these ancient plants is that once known as the James' Ranch smelter, in the extreme southern part of Mariposa county, of which an illustration is here given. This little affair still stands, the representative of a past metallurgy. It is built, like most of the blast furnaces of that age, of ordinary stone, with a lining of some material of a more durable kind.

reader will notice what appears to be an iron smokestack lying partly upon the furnace. This is not what it seems; it is a boiler which once occupied the space between the furnace and the stone draft stack, and was set horizontally over the flue, of which it formed the top, the intention being to utilize the waste heat for the purpose of producing steam to drive the blowing apparatus. From this we may infer, first, that the old men were not so very far behind us moderns in our efforts to economize fuel, and, second, that the furnace was run with a hot top—a practice not yet wholly outgrown.

these old slags and find them reasonably "clean" and well fluxed. The old Victory mine slags, which were made in a water-jacket, in connection with copper matte, assay quite low, but contain, or rather are mixed with, an unduly large proportion of semi-fused matter, which seems to have arisen from some defect in tapping. It would even appear as if the old operators were in the habit of dragging out half-fused materials along with the proper slag, in which case their furnaces must have been provided with open breasts. The surface ores of the Belt, being composed of the broken-down schists, mixed



GREAT NORTHERN MINE

The schists of that region served very well for the outside of such constructions, but it is not likely that the lining material, which was a lighter colored and more silicious stone, proved very resistant to the heat and corrosion of the slag. A pile of perhaps 200 tons of slag remains near at hand and shows the extent of this plant's usefulness. The ore came from the neighboring mines, of which the Green Mountain and Lone Tree were the more important. These are still worked to some extent, but the ore, instead of being reduced on the spot, is shipped to distant smelters at considerable cost for freight. The

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## FAILURES OF THE FIRST SMELTERS

Two stone furnaces were set up at different times at the Fresno mine, and I have examined the few remains, which have lain there to this day. They could not have been considered successful from any point of view, as the whole amount of slag now to be seen there cannot exceed 20 tons in weight, judging from which the campaigns must have been short. The ores which were to have been handled still remain in piles ready for the work, but they are far from being of the quality necessary for successful smelting in such a small way, not averaging above 5 per cent. copper, with little gold or silver. I have collected and assayed samples of

with sufficient oxidized iron, were unquestionably easy to smelt, and had the operators of that day possessed more experience, along with a little chemical knowledge, so that their work would have had a more practical cast, and had they built on a larger scale, there is no doubt that they would have succeeded. As it was, not one of the early establishments was pecuniarily successful, unless for very short periods, and the smelting business did not take permanent root. Ten of these small furnaces date from the sixties, being those at the Fresno (2), Buchanan, James' Ranch, Victory (formerly La Victoire), Copperopolis, Campo Seco, Newton, Copper Hill and Spencerville mines.

## LATER SMELTING OPERATIONS

After the lapse of years, during which leaching operations were carried on at several of the more important mines, including the Victory, Copperopolis, Campo Seco, Newton and Spenceville, smelting took a new lease on life, on account of the improvements which had been made elsewhere; and furnaces were erected at Copperopolis and Campo Seco and campaigns of considerable length were made. The ores were first roasted in heaps and then fused in brick stacks of the Orford type. The low price of copper at that time (about 1890) injured the chances of success, and the works closed within a year or two. *Post facto* criticism is easy, as all know; and the most decent reflections that we can now make on this renewed attempt at smelting relate to the ratio of concentration, which does not appear to have been high enough for profit. The matte averaged 40 per cent. copper and was shipped East for sale. A great deal might be said as to the metallurgy of this period, which we may designate as the transitional epoch, characterized both by the methods of the first, and the practice of the latest period; but let it pass. In 1899 the Newton mine, near Ione, Amador county, put up a moderate-sized jacket and made a short run, smelting 3000 tons of heap-roasted sulphides, and producing a matte of fair grade, which found sale in the East at no lucrative rates. The works then shut down, not to resume. So far as I can see, the difficulty seems to have arisen from the brief duration of the campaign, which scarcely gave opportunity for the demonstration of the facts that would naturally be sought. The ore was exceptionally rich, yielding, it is understood, nearly 6 per cent. copper, and the conclusion would seem to be that if success could not be had with such material the case was hopeless.

## THE DAULTON SMELTER

Another attempt was made contemporaneously by another mine, the Daulton, called also the Ne Plus Ultra, which is situated in Madera county. The ore accessible at that time in the Daulton was much poorer than that of the Newton, but was handled with more skill and in larger quantities. I cannot say as much for the general plan of the operations, which seem to indicate a lack of comprehensiveness, if I may put it in that form. The original intention was, as I have learned, to utilize the contained sulphur as a source of sulphuric acid, by shipping the ore to acid works on San Francisco bay, whence it was to be returned, in the roasted condition, to the smelter (situated at the town of Madera) for smelting. The Daulton is one of the very few copper belt mines that have railroad connection with the outer world. It was fitted with three hoists, run by steam. The smelting works are a good example

of the ideas prevailing at that date which, though it was but some seven years ago, are now quite antiquated. The attentive student of metallurgy can receive no better lesson than that he will derive from a contemplation of the merits and defects of this plant. The furnace, a water-jacket of some 100 tons daily capacity, like the Newton stack was fed by wheelbarrows from ore-bins so built that the charges had to be shoveled up from the floor into the barrows, which were then shifted by hand through a distance of 200 ft., to an elevator, hoisted to the feed-floor and then, after another run, dumped upon the floor, to be shoveled into the furnace. The product consisted of matte, of an average tenor not above 10 to 20 per cent. copper, for which no market could then be found nearer than the Atlantic seaboard. The whole cost of shipment and treatment was not less than 7c., and perhaps as much as 10c. per pound of copper, leaving very little for the expenses of mining and transporting the ore, etc. Inasmuch as the notions of pyritic smelting, which include the treatment of low-grade mattes by passing them again through the blast furnace in admixture with silicious fluxes, had penetrated almost all minds, by that time, it is curious, to say the least, that no effort was made to reduce the bulk and weight of the Madera mattes in that manner. Ample warrant for such procedure had been furnished by the practice of the Campo Seco works, and by many more distant smelters. After four months of effort the Madera plant shut down, and has been subsequently offered for sale. From an engineering point of view the best thing about the operations of this company (called the California Copper Company) consisted in the connection of the mine with the outside world by means of a standard-gage railway, the company having built a connecting line to the Southern Pacific, some few miles away.

## SUCCESSFUL SMELTING

The Campo Seco mines, which had previously been the scene of two unsuccessful attempts at smelting, inaugurated a better system some eight years ago, since which time they have run constantly and profitably, furnishing an excellent example of persistence and common sense. The success of this institution, which had merely a single stack (another since added) and of small pretensions in point of size or arrangement, is the only instance among the works that have been built to treat the ores of the Copper Belt. Its success is due to a variety of causes, first among which is the fact that it is under private ownership, a manifest advantage. The supply of ore, being derived from a group of mines of large extent and considerable development, has always been great enough to enable the smelting works to keep in steady operations; and this ore, being rich enough to warrant

such operations, has always been profitably worked. It is a blast-furnace plant working on the pyritic system, but using cold blast. I am not familiar with the details of its more recent work, but my impression is that there are few examples of better smelting. The economy of fuel is carried to the extreme, but I suppose it is allowable for me to criticize in opposition the manifest waste of labor, necessitated by the somewhat disadvantageous location and lay-out. Report has it that this smelter, which goes on year after year, quietly and without fuss, has a longer probable life before it than any other smelter in California. The average amount of ore treated for a number of years was some 60 to 80 tons daily, but the erection of the second stack lately has increased this capacity. The practice is, or has been, to smelt the ore first to a matte of some 20 per cent. copper, and then to re-treat this in the same furnace, in a concentrating campaign, getting a 40 per cent. product. This again is re-smelted, giving a 60 per cent. matte, which is as rich as they care to go. This is then sacked and shipped to the East for refining, the cost of shipping being about \$20 per ton.

## THE COPPEROPOLIS MINES

More interest attaches to the history of the mining operations at Copperopolis, in Calaveras county, than to that of any other locality along the lode, for that place has become historical since the opening of its extensive mines, the Union and the Keystone, back in the early sixties. Not only have they held the most prominent place among the Belt mines, but until within a comparatively few years their record of production surpassed that of every other copper mine on the Pacific coast. They have seen many ups and downs, and the ordinary casualties of mining and ore reduction seem to have been multiplied in their case. They have been the scene of numerous metallurgical experiments. Smelting, concentration and leaching have been applied to the ores, either experimentally or practically, but the principal pecuniary successes have been made by shipping the ores away to distant markets. It is indeed interesting to look over the ground where so many and various processes have been in use, and to learn the details of their work. Copperopolis has seen three successive smelting plants in blast; it has looked on while water concentration demonstrated its power or its weakness; and it has observed the operation of the cementation method for a third of a century. The traveler may inspect large heaps of ore that have been leached for 30 successive years, yet still contain an important part of the copper which was in them at first. My personal interest in these things dates from quite a remote epoch, I may say, for it was in 1870 that I, with other youths, touring on foot in that county,

visited Copperopolis and saw for the first time the interior of a mine. The sight, though it could not have been anything extraordinary, captivated and made miners of more than one of our little party. At that time the Union-Keystone had reached the expiring phase of its early season of activity, and mining operations shortly ceased, not to be resumed until a good many years had passed. During the interim the accumulated heaps of second-class ore began to be leached, a process that still goes on, but scarcely with significant results.

#### SMELTING AT COPPEROPOLIS

The Copperopolis mines have undergone two later periods of activity in recent years, the first some 20 years ago, the other within a year past, contingent upon the erection of smelting works. A large Orford furnace set up in the former period was run for some months, smelting, I believe, about 25,000 tons of ore. At the later date, under the management

amount to more than the cost of the whole pyritic treatment, especially in an era of high prices for that metal. We may cite briefly the accepted and oft quoted facts that the blast furnace is favored by the coarsely fragmental nature of the sulphide ores; by their high content of sulphur; by the fact that its slags are cleaner than those made in the reverberatory; by the lesser demands for fuel; and finally by the fact that the ores do not require previous roasting. Doubtless the reverberatory would make a richer matte as the result of its fusion of roasted ores than the other furnace with raw ones; but this concession to the value of the first is nullified by the now accepted fact that the production of a rich matte at the first fusion does not generally pay, as the slag which falls with it is found to carry off more values than if made simultaneously with a poorer matte. The fine results of modern copper matte smelting of low-grade ores are obtained by making a low-grade first matte, the

merits of the mines of the Copper Belt; but in cases like those of the Copper King and Fresno, I consider that to allow the whole belt to rest under the imputation naturally caused by the fiasco of the former and the partial stagnation of the latter company would be unjust. I submit that a mine which, like the Copper King, contained 50,000 tons of ore having a total available content of \$20 per ton, thus aggregating a million dollars, is not an insignificant property; and, furthermore, that as such ore can be worked by economical methods so as to leave a profit of \$8 per ton, or an aggregate of \$400,000 above the original cost of the mine, works, equipment and all other expenses, it would not be a bad sort of mine to invest in for those who understood what mining really is. Rumor has it that the mine has been bottomed and pretty well worked out—but even so, the showing has not been by any means a bad one for the mine, which is small but good, and of a type with which workers along the Belt are quite familiar. It never gave warrant for the great expenditures which were made by the now defunct company, which quit without having received back a single penny of the more than £550,000 lost by it and its creditors. To all appearance the mine, when it was incorporated in London and the stock sold for £275,000, was not a whit better than several things along the Belt which then could and even now may be had for \$25,000 to \$50,000; nor did it warrant a greater expenditure for plant than such mines, which would be amply provided if they had apparatus worth \$100,000, in place of the \$700,000 that the Copper King mining and reduction works cost. With management like, let us say, that of the Campo Seco property, the whole mining and treatment cost would not have exceeded \$7 per ton; under Copper King management it reached \$26 per ton. Allowing \$7 for running costs, and \$5 more to meet the expenses of construction and maintenance, there is left \$8 per ton as profit, based on the conditions prevailing during the mine's active life.



FRESNO MINE

of G. McM. Ross, another attempt, not longer-lived, was made, a modern reverberatory furnace being erected. This is now quiescent, for reasons unknown to me, but supposedly connected with some difficulty of ore reduction. Considering the nature of the ores, which carry a large proportion of sulphur and come from the mine in coarse masses, and considering also the surrounding conditions that would seem to make reverberatory work arduous, I believe the blast furnace would have proved more advantageous.

#### BLAST FURNACES AND REVERBERATORIES

It is generally understood by smelting men who have mastered the pyritic method, that its advantages when dealing with ores of this description are undeniable. The advantages of making a low-grade matte at the first operation, and of concentrating it in a second, instead of aiming, as in the ordinary practice with the reverberatory, at a rich matte at the first smelting operation, are well understood. It might well be that the copper lost in the reverberatory slags would

slag from which will invariably be found to contain very little copper. Consequently a furnace thus run furnishes a desirable—in fact almost indispensable—means of re-treating richer slags and of reducing their content of copper to a practically negligible quantity. This the reverberatory cannot do.

#### FRESNO COUNTY MINES—THE COPPER KING

Two mines in Fresno county, the Copper King and the Fresno, have had an interesting recent history, with many aspects of which the public are familiar. Both have been in the hands of British companies, and to delineate their history for the past few years would throw much light upon the methods of British mine management and company promotion. Both these companies failed, the one temporarily, the other for all time, but I cannot look upon the mines themselves as having failed in any fair sense. In neither case do I consider that they have had a fair show. It is not my intention either to extenuate or depreciate the

#### THE FRESNO MINE

The Fresno mine is only 15 miles distant from the Copper King, but resembles it in few particulars. The ore is far more abundant but much poorer; there are several lenses instead of one; and the conditions as to transportation, etc., are much more favorable. The lens upon which the major part of the development has been done gave promise at first of carrying good values; but after the long deferred sampling had been performed it was found that its sulphide portion contained on the average hardly 2 per cent. copper. The ore is of a character preeminently suited for fluxing silicious material, and its existence in such quantity gives hope that the mine may some time become the seat of an extensive custom smelting business. The re-

serves seem to be of rather lower tenor than those low-grade bodies that are being so extensively developed and worked in the northern part of the State; but the conditions surrounding the mine are more favorable. Among these conditions we may enumerate the barren nature of certain tracts of ground upon which the fumes of the smelter may be discharged; the isolation of the mine from centers of labor disturbance; and the comparative propinquity of deposits of silicious ore carrying gold, silver and copper, which may be drawn upon for flux. If to these manifest advantages we could add the possession by the mine officials and directors of experience, skill, and adaptability, I think it would be safe to claim that the Fresno mine possesses most of the essentials of a successful institution. If the company rises to the occasion and pulls out after having invested nearly or quite three-quarters of a million dollars in what they, or some of them, fear is a losing speculation they will deserve much praise. The conditions resemble those at Ducktown, Tenn., where the Tennessee Copper Company has made such a brilliant success; but they are better, inasmuch as in place of using barren quartz for flux, as the Ducktown smelters do, there are immense supplies of pay rock for the Fresno works to draw from. But the custom smelting business presents so many perplexities to inexperienced boards of directors and narrow-gage managers that most companies shrink from it in despair. It is true, I suppose, that this branch of business demands at least as much skill, experience and technical knowledge as any pursuit in the world—perhaps more than any other; but surely if it stands between a company and failure, and presents inducements that may turn a losing into a winning investment, it is worth while to enter upon and conquer those difficulties and perplexities. Without aids of this sort I do not see how a company situated as this one is can be expected to achieve ultimate success under the existing conditions.

#### FLUXING ORES

It has seemed heretofore that suitable fluxing ores might be procured in any desired quantities from the Tonopah mines in Nevada; but owing to the construction of local milling establishments there, this supply seems destined to be cut almost entirely off. Failing this, the next available source would be the small gold quartz mines lying to the east and northeast of the Fresno, and generally within 20 miles of it. These are developed to no great extent, but I believe that they may in time prove capable of furnishing the required amount of flux, of a quality sufficient to pay the necessary mining, teaming and smelting expenses, and leave a profit. These nearly "straight" silica ores would be used in the proportion of one to four or thereabouts, of the Fresno sulphides. Other sources of fluxing materials present

themselves, there being many mines, scattered throughout a great region, from which suitable ores might be had, and probably at remunerative rates in many cases.

#### PYRITIC SMELTING

The Fresno smelter, the main features of which are of my design, is on the pyritic plan, having hot-blast stoves, high-pressure blowing engines, and two round furnaces of a nominal capacity of 200 tons each of charge. The plant is electrically driven and has a converter plant of three stands. It is so located with respect to the mine that the slag, being first cast in prismatic blocks, can be carried on the standard-gage tracks to the mine shaft, some 2000 ft. away, and sent down to be used as filling, thus taking the place of timbering, which in this mine would be a source not only of considerably greater expense but of danger, owing to the character of the ore, which in certain parts of the mine takes fire spontaneously. The smelter site is so spacious, and the curves of the connecting tracks of so liberal a radius that a train of Pullman cars might be run through the plant with ease. It is to be hoped that the search for richer orebodies, which is now going on, will be rewarded; and that the carefully planned schedule of operations will result in financial success for the company. The mineralized area is so large, and the amount of prospecting thus far done is so small, as to leave ample opportunities for the discovery of valuable orebodies.

#### SULPHUR CONTENTS OF THE ORE

For a number of years the sulphides of the Copper Belt have been utilized in the manufacture of sulphuric acid in the acid works around San Francisco bay. In this they have come in competition with and have displaced to a great extent the native sulphur of Japan, which for a long time was the chief source of the acid. Pyrite suitable for this purpose can be had in large quantities in many of the mines, but those near Spenceville have been the main reliance thus far. They are quite as pure as the pyrite ores of the Eastern deposits, containing from 40 to 48 per cent. sulphur, with little arsenic or other deleterious substances. They cost delivered at the kilns from \$4.50 to \$5 per ton net, while the sulphur that they replace has averaged \$22 per short ton. It appears that at these prices the sulphur in the form of pyrite costs but 10c. per unit, while that bought from Japan costs nearly 22c. for the same weight, showing a notable saving in using pyrite. It is generally held that the mines of the Copper Belt are likely to supply the needs of the acid-makers for many years to come, such is the amount of suitable material in sight. While the makers generally demand a pyrite sufficiently free from copper to meet Eastern requirements, quite an amount of acid has been made from material quite rich in copper, which is commonly re-

garded as detrimental. The use of such ores is, of course, an advantage, inasmuch as by another operation the copper may be won. Sometimes such copper-bearing ores are burned in one works and the residue removed to another for smelting. Variations on this method are also used. Thus the Selby works, which purchase regularly large quantities of pyritic concentrate from the gold mills, have turned considerable of this material over to the Peyton works where it is burned in McDougals for the sake of the sulphur from which acid is made, the cinder then being shipped back to Selby's for smelting. The cinder from cupriferous pyrites has been found worth treating as a general thing, the process used being smelting in some cases and leaching in others. Generally speaking, it is handled in rather a small way at present, but with the prospect of considerable increase in the scale of operations in the future.

#### PYRRHOTITE FOR ACID MAKING

The low sulphur content of the pyrrhotite ore renders them less valuable for acid-making, but it is not by any means impossible that in time they may be utilized for that purpose to some extent, especially under conditions that allow the sulphur fumes to be converted directly into acid, thus making the latter process subsidiary to smelting. The industrial growth of the country may in time make it commercially possible to manufacture sulphuric acid at one or more points in the Belt, where the two industries may be combined. I judge that the Fresno mine, if any, presents advantages of this sort, for notwithstanding the comparatively low sulphur contents of the pyrrhotite which composes the greater part of the ore, the pyritic plant there built will give out gases sufficiently rich in dioxide to serve well for the manufacture of acid. Several growing industries might be subserved by the manufacture, such as oil refining, which is carried on locally, and the manufacture of fertilizers, which are in increasing demand.

#### GENERAL CONCLUSIONS

In the foregoing I have endeavored to bring out to the best of my ability the salient features of this remarkable series of ore deposits in such a manner that the reader could form his own conclusions as to their value as investments. I think it will not be difficult for him to form a reasonably close opinion as to their position and their facilities for economical extraction, as well as to the facts that bear upon the metallurgical treatment. The main questions in the mind of the experienced miner would be embraced in one—What are such mines worth to the investor, or what allurements do they hold out to those who would like to mine in that field? People habituated to the practice of mining will justly conclude that in mines that present such similarity, and in the working of which so much ex-

perience has been had, the chances of great errors in future working should be small. I have shown that the almost universal rule that copper mines get poorer in depth holds good in the Belt, but I might also show that the conditions of mining improve from year to year, in a measure offsetting the diminished tenor of the ore; and I believe that while the chance of great strikes is small, I also believe that there are few mining fields where the opportunities for moderate profit and certain returns are more frequent. It will have been gathered that the deposits conform closely to a single type, the characteristics of which have been made known by the work of two-score years, and the experience thus gathered should show the future worker where to look for and how to utilize the values yet to be found. We have seen that the sequence of ores and minerals from the surface to the greatest depths yet reached is the same in all the mines, and that the quality of those below may be predicted from what is seen above. In their physical features the lodes differ but little, their dip, strike, etc., being nearly the same throughout the great area of the copper formation.

The methods of prospecting and developing have become in a sense conventionalized.

#### DEPTH OF THE ORE DEPOSITS

The grave question of the hour among the miners of this region is, Do the mines go down? I think that a preferable form of the query would be, Do the known lenses hold out as depth is gained? In answer to this I can only cite my own impressions. I have some evidence, though scarcely enough to warrant a sweeping generalization, to the effect that the few lodes that have reached considerable depths, show signs of impoverishment if not of actual exhaustion. Information of this kind is hard to get, and I speak more from hearsay than from actual knowledge in most of these cases; but relying upon reports that have from time to time been circulated, I conclude that, so far as is disclosed, no lens yet explored has held its values to a greater depth than 600 or 700 ft.. This refers, not to the mines in general, but to some half-dozen that have been developed to the greatest depth; and not to the mines, but to single orebodies or lenses in those mines. It should be remembered that several such lenses exist in some mines, and that the extent of mineralized ground in those and in many others is such as to lend hope that more lenses may be discovered, whenever the ground is more fully explored. In such exploration the use of the core drill is strongly indicated for reasons heretofore noted, among which I may name the character of the country, which is extremely favorable to such a method, together with the uniform dip and strike of the lodes, which enable the driller to select his position with positiveness. By such means

I believe that it is possible that discoveries of importance may be made at many points in the field. At the present time there are more of the Belt mines in operation than ever before, unless we go back to the primal times when they were discovered. Continuous work is proceeding on not less than 40 of these properties, including the Copper King, Fresno, Daulton, Buchanan, Green Mountain, Great Northern, Pocahontas, Victory, Donahue, Oat Hill, Olsen, Salamambo, Copperopolis, Napoleon, Campo Seco, Buena Vista, Cosumnes, Spenceville, Mineral Hill and Trent. On an even larger number intermittent work takes place, in some cases merely to comply with the law of locations, in others for real development. A great deal of bonding has been going on, and quite a number of properties have changed hands recently.

#### PRESENT PROSPECTS

Had the abnormally high price of copper continued, there is no doubt that the field would have received continued and rapid development; but the effect of a grave decline may be easily conjectured. I trust that we may not see a repetition of conditions that succeeded the active days of the early sixties, in which the mines were abandoned and left to fill with water, the population of the Belt was scattered, and a promising industry was crushed almost out of existence.

## The Gypsum Industry at Grand Rapids, Mich.\*

LERoy A. PALMER†

Michigan furnishes about twice as much gypsum as any other State, and most of this comes from one small district in the southwestern part of Kent county, adjoining and included in the city of Grand Rapids. Here an area of approximately six square miles is underlaid with an average thickness of 10 ft. of almost pure gypsum, enough to supply the United States at the present rate of consumption for more than 150 years.

#### ORIGIN OF THE DEPOSITS

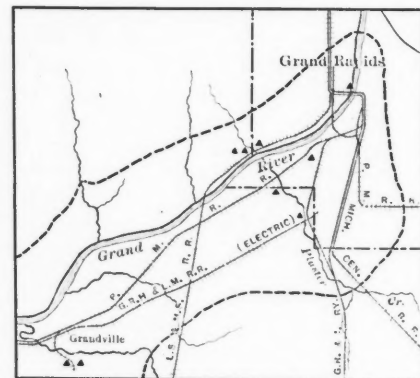
There are various theories as to the origin of gypsum deposits, but the following is the most plausible in regard to the Michigan beds: The Kinderhook sea was a large body of water covering part of what is now the American continent, with an arm extending northeast into Michigan. This sea eventually retreated to the southwest, and an uplift of the land in this area exposed what is now southern Michigan and northern Indiana. This sea was fed by tributary streams from the north which brought with them salt and gypsum. Analysis of the water

of the Atlantic ("Challenger Reports") shows 3.6 per cent. sulphate of lime. Were a body of such water cut off and evaporated, gypsum would be deposited after the removal of 37 per cent. of the water, and as the supposition is that the waters of the Kinderhook were analogous to those of the Atlantic we have thus a simple explanation of the Michigan deposits of gypsum and anhydrite.

The gypsum industry in this part of Michigan dates back to 1837, when the rock was ground in corn mills and sold for fertilizer. Development was rapid and the year 1841 saw the first mill erected and the first calcined product placed upon the market.

#### METHOD OF MANUFACTURE

The present process of treatment is practically the same at all mills. The rock as brought from the mine is dumped into a jaw crusher from which it goes to the crackers, a modification of the corn mills used in the early days of the



▲ Mines  
GYPSUM DISTRICT, GRAND RAPIDS, MICH.

industry, which discharge a product the size of fine gravel to buhr stones. The kettles are upright hollow cylinders of boiler steel of about the same depth as high, having a convex bottom, the most improved types having flues either direct or both direct and return. Just above the bottom of the kettle are the arms of the mixer which is turned by a vertical shaft.

Calcining is the most delicate part of the process and calls for the most skilled labor. The expert calciner judges by the appearance of the boiling mass, the amount of steam given off and the creaking of the machinery; the evaporation makes the mixture more dense, thus throwing greater strain on the gears.

The *Times of Malaya* reports that the Eastern Smeltern Company has been formed among the principal tin-miners of the Federated Malay States and Penang. The company will take over the stock-in-trade and good-will of Messrs. Chin-Ho & Sons, tin-smelters, of Penang. The capital stock is \$1,500,000. The directors consist mostly of Chinese tin-miners.

\*From the Gypsum Report of the Michigan Geological Survey, by G. P. Grimsley.  
†Stockton, Utah.



# A Further Study of Segregation in Ingots

Surfusion and Quiet Are Suggested as Reasons Why Increase of Ingot-size and Slow Cooling Do Not Always Favor Segregation

B Y H E N R Y . M . H O W E \*

This paper gives certain of the results of my attempt to digest and analyze the great mass of scattered data on the subject of segregation which many different experimenters have given us, and to supplement them with some results which I have lately reached by means of a grant from the Carnegie Institution of Washington. It is time that such an attempt was made, because there has been none since that of which I published nearly twenty years ago in the columns of this journal and later in my "Metallurgy of Steel."

In particular, I aim to answer two very important questions: What is the influence of ingot size, and what is the influence of the rate of cooling, on the degree of segregation in steel ingots? In addition I have examined certain other questions, with the wish to reduce our knowledge to a quantitative state. We have long known that there is such a thing as segregation, and that it might do much harm. But what the influence of different variables on the degree of that segregation is we have hardly tried to ask. These further questions are:

(3) How far below the top of the ingot does the most enriched part lie?

(4) What degree of enrichment is there in the remainder of the ingot after cropping off and discarding certain definite percentages of the upper part; viz., 10, 15, 20, 30, 40 and 50 per cent.?

(5) How uniform will the remainder of the ingot be after cropping off and rejecting certain definite percentages of the upper part?

The foregoing are evidently of direct practical importance to the steel maker. In addition I propose certain further questions; viz.:

(6) Is the most enriched part in the axis of the ingot? If so, then the study of questions 1, 2, 3 and 4 is greatly simplified, because our attention may be confined to the axial region.

(7) Is the most impoverished part in the axis of the ingot? If so then the study of question (5) is greatly simplified, because in like manner our attention may be confined to the axial region.

(8) Is the segregation of phosphorus and sulphur parallel with that of carbon?

(9) How does the degree of enrichment in phosphorus and sulphur compare with that in carbon?

(10) How is the degree of enrichment in carbon affected by the percentage of carbon present?

(11) How is the segregation of carbon affected by the percentage of phosphorus and by that of sulphur present?

The present paper discusses the first two questions at length, and ends with a summary of such answers as I have been able to make to these two and the others.

## RATE OF COOLING AND INGOT-SIZE

Before I present the evidence, let me point out the very simple reasons which lead us to expect that segregation should be favored by slow cooling and by large ingot-size. Taking up first the effect of the rate of cooling, we note that each layer as it freezes splits up into two sub-layers, a more pure one which freezes, and a less pure one which remains molten. This is the fundamental action which leads to segregation. If the cooling is very slow, then the impurities in this molten sub-layer have a good opportunity to pass centerward by diffusion and convection, and thus when the next layer comes to freeze the enrichment which it has received from the freezing of the last preceding layer will have been in large part effaced by this centerward movement. But if the freezing is very rapid, then when the second layer comes to freeze, it will still retain most of the impurities expelled into it by the freezing of its predecessor. Of course the richer in impurities the layer in the act of freezing is, the richer in them will be the sub-layer which freezes out of it. By this mechanism slow freezing should favor the centerward migration of the impurities set free by the differentiation of each layer in the act of solidifying, and this centerward migration is the very essence of segregation; whereas sudden freezing, by denying the time needed for this migration, should favor locking up in each layer as it freezes the impurities injected into it by the freezing of the last preceding layer, and should thus oppose segregation. We should naturally expect that slow cooling would imply slow freezing, and *vice versa*.

The reason why the direct influence of large ingot-size should be to favor segregation is equally simple. First, the large ingot should cool more slowly, and we have just seen that the direct effect of slow cooling should be to favor segregation. But there is further reason which may be made clear by taking a simple example. Let us consider the case of a 16-in. ingot *ABCD*, Fig. 1, and let us set off within it an imaginary space *EFGH*, representing an 8-in. ingot. In the freezing

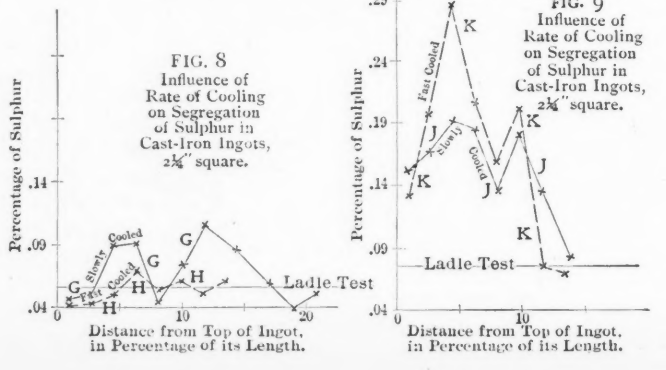
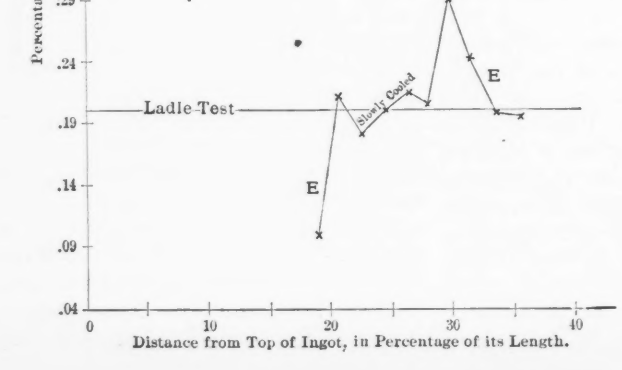
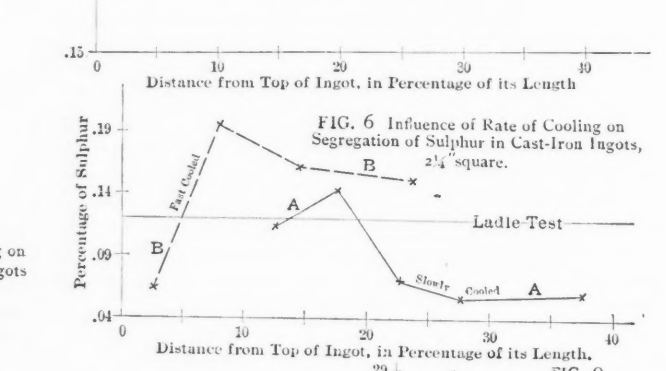
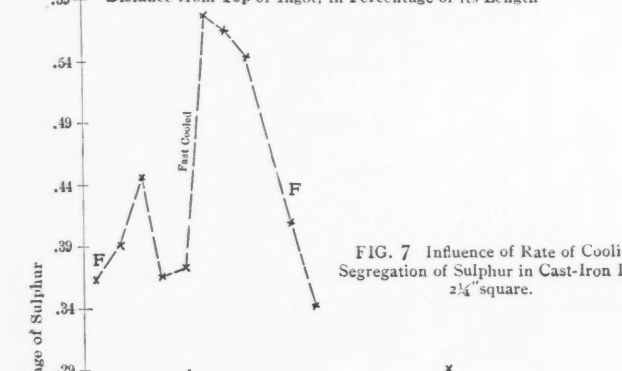
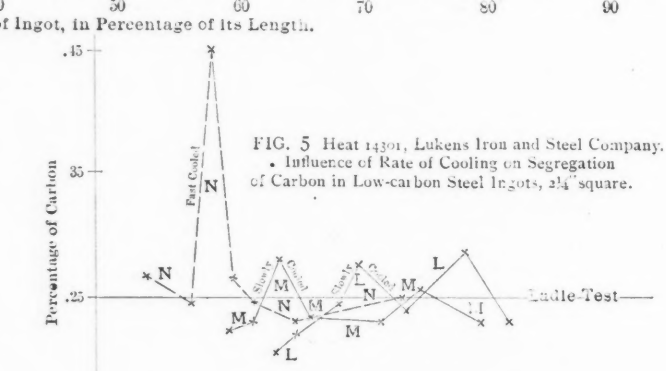
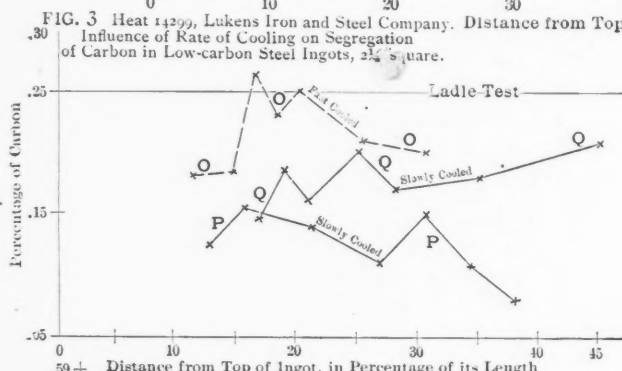
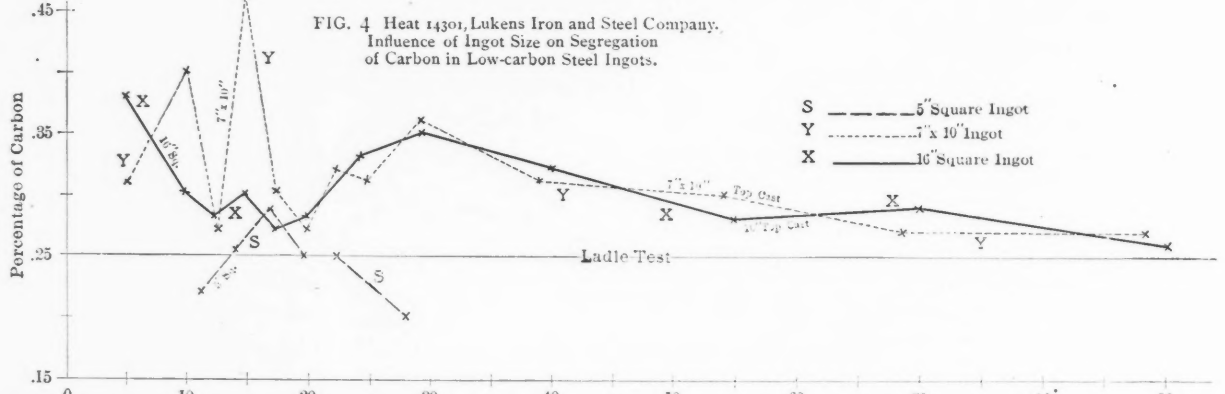
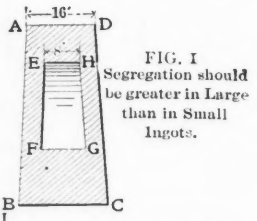
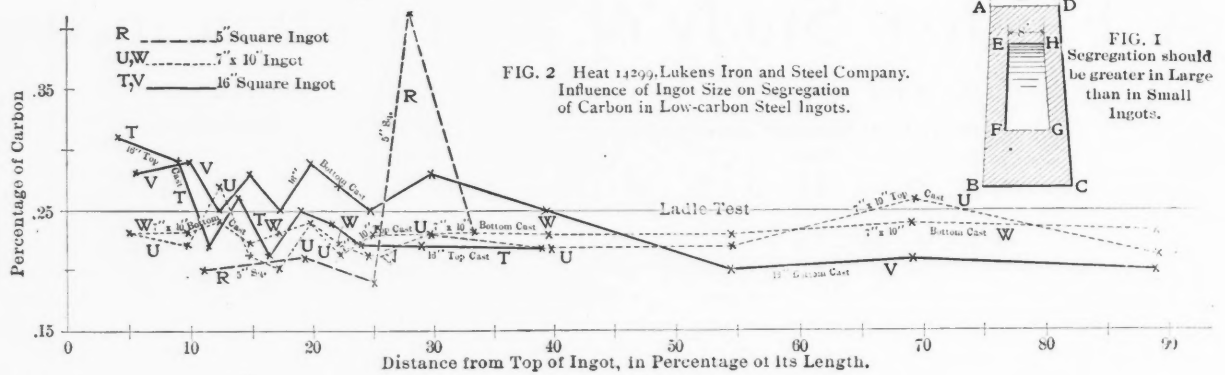
of the 16-in. ingot, up to the time when the still molten region is reduced approximately to the size of *EFGH*, it will already have undergone much segregation. Now when this part *EFGH* in turn comes to freeze, there will be superadded to its own segregation, i.e., that normal for an 8-in. ingot, this segregation which has already taken place in the freezing of the outer region between *ABCD* and *EFGH*. The segregation in the 16-in. ingot then should be that corresponding to the outer 4-in. space plus that normal to the central 8-in. space; whereas it is this latter alone that is normal for the 8-in. ingot.

## ACTUAL RESULTS

Now that we have seen what a superficial examination of the questions would lead us to expect, let us see what we actually find. On seeking the recorded cases which ought to throw light on this question I found 70, representing the chemical analysis of 2216 lots of drillings, most of which were analyzed for several different elements, so that the total number of determinations is very large. I hope to present later the large part of this important evidence which has not yet been published. Though my analysis of these results tended to show that there was more segregation in large than in small ingots, yet it left the question so much in doubt that I decided to appeal to the Carnegie Institution, to C. L. Huston, vice-president of the Lukens Iron and Steel Company of Coatesville, Penn., to F. H. Daniels, chief engineer of the American Steel and Wire Company, and to T. D. West of Sharpsville, Penn., for aid in working out answers to this question, and also to certain of the others which have been enumerated above. Messrs. Huston and Daniels kindly made for me 17 steel ingots, varying in size from 2¼ to 17 in. square, with a total weight of about 22,000 lb. These were cast under conditions which in general were identical except as to the size of the ingot, so as to make plain the influence of this variable. In order to show the influence of the rate of cooling, T. D. West of Sharpsville, Penn., kindly cast for me four pairs of cast-iron ingots under conditions identical except as to this rate. Our warmest thanks are due to these gentlemen for their generosity.

The analyses which I have already had made seem to answer the two questions before us so clearly that, though I intend making additional ones immediately, I have decided not to postpone publishing

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my present results, especially in view of certain existing conditions into which I need not here enter.

In examining these ingots, my general procedure was to analyze drillings from the axis only of each ingot, because my study of the previously recorded cases showed that the richest of the segregate lies in the ingot's axis. If there are any who doubt this antecedently very probable law, I think that they will be convinced by the evidence which I hope to publish soon. Meanwhile I ask them to suspend judgment. I determined in each case only one element, carbon in case of the steel ingots and sulphur in case of the cast-iron ones, because my previous study had shown that the segregation of the three segregating elements, carbon, phosphorus and sulphur, is parallel, so that what is true of the effect of ingot-size and rate of cooling on one of these elements may safely be assumed to be true of the rest. These laws which I had previously determined enabled me to go much farther than otherwise would have been possible with the limited means at my disposal. Many drillings were taken from the upper part of the ingots and only few and in some cases none from the lower part, because it had been shown that the richest of the segregate lies in the upper part.

My results are shown graphically in Figs. 2 to 9.

Figs. 2 and 3 represent analyses from ingots cast from the same ladleful of steel from heat No. 14,299, and Figs. 4 and 5 represent like ingots from heat No. 14,301 of the Lukens Iron and Steel Company. Both of these heats were from the same 50-ton basic open-hearth furnace. The 7x10-in. bottom-cast and the 16-in. square bottom-cast ingots of heat No. 14,299 were cast in the same group, so that the metal as it entered one of these ingots must have been exactly like that which was entering the other. All the determinations of carbon in the 2¼-in. ingots were by combustion, but most of those of the large ingots were by the color method. After I have finally found the richest point in each one of these larger ingots, I shall have its carbon-content verified by combustion; but for the purpose of finding out where this richest point lies, the color method gives close enough results in case of these large ingots, which necessarily cool so slowly as to bring practically all of the carbon to the condition of cementite.

#### INFLUENCE OF INGOT-SIZE

Turning now to Figs. 2 and 3, we do not find any evidence which tends to show that segregation increases with the size of the ingot. Much the greatest enrichment occurs in the 5-in. square ingot. The richest spot in the 16-in. bottom-cast ingot has practically the same carbon content as the richest in the quickly cooled 2¼-in. ingot.

Turning to Figs. 4 and 5, we find much greater segregation in the fast-cooled 2¼-

in. ingot and the 7x10-in. ingot than in the 16-in. square ingot. Throughout the greater part of their length, these last two are practically alike in their carbon content; as the carbon of one increases or decreases, so does that of the other. But toward its top the 7x10-in. ingot undergoes surprising variations in carbon content.

Now if our old idea that segregation increases with the size of the ingot were true, or if within the limits here chosen the size of the ingot had any very strong influence on the degree of segregation, it certainly should appear in these results. The fact that no relation can here be traced between ingot-size and degree of segregation then seems to indicate very strongly that whatever influence ingot-size within these limits has on the degree of segregation is relatively unimportant, and liable to be completely masked by other variables.<sup>1</sup>

#### INFLUENCE OF THE RATE OF COOLING ON ENRICHMENT

Of the three ingots represented in Fig. 3, and of the three represented in Fig. 5, two were cast in sand molds and hence cooled slowly, and one was cast in an iron mold and hence cooled rapidly. In each set the richest of the segregate is much richer in the fast-cooled than in the slowly cooled ingots. In each case the three ingots were cast in immediate succession from the same hand ladle.

Figs. 6, 7, 8 and 9, show the distribution of sulphur in the axes of four slowly cooled and four fast-cooled cast-iron ingots made for me by T. D. West. In each case the metal was poured from the same hand ladle through a distributing funnel simultaneously into two ingot molds, one of sand and one of iron. In order to make the segregation of sulphur evident, the sulphur content was exaggerated by adding finely ground pyrites to the cast iron. This was done by spreading the pyrites on the bottom of the casting ladle, pouring the cast iron upon it, and then stirring with an iron rod. The iron thickened and stiffened at first when mixed with the pyrites, but soon recovered its fluidity. This stirring was kept up till the temperature had fallen as low as seems consistent with making sound ingots, and the iron was then poured. The whole of the axial metal in the upper part of each of these ingots was taken in the form of a series of drillings, each lot of which was as small as is consistent with getting trustworthy sulphur determinations, so as to have data from as many axial points as possible.

Now notice that in three out of these

<sup>1</sup>The analyses of 27 additional sets of drillings which have been taken from the 7x10-in. and the 16 in. square ingots since the above was written and figures 2, 3, 4 and 5 were drawn, go to confirm what is here said as to the influence of ingot-size. They do not materially affect the shape of any of these curves.

four pairs of ingots, the segregation of sulphur is not only greater but much greater in the fast- than in the slowly cooled one. Thus in five out of six cases, in each of which all the conditions except the rate of cooling seem to have been perfectly constant, we find that rapid cooling increases segregation, as was reported by Jars in 1781 and Roberts-Austen in 1875, and implied by Seyd in 1871. (See a paper on "Piping and Segregation in Steel Ingots," by the author, p. 252 of *Bi-monthly Bulletin* of the American Institute of Mining Engineers, March 1, 1907.)

#### WHY DEGREE OF SEGREGATION NEED NOT INCREASE WITH INGOT-SIZE AND WITH SLOWNESS OF COOLING

On seeking reasons why large ingot-size and slow cooling do not have their expected effect of increasing segregation, we may do well to consider a somewhat like case, the influence of aluminum in lessening segregation, as shown by B. Talbot in the *Journal of the Iron and Steel Institute*, 1905, II, p. 204. Stead pointed out (*idem*, p. 226) that this effect of aluminum was due to its quieting action. This seems to consist in its suppressing the evolution of gas, either by increasing the metal's solvent power for that gas, or by removing oxygen and thus preventing the later formation of carbonic oxide, or by both means jointly. There are three ways in which this evolution of gas may increase segregation, and hence three ways in which quiet, brought about by suppressing this evolution, can restrain segregation.

First, when any given layer of metal in the act of freezing splits up into a purer sub-layer which freezes and a less pure one which remains molten, this less pure one because of its impurity is lighter than the remainder of the molten mother metal, because each of the segregating elements, carbon, phosphorus, and sulphur, forms compounds with iron which are lighter than the iron itself. This lightness of the littoral layer tends to make it rise, and this causes a slight tendency to an upward flow of the molten metal along the solidifying shores of this molten central lake,<sup>2</sup> and this upward flow tends to move this impure sub-layer first to the top of the ingot and thence into the upper part of its axis. In case of ingots of ice the impurities are heavier than the liquid mother liquor, and hence they concentrate at the bottom instead of the top. Now, if the steel in solidifying sets free gas, this gas in rising along the solidifying shores helps this upward swimming of the impurities, by causing upward convection currents.

The second and third ways in which

<sup>2</sup>"Piping and Segregation in Steel Ingots," the author, *Bi-Monthly Bulletin*, American Institute of Mining Engineers, No. 14, March, 1907, p. 233. This matter was presented at the July, 1906, meeting of the Institute in London.

quiet tends to restrain segregation are due to its diverting the course of solidification from what I have called the "onion" to the "landlocking"<sup>8</sup> type of solidification. In the latter, solidification proceeds by the outshooting of long columnar or pine-tree crystals from the walls of the ingot into its molten interior. The branches of these pine trees landlock much of the molten metal, and thus mechanically impede the centripetal motion of the carbon, sulphur, and phosphorus, in the molten interior, which is the essence of segregation. In the onion type solidification proceeds by the regular deposition of smooth concentric layers of metal, one after another, as with the progress of solidification more and more of the metal passes from the molten to the solid state. I do not mean to say that this onion type is ever followed literally. There is probably always more or less outshooting of crystals. But in some cases this outshooting seems to be very slight, so that the onion type is approached, whereas in others the outshooting is extreme. The difference is probably always one of degree rather than of kind; but still for purposes of explanation it may more conveniently be spoken of as if it were a difference of kind.

A stream of rising gas bubbles, and the convection currents which they cause, should tend to wash off the trunks and branches of any incipient pine-tree crystals, and, by thus razing the landlocking growth, forcibly turn it into the onion type of growth. Hence quiet resulting from suppressing this evolution of gas should protect the landlocking growth from this form of destruction, and, by thus increasing the landlocking of the impurities, should lessen their migration into the last freezing parts, i. e., should lessen segregation.

#### SURFUSION

It remains to consider the third way in which, under suitable conditions, quiet may be expected to have an extremely powerful effect in lessening segregation, viz.: by leading through surfusion to the landlocking type of freezing. This way has been surprisingly overlooked from the time when P. Ostberg disclosed to a delighted audience in Pittsburg the remarkable effects of aluminum in permitting the manufacture of extremely fine, indeed almost hair-like, steel castings. He said that aluminum made the steel fluid by superheating it in effect. It did not raise the temperature of the metal, but lowered its freezing point; this was in effect superheating, because it increased the margin between the existing temperature and the freezing point. To this it seemed a sufficient answer that no aluminum remained in the castings, and that the melting point could not be lowered by the mere fact that the metal had once contained alumi-

<sup>8</sup>"Iron, Steel and other Alloys," the author, pp. 85 and 93.

num. This, I say, seemed a sufficient answer, but I now see that it really was not. It is true that the mere fact that aluminum had once been present could not alter what we may call the normal or theoretical freezing point of the metal, but it could indirectly lower its actual freezing point very materially by inducing "surfusion."

It is an old and familiar experiment that, when a solution of sodium sulphate is cooled without agitation, it does not actually freeze on reaching its normal freezing point, but still remains liquid. If now it is agitated, and especially if a crystal of solid sodium sulphate is dropped into it, the whole crystallizes almost instantaneously. In the same way when molten metals and alloys cool, freezing may set in, not on reaching the true freezing point, but at a considerably lower temperature, and when it then does begin, finding the whole of the metal like a bent spring eager to leap into the normal, i. e., the solid state, it takes place very rapidly. This phenomenon is called "surfusion."

Soon after the practice of adding aluminum to molten steel in order to quiet it had become common, it was reported that ingots to which aluminum had been added sometimes froze across suddenly when once they began to freeze. The significance of this was overlooked, and indeed its accuracy was doubted. But this report really signified that these ingots underwent surfusion, doubtless because the aluminum, in suppressing the evolution of gas, caused that quiet which is the condition necessary to surfusion. If aluminum thus induced surfusion in these ingots, then its effect of enabling Mr. Ostberg to make his remarkable castings was probably due in part<sup>4</sup> to its inducing surfusion in them. If the molten steel to which he had added aluminum did not actually freeze when it cooled to its normal freezing point, but instead remained molten till it had cooled much below that point, this should give it the power of running into the finer cavities in his molds through which it could not otherwise have passed, because it would have frozen before traveling far in them. In like manner, if the quiet induced in steel ingots by the addition of aluminum actually causes surfusion, so that even the outer layer of the steel does not solidify until much or even the whole of the molten mass has cooled below its true freezing point, then once freezing does set in, it might well be almost instantaneous throughout the whole ingot; or, if not instantaneous, then it would naturally proceed through the outshooting of interlocking pine-tree crystals, which must act powerfully to restrain segregation by op-

<sup>4</sup>"In part," because two other effects of aluminum probably contributed to this same effect, first, its oxidation by the oxygen dissolved in the metal actually raised the temperature slightly; second, the removal of this oxygen probably in and by itself made the metal more fluid.

posing centripetal movement, rather than by the regular deposition of layer upon layer as in the onion type of freezing. In short this accelerated freezing of a mass already below its normal freezing point would naturally proceed by the far outshooting and landlocking type; indeed instantaneous freezing might be considered as the landlocking type pushed to its logical conclusion.

#### SLOW COOLING NEED NOT FAVOR SEGREGATION

To sum this up, the quiet which aluminum causes restrains segregation, first, by preventing the upward convection currents of gas bubbles, which sweep into the upper part of the axis the impurities set free by freezing; second, by preventing the razing of the landlocking growth by these convection currents; and third, by inducing surfusion, which, if it actually does take place, must restrain segregation most powerfully, both by favoring landlocking and by leading to extremely rapid freezing.

This same quiet with its three ways of restraining segregation, is the only explanation which I now see of this surprising fact that in my experiments neither slow cooling nor large ingot-size increased segregation. Thus slow cooling should favor quietness by making the convection currents and the evolution of gas slight. Their slightness might lead to surfusion and this in turn might cause freezing, once it sets in, to be extremely sudden, so that slow cooling would thus actually result in rapid freezing. On examining my ingots I find evidence of this quieting effect of slow cooling. Thus both of my quickly cooled 2¼-in. steel ingots "rose," though all four of the slowly cooled ones "sank;" i. e., the evolution of gas in the former was so strong that the top of each ingot when finally frozen was strongly convex, whereas in the latter it was so slight that the ingot tops were concave.

In the same way a large ingot naturally cools much more slowly than a small one. The large ingot quickly heats up the walls of the mold to nearly its own temperature, so that henceforth the flow of heat from the molten metal into the walls of the mold is relatively slow. Further, the heat which is conducted in a given length of time into those walls forms a smaller part of the total heat of a large than of a small ingot. For both these reasons, then, the large ingot is the slower to cool, and, because the slower to cool, it should have less violent convection currents and less violent evolution of gas, both of which should incline it more to the landlocking type of solidification, and this in turn should lessen its segregation. If the quiet should go farther and lead to surfusion, this would favor still more powerfully the landlocking type of growth, and thus still more powerfully restrain segregation.

It appears to me that we here have to do with two distinct sets of tendencies, directly opposed to each other, both in case of the rate of cooling and in that of ingot-size. The direct effect of slow cooling and of large size of ingots should be to favor segregation; their indirect effect in leading to quiet, and through quiet to surfusion, should be to oppose segregation. The resultant of these two opposing forces should vary very greatly, and may indeed vary in sign, for the simple reason that surfusion is so capricious a thing, influenced by such apparently trivial circumstances. A little dust, a little jarring, may induce freezing; their absence may postpone it. Hence the conflicting evidence which we find is but natural. Thus, in contrast with the cases above cited in which rapid cooling increases segregation there are: first, one in which I found slightly less segregation in a fast-cooled copper-silver ingot;<sup>3</sup> second, one in which Professor Stoughton and I found less segregation in a fast-cooled wax ingot than in a like one cooled slowly;<sup>5</sup> third, the pair of cast-iron ingots represented in Fig. 8, of which the fast-cooled one segregated less than the slowly cooled one; fourth, the experience of an eminent maker of pure chemicals that rapid cooling of aqueous solutions opposes segregation.<sup>6</sup> His direct statement was that fast crystallization led to the formation of impure crystals; but this of course means that it opposes segregation, because the effect of segregation is to remove the impurities to the central mother liquor and thus to leave the crystals pure. Fifth, and finally, the fact that, as we pass from the outside of a steel ingot inward, the carbon, phosphorus and sulphur first decrease suddenly and then increase slowly, seems to mean that the sudden cooling of the outer crust has restrained segregation.

In regard to the influence of ingot-size on the degree of segregation it is dangerous to extrapolate, and to assume that, because between the limits of 2¼ in. and 16 in. the influence of ingot-size is of secondary importance, it will continue to be of secondary importance in case of much larger ingots, for instance great gun and armor-plate ingots. The additional quiet in the great gun ingots may be so slight that it will be outweighed and greatly outweighed by the additional time afforded for migration, and by the superadding of the segregation in the outer parts to that normal for the interior parts, so that these great ingots may segregate much more than those of moderate size. Thus the segregation in the very large ingots of Reuss, Maitland, Stubbs, Hogg, and Colby, is greater than that in any reported

ingot of moderate size, in spite of the fact that in all of these except those of Hogg and Maitland, drillings from only a very few points were analyzed, so that it is probable that the greatest enrichment was very much greater than that here given. In the Stubbs case there are only two axial analysis and in each of the two Colby cases only one.

A very important and practical corollary would follow if my surmise is true that surfusion may play an important part in checking the segregation in large ingots and in slowly cooled ones. It is that

and the evolution of gas, and at times indirectly and even more strongly by leading to surfusion.

The most enriched spot lies in the axis of the ingot, usually at a distance from the top of between 6 and 28 per cent. of the ingot's length.

The most impoverished part is probably rarely if ever axial.

The enrichment in phosphorus and sulphur seems to be parallel with that in carbon, so that the isophoses and isotherms (lines of equal phosphorus and equal sulphur) are parallel with the isocarbs.

SEGREGATION IN CERTAIN VERY LARGE STEEL INGOTS.

Authority.	Ingot-size.	Weight.	Excess of the carbon, phosphorus, and sulphur in the richest spot reported, over the average, in percentage of that average.			Number of Axial Points.
			Carbon.	Phosphorus.	Sulphur.	
Reuss (a).....		7 tons.	183	257	339	(f)
Hogg (b).....	30 in. diam. 10 ft. long.	} 11 tons, 1 cwt.	258	326	305	} 27 (g)
Stubbs (c).....	39 in. thick. 90 in. long.		149	172	544	
Maitland (d)....	Gun ingot.		153			
Colby (e).....	43x79 in.	56 tons.	155	325	568	1
Colby (e).....	43x79 in.	57 tons.	327	286	645	1

Note to table:

a. *Stahl und Eisen*, 11, p. 643 (August, 1891).

b. *Journ. Soc. Chem. Ind.*, XII, March 31, 1893.

c. *Journ. Iron and Steel Inst.*, 1881, I, p. 200.

d. *Proc. Inst. Civ. Eng.*, LXXXIX, p. 12 (1887).

e. *Iron Age*, 64, Nov. 30, 1899, p. 5.

f. There is no information given in the original, as to whether any of the drillings were taken from the axis of the ingot.

g. Twenty-seven axial determinations of carbon, and two of phosphorus and sulphur each, were made.

everything should be done to induce surfusion. In particular, the ingots should not be disturbed soon after casting, because agitation is one of the surest ways of preventing surfusion.

#### CONCLUSIONS

To sum up the present results of my study:

Between the limits of 2¼ in. square and 16 in. square, the influence of ingot-size on the degree of segregation is of such slight importance that it is masked by that of other variables, but the recorded instances of segregation in very large ingots, e.g., those which are 30 in. across or more, indicate that very large ingot-size increases segregation.

In most cases there is more segregation in ingots cooled quickly than in those cooled slowly.

The direct effect both of an increase of ingot-size and of slow cooling should be to increase segregation. The fact that they do not under the conditions of my tests indicates that some secondary but powerful cause is at work in the opposite direction. The cause which I offer as at least a part explanation of the paradox is the quietness to which both large ingot-size and slow cooling lead. This quiet should restrain segregation by favoring the landlocking type of solidification, directly by lessening the convection currents

On a general average of many cases, the maximum enrichment in phosphorus is about twice, and that in sulphur about thrice, that in carbon; but in individual cases the ratio of enrichment in any one of these three elements to that in either of the others varies very widely.

Unusual freedom from sulphur and phosphorus does not appear to restrain the segregation of carbon, but if anything rather to increase it.

I am not yet prepared to report on the degree of enrichment and the degree of homogeneity in the remainder of the ingot after discarding certain definite percentages of its upper part, nor on how the richness in carbon influences the segregation of that element.

The Pittsburg, Bessemer & Lake Erie road has contracted for 70,000 steel ties for renewals. When these are in use about 90 miles of the road will be laid with steel ties. According to the *Railroad Gazette*, the railroads controlled by the United States Steel Corporation are now using steel ties enough to lay 160 miles of track. Roads not identified with the corporation are using about 120,000 steel ties on 40 miles of track. The present year the company has sold about 3000 tons of ties. A plan has been completed whereby the ties can be insulated, making them available for electric roads.

<sup>3</sup>"The Influence of the Conditions of Casting on Piping and Segregation, as Shown by Means of Wax Ingots." *Trans. Am. Inst. Mining Engineers*, to appear.

<sup>6</sup>*Bt-Monthly Bulletin Am. Inst. of Mining Engineers*, March, 1907, pp. 252-253.

# Hoisting Ropes for Mines—III

Report of the Transvaal Commission. Deterioration of Hoisting Ropes in Use; Its Causes. Examination of Ropes to Insure Safety

BY U. P. SWINBURNE AND ASSOCIATES

With reference to the possible deleterious effect of working conditions on the life of the rope, one manufacturer remarks: "A hoisting rope, made to suit the special apparatus at a mine, should only depend upon the number of foot-pounds of work done for its life. The more material lifted from the mine, or the quicker that it is lifted, has an effect upon these foot-pounds in direct proportion to the life of the rope."

While the statement is doubtless theoretically correct, it has been found in local experience that practical difficulties exist in the manufacture of a hoisting rope that will absolutely suit special working conditions. There may be a combination of adverse factors such that any provision made to combat the one only tends to weaken the defense of the other. For instance, in a compound shaft (partly vertical and partly inclined), the large frictional wear due to the guide-sheaves in the bend and the rollers on the incline, naturally points to the use of large outer wires in the strands of the rope, but if the winding drum is of small diameter, the maker might well hesitate to do this. Speaking broadly, it may be said of winding ropes on the Rand that the working conditions have such an effect on their lives that comparison in respect of the duty of the rope is seldom attempted.

It is quite usual for the rope to be wound in several layers on the drum, especially in the cases of some of the older plants which are now being used for considerably greater depths than those for which they were designed. Where heavy loads are hoisted and the small diameter of the drum leads to the use of ropes of compound construction, there occurs very severe and rapid wear on the rope, due to crushing and pinching actions. In several such cases it has been found that a rope of "best crucible" steel of about 100 tons breaking stress proves to be the longest-lived, although it is more unfavorably conditioned with respect to statical loading and bending stress than the ropes of other constructions.

## INCLINED AND VERTICAL SHAFTS

Variation in the direction of shaft also introduces a very destructive influence. Of the shafts in the Rand in which raising and lowering of persons is permitted, there are 89 vertical, 56 inclined, and 34 compound. The compound shafts are, in nearly every case, graded vertical to in-

Note—From the report of the commission, appointed by the Lieutenant-Governor of the Transvaal, to inquire into and report upon the use of winding ropes, safety catches and appliances in mine shafts.

clined, and the turn is made on a bend of fairly large radius, varying from 50 to 170 ft., and, in some cases, even up to 600 ft. The rope in going round the bend is guided by a series of seven or eight wide rollers. These rollers, to minimise inertia effects, are generally made up of a series of narrow flat-rimmed sheaves, threaded on the same spindle with, designedly, but slight clearance between adjacent sheaves. Inertia troubles are, however, never completely got rid of, and the spacing of the sheaves widens with wear, and has been known to allow the strands of the rope to be pinched between the rims.

The rollers on the inclines are not always moving freely, and the gritty dust that hinders their successful operation also causes the rapid wearing away of the wires of the rope. While this wear is evenly distributed over the circumference of the rope, it is not nearly so dangerous as when it occurs, as it sometimes does, near the attachment to the skip, in a one-sided manner, perhaps, nearly severing an individual strand of the rope. Uneven deterioration in one particular part of a winding rope is a particularly dangerous defect, as the equal distribution of the load among the component wires is disturbed, and the danger of actual fracture is more nearly approached.

The rollers should be of the lightest possible design, well balanced, and of sufficient size to prevent excessive speed on the wearing spindles. No matter how well designed, they still have the effect of shortening the life of the rope, as it is impossible to keep them always in the best working condition, owing to grit, acid water, etc. This no doubt accounts to some extent for the shorter life of many of the winding ropes in inclined shafts on the Witwatersrand, as compared with ropes working in the vertical shafts of coal mines, where such severe conditions do not obtain.

## USE OF RESTS

Evidence was taken as to the advantage or disadvantage of using rests (keps) to facilitate the loading of the conveyance. Nearly all the witnesses were opposed to the use of keps, although acknowledging that they are probably necessary where a cage is used and truck loading is in vogue, especially so in the case of deep winding. They have not, up to the present, been proved necessary for skip loading, even in very deep shafts. On the majority of the Witwatersrand mines they are certainly not necessary, and, if installed, would constitute a source of danger if used any-

where else in a shaft than at the lowest loading stations. Apart from any such danger, the general objection to the use of keps is that they shorten the life of the rope by introducing more severe alternation of the loading of the rope than is necessary, and lead to a pick-up shock which is greater than the shock of loading with the rope hanging taut. They are not, therefore, recommended, as their use increases the risk of accident, and they are harmful to the rope.

## SPEED OF ROPE

With reference to the question as to how far the rope is affected by the speed at which hoisting is carried out, rapid winding is considered to be the more harsh condition, and the opinion was expressed by several witnesses that slow winding with big loads will give longer life to the rope than quick winding with small loads. This is not on account of the fact that the average speed is higher in one case than the other, but because of the existence of a greater liability to shocks due to sudden changes of velocity.

In order to minimize the bad effects of quick winding on the rope, it is necessary to have the pit-head sheave as light as possible and the winding drum massive, so as to moderate the shocks in starting and stopping. With a heavy sheave there is a tendency to wear the ropes very severely at the points of acceleration and retardation owing to the ropes skidding when the velocity of winding changes quickly. In a well designed winding plant it should be possible, with careful driving and good governing, to avoid sudden large alterations of speed. A good speed indicator, such as a recording tachometer, is likely to conduce materially to the smooth running of the cages, both from the assistance it gives to the engine-driver and the check that it provides on the manner in which he performs his duty.

## SMALL DRUMS

Where small winding drums are used to carry several layers of rope, very severe damage is frequently caused owing to the pinching effects that occur at the cheeks (flanges) of the drum, where the winding rope is forced by wedge action to turn backward on itself in a riding turn. This can be obviated if the flanges are constructed to a design introduced by H. C. Behr, consulting mechanical engineer to the Consolidated Gold Fields of South Africa, Ltd. In his standard specification for winding engines, as mentioned in E. J. Laschinger's evidence, it is provided

that: "The last groove opposite to where the rope is attached shall rise gradually above the other grooves, so as to raise the second layer of the rope gradually, and without shock, above the first layer. In order to prevent overstraining the drum flange, or wedging the rope as it mounts from the second to the third layer, where it cannot be assisted by a rising groove in the drum as employed in the case of mounting the rope from the first to the second layer, the drum flange at that point shall be formed with an annular projection sloping at an angle of 45 deg. for the depth of the second layer of rope. Below the sloping part there must be a filling piece shaped along a spiral, so as to fill the space between the edge of the rope and the lower edge of the conical projection of the drum flange, for the purpose of preventing the end of the second layer of rope from being wedged in between the first layer and the foot of the flange."

Side friction of one coil of rope on the next coil, as also on the lower coils on which it is bedding, may be produced by too short a lead from the pit-head sheave to the drum. The angularity of the pit-head sheave and the horizontal distance of the drum from the shaft should so conform to the width of the drum that the deviation of the rope is not too great; an angle of 2 deg. on each side of the center line has been found to be sufficient. If this limit is departed from to any extent, there is considerable side friction on the rope, and the coiling of the rope on the drum is likely to give trouble. However, in the case of a grooved drum with the rope coiling in only one layer, it may be permissible to have more lateral deviation.

Practically all the evidence tendered was in favor of the view that periodical re-capping materially increases the life of a winding rope, from 10 to 30 per cent. being the estimates of the gain resulting from the regular practice. Each time 10 or 12 ft. are cut off from the lower end, the whole working part of the rope is shifted that amount toward the conveyance, and the positions of greatest wear are thereby altered, with the exception, however, that any local damage that exists in the rope due to pinching at the flanges of the drum, is not prevented from increasing. To change the wear from these places, it is necessary to alter the position of the attachment of the drum-end of the rope, or to slack out this end, should there be spare rope carried inside the drum.

#### EXAMINATION OF HOISTING ROPES

The absolute necessity for a daily examination of each winding rope by a competent person is a point on which all witnesses agree. The commission also recommends a weekly examination on the following lines: The person making the examination stands in a safe position at the collar of the shaft and allows the rope

to be slowly raised or lowered through his hand, which is protected by a thick glove or piece of waste. The rope should not be moved faster than 40 or 50 ft. per minute, and, while feeling with the hand for any broken wires, the eye of the operator watches closely for any other defects, such as excessive wear, loosening of the strands, straightening of the lay, kinking or severe corrosion. When anything abnormal is noticed, the motion of the rope should be stopped and the suspected part thoroughly cleaned and examined. If the defect is a serious one, such as the occurrence of two or more broken wires in a short length of the rope, say 2 ft., the engineer's attention should at once be called to the fact, while, in the case of a lesser defect, a note should be made of its position in the rope, a proper entry logged in the record book, and the engineer duly informed. It is also advisable that the rope should be watched for a short time while it winds on and off the drum and while coiled on the drum, so that the positions of possible pinching or crushing can be located and examined.

A few of the witnesses were of the opinion that the daily examination of the ropes was not regularly or properly carried out, and others spoke of the difficulty in finding time for it. There appear to be difficulties in the way of setting apart a particular time of the day in which the rigger, or other person detailed for the work, shall have the rope and winding plant at his disposal. This commission, however, feels strongly that the regulation which provides for the daily examination of the ropes that raise or lower persons should be enforced with the utmost stringency. The withholding of facilities for the carrying out of this examination should constitute an offense against the regulations, while, on the other hand, the penalty for making a false entry in the record book should be most severe.

The proposal was made to the commission by the three riggers who gave evidence, that the rigger (or wire-splicer) who carries out the daily examination, and who, under the supervision of the mechanical engineer, has sole charge of the winding ropes, should be certificated; that is to say, he should pass a practical examination under Government regulations to insure his competency. The commission has not gone deeply into this question, but regard it as one worthy of serious consideration. It has to be noted, however, in this connection that the mechanical engineer, who is responsible under the regulations for the monthly examination of the rope, has to be a holder of a certificate of competency. In the subjects comprised in the examination, "Wire Ropes—their Structure, Inspection, and Maintenance," find a place. So that it appears probable that this member of the staff of the mine, who actually engages and supervises the rigger, will be quite

able to decide as to his competency or otherwise.

A good deal of evidence was given in favor of making the thorough examination of the rope a weekly duty, as contrasted with the present monthly practice. The necessity for the change is not considered to be established. The monthly examination appears to be designed for the purpose of carefully gaging the progress of normal wear and assessing the probable strength remaining in the rope, while the daily examination is emphasized in importance as being the one which is relied upon, and that practically entirely, for the detection of abnormal and unforeseen deterioration. The functions of the two examinations, although related, are very far from similar.

When a rope has been working for some months, or when there are signs of rapid deterioration, the engineer will naturally make his thorough examination more frequently—every fortnight, or even once a week.

#### METHODS OF EXAMINATION

To clean a rope for thorough examination, certain mechanical devices were suggested, the idea being in each case to pass the rope through a box containing scrapers or revolving brushes. In one case a trough of boiling oil was suggested. Most persons appear to consider it unnecessary to thoroughly clean the whole rope, and it is doubtless quite sufficient for the purpose of even thorough examination to clean the rope at selected places by means of the usual appliances, a stiff wire brush and paraffin or oil, according to the preservative composition used on the rope.

The portions of a rope that should be most carefully examined will generally be well known to the mechanical engineer from his experience with preceding ropes, and the knowledge of why and where they deteriorated most. With respect to external wear, the places in the rope that should be especially watched are those where contact with the pit-head sheaves or heavy guide pulleys occurs at acceleration or retardation periods of the hoist. These places are also likely to suffer more than any others from internal wear, excepting perhaps that portion of the rope near the skip or cage, which, although generally subjected to no rubbing wear, yet is exposed to the corrosive effects as well as to the bending and shock stresses. In addition to these positions, attention must also be directed to that part of the rope which lies between the drum and the sheave when the load is at the bottom of the shaft, as also to those parts of the rope which come in contact with the flanges of the drum.

Some interesting particulars of the tests of three worn ropes were obtained. These ropes had been discarded by the mine authorities, and it was, therefore, possible to cut them up and obtain sam-

ples showing the condition of the rope at various points. One of these ropes, the original breaking strain of which was  $62\frac{1}{2}$  tons, broke at loads varying from 46.1 tons to 47.9 tons. This rope had only been in service  $7\frac{1}{2}$  months, and was discarded owing to a bad kink. Another similar but longer rope broke in various places at loads ranging from 36 to 53.8 tons. The third rope of  $1\frac{1}{2}$  in. diameter, and originally of 105 tons breaking load, broke at loads varying from 74 to 89 tons. The results of these tests bear out what has been previously said regarding the positions of probable maximum deterioration.

Opinions are equally divided as to the necessity of relieving the rope from the stress of its load during the examination. For taking circumferential measurements at various positions on the rope so as to compare wear, it is certainly not desirable, but for the purpose of internal examination it is absolutely necessary. Slack strands or wires, or straightening of the lay, where such occur, can generally be seen under ordinary working conditions.

#### TESTING DETERIORATION

As to methods of assessing the deterioration of a worn rope, other than by the examination of the separate wires of a piece cut from the end at the time of re-capping, it appears correct, in the case of a rope of simple construction, such as 6.6.1, to state that, if the wear evident externally is taken into consideration—neglecting the deterioration that may possibly exist internally—a fair idea of the strength of the rope will be arrived at. If however, corrosion is, to any appreciable extent, visible externally, then it will be wise to assume that it also exists on those parts of the wires which cannot be seen. In a rope of compound construction, the possible condition of the internal wires has to be considered, and this makes the calculation more difficult and naturally more of the nature of a guess. A point of possible assistance is the fact that in a rope of this description, when the internal wires are corroded, this generally has the effect of loosening the strand somewhat, and the outer wires are standing up, or probably can be raised up or pushed aside so that the condition of the inside wires can be seen.

Most witnesses agree that the internal wear or corrosion is very difficult to discover, but some suggest that by untwisting the rope slightly, the condition of the wires on the under side of the strand can be seen. This can be done by means of two twitches and levers, and it is maintained that the strands of the rope can be closed into their normal positions again without injury. Several witnesses were strongly adverse to this opening out of the rope, and it appears fairly certain, in the case of a well worn rope, that the strands would not naturally return to their places. It stands, therefore, as a procedure not

to be recommended except in exceptional cases, where internal corrosion is known to exist and must be gaged, and where the user of the rope is prepared to discard it if damage is occasioned thereby. The use of a marlin-spike was also advocated by one or two practical witnesses, to open up the rope for internal examination. While it is possible that in the hands of a wire-splicer of large experience this method might be safe, the great possibilities of dangerous damage being done to the rope by a less skilled person absolutely condemn what, it is trusted, is not a practice.

(To be Continued)

### Nevada Consolidated Copper Company

The report of the Nevada Consolidated Copper Company for the year ended June 30, 1907, shows assets of \$8,644,425, which include property and investment accounts, a fund for acquiring bonds in the Nevada Northern railway, accounts receivable, cash and call loans.

The liabilities amount to \$6,500,000, being the par value of 1,300,000 shares of capital stock; a surplus account of \$1,961,503; accounts payable, not yet due, \$139,185; and income account, \$43,807.

The president's report calls attention to the salient features of the report of Pope Yeatman, the company's consulting engineer, and concludes as follows:

"Concerning the Nevada Northern railway, I can only add that the road is well built, excellently equipped throughout, and is in a prosperous condition.

"The concentrator and smelter are in an advanced stage of construction and are nearing completion. I confidently expect to see both in full operation in the first half of 1908."

The condensed report of Pope Yeatman, under date of Oct. 1, 1907, follows:

"The claim area of the Nevada Consolidated Copper Company amounts to about 850 acres, consisting of 63 claims. It is divided into two general sections, the Eureka group, comprising 27 claims, and the Ruth group of 36 claims.

"The copper ore occurs mainly as chalcocite as a secondary enrichment; this chalcocite, in the form of specks, veinlets and bunches, being in porphyry, of which there are large intrusive masses in both the Eureka and the Ruth groups. Besides copper in the form of chalcocite, there is also some chalcopyrite. Iron pyrites is associated with both minerals.

"The orebodies in the Eureka and Ruth groups have been developed and show ore blocked out by shafts, levels, raises, and drill-holes, aggregating 14,432,962 tons, with an average content of 40 lb. copper per ton, and some gold and silver, for which an extraction of 15c. per ton of ore is allowed.

"Outside of the developed orebodies

there are great possibilities. These are indicated: (1) by the typical porphyry croppings; (2) by underground workings, which have not yet been carried out beyond the limits of the ore; (3) by development by means of drill-holes, which have penetrated orebodies.

"The most important of these possibilities are: (1) a new orebody in the Ruth section, very promising because of the fact that the crosscuts of the Ruth are still in payable ore. (2) A large mass of copper-bearing porphyry, a portion of which has been prospected by drill-holes, showing ore averaging about 2 per cent. (3) The extensions of the Eureka, where borings with the diamond drill have disclosed considerable bodies of good ore; and probably the most important of all these possibilities is an orebody, lying adjacent to the main Eureka orebody and opened up by drill-holes. This shows a thickness of ore averaging 142 ft., a possible length of 2200 ft., and an average assay value of 2.42 per cent. copper.

"The Nevada Northern railway furnishes ample transportation facilities for cheaply taking the ore from the mines to the concentrator and smelter of the Steptoe Valley Smelting and Mining Company, in which the Nevada Consolidated Copper Company owns a half interest.

"The ore will be treated at the concentrator at McGill, Nev. One-half of this concentrator is for the use of the Cumberland-Ely Company, and the other half for the Nevada Consolidated Copper Company. There is an abundance of water brought from Duck creek by a pipeline having a capacity of 1200 cu.ft. per minute.

"The concentrates will be treated at the smelting plant which will consist of roasters, reverberatories, blast furnace and converter plant.

"A thoroughly modern and up-to-date power plant, to furnish power for the smelter, concentrator and mines, will have a capacity of about 6500 h.p.

"The enormous orebodies, the cheapness with which the ore can be mined, concentrated and smelted, and the generally favorable mining conditions, make the property one of wonderful promise."

The output of lead ores in the United Kingdom during 1906 was 30,795 long tons of dressed ore and the amount of lead obtainable by smelting was 22,335 tons, containing 147,647 oz. of silver. The corresponding figures for 1905 were 27,649 tons of dressed ore, 20,646 tons of lead, and 163,399 oz. of silver. There were sixty-five mines in operation, and in addition there were a few places where lead ore to the extent of 569 tons was won from open work quarries. The largest producers are the Mill Close mine in Derbyshire, Rhossemor in Flint, Van mine in Merroneth, Foxdale in the Isle of Man, Lead hills in Lanark, and Greenside in Westmoreland.



# The Work of the U. S. Geological Survey

Past and Present Work of the Geological Survey. How it Has Aided the Mineral Industry. Plans and Opportunities for the Future

BY GEORGE OTIS SMITH\*

In the year 1907 the value of the mineral production of the United States will probably equal or exceed \$2,000,000,000. In the first year of the Geological Survey's history the value was only about one-ninth of that amount. The value of the coal mined in 1907 will be, alone, more than \$500,000,000, or more than twice the value of the total mineral output of 1880. It is fair to consider whether the Geological Survey has had any part in the national progress and whether it intends to keep pace with the development of your industry, a development it has carefully recorded these 28 years. In any review of the development of American mining the man behind the pick and the drill must be given his due, but motive power counts for little without knowledge to guide it. And I take it that the American Mining Congress stands for the intelligent guidance of the mining industry, and in this the United States Geological Survey heartily joins.

## LIMITATIONS OF THE SURVEY

The United States Geological Survey is the servant of the people along lines defined by the law of Congress, and both the direction of its progress and the distance covered are determined and limited by the appropriation act. Congress has expressed the scope and purpose of this branch of the public service in its name. The words "United States" define its national character. In no branch of industry, probably, are State lines of so little moment as in the mining industry. Our smelters, wherever situated, recover metals from ores mined in almost every State; and the collection of statistics of every branch of the industry necessarily disregards State lines. In the study of ore deposits the mining geologist who, for instance, can continue his investigations year by year through a series of copper camps, has a great advantage over an investigator whose observations must be confined to the mines of a single State. This increase in opportunity means increase in value of results secured and published for the information of the public. The collection of mineral statistics and the study of mineral deposits, then, must of necessity be made by an organization whose field is the whole country.

The second part of the name is "Geological." In the wording of the law creating the Geological Survey, "mineral

resources" and "geologic structure" are linked together in a closeness of union that is well justified by the results of investigations showing the absolute dependence of the one upon the other in so many mining districts. There is then a fitness in the use of this adjective "geological" in the title of the organization. It expresses a recognition of the real basis of the mining industry, and upon this foundation the Geological Survey has built. Practical men must not underrate the contribution of the worker in pure science, but rather realize that his work is fundamental. For these reasons, again, we count it not a limitation, but the greatest advantage that this Federal organization approaches this important industry from the scientific side.

In the third place, the word "Survey" expresses the idea of getting at the truth at first hand, while such a word as "bureau" serves only to emphasize the administrative and clerical side. "Survey," then, stands for work in the field, the winning of truth, not from books but from rocks, not in the office but in the stope; and it is upon thorough field investigation alone that you can rely. The subject of mining geology was put foremost in the plan of the organization of the Survey and the impetus then given to the investigation of ore deposits continues to the present day. Dr. Raymond, the secretary of the American Institute of Mining Engineers, has said that the leadership which American observers have taken in the science of ore deposits must be attributed not only to the rich field here afforded and its active development by mining, as well as to the liberal expenditures made by State and Federal governments for its study, but also to what is most important—the presence of men competent to take advantage of these favorable conditions and "the wise provision made for such investigations by the first director of the United States Geological Survey."

At other sessions of this congress representatives of the Survey have explained to you the contributions it has made to your industry, and already I have incidentally touched upon the same subject. I propose, therefore, to confine myself to only a brief mention of the present work, as a basis for the statements of further possibilities of development.

## THE VALUE OF MAPS

Our topographic maps in accuracy of detail and in excellence of mechanical execution are of the highest grade. Every

three days our office is publishing one of these maps based on actual survey, and much oftener is printing a new edition of some earlier sheet; yet we appreciate the fact that one class of men, to whom many of these maps would be of greatest assistance—the prospector—rarely knows that such a map is extant. Of even greater value is this map to the mine operator, who follows the prospector and plans the development of the property, and therefore should have before him all the data bearing upon the important questions of water supply and transportation. The endeavor of the Geological Survey must be, not alone to make better topographic maps and more of them, but to get these maps into the hands of the people for whom they are made.

Much the same statement can be presented regarding our geologic maps. Every month, on the average, a folio is issued which presents graphically all that is known regarding the geologic structure and the distribution of the mineral wealth within a district embracing an area of from 200 to 1000 square miles. A large proportion of these geologic folios cover mining districts. However, it again appears that the Survey's geologic folios do not reach all who might profit by the facts they set forth. The price asked for these publications is only nominal; the real difficulty is that of advertising our output.

## WORK IN ALASKA

Perhaps the Survey has nowhere better improved its opportunity to aid the mining industry than in Alaska. The literature on Alaska of value to the mining man is almost wholly composed of Survey publications; yet the exploration work represented by these reports and maps has involved an expenditure of less than half a million dollars, or only one-half of 1 per cent. of the gold output for the same period.

## THE COLLECTION OF STATISTICS

Reference has already been made to the importance of reliable statistics regarding the mining industry. At the time of the organization of the Geological Survey the country possessed no adequate knowledge of the status of mining. Advantage was at once taken of the new organization, and the systematic statistical study of the mining industry under the tenth census was intrusted to Director King. I refer to this because in the successful issue of the work under these auspices can be discerned the correct policy for this important work. Mr. King's plan of utiliz-

Note—Abstract of address delivered before the American Mining Congress, Joplin, Mo., November, 1907.

\*Director United States Geological Survey.

ing for statistical work the services of those most closely in touch with the mines deserves continuance, and in view of our recent progress along this same line I assure you that there is within our reach the possibility of much greater usefulness to your industry.

The scope of the Survey's statistical work, like that of all other of its investigations, has been limited by the appropriation available; increase that, and more and more can be done in the matter of keeping the country informed as to the development in the technology of the mining industry as well as the no less marked increase in production. Here it is to be noted that to secure the best results there must be the closest relations between geologist and statistician; best of all is it when the investigator can justly claim both titles.

#### ECONOMIC GEOLOGY

The record of the Geological Survey in mining geology warrants the hope of greater development in the field it has occupied during these years. The disinterested testimony of those unconnected with the organization, as expressed a few years ago by a leading mining journal, is that in no other country "has economic geology been applied to the development of industry with such beneficent results as in the United States, and no (other) geological survey has contributed so much to the practical application of the science of geology to mining operations." Not only in this country, but abroad, the United States Geological Survey is regarded as in reality performing the work of a mining bureau by reason of its activity in fostering the development of the mineral resources of the country. I must not leave this subject without a reference to one of the greater possibilities for increasing the efficiency of the Geological Survey. Legislative authority should be secured for a certain amount of investigation in foreign countries of ore deposits, together with mining conditions and methods. Several of the Survey's mining geologists, from time to time, while on leave of absence, have been engaged by foreign corporations to report upon properties in South Africa, Australia, and South America, and the extent to which the survey has benefited by reason of their foreign service is keenly appreciated.

#### TECHNOLOGY OF THE MINERAL INDUSTRY

The statement of official publications planned by the first director of the Geological Survey indicates the value which he attached to investigations into the technology of the mineral industry, even to the matter of testing the relative cost and efficiency of different types of mining and milling machinery. Little, however, was done along these lines until, under Director Walcott, the Survey took up the fuel-testing work which has reached so successful a development under the recently organized Technologic

Branch of the Survey. Again, I wish to call attention to the complexity of the mineral industry of today. The interdependence of the one mineral product upon many others makes the miner, of all men, dependent upon many factors outside his own mine. Waste of our supply of wood, water, and mineral fuels will hasten the day when certain ore deposits can no longer be mined at a profit. Hence, we count upon mine-owners for hearty support in the work that the Forest Service and the Geological Survey are doing in the conservation of the natural resources of the nation.

#### PUBLIC AND PRIVATE WORK

A distinction must be made between what may be asked and what can be granted by the Geological Survey. I refer to the legal restrictions by which "the director and members of the Geological Survey shall have no personal or private interests in the lands or mineral wealth of the region under survey, and shall execute no surveys or examinations for private parties or corporations." This law may be thought to restrict our activity somewhat, yet it surely adds to the value of our results. Increased appropriations would enable us to meet these specific needs, although the assays and other examinations made by the Geological Survey should be only for new finds, or for new methods, and the results should be promptly published for the information of the public rather than of the individual. In a word, the work of the Survey geologist, engineer, statistician, or chemist is planned not to encroach upon that of the mining engineer or the assayer in private practice, but to be basal in character, and of a nature to assist these professional men, as well as the prospector and the mine owner. I am not unmindful of what the industry has suffered at the hands of the unscrupulous, who masquerade under the title of expert, and against these the Federal Survey is ready to protect both prospector and investor. More and more is the organization taking upon itself work of this kind, which is always delicate and often thankless.

#### CLASSIFICATION OF PUBLIC LANDS

It may be well to note that the Geological Survey is not charged with the enforcement of the law, but is rather a bureau of information; yet as such it is no less its duty to assist in law enforcement, especially in all that relates to the classification of the public lands. At the time of the inauguration of the Geological Survey the classification intended by Congress was believed to be general in character, and such as would be expressed upon maps issued for the general information of the people. The present interpretation is that the classification should be more definite, and therefore, during the past season, the Survey has been actively engaged in the classification and valuation of the coal land of

the public domain. Increased demands are also being made upon mining geologists for assistance in the determination of the mineral or non-mineral character of land of which title from the Government is sought. In all this work the sole purpose of the Geological Survey is to determine the truth of the issue and thus to protect the interests of the public; to assist the legitimate miner by opposing his worst enemies, the land grabber and the unscrupulous promoter of wildcat schemes.

#### FUTURE WORK OF THE SURVEY

President Richards has outlined definite recommendations for the further extension of federal work in aid of the industry you represent. In the Survey's effort to serve the mining industry, I recognize no limitation beyond those set down by Congressional enactment, and I will gladly join with you in the effort to seek to make such enactment fit your real needs. Under what federal auspices the mining work should be conducted is not so important a consideration as that the work should be done and done well. If changes in organization become necessary, there will be no hesitation in making those changes, nor in coöperating with any other agency that may share with us the work. It is the work itself that is of prime importance.

#### CONCLUSIONS

In conclusion, the lines along which I propose to have the United States Survey advance to a position of greater usefulness to the mining industry are these:

1. The fuller recognition of its duty in the classification of the mineral lands of the public domain.
  2. The rapid extension of systematic field study of all mineral deposits, so that geological exploration may keep in advance of economic development.
  3. The further development of the Survey as a source of authoritative and disinterested information, for the benefit of the prospector or the land-owner.
  4. The broadening and improvement of the methods of collecting mineral statistics, with the purpose of securing more accurate returns and of expediting their compilation and publication.
  5. The investigation of processes relating to the mining and later treatment of fuels, ores, and other mineral products, in so far as such investigation may be fundamental to the best utilization of the nation's mineral wealth.
  6. The preparation of reports that will better meet the needs of the mining industry, and the distribution of these publications more promptly and effectually.
- These are not radical departures, for the Survey is at present making progress along each of these lines of public service, and we mean to continue that progress; yet the rate of our advance, and that is what you are most interested in, will be largely accelerated by the more generous support which you are able to ask for us.

# The History of Gold and Silver

A Summary of the Ancient and Modern Uses of the Precious Metals, the Sources of Supply and the Effect of Supply on Values

BY JAMES W. MALCOLMSON \*

The history of gold and silver, to a large degree, is the history of civilization. These metals have been found in all countries of the world and are widely diffused throughout the crust of the earth. In the earlier ages of the world's history, gold was obtained more readily than silver, as it is not affected by oxidation or decay. On account of its weight, it settles in the metallic state in streams to the bed rock and on account of its resistance to natural leaching processes, it is often found at the outcrops of mineral deposits when all other minerals have disappeared entirely.

Silver, on the other hand, is but seldom found in the metallic state, but is more often mixed with gold, lead, copper or zinc. Pure silver minerals, such as the chloride or sulphide, are almost as rare as native silver and silver ores are usually complex mixtures in which other minerals predominate. The processes of treatment of silver ores are therefore more complex than those of gold, and the metal is only obtained by regular underground mining operations, as it is but rarely carried far away from its original deposition.

## EARLY USE OF GOLD AND SILVER

It is probable that gold was employed long before silver was known, and the value of silver in some ancient states appears to have been superior to that of gold. Even in Japan, up to the seventeenth century the values of gold and silver were almost equal. Soon after the first opening of that country to commerce, the Dutch secured nearly all the gold of Japan in exchange for silver, before the Japanese learned the difference in values in Europe.

In ancient Greece, in the days of Herodotus, gold was 13 times more valuable than silver and this ratio appears to have been fairly constant for many centuries. For nearly 1000 years, to the fall of Constantinople, the ratio of value of gold to silver in the Roman Empire was approximately 12 to 1. In Arabia, in the sixth century, the ratio was  $6\frac{1}{2}$  to 1, while at the same time it was 10 to 1 in France. In Spain in 1493, it was  $10\frac{3}{4}$  to 1; in 1500 the ratio of value of gold to silver was  $10\frac{3}{4}$  to 1; in 1600 it was 12 to 1; in 1700 it was 15 to 1; in 1800 it was  $15\frac{1}{4}$  to 1; in 1900 it was  $33\frac{1}{2}$  to 1, probably on account of its demonetization throughout nearly the whole of Europe and America.

Note—Paper presented to the American Mining Congress, Joplin, Mo., November, 1907.

\*Mining engineer, Kansas City, Missouri.

It was a remarkable fact that from 1660 to 1860, a period of 200 years, the ratio of the value of gold and silver remained almost stationary at  $15\frac{1}{2}$  to 1.

## ANCIENT PRODUCTION OF GOLD

The search for gold has been the first cause of the settlement of much of the earth's surface by civilized races. Del Mar believes that the Argonauts, who sailed from Thessaly with Jason to obtain the golden fleece in Colchis, were probably leaders in a rush to a new goldfield or placer deposit along one of the rivers flowing into the Black Sea. The allusion to the golden fleece perhaps indicates the use of sheep skins in sluice boxes in the way that we still use woolen blankets for the same purpose.

The settlement of Egypt by the Semitic races of Asia has been thought to be contemporaneous with the first discovery of the gold mines of the Peninsula of Sinai more than 2500 years before Christ; and the Phœnicians and Jews, the kinsmen of these hardy pioneers, went out and searched the whole world for minerals.

In the Book of Job, supposed, I believe, to have been written about 1500 B.C., a notable reference to gold and silver occurs, as follows: "Surely there is a vein for the silver and a place for gold where they fine it; as for the earth, the stones of it are the place of sapphires and it hath dust of gold."

Of Solomon, who lived 1000 years before Christ, it was said that "All his drinking vessels and all the vessels of his house were of gold; none were of silver, it was nothing accounted of in the days of Solomon." Solomon was perhaps our first "bonanza mining king." It is a curious fact in the history of mining the precious metals, that no matter how intelligent or economical a man may be, if he be unsuccessful in finding ore, his industry and talent count for nothing; and no matter how imprudent or unintelligent he may really be, if he finds rich ore and makes a huge profit, he is hailed everywhere as Wisdom personified.

It was probable that something of this sort happened to Solomon, and since then his mines have been the theme of the novelist and the poet. He was closely allied with both the Egyptians and the Phœnicians; he married Pharaoh's daughter and was a close friend and ally of Hiram of Tyre, king of Phœnicia. On account of his successes in gold mining in Africa, in Egypt and elsewhere, it is probable that every wise saying for centuries was attributed to him. Even his

matrimonial adventures are more or less characteristic of many successful mining operators of our own time. In south-eastern Africa, over an area of 600 miles square, the ruins of fortified cities and great mining camps are found, about which almost nothing is known today, except that the occupation of the ancient inhabitants was gold mining. It is estimated that over four hundred million dollars worth of gold was extracted from these mines. Andrew Lang says of them:

"Into the darkness whence they came,  
they passed,  
"Their country knoweth none;  
"They and their gods without a name  
"Partake the same oblivion  
"Their work they did, their work is done  
"Whose gold it may be shone like fire,  
"About the brows of Solomon  
"And in the house of God's desire.  
"We know but that men fought and fell  
"Like us, like us, for love of gold."

The silver mines of Laurium, 30 miles west of Athens, were worked for centuries by the Greeks and are referred to by Tacitus, Aristotle, and many other writers. They seem to have been worked originally by the Phœnicians, about 1200 B.C. Demetrius, a Greek writer who lived about 300 B.C., boasted that the Greeks worked these properties with such energy that they threatened to dig up the devil himself. Shortly after this period, mining operations were shut down. The mines of Laurium were reopened successfully by the French in 1860 and are paying dividends at the present time.

In the search for gold, the Phœnicians and afterward the Romans, who were more skillful miners than the Greeks, were led to Spain, which was to the ancient world what Mexico is to us today; but during the most critical period of the Punic wars, Rome debased its silver money and demonetized its copper coinage because the silver and copper supplies of the world at that time came from Spain, then in possession of the Carthaginian army. Hannibal, however, had other resources and this became probably the first great war in history where the troops of both armies were paid in gold coin. In the fourth century, the Romans worked gold mines in every province of Europe and practically all the gold known at that time was in their possession.

## THE SEARCH FOR THE PRECIOUS METALS

Humboldt is authority for the statement that America was discovered because Columbus sought a nearer way to the gold mines of Japan; while Cortez and Pizarro penetrated the unknown forests of the New World in the search for the precious metals. The conquest of India

and South Africa, the settlement of California, Australia and Alaska, all originated in the desire to obtain golden treasure and the search for gold has carried the torch of civilization throughout the world. It is a curious fact, however, that the English-speaking people alone produce today nearly seven-eighths of the world's production of gold.

Asia possesses a remarkable capacity for the absorption of gold and silver and much of the precious metals sent there seems to be permanently withdrawn from our stocks available for money. It may be that much of this is hoarded or buried in the ground and lost, becoming practically nonexistent. Asia has been called the sink of gold and silver and its ability to absorb or lose these metals has been a subject of remark, ever since the time of Alexander the Great.

#### GOLD AND SILVER AS MONEY

Among all civilized people, gold and silver have derived their chief importance from their use as money. In the earlier period, the first money known, and even still in use among undeveloped or isolated communities, consists of skins, salt, shells, soap, slaves, cattle, sheep, olive oil, tobacco, iron, tin, lead, copper, nickel and platinum. In such communities transportation facilities were rudimentary, commercial operations were limited to small areas and carried forward slowly, on a small scale. Money has been defined as that which passes from hand to hand throughout the community in final discharge of debts and as full payment for commodities or service, being accepted without reference to the character or credit of the person who offers it.

For many reasons, the metals finally superseded all other forms of money and gold is gradually displacing all other metals and driving them from the field. Cattle die, iron rusts, slaves grow old, but gold and silver—more especially gold—fulfill all the requirements of money, better than anything else we know of. Gold is of small volume compared with its weight and value, it is of uniform goodness and quality, easy of transport, easily guarded, readily divided and reunited without loss. Its identity is perfect, it is easily recognized and is beautiful, brilliant and durable almost to eternity. It is probable that gold which was in use at the time of Solomon is in active service still. Gold does not deteriorate with storage or time and its firm and compact texture, makes it difficult to wear away.

#### THE VALUE OF GOLD

Until within the last generation, the value of gold bore practically no relation to its cost of production, but depended only on the total quantity in the hands of mankind. For ages, its value changed only by slow degrees. In ancient times, strong nations plundered weaker races of their hoards of the precious metals and more modern powers have followed their ex-

ample, using it without regard to its cost of production.

It is probable that gold and silver were used as money long before the metals were stamped and coined and this was ultimately done in order to save the trouble of weighing and assaying for each transaction. The talent, shekel, etc., in the Hebrew records all refer to the use of money by weight, while the English pound and the Spanish *peso* and *onza* all indicate weight. The word coin itself, meaning a wedge, indicates a primitive method of using money. Our word pecuniary, now applied to metallic money, originally meant cattle, and from the custom of counting cattle, comes our present designation of money as capital, meaning heads.

The coinage of gold and silver was adopted at first by private individuals and cities to guarantee originally the fineness and afterward both the weight and purity of the metals. In Rome under the Empire, however, coinage became the exclusive privilege of the Emperor. Herodotus attributes the first use of coined gold and silver to the Lydians, but it is probable that the real date was much earlier. As civilization advanced, the use of gold and silver as money became a modification and an improvement on the earlier methods of simple barter, and gold presented us with a desirable standard of comparison with which all other values, even including future obligations are compared and measured.

Gold, however, is not an absolute standard, such as the pound weight or the meter length, but is simply a relative measure of value as steady as anything we know of. In other words, it is possible for gold itself to change in value. The control of weights and measures has always been one of the great functions of governments and is one of the necessary prerogatives of national life and honor, and every honest government since the dawn of history has protected the use of gold and silver with the best guarantees it could devise, both as regards its weight and its purity. The reputation of any government can be more readily and more seriously injured by the debasement or the defects of its currency than in any other way. Changes in the value of gold are reflected immediately in the price of some commodities and very slowly in the price of others, particularly in wages and returns from investments bearing a fixed rate of interest. In any change in the value of gold, the majority of the poorer portion of the community suffers most; employers and merchants are quick to discount any change and they adjust themselves to new conditions more readily than the wage-earning classes. Those living on the interest paid on bonds or mortgages, cannot adjust themselves to the change at all, and are paid a fixed amount of gold, irrespective of its value. The wealth stored up by all communities in interest-bearing bonds, using gold as a fixed standard for future payments, is af-

ected enormously by changes in the value of gold and the result of such changes on the business and-commerce of the world is hard to realize.

#### VARIATIONS OF VALUE IN ANCIENT TIMES

Although gold is mentioned in the earlier literature of every race, it is difficult to learn its ancient value as measured in terms of food and wages. It is certain, however, that its value in early times was a thousand times greater than it is today and that this value had been decreasing slowly until the discovery of America. In the thirteenth century, it was estimated that the total stock of gold and silver in Europe was approximately \$6 per capita, the population at that time being thirty millions. Only one-half of this gold and silver was coined; no banks or negotiable paper existed. Good roads were few and there was little peace and no credit. From the fifteenth to the eighteenth centuries, enormous quantities of silver were obtained by Europe from the New World and the gold supplies of Japan and India were gradually transferred to Europe until by the end of the eighteenth century there was estimated to be ten times as much of the precious metals in Europe as in the thirteenth century. As before mentioned, previous to the eighteenth century the value of gold bore practically no relation to its cost of production, but depended primarily on its peculiar fitness for money as a basis of value and on the total amount in use. Before 1840 the annual production of gold bore such a small relation to the total quantity existing that its cost of production from year to year never materially affected the value of the whole quantity in use and Von Humboldt, in a remarkable article on the production of gold, written in the early part of the nineteenth century, predicted that these conditions would continue for all time.

#### INCREASE IN GOLD SUPPLY, 1840-1860

In 1845 the annual production of gold in Russia increased very largely and all Europe was alarmed. In Holland, the desirability of a single silver standard was widely discussed. In the Netherlands, gold was demonetized in 1847, and the silver florin declared to be the sole legal tender. Belgium soon after followed suit. In 1847 a run occurred on the Bank of England. In 1848 the Bank of Austria stopped payment and when, in 1849, California began to give its golden treasury to the world, the golden panic reached its height. In 1857 Russia suspended payments in specie and the German States, including Austria, adopted a single silver standard. Chevalier advised the government of France to demonetize gold and Cobden in England seriously recommended a return to simple barter. After this increased production of gold, however, the actual course of events reversed all predictions, prices rose everywhere, and the world entered

upon a period of unexampled progress and prosperity; and in 1871, the German Empire finally adopted the gold standard and discontinued the free or unlimited mintage of silver, being followed in 1873 by the United States and France and by the Latin Union, Holland and Belgium in 1875.

#### RECENT MOVEMENTS OF GOLD

It is, however, owing to the utilization of the power of steam during the past 50 years, a cause which has wrought so many changes in human affairs, that the use of gold as money has been almost completely revolutionized. The amount of gold in the world, which before 1850 had increased slowly and had barely kept up with the increase in population, suddenly increased by leaps and bounds. It became twice as great, ten times as great and by the year 1900, the annual production of gold became approximately 400 tons or 22 times as great as in 1800. Since then, the production has increased with equal rapidity, until now, it has reached 680 tons per year and it is estimated by competent authorities that in the next 16 or 17 years, the amount of gold in the world will be doubled. In other words the amount of gold which has taken the whole civilized world thousands of years to accumulate, will be doubled in our lifetime. In addition to this, the spread of knowledge, the development of railroad and ocean transportation, the use of the telegraph and the growth of modern banking methods, have all increased the efficiency of gold as money. This has also been aided by the greater confidence which races and individuals now have in each other, which is one of the great underlying features of our modern civilization and a golden dollar can now be made to do more than a hundred dollars did a century ago. These rapid changes are being accompanied by others equally remarkable; money can now be transported throughout the world at a speed undreamt of by our fathers, cheaply and with almost perfect safety. Its use has been still further facilitated by international and other clearing houses, where transactions involving the use of the measuring power of gold are effected to an enormous extent by telegraphic communication without actually moving or handling the gold itself at all. All this has tended to make gold cheaper. On the other hand, the enormous scale on which commercial enterprise is now being carried forward, the improved mode of living of whole races, the demands of industry for money along so many different lines, the money needed in the building up of new countries and the funds required for war purposes, all tend to keep up the price of gold.

Underlying all these activities, however, remains the commodity gold, upon which all our calculations are based, and the fact must always be remembered that gold as money is only a measure of value by virtue of its relation to the value of other

commodities. In all countries, apprehension is felt when gold is exported, and this perhaps is an unconscious admission that the quantity of gold in any community exercises an important influence on its industries and its commerce. The use of gold as money is primarily a modification of the system of barter or exchange and is to a lesser degree than any other material human standard a creation of law. At the same time it must always be the effort of government to limit and define its use with precision.

#### FUTURE VALUE OF GOLD

In spite of the present efficiency of mining operations and the improvements and economies in metallurgical processes, it is probable that the demands of industry and commerce which are increasing so enormously, will ultimately increase the value of gold, or at least prevent its depreciation to any serious extent below its present level. Whether the value of gold will change materially in the future or not, is a subject that deserves the earnest consideration of every statesman. Although this subject has received the attention of thinkers in all ages, the issues have usually been hidden by the personal interests of rulers, or of those controlling the supplies of the precious metals, or by the desire of governments to secure the greatest benefits for their own coinage. It is seldom that the people of any community have had an opportunity to investigate the relation of this question to their own welfare and it is not improbable that some of the inequalities of our social system may be traced directly to this cause. The growth of organized society depends largely upon the development of exchange, and exchange is impossible without money. If we must continue to use gold, it is of prime importance that our government should be able to form an accurate judgment regarding its present and future because this, the basis of our monetary system, fixes the value of much of the property in our own country over long periods of time.

#### Russian Quicksilver Production

A report in the *Visetnik Finanssoff*, reprinted in the *Min. Journ.* (Oct. 5, 1907), shows that the quicksilver output of Russia, according to figures of the Auerbach company, the only concern in Russia smelting quicksilver ores, has suffered a practically continuous decline in output from the beginning of 1906 to the end of July. The January production in 1906 was 1178 poods, while in January, 1907, the production was only 780 poods. The output for July, 1906 and 1907, was 1000 and 598 poods respectively. Total production for the first seven months of 1907 was 5177 poods, as against 7817 poods in the corresponding period of 1906.

#### Peat Investigations

The technologic branch of the United States Geological Survey recently published the results of preliminary investigations upon the gas-producing powers of peat, and gave definite information as to the performance of this substance in gas producers. The first test described was somewhat inconclusive in that the five tons of material shipped to the testing plant was not sufficient to permit building up a fuel bed and Illinois coal was used for this purpose. Accordingly, it is uncertain just what part was played by the coal in the conversion of the peat into gas. The peat was macerated, briquetted at the bogs in Massachusetts and dried. It burned well in the producer and the gas obtained was of good quality averaging about 166.6 B.t.u. per cu.ft. of gas. This figure may be compared with 160.6 B.t.u. obtained from North Dakota lignite and 139.2 B.t.u. per cu.ft. of gas obtained from West Virginia coal when run in a producer.

A more satisfactory test was made on peat from Orlando, Fla. This peat showed a shrinkage of 45 per cent. in bulk and 85 per cent. in weight in drying. The briquets used were approximately 3x6x1.5 in. and enough were available to allow a 54-hour test after building up the bed and making the preliminary trial. The total consumption of peat during the run amounted to 29,250 lb. or about 585 lb. per hour. The producer gas obtained had a calorific value of 175 B.t.u. per cu.ft. It contained 18.5 per cent. hydrogen and was comparatively low in nitrogen, having only 45.5 per cent.

In using peat in gas producers more or less inconvenience arises from the fact that peat is very light. Firing must therefore be persistent, and by consequence, the amount of peat required to generate one horse-power is considerably greater than in the case of coal or of lignite. Thus for Florida peat 3.16 lb. per hour were consumed in the producer for each unit of electrical horse-power available for outside use, as compared with 2.88 lb. of North Dakota lignite and 1.03 of West Virginia coal.

In testing peat briquets under boilers it was not possible to prolong the trials as much as was desired, but the results obtained were satisfactory as far as they went. No difficulty was found in keeping the boiler up to its rated capacity. The peat delivered a calorific value of 10,082 B.t.u. per lb. of dry peat as compared with 14,436 B.t.u. for West Virginia coal. The amount of peat burned per hour for each unit of electrical horse-power output was 6.98 lb. against 3.45 lb. for West Virginia coal. The principal difficulty in using peat for steam generation as indicated by these figures arises from its lightness which demands persistent, steady firing.

# Mining the Coal Measures of Michigan

The Seams near Bay City Are Worked Chiefly with Pick and Shovel. Undulations of the Strata Prohibit Straight Entries

B Y L E E F R A S E R \*

Nowhere within the boundaries of Saginaw and Bay counties, the principal coal districts of Michigan, does the hardpan or bedrock outcrop on the surface, but is covered by a drift sheet varying from 30 ft. in thickness in the north of Bay county to 220 ft. in the south, continuing at approximately this same thickness throughout Saginaw. The drift shows a tendency to thicken toward the west.

itself. Some ten or twelve beds of coal have been deposited at different elevations.

#### THICKNESS OF THE COAL MEASURES

The thickness of the coal measures varies considerably, due to glacial and pre-glacial erosion, and to the elevation of the basement upon which the formation rests. The basal strata—the Parma Sand-

the Saginaw river in both Bay and Saginaw counties would seem to give a satisfactory explanation of the formation of part of the pockets of coal. Weeds and rushes waving above the surface of the water in Saginaw bay, many miles from the shores, may also serve as a criterion to the nature of the deposition of the coal beds.

Referring to the accompanying maps

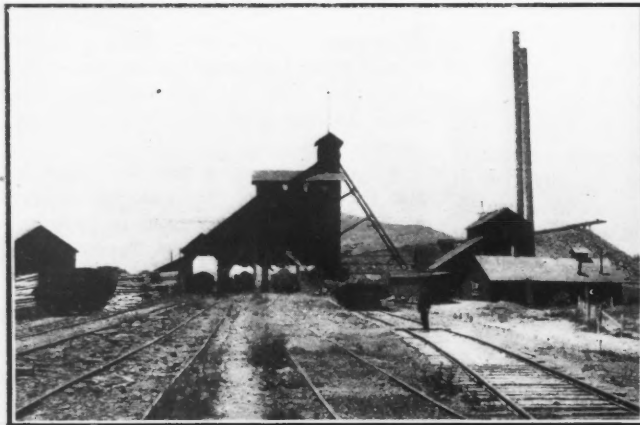


FIG. 1

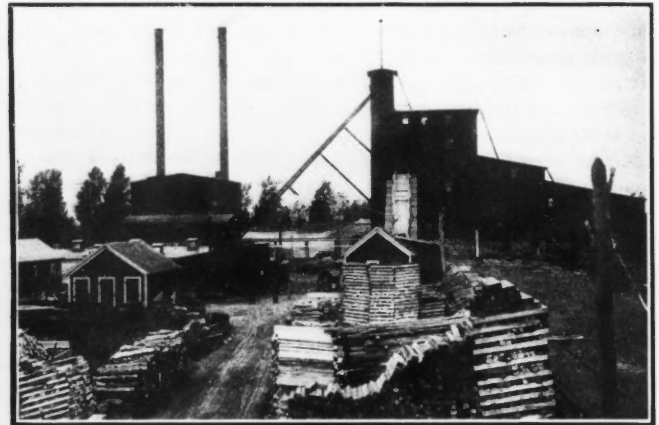


FIG. 2

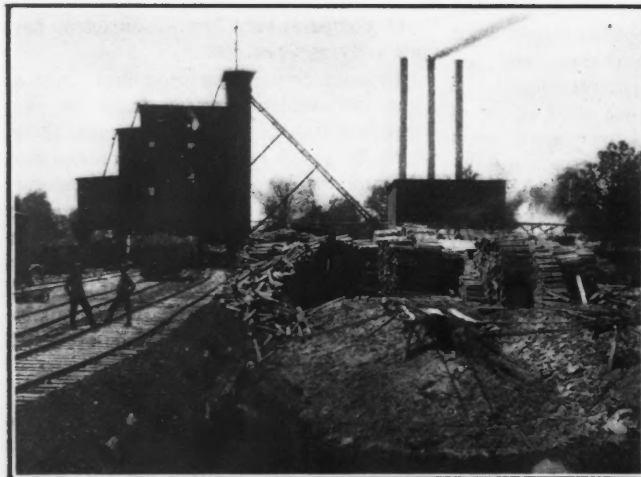


FIG. 3



FIG. 4

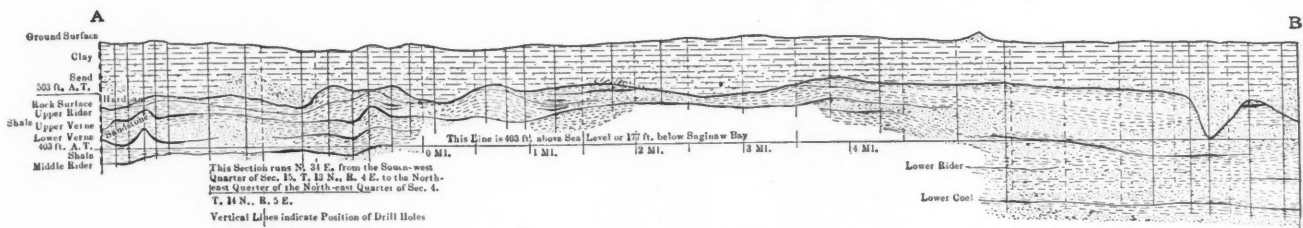
This vast accumulation, overlying the coal deposits, is composed of muck, alluvium, sand, gravel and clays with here and there beds of iron ore and interglacial deposits. The coal measures, or Saginaw formation, consist chiefly of shales and sandstones. Lime and occasionally iron carbonates occur in thin layers, while iron pyrites is found together with the coal and in layers by

\*Saginaw, Michigan.

stone—measures from 100 to 525 ft. in Bay, while in Saginaw county the thickness decreases. Where the basement has been eroded the soil and subsoil deposits are noticeably thicker, measuring as much as 385 ft. in the west of Bay. It is improbable if coal of sufficient quantity to be of commercial importance will ever be found below the Parma sandstone.

Beds of muck in Kawkawlin and Merritt townships, and the reclaimed swamps and marshes along the banks of

and sections (prepared by the Michigan Geological Survey), we note the successive seams of coal which proceed in order as follows, commencing with the lowest: Bangor coal, Bangor Rider, Lower coal, Lower Rider, Saginaw coal, Middle Rider, Lower Verne, Lower Verne Rider, Upper Verne, Upper Verne Rider, Salzburg coal, Salzburg Rider. Any section throughout the coal formation is not thoroughly reliable on account of the pockety deposition of the coal; no bed being continuous or



VERTICAL SECTION OF COAL MEASURES

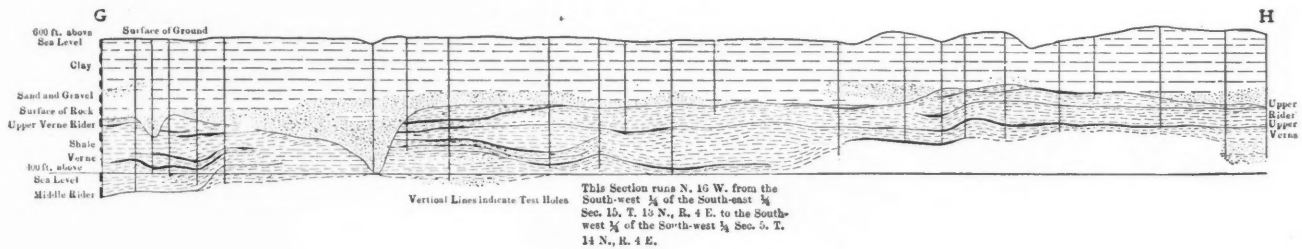


FIG. 5. VERTICAL SECTION OF COAL MEASURES

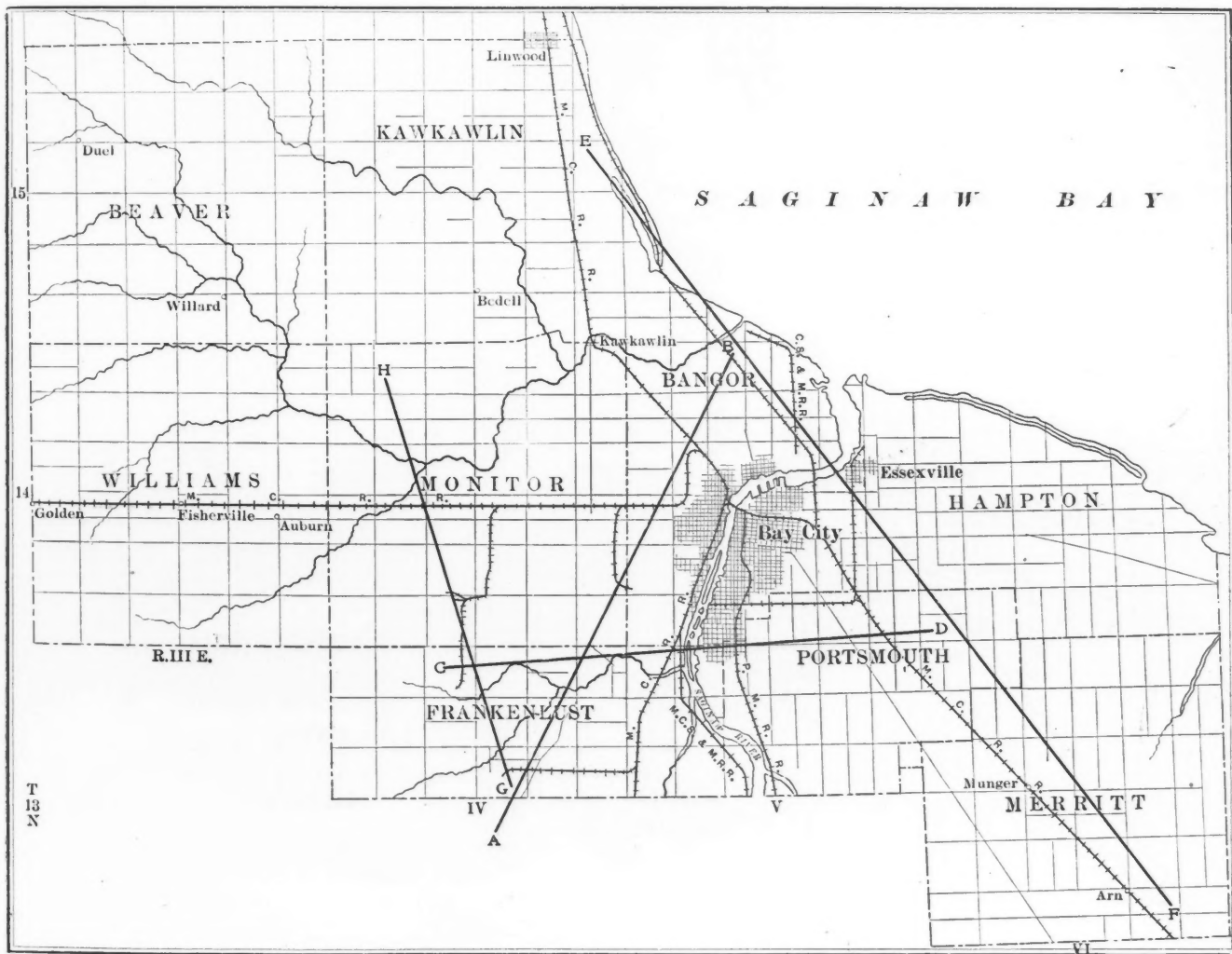


FIG. 6. MAP OF PART OF BAY COUNTY, MICHIGAN



FIG. 7

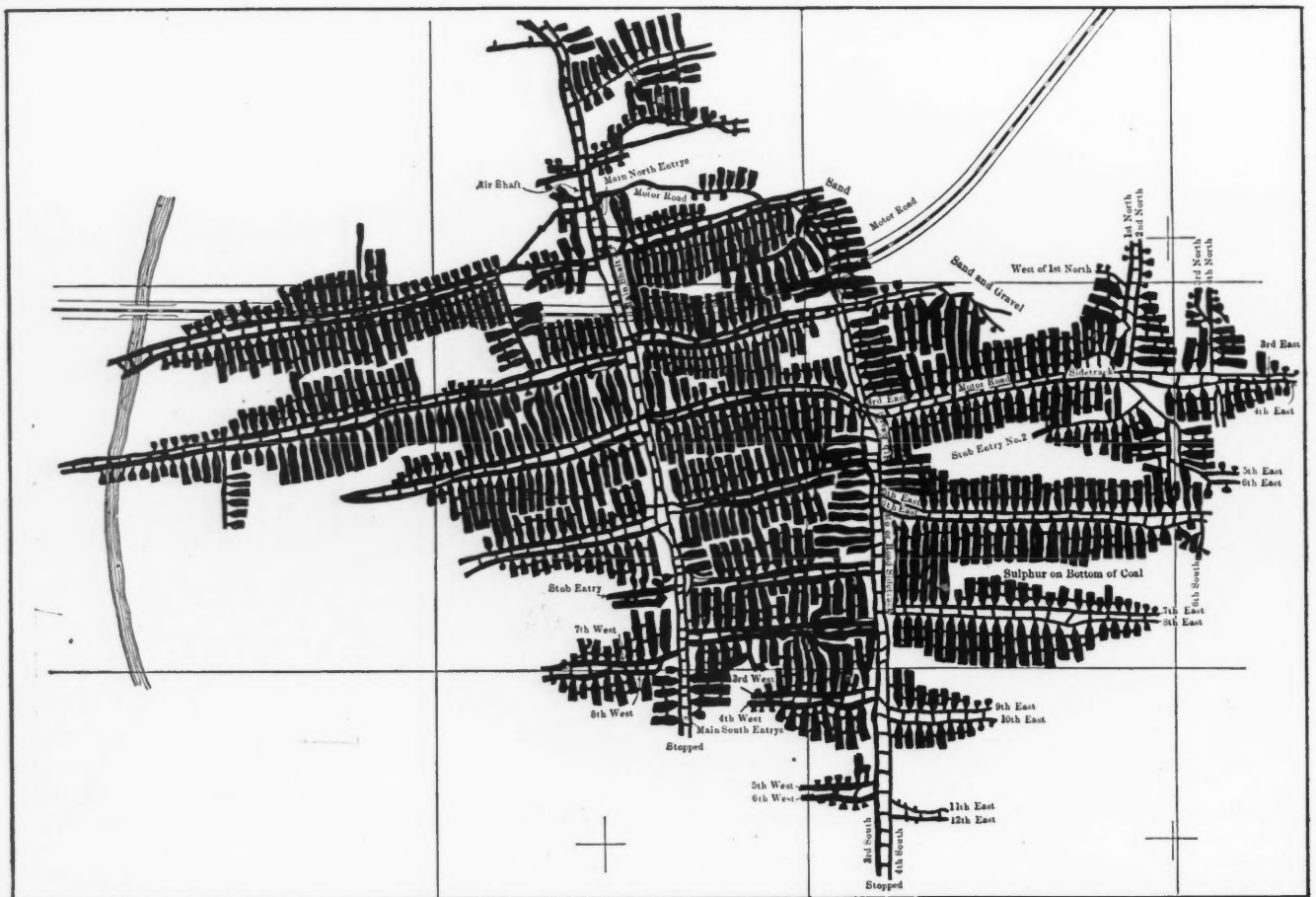


FIG. 8



workable over an extent of more than 3 or 4 sq. miles, but much may be had from such sections showing the relative elevations and contours of the seams. The Verne seams in Bay county, while the Saginaw seam in the vicinity of Saginaw have sustained the chief economic development.

#### METHODS OF WORKING

Illustrations of the methods of working the seams are shown in the accompanying prints. Fig. 7 represents a mine operating on the Lower Verne and Rider measures. The two seams are in places directly superimposed, while in others they are separated by seams of bituminous shale, slate or clay varying from an inch to several feet in thickness. In other places a band of sulphur intervenes. Where the two seams join they measure from 7 to 8 ft. in thickness. The minor undulations of the strata are so decided as to prohibit straight entries and rooms, so that the swale of the coal must be followed and hills avoided. Fig. 8 represents a mine operating on the lower Saginaw formation which averages 2.5 to 3 ft. in thickness, but lies evenly and is not characterized by heavy grades.

lished in the State Geological Survey reports. The amount of sulphur is distinctly noticeable in the Verne coals and proves detrimental to such an extent as to prohibit its sale. To obviate this difficulty the Consolidated Coal Company is erecting at Saginaw a coal washer of 100 tons per hour capacity to remove the sulphur, sand and shale.

### The Coal Market in Europe

According to a recent consular report there is a scarcity of coal throughout Europe and prices have been advanced. England is unable to meet the demands from the Continent, and several European countries are now looking to other countries for their winter supply.

The increase in the price of coal in England is ascribed to various causes. It has been stated that one of the principal reasons for the advance is that many railroad companies are unable to find sufficient cars to carry to the consumers the output of the collieries. This statement is ridiculed by the railroad companies. The exceptionally cold weather during the last few months and the great

at the mines. Prices have risen 25 per cent. in the last 12 months and the scarcity is likely to continue.

Although coal production in Germany is at present at high-water mark, prices maintain a high level owing to the immense demand. The Prussian state mines in Silesia recently decided to raise the rates for certain qualities. In April the price of coal rose from 36 to 48c. above the previous rates. In the last three months no fluctuations have occurred. In Switzerland, since June, French coal has risen 8 per cent., while German coal is 10 per cent. dearer than in July, and a 20 per cent. rise was predicted from the beginning of October. In Norway last year steam coal was \$4.14 and house coal \$5.11. They are now \$5.84 and \$6.45, respectively.

### Dust in Welsh Collieries

In his annual report, Henry Hall, inspector of mines in North Wales, refers to the dust question in coal mines. He points out that a very considerable part of the accumulated dust on the roads is the result of transporting the coal in badly built trams, many of which are little better than riddles, distributing the dust along the roads. This dust is, of course, of no value to the mine owner; if it had been, some better method would have been adopted long ago. Then another source of dust accumulations underground is the close proximity of the screening and cleaning machinery to the downcast shafts, causing the dust created in these operations to descend with the ventilation, when the wind blows from particular quarters, and spread itself along the intake air roads. The present elaborate screening plants have seriously increased this evil. It should not be a difficult matter, if energetically taken in hand, to prevent this poisoning of the ventilation. If the dust made at the surface in this way cannot be kept within bounds by watering, then there is little hope of its effective treatment underground.

### Turbine Pumps in Coal Mines

High-speed turbine pumps are now being very extensively used in coal mines. The cost of laying the foundations and excavating for the same is much less than for a reciprocating pump of the same capacity, because the turbine pump and its driver are very compact. There are no air vessels, no water hammering in the pipe, and the flow is continued. The quality of the water to be pumped should be considered when designing a turbine, also when regulating its speed. If the water is gritty and dirty the speed should be as moderate as possible, as the excessive wear of the internal parts is greater in dirty water than in clean.

ANALYSES OF MICHIGAN COAL SAMPLES.

Number.	1	6	9	10	15	19	23	27
Location ...	Saginaw.	Saginaw.	Saginaw.	Saginaw.	Bay. Verne.	Bay.	St. Charles.	St. Charles. UpperCoal.
Seam.....	Saginaw.	Saginaw.	Saginaw.	Saginaw.	Bay. Verne.	Bay.	St. Charles.	St. Charles. UpperCoal.
Moisture...	10.15	7.60	12.51		5.82	1.7	7.79	4.84
Vol. Comb.	33.14	37.898	30.58	34.78	39.79	35.25	34.74	40.13
Fix. Comb.	53.95	50.73	55.89	63.83	45.15	53.55	52.58	51.49
Ash.....	2.76	3.77	1.22	1.39	9.24	9.5	4.89	3.584
Sum.....	100.00	99.995	100.00	100.00	100.00	100.00	100.00	100.00
Total S....	1.10	0.69			3.83		1.50	2.22
B.t.u.....	12,726	12,521	11,663	13,345	12,861		12,836	

The coal is extracted chiefly by pick and shovel mining, but compressed air punchers and electric chain machines are used in some mines to advantage. The presence of hard sulphur precludes the use of the chain machines to a considerable extent. The coal is loaded into cars of 1500 lb. capacity and hauled by mules to "partings" from where it is taken to the shaft by electric locomotives.

Figs. 1, 2, 3 and 4 show several of the tipples of the Consolidated Coal Company. Notice should be taken of the use of rods and turnbuckles, and the absence of knees and braces and mortised joints. It has been found easily possible to keep perfect alinement in the shaft house by tightening or loosening where the superstructure becomes drawn, and especially when the structure is being erected, little attention need be paid toward keeping a perfect line until after completion, when any curvature may be corrected, it being possible to move the timbers 8 to 10 in. Cheapness, durability and speed recommend this practice. Tipples that have stood for eight years have been corrected but once or twice.

Analyses of samples taken from 4 of the 12 veins have been made. The following are the results of analyses pub-

consumption of coal by the manufacturing factories are doubtless contributory causes to the advance.

The Nottingham colliery proprietors advanced prices 1s. on Sept. 11. Leading colliery owners in the Cardiff district are booked well ahead. In Leeds the September advance has been made without there having been any summer reduction. To the 97c. advance already made there will be added another 73 or 97c. before next summer. In many cases industrial firms will be working at a loss owing to the high coal prices. During the last 12 months house coal has advanced 97c. at Bradford, but at Newcastle the lack of ships is preventing Northumberland and Durham coal trade from participating in the boom.

The principal Italian markets for coal are Naples and Genoa, where the prices of Welsh coal are \$7.70 to \$8.10 per ton, and anthracite coals are from \$10.15 to \$11.35. The prices of both kinds have increased about \$2.03 per ton since the beginning of last winter. In Russia the price of coal has risen steadily since May from \$4.45 to \$5.20 per ton and is likely to go still higher. In Austria-Hungary there is a great scarcity of coal, owing to industrial activity and lack of labor

# Colliery Notes, Observations and Comments

## Practical Hints Gathered from Experience and from the Study of Problems Peculiar to Bituminous and Anthracite Coal Mining

### DEVELOPMENT AND MANAGEMENT

Coal to the total of 25,267 tons was imported into Santo Domingo last year, of which 3191 tons were of British origin and 21,700 tons from the United States.

If a compressed-air plant is to be efficient, all the moving parts of the machinery should be taken apart and cleaned once a week. If the machinery is used without cleaning for any length of time, all the valves, springs and other moving parts become gummy.

In many of the deeper English mines very little shot-firing is permitted. Before any shot is fired in any main haulage road, special permission has to be obtained from the certified manager, who in most cases makes a personal inspection before giving such permission. Such shots are fired between the shifts, or on Saturdays when the ordinary work is suspended.

The two conditions that limit the output of a motor are, heating and sparking at the brushes. A motor should not spark at the brushes under a full load. At 25 to 50 per cent. overload some sparking should be expected. Two causes of sparking are, dirty commutators, and brush holders out of adjustment, so that the brushes are not free to make a perfect contact with the commutator.

Experience has shown that there are two things to be guarded against in connection with cables in mining work, mechanical injury to the insulating envelop of the cable, and the action of moisture upon the insulating envelop. These can be guarded against by placing the cables in wooden troughs by the side of the road. These troughs should be filled with pitch which will follow the undulations of the ground without opening a passage for moisture. Cables so arranged are easily inspected and can be closed up again after inspection.

Under ordinary conditions of roof and bottom, in a seam not more than 3 ft. thick, when the coal has to be undercut, and cannot be shot from the solid, it is best to undercut the coal and take down roof to secure light rather than to undercut in the bottom under the seam. The latter system causes an uneven bottom and makes track laying difficult. Moreover, the machine men keep coming up into the coal, consequently mixing in dirt, and lastly, it is difficult to get men to cut the bottom at a reasonable and uniform rate of pay.

While the main and tail rope systems of haulage can be used in all mines, the

best results are obtained under the following conditions: When the engine planes are straight and long and the branch roads lead off at some distance from the shafts, which allows the trips to attain high speed; where the engine planes have curves of large radius, the plane can have any number of curves along its course bearing to the right or left without materially increasing the risk of de-railing the cars; where the roadways are narrow and require only width enough for a traveling road at one side of the single line of rails.

One distinct advantage resulting from the use of machines in coal mining is due to the increased safety afforded the miner. This is especially true in a high seam (7 ft.), where the miner often attempts to get down the coal by using a heavy charge, and shooting on the solid. Where such a hole is improperly loaded, or wrongly placed, a blow-out or windy shot results, sometimes causing gas or dust explosions. If machine undercutting is practiced, the explosion has two free faces on which to exert its force instead of one, so the danger of missed shots is greatly lessened. It is a serious question whether it would not be best to prohibit shooting coal from the solid.

Coal mining is a new industry in India. Though the first coal mine was opened in Bengal in 1820, the true development of the industry has taken place in the last decade. That the Indian is capable of acquiring considerable skill, in most mining operations, is evident on every hand. In loading coal into tubs underground they have become so remarkably expert with the shovel, that an average English loader would have to do his very best to beat them. Most of the loaders are women, and it is not uncommon for two of them working together to load 50 cars of 11 cwt. each, or 27 tons, 10 cwt. of coal in a shift of eight hours. In the presence of the inspector, two women recently loaded a tub of 11 cwt. in four minutes.

In a mine haulage road the car resistance on level tracks is generally from 1 to 2 per cent. of the gross weight according to the condition of the tracks and lubrication. To haul a trip up a 1 per cent. grade requires an additional force, which is equal to 1 per cent. of the total weight and similarly for higher gradients. The draw-bar pull exerted by the locomotive in hauling the cars must equal the resistance percentage plus the gradient percentage of the train weight. The fol-

lowing is the efficiency of a motor hauling against various grades as compared with a level track, taking the draw-bar pull at 6000 lb.:

For 0 per cent. grade...	100
For 1 per cent. grade...	63 1/3
For 2 per cent. grade...	45
For 3 per cent. grade...	30
For 4 per cent. grade...	25
For 5 per cent. grade...	20
For 6 per cent. grade...	16 2/3
For 7 per cent. grade...	13 1/3
For 8 per cent. grade...	11
For 9 per cent. grade...	9 1/2
For 10 per cent. grade...	8 1/3

When placing the shaft of an engine, three essential requirements must be strictly observed. First, place the shaft at right angles with the axis of the cylinder. Second, it should be level. Third, it should lie fairly on its bearings. The shaft can be easily "squared." The crank disk is furnished on the shaft centers, after the pin has been set, so if its rim is on its opposite side, equally distant from its center line the shaft is square. The leveling can be done by plumbing the crank disk. When set as above described, it will lie fairly well on the main bearings; if the outer bearing is correctly set it will lie fairly on that also. This can be tested by rotating the shaft entirely dry. Brightened rings will show what parts of the journals have found bearings and on raising the shaft the polished spots on the babbitt metal will indicate where these bearings were. Should the shaft ever get out of line, it may be squared by gaging between the rim of the crank and the bosses provided on the bed.

Endless-rope haulage is not practical for all seams. A continuous double track is necessary, one for the full and one for the empty cars; besides, an extra width is necessary for a traveling way. It cannot be used where the roof is weak and curves and branch roads sometimes give trouble. Still this system has many undeniable advantages. All parts of the mine are sending coal to the shaft simultaneously. Accidents in one part of the workings do not affect others, because the damaged section can be stopped. Large shaft sidings are unnecessary. A smaller engine can be used, for where the grade is undulating the cars on the down-grades will help the engine to pull up others on the up-grades. If little coal is coming from a district the rope can be stopped and the work of the engine lightened. The engine may be erected on the surface. If the haulage road must be close-timbered there is less liability of cars being derailed and props and things in general wrecked when the slow-going endless-rope system is used.

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\*Illustrated.

## The Situation in Spelter

The situation in the market for spelter is quite analogous to that in the markets for copper and lead, which we have previously discussed, but it is even more aggravating. A somewhat large stock of metal has accumulated and there is no demand. Fortunately the stock is largely in strong hands. If the pressure to sell were any greater than it is, the price which has been sagging under comparatively small offerings would certainly break sharply. This is a condition which does not augur an early recovery in the market, but rather the contrary. The brass trade is poor, the demand for sheet zinc is slack, and the galvanizing trade is also suffering from the general depression. The smelters have been running at nearly full capacity, but they are unable to sell any considerable part of their product.

In the meanwhile they are obliged to take in considerable supplies of ore under contract. The situation is an awkward one and under the conditions of a few years ago would have created a condition of demoralization, but at present most of the smelting is done by companies with excellent financial backing. However, some of these are feeling the strain rather keenly. Under the circumstances the open market for ore at Joplin cannot be otherwise than weak. If the absence of demand for spelter continues (at present there is no sign of a revival) the ore market will become still weaker, because the smelters will put their furnaces on dead-fire, as some are doing now, and consequently the demand for ore will be reduced. Indeed, it has been reduced so much already that the suspension of operations by miners who could not produce at a profit at less than \$40 for ore has had no effect in sustaining the price.

The situation in the Joplin district is particularly distressing because depression occurs simultaneously in the markets for lead ore and zinc ore. It is not now a question of what is the average cost of production, but rather the cost of producing the last lot of ore that is required to meet the diminished demand. The cost of production is variable, depending upon the yield of the ore, the expense of mining and milling, and the rate of royalty to be paid to the fee-owners. In each of these items there is margin for economy. In mining, a gain has already been made by reductions of 10 to 20 per cent. in the

wages for labor (which reductions, it is gratifying to note, have in some cases been proposed by the men themselves and in all cases have been accepted cheerfully). However, mining is done with so high a degree of efficiency in the Joplin district that the room for further economy in this item is not large. A greater opportunity lies in increasing the extraction of mineral in the mills. This is a subject to which Joplin operators should immediately direct their attention. Finally, the present should be an opportune time to secure readjustment of royalties. Let it be remembered that when conditions are such that the operator comes out only even, the owner of the fee realizes from 10 to 20 per cent. of the gross product, which under any circumstances is a handsome profit from mines of so low grade. Thus even when the operators are making no money the mines of the Joplin district are nevertheless yielding a profit which compares more than favorably with that of other mining districts that have much higher grade ore.

The miners of zinc ore not only in the Joplin district, but also in other parts of the United States must face the present adverse conditions. Artificial restriction of production is of no account when there is so slack a demand. There is nothing more to be squeezed out of the smelters because they cannot stand it. It is not to be doubted that some day we shall again see high prices for both spelter and ore, and both smelters and miners who can afford to wait will realize great profits by holding back their production, but for those who are not certain of their financial ability it is wiser to let natural laws operate, meeting the market on a scale downward, than to withdraw only to be obliged to sell later at a decidedly lower level. For the present it is a consumers' market.

## Iron and Steel Prices

Up to the present time the course of prices in the iron and steel markets has been in remarkable contrast to the quotations for the other metals. While copper, lead and spelter have fallen continuously and rapidly during the last three months, the quotations of finished iron and steel have, at least nominally, shown but slight variations. Although trade has fallen off, and new business is of very small dimensions, no lower prices have

been made. The cause of this steadiness is not difficult to find. The United States Steel Corporation, while it controls only about two-thirds of the production of finished iron and steel, has been able to secure the coöperation of nearly all the larger companies, and it has pursued throughout a consistent and moderate course. At the height of the recent boom, when copper and other metals were touching the highest points, the Steel Corporation and its allies kept prices down to a moderate level. It is true that some advances were made by other companies—notably in the case of structural steel—under the disguise of premiums for special deliveries; but these were not general enough to make them market prices. This course proved, on the whole, a successful one, and there is little doubt that the absence of too great advances has been, on the whole, of much benefit to the trade.

A similar policy of regulation is now being followed as demand falls off, and prices would naturally recede. The leading interests announce their intention of making only slight reductions, if any. Whether this determination can be maintained remains to be seen, even if it is supported by a severe curtailment in production. For the present business is practically dead, and no reduction in prices would be likely to revive it until the financial position improves. The test will come a little later when it is probable that there will be at least a moderate revival in demand, and a fair amount of new business will begin to come in. Probably this could be encouraged by a lower scale of prices, and this is very likely to be offered by some of the independent companies, in order to secure whatever may be coming. Whether the Steel Corporation's schedules will be maintained under the defection of its allies is an open question.

The pig-iron market has been really the only open market, since the Steel Corporation is a buyer and not a seller of pig, while few of the other large companies make more pig than they need to supply their steel furnaces. This market has shown considerable variations, and the competition among the merchant furnaces has made prices an indication of the decreasing demand. Thus bessemer pig in Pittsburg, which touched \$25 per ton last June, is now quoted at \$19. No. 2 foundry, which was higher than bessemer at \$26, has now reached a more

normal comparative level at \$18.50. Gray forge shows a decrease from \$23 to \$18, and basic from \$22 to \$17. It must be remembered, however, that over three-quarters of our pig iron is now made by the steel companies, and that the merchant furnace product is less than a quarter of the total.

The iron market during the next year will be an extremely interesting study. There is no precedent for the present situation, since it is the first time that the present control, or partial control, has had to face a period of extreme depression.

### The Work and Scope of the Geological Survey

The paper by Dr. Smith, which is reproduced elsewhere in this issue, is particularly important inasmuch as it outlines the views, wishes and policy of the new director of the Geological Survey, who has already created a distinct impression of energy and broadmindedness which augurs well for the future of the Survey. The immense benefit that the Survey has been to the mining industry during the 27 years of its existence is heartily recognized. It has been one of the leading contributors, perhaps the chief contributor, in the development of the science of mining geology, and what that science means today is thoroughly appreciated by all experienced mining men. It is not to be expected that the Survey will rest on these laurels. Rather is it to be expected that having done so much it will be anxious to progress in directions that will increase its usefulness, and under the enthusiastic leadership of Dr. Smith this certainly it will do.

We feel that the plans outlined by Dr. Smith will meet with general approval, as they do our own, save in one particular. It was certainly not contemplated in its original creation that the Geological Survey should go into the investigation of processes relating to the mining and later treatment of fuels, ores and other mineral products. It did so without authority in the Leadville report and was keenly criticized therefor. It has been doing so in connection with the fuel investigation under special authority of Congress. But that it should be authorized to go broadly into the questions that are in the distinct province of the private engineering profession would be a blow to individual-

ism, and doubtless also be unwise for the Geological Survey itself, which would suffer from the diversion of attention from its specialty of geological investigation. The limitation of such investigations as are proposed to the questions that are fundamental to the best utilization of the nation's mineral wealth is one that would need to be more carefully defined than there is any probability that it would be.

We are ready to admit that there is investigation of this kind that may properly be done by the Government providing such does not encroach upon what the people can and ought to do for themselves. It is quite evident that a large element in the mining industry is strongly of the belief that the Government ought to recognize and assist it in a way that has not yet been done. This will be embodied in a bill for the creation of a bureau of mining to be introduced at the forthcoming session of Congress. There is considerable work of importance to the mining industry that such a bureau can properly undertake, but its creators should be careful to avoid the pit-falls of paternalism which lurk in the suggestion of Dr. Smith for the Geological Survey in the particular that we have criticized.

### Disregard of Mining Regulations

The paternal attitude adopted by foreign governments in the matter of regulations for the protection and welfare of miners has never been followed to any great extent by the various States of the Union, although some of them have good mining laws and make an earnest effort to enforce them. However, our laxity in this respect is illustrated by the fact that so old and so eminent a mining State as California has no general law of this character, and indeed few regulations of any kind.

While too much oversight and meddling in an industry on the part of a government is bad, it is certain that an extension of present regulations and more particularly their rigid enforcement would result in a greater degree of safety in mines and smelters, and this is what all earnest and honest mining men desire to see effected. It is no secret that the influence of powerful corporations in converting protective legislation into a more or less dead mass of unenforced statutes has had much to do with the small regard in which human life is held in the

United States as against public sentiment on this subject in European countries.

A case in point is the recent arrest of several mining foremen of the H. C. Frick and other coal companies for allowing miners to break down coal without having first undercut it. This practice is in contravention of the Pennsylvania mining laws of 1903. The operators are against the law for the reason that if it is strictly enforced they will have to employ more men to maintain their present rate of production. In other words, the enforcement of the statute spells reduced profits. Without entering into a discussion of this particular case, which is now before the courts, it may be remarked that any antagonistic attitude of capital to protective industrial regulation is not only inhumane, but also is unwise. It is gratifying that this is recognized by many of the best managed corporations.

### Transvaal Gold Production

The gold production of the Transvaal in October, while not the highest monthly output on record, approached it very nearly, in spite of the repatriation of a number of Chinese laborers. It was claimed that this loss of men would seriously cripple several of the mines, but such a result is not yet apparent in the returns. This October production brings the total gold yield of the Transvaal for the ten months of this year up to \$109,924,238. No considerable changes, either increase or decrease, can be expected in November and December, so that the total for 1907 may be fairly estimated at nearly \$133,000,000. This will be an increase of \$13,391,000 over the total for 1906; and it will be very nearly one-third of the probable gold production of the world in the present year.

### Progress in the Aluminum Industry

The production of aluminum is forging rapidly ahead and the vision of the prophets that this metal in the comparatively near future will become of common industrial importance is growing clearer and clearer. Several companies are preparing for the aluminum business in the United States, and when the Bradley patents expire in February, 1909, there will be a battle royal between the Aluminum

Company of America and its new competitors. The older company will occupy the superior position because of its prestige, experience and large capacity for production, but the price for the metal will inevitably come down. An expert in the aluminum industry, in whom we have great confidence, foresees that aluminum will be produced eventually by the hundreds of thousands of tons yearly and considers that a large figure may be expected in the not very distant future. Indeed, the one hundred thousand ton mark may be passed inside of five years.

If we consider the statistics of production in 1906 this estimate does not appear unduly extravagant. In that year the production of the United States and Canada was considerably upward of seven thousand metric tons; the production of the world was 18,325 metric tons, which was more than twice as great as in 1904. The production has been, indeed, increasing by leaps and bounds. The Aluminum Company of America undertook the installation of new equipment and plant in 1905 which was only partially completed in 1906. It was pointed out in "The Mineral Industry," Vol. XV, however, that on this account the increase in production in 1907 and 1908 will be very marked, and by the end of 1908 the production of aluminum in the United States will make a significant comparison with the production of copper, taking into consideration the relative bulks of the two metals.

In the meanwhile a great expansion in production is going on in Europe. Since the Heroult patents expired, four new aluminum plants has been started in Europe. The Aluminum Corporation has just been formed in England and will have its works going by the end of this year. This company expects to have 12,000 h.p. available for use in 1909. The new works of the British Aluminum Company, at Loch Leven, are being rapidly pushed forward. This company originally started works on the Caledonian canal, using the water that came down the celebrated Fall of Foyers. The demand for aluminum has made it necessary to provide a much greater source of supply. The new works are on the borders of Argyll and Inverness. The reservoir is 1000 ft. above sea level and about five miles distant, the country draining into the reservoir being about 55 square miles in area, and inasmuch as the yearly rainfall is about 100

in., an idea of the amount of the water supply can be obtained. The cost of these water works will be \$2,500,000, and the construction will not be completed before 1909. On the continent of Europe there is a similar exhibition of interest in the production of aluminum.

However, although there is so strong promise of a remarkable increase in the output during the next five years, and although it is inevitable that the price for the metal will eventually come down to lower figures, there is no reason to anticipate a decline in the very near future, the present demand being so largely in excess of the supply in spite of the large increase in the latter which has already materialized.

### Reforestation of Mineral Lands

It is gratifying to learn of the efforts of the Cleveland-Cliffs Iron Company to reforest a portion of its land in the upper peninsula of Michigan. It is proposed to replant with pine and certain deciduous trees about 14,000 of the 1,000,000 acres controlled by the company and later to extend the work. One of the present characteristics of upper Michigan is the vast extent of cut timber land, with its multitude of stumps. A few years ago the forests were ample; today lumber is scarce and the price is nearly double what it was 10 years ago. The action of this well known and enterprising mining company is commendable and if followed by other large mining interests, the impending lumber famine would be ameliorated; if not during the life of this generation, at least, for the following ones.

EXHIBITS BY MINING COMPANIES of the State have been a feature of the State fair recently held in Montana. The Anaconda Copper Mining Company had a display of small bins containing samples of ore from all the principal mines of Butte and other parts of the State furnishing ore to the Washoe smelter. Specimens showing all stages of concentration, smelting and refining were also shown by the company. The East Helena smelter contributed a miniature landscape done entirely in smelter products. A gold nugget from California gulch worth \$800 proved that that old sluicing ground is not by any means worked out.

# Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice or Suggested by Articles in the Journal, and Inquiries for Information

## CORRESPONDENCE AND DISCUSSION

### Licensed Chemists

Just as the different States regulate the practice of law, medicine, pharmacy, dentistry and various other professions, so should each State limit the practice of chemistry within its bounds to those who have been thoroughly examined and licensed by a State board of chemistry examiners.

The law protects the public from the danger of allowing incompetent physicians to administer medicines and to perform surgical operations. The law protects the public from incompetent attorneys who might ruin their clients and cause irreparable damage of thousands of dollars. The law protects the public from the incompetent pharmacist who must be capable of compounding prescriptions containing the deadliest poisons. The law protects us all from incompetent dentists, veterinary surgeons, embalmers, horse-shoers, engineers, etc. The law should go one step further and in a similar way protect the public from incompetent chemists.

#### DUTIES OF THE CHEMIST

The chemist is often called upon to decide momentous problems involving health and sanitation as well as the safe investment of hundreds of thousands of dollars. The chemist is called upon to decide as to the purity of a water supply for a city of a million inhabitants, and on his report rests the health and safety of the entire populace. The chemist is called upon to decide as to the purity of food products, and on his decision rests the safety of our daily food supply. The chemist is called upon to give an accurate and true valuation to the ores and minerals extracted from the depths of the earth, and on his decision depends the success or failure of our mining and metallurgical enterprises. The chemist is called upon for the analysis of steel and other building materials, and upon his decision depends the safety of our thirty-story skyscrapers, our suspension bridges, our subways, our elevated railway structures and of our steel-lined tunnels under the rivers. The chemist is called upon for the examination of fuels, coal, gas, oils, etc., to pronounce as to their safety for use in our cities, in our places of business, and in our homes. The chemist is called upon in poisoning cases to pronounce as to whether or not poison has been administered, and if so, whether in fatal quantity, and on his decision rests

the life or death of the accused person.

The chemist comes to us in many and varied unsuspected ways. He is closer knit with our every-day life than the physician or lawyer. Not every day do we need a doctor, not every week do we require the services of an attorney. Daily, however, do we require pure food, pure water, pure air, pure milk, substantial steel buildings, safe bridges and elevated railway structures, safe tunnels and subways. The chemist is the one who is daily called upon to certify as to the safety of our water, food, steel buildings, bridges, railroad cars, etc.

#### ELIMINATION OF THE UNFIT

The entire country, and especially the larger cities, are flooded with so-called "chemists." Many have had college or university training and are capable and competent to practice the chemical profession. Others are high-school graduates, self-taught and correspondence-school students, boys who have been employed in the offices and laboratories of chemists, all of whom assume the title of "chemist." Last, but not least, a host of graduates from unheard of and unknown colleges and universities of Europe flock to this country, generally land at the port of New York, and often stay in the big city or its numerous manufacturing suburbs. All of these classes are welcome to the broad field of the chemical profession, but should not be allowed to turn themselves loose on an unsuspecting public without some guaranty of ability, training and competency.

Our new pure-food and drug law has made the chemical profession a most important one, and thousands of cases will come up which will need the advice and assistance of the chemical expert. The United States Government has already commenced to increase its staff of chemical experts and our food and drug manufacturers, importers, dealers, etc., will also need the services of such experts and should have the security of being able to employ trained men upon whose competency the State has placed its mark of approval in the form of a license to practice the chemical profession after a suitable examination as to qualifications.

The first great objection to the passing of such a chemists' license law would come from some of the men who are now actively employed in the chemical field. This objection would be that it might deprive them of a means of earning a liveli-

hood. The provision in the Constitution of the United States against the passage of any *ex post facto laws*, laws which are to be retroactive and become effective on conditions as existing prior to the date of their passage, is a sufficient answer, and, as a matter of course, every one actively engaged in the chemical field in any State, at the time of passage of such an act by the State legislature, would be entitled to a license on application.

Another class who would be likely to oppose the passage of such bills by the legislatures are the manufacturers and other employers of chemists, on the ground that such a law would, by raising the standards of the chemical profession, tend to raise the salaries of the chemists employed by them. It is frankly admitted that there would be such a tendency and it is one which is much to be hoped for, because the chemical profession today is the most inadequately recompensed of any of the learned or technical professions. The increase of the salaries of our technical chemists must come, and it is better for it to come willingly from the employer. If such license laws be not passed, it would seem that the field would be open for a union of chemists, just as a union of pharmacists was looming up in New York until the new license law for chemists was passed by the New York legislature and which went into effect on January 1, 1905. The existing unions and federations would hail with delight the addition of such a body of educated and trained men to their ranks.

#### THE LICENSE PLAN

Nor is the requirement of examination and license to practice chemistry a matter of experiment. The Province of British Columbia passed an act in 1895 called the "Bureau of Mines Act," which provided for the examination and license for certificates of efficiency to practice assaying in British Columbia. Assaying, as is well known, is but one of the subdivisions of chemistry, just as draughting is a branch of mechanical engineering. That portion of this act relating to the examination and license of persons desiring to practice assaying in British Columbia, was enlarged by amendment in 1899, and is now in force in that Province with excellent results.

The sentiment that some measure of this sort should be adopted, both to protect the public and the profession of chemistry, is widespread throughout the country. In this connection is quoted an abstract from the address of the retiring

president of the American Chemical Society, Dr. W. F. Hillebrand, at the New York meeting held in December, 1906. Speaking of a matter that must eventually be considered, he said, "A serious obstacle to be overcome before analytical chemists can occupy the position in public estimation that should be theirs, is that presented by shysters, posing as qualified chemists, particularly as analytical chemists, who seek and accept work at rates so low as absolutely to preclude accuracy in the results they obtain, so that the whole profession suffers from their misdoings. That these men are able to attract customers may be due to the greed of both employed and employer, but is in a larger measure due to the ignorance of the employers as to the real nature of chemical work. It will be difficult, if not impossible, to educate the public in chemistry, but it would seem as if a partial solution might be reached by establishing some such standard of efficiency as that represented by membership in the Society of Public Analysts in Great Britain, which should be a guarantee, so far as such things can be guaranteed, that the member is a duly qualified analyst."

#### ASSOCIATIONS OF CHEMISTS

Doctor Hillebrand, without doubt, meant to refer to the Institute of Chemistry of Great Britain and Ireland and not to the Society of Public Analysts. The Institute of Chemistry is somewhat similar to the institutes of engineering, mining, civil, mechanical and electrical, and holds a relation to the chemical profession in England similar to that held by our bar associations and state medical societies to the legal and medical professions in this country.

The idea and scope of the Institute of Chemistry is excellent and thorough, and the foundation of a similar society in this country would, without doubt, tend to elevate and better the conditions of the chemical profession internally. As to its effect upon the public at large, its results are extremely doubtful. It can hardly be expected that such an organization would accomplish all the required results. It is a hopeless task to try and educate the whole people as to what membership in such an institute would mean. Without such knowledge on the part of the general public, the institute would have but little effect. When in need of the advice and opinion of an attorney, one does not first inquire as to whether or not he is a member of the local bar association. Enough if he is legally entitled to practice his profession and commands the esteem and respect of his fellow men. In seeking the services of a physician, one does not stop to ascertain whether or not he belongs to the State medical society. We are content if he be a graduate of a reputable medical college and has been duly licensed to practice medicine.

#### SOCIETIES NO ADEQUATE PROTECTION

In a similar way, any layman in need of chemical advice or analyses does not inquire as to whether or not any particular chemist is a member of the American Chemical Society or of the Society of Chemical Industry, and employ him because of such membership. He would, very likely, not know of the existence of such, nor of any institute of chemistry but would employ any self-styled "chemist" who had placed his name prominently before the general public, through advertising, newspaper notoriety and numerous other methods of publicity. On obtaining incompetent service, bad advice and inaccurate analyses, he would curse the whole profession of chemistry and an institute could do nothing to punish the offender, and nothing to prevent the recurrence of similar experiences.

It seems that there is a need for an institute of chemistry in this country. Not to take the place of legislation, but as a correlative of a chemist's license law in the several States. Examination and license would limit the profession to those who were, at least, sufficiently trained. The institute would build up within this body of licensed chemists an organization of men with prestige and recognized ability. The license law is the simple and effective plan for keeping out incompetents and shysters; the institute is the complex and theoretical scheme for the creation of a caste inside of the chemical profession. Legislation must be the foundation of the standing of the chemical profession; as in all others, upon which the superstructure of the institute, the select, must rest. HENRY STANLEY RENAUD.

New York, Oct. 3, 1907.

### Negative Results in Pyritic Smelting

In the recent discussion of this subject by Beardsley, Lang, Hixon and Koch, it seems that the conclusions derived from the able discussion of the answers to the 10 questions by Dr. Peters, have been lost sight of, especially by the first and last gentlemen. Mr. Hixon has called attention to the liquation resulting from the bed of coke in the furnace melting out the sulphides and leaving no fuel to continue the operation, and, in the discussion by Dr. Peters, this point, and the necessity of having free silica and plenty of it instead of silicates such as garnet, was strongly emphasized. I will therefore only discuss the hot top and heated blast question, so strongly dwelt upon by Mr. Koch.

In the first place the consensus of opinion in the discussion published in "Pyritic Smelting" was that a heated blast was desirable, and I know of no one who objects to it; in fact we all would like to

have heated blast if we could get it economically, uniformly and regularly. There is no question that the blast and gases resulting from combustion must take the temperature of the focus of the furnace, and the only point is how to secure the temperature and amount of heat required at the focus the most economically. Neither is there any question that if a heated blast of 100 deg. C. will give a certain improvement, the same amount of heated air at 500 or 1000 deg. C. will give about seven or sixteen times as much, respectively, if it is intelligently applied and utilized.

The mean specific heat of air is  $0.303 + 0.000027t^2$  per cubic meter, and if we use the example given by Prof. J. W. Richards in the *Electrochemical and Metallurgical Industry* of August, 1907, page 305, problem 107, and assume the temperature of cold blast as 30 deg. C., we have the following, solving for 30, 100, 500 and 1000 deg. C.:

30 deg. =  $921 (0.303t + 0.000027t^2) = 8,394$  calories  
 100 deg. =  $921 (0.303t + 0.000027t^2) = 28,155$  calories, gain 19,761 calories.  
 500 deg. =  $921 (0.303t + 0.000027t^2) = 145,748$  calories, gain 136,354 calories.  
 1000 deg. =  $921 (0.303t + 0.000027t^2) = 323,930$  calories, gain 315,536 calories.

The total heat developed in the furnace by the combustion of this blast was 732,930 cal., so that the heating of the blast to one of the higher figures would appear highly desirable in some instances, and Prof. Richards has calculated for that particular case, assuming that the same amount of sulphides were oxidized, that if the blast were heated 313 deg. C. the coke on that charge could have been entirely dispensed with, the blast volume reduced by the amount of oxygen corresponding to the carbon consumed, and still have made the same tonnage of charge and maintained the same temperature of 1569 deg. C. in the focus of the furnace. We may reason from this that if the blast were heated to a higher temperature, or if heated to the 313 deg. C. without reducing the fuel correspondingly, we would have an enormously higher temperature in the furnace focus, and the result would be the equivalent of an excess of fuel on the charge, causing liquation of the sulphides and a subsequent shortage of fuel.

It is evident also from these calculations, that the difficulty of making high concentrations is really due to excess of fuel value in the charge, which, inducing liquation, causes a subsequent fuel shortage or low concentration. It is apparent that it would not do to have a fluctuating hot blast. It must be entirely uniform both in quantity and temperature in order to apply it properly.

The method by which we are to secure a hot blast of uniform quantity and temperature is our next concern. Coal at \$13, with coke at \$14 per ton and wood at \$5 per cord here, does not seem promising, even if U-stoves were economical or brick regenerative heaters obtainable. Let us calculate what the escaping gases or

hot top so strongly recommended by Mr. Koch will do.

The expression for the mean specific heats of the escaping gases and volatilized sulphur as follows:

$$\begin{aligned} \text{sulphur (vapor)} &= 179 + (t - 445) 0.11 \\ \text{sulphur (solid)} &= 0.1844t \\ \text{SO}_2 &= 0.36t + 0.0003t^2 \\ \text{CO}_2 &= 0.37t + 0.00022t^2 \\ \text{N}_2 &= 0.303t + 0.000027t^2 \end{aligned}$$

If we take the temperature at the hot top as 600 deg. C. as the gases leave the charge and of the cold top as 60 deg. C. (actual temperature observed at Aguascalientes on 18-ft. ore column furnace) and use the quantities given in the example, problem 107 before cited—sulphur, 101; SO<sub>2</sub>, 35; CO<sub>2</sub>, 69; N<sub>2</sub>, 727; and calculating at 60 deg. C. for *t*, we have the sum 16,784 calories. Also calculating *t* at 600 deg. C., we have the sum 190,940 calories; and the difference wasted is 174,156 calories, or nearly 24 per cent. of the total heat generated in the furnace. I do not know precisely what the temperature of a hot top furnace would be and have simply made a guess from what I have seen taking place there—slag forming at about 1150 deg. C., matte melting at about 1000 deg. C., and portions cold at probably near the temperature of the outside air, especially just after dropping in fresh charges—and have simply taken what I suppose to be a probable temperature. The construction of our copper and lead furnaces makes it practically impossible to get the average temperatures or average gases except in cool top furnaces.

The intermittent charging of the furnaces would have the effect of producing a very great lack of uniformity in the temperature of the blast, which we have already shown to be contrary to the condition requisite for the proper utilization of the heat in heated blast. This would be regulated somewhat by the free air which enters through open doors and cracks, so that the proportion of air to gases as I determined it in one plant was generally between 4 and 5 air to 1 of escaping furnace gases. It seems to me, however, that the attempted heating of the blast by running hot tops for that purpose, as recommended by Mr. Koch and patented by Loder, Mitchell, McDonald and possibly others, is very bad practice, showing, as it does, in the special case under consideration and with the assumptions of temperatures which I have made, a net loss of over 150,000 calories, which should go to preheat the charge before it arrives at the focus of the furnace. It would seem, however, that if one had an improperly constructed furnace in which necessarily he must have hot tops, that it would be not only desirable but quite necessary to utilize some of the heat that is wasting for the heating of his blast, which will then undoubtedly be of service, where the fuel value of his charge is too low to do the work without adding coke.

Mr. Koch loses sight of the fact that the plants making slags with 0.3 per cent. of copper in the slag were making a much higher grade matte than he made at the Lustre, and the copper contents of slags is roughly proportional to the copper contents of the mattes produced with them; so that if making a matte of 8 per cent. copper such as the Lustre smelter made in 1905, with 0.1 per cent. copper in the slag; with a similar slag and making a 45 per cent. copper matte, the slag should run 0.35 to 0.40 per cent. copper. As a matter of fact, the cleanest slags are made with high silica, high lime—over 40 per cent. SiO<sub>2</sub> and over 26 per cent. CaO—with low iron.

I would also call his attention to the fact that the formation temperature of such slags as he reports made at the Lustre smelter are as determined by H. O. Hofman<sup>1</sup> about 1150 deg. C., and the formation temperature is the temperature at which fritting takes place, and 1150 deg. C. is a long way from red hot through and through. REDICK R. MOORE.

Oaxaca, Mexico, Oct. 29, 1907.

## New Publications

ANNUAIRE DES MINES, DE LA METALLURGIE ET DE LA CONSTRUCTION MECANIQUE. Pp. 808; illustrated. 6x9½ in.; cloth. Paris, France, 1907: E. Bernard.

TABLES OF QUANTITIES FOR PRELIMINARY ESTIMATES. By E. F. Hauch and P. D. Rice. Pp. 92; illustrated. 4½x7 in.; cloth, \$1.25. New York, 1907: John Wiley & Sons.

NINTH ANNUAL REPORT OF LABOR STATISTICS OF VIRGINIA FOR THE YEAR 1906. Pp. 318. 6x9 in.; cloth. Richmond, Va., 1906: Davis Bottom, Superintendent of Public Printing.

BALANCING OF ENGINES, STEAM, GAS AND PETROL. By Archibald Sharp. Pp. 212; illustrated. 6x9 in.; cloth. New York, Bombay and Calcutta, 1907: Longmans, Green & Company.

RURAL HIGHWAYS OF WISCONSIN. By William Otis Hotchkiss. Wisconsin Geological and Natural History Survey, Bulletin No. XVIII. Pp. 136; illustrated. 6x9 in.; paper. Madison, Wis., 1906: Published by the State.

ANNUAL REPORT OF THE BOARD OF REGENTS OF THE SMITHSONIAN INSTITUTION FOR THE YEAR ENDING JUNE 30, 1906. Chas. D. Walcott, Secretary. Pp. 546; illustrated. 6x9 in.; cloth. Washington, 1907: Government Printing Office.

THE ABANDONED SHORE-LINES OF EASTERN WISCONSIN. By James Walter Gold-

<sup>1</sup>Transactions American Institute of Mining Engineers, California meeting, 1899.

thwait, Assistant Professor of Geology at Northwestern University. Wisconsin Geological and Natural History Survey, Bulletin No. XVII. Pp. 134; illustrated. 6x9 in.; cloth. Madison, Wis., 1907: Published by the State.

POCKET-BOOK OF ELECTRIC LIGHTING AND HEATING, COMPRISING USEFUL FORMULAS, TABLES, DATA AND PARTICULARS OF APPARATUS AND APPLIANCES FOR THE USE OF CENTRAL STATION ENGINEERS, CONTRACTORS, AND ENGINEERS-IN-CHARGE. By Sydney F. Walker. Pp. 438; illustrated. 4x6½ in.; leather, \$3. New York, 1907: Norman W. Henley Publishing Company.

HANDBUCH DER PRAKTISCHEN ELEKTROMETALLURGIE (DIE GEWINNUNG DER METALLE MIT HILFE DES ELEKTRISCHEN STROMS). By Dr. Albert Neuburger. Pp. 466; illustrated. 5½x8½ in.; cloth. München und Berlin, 1907: R. Oldenbourg.

This book is disappointing because it does not treat its subject with any near approximation to the completeness that is desirable. It is a brief summary of the electrometallurgical processes that have been described and applied for the extraction of the various metals, but undue space is given to many which have been of little value and insufficient space to some which have proved of superlative value. We cannot conceive of anyone deriving satisfaction from the section relating to the electrolytic refining of copper.

A REVIEW OF LAKE SUPERIOR COPPER MINING AND SKETCH OF THE HISTORY AND OPERATIONS OF THE QUINCY MINING COMPANY. By Charles DeWitt Lawton. Pp. 30. 6x9 in.; paper. New York, 1907: J. & P. B. Myers Press.

The early discoveries of copper, the trials of the pioneer miners and the conditions in the early days of mining in the Lake Superior copper district form a preface to the history of the Quincy Mining Company from its beginning to the present day. The author was formerly commissioner of mineral statistics for Michigan and has followed the development of this important mining region for many years. The resumé contains an account of the Quincy Mining Company's administration and its records of output and dividend disbursement for 45 years. Mr. Lawton makes no mention whatever of the long and faithful service of Capt. S. B. Harris, nor of that of his son, John L., who succeeded him as superintendent of the Quincy mine. The Harrises, father and son, were in active charge of the mine for upward of 30 years and its efficiency and splendid record are largely due to their efforts. In justice to them some mention should have been made in the review.



# Patents Relating To Mining and Metallurgy

A Selected and Classified List of New Inventions Described during the Past Month in the Publications of the Patent Offices

## UNITED STATES AND BRITISH PATENTS

A copy of the specifications of any of these patents issued by the United States Patent Office will be mailed by THE ENGINEERING AND MINING JOURNAL upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

### COAL AND COKE

**COAL-DRILL.** Benjamin V. Gilmore, Red House Shoals, W. Va. (U. S. No. 870,281; Nov. 5, 1907.)

**COAL HANDLING.** J. Parkin, Castleford. Improved conveyer for loading coal or other mineral at the working face and for carrying it away. (Brit. No. 22,960 of 1906; Oct. 26, 1907.)

**COAL MINING.** A. Gultziuff and G. Koenig, Redon, Germany. Improved apparatus for wedging down coal that has been undercut on more than two sides. (Brit. No. 9841 of 1907; Nov. 9, 1907.)

**COAL-MINING MACHINE.** William Yeatts, Riceville, Va. (U. S. No. 869,609; Oct. 29, 1907.)

**COKE-PULLING APPARATUS.** Francis M. Hogg, Bessemer, Ala. (U. S. No. 869,305; Oct. 29, 1907.)

**DRILLING.** R. Armstrong, Motherwell. Improvements in the method of feeding and fixing machines used in drilling holes in coal, using a rotating drill. (Brit. No. 14,835A of 1906; Nov. 9, 1907.)

### COPPER

**CONVERTER.** Ralph Baggaley, Pittsburg, Penn. (U. S. No. 870,925; Nov. 12, 1907.)

**PURE COPPER—Process of Obtaining Pure Copper.** Lucien Jumau, Paris, France. (U. S. No. 870,786; Nov. 12, 1907.)

**SMELTING—Means for Increasing the Air-Blast of Converters and Furnaces.** Ralph Baggaley, Pittsburg, Penn., Charles M. Allen, Lo Lo, Mont., and Edward W. Lindquist, Chicago, Ill., assignors, by direct and mesne assignments, to Pittsburg and Montana Copper Co., Pittsburg, Penn., a Corporation of West Virginia. (U. S. No. 871,079; Nov. 12, 1907.)

### GOLD AND SILVER

**AMALGAMATOR.** George E. Paulins, Colorado Springs, Colo., assignor of five twenty-fourths to Charles E. Bibb, five twenty-fourths to Charles H. Theobald, and five twenty-fourths to Haywood L. Butler, Colorado Springs, Colo. (U. S. No. 870,643; Nov. 12, 1907.)

**AMALGAMATORS.** H. I. Seemann, Denver, Colo. Detailed improvements in amalgamators in which pulp is passed through mercury. (Brit. No. 16,218 of 1907; Nov. 2, 1907.)

**CYANIDE TREATMENT of Ores.** Alfred Adair, Troyville, Johannesburg, Transvaal. (U. S. No. 869,287; Oct. 29, 1907.)

**GOLD DREDGE—Deep-Water Gold Dredge.** Wardell Guthrie, Chicago, Ill. (U. S. No. 870,235; Nov. 5, 1907.)

### IRON AND STEEL

**BESSEMER PROCESS.** W. Galbraith, Sheffield, England. Increasing the temperature obtained in the bessemer process by providing tuyeres above the molten metal and introducing jets of producer gas. (Brit. No. 23,293 of 1906; Nov. 2, 1907.)

**BLAST FURNACE CHARGING—Means for Controlling the Operations of Blast-Furnace-Charging Devices.** Barton R. Shover, Youngstown, Ohio. (U. S. No. 868,711 and 868,712; Oct. 22, 1907.)

**FERROCHROMIUM—Manufacture of Ferrochromium.** Henry W. C. Annable, Battersea, London, England, assignor to Ferro Alloys Syndicate Limited, London, England. (U. S. No. 869,681; Oct. 29, 1907.)

**OPEN-HEARTH STEEL—Manufacture of Open-Hearth Steel.** Anson W. Allen, Philadelphia, Penn. (U. S. No. 870,921; Nov. 12, 1907.)

**SMELTING IRON ORES—Process of Smelting Ores.** Henry Arden, Los Angeles, Cal. (U. S. No. 869,643; Oct. 22, 1907.)

### NICKEL

**NICKEL RECOVERY—Process for the Recovery of Nickel from Ore.** Charles H. Ehrenfeld and Jacob R. Grove, York, Penn. (U. S. No. 868,769; Oct. 22, 1907.)

### SULPHUR

**MINING SULPHUR.** Herman Frasch, New York, N. Y., assignor to Frasch Sulphur Process Co., Kittery, Me., a Corporation of Maine. (U. S. No. 870,620; Nov. 12, 1907.)

### TIN

**ORE REDUCTION.** R. W. E. MacIvor and M. Fradd, London, England. Improvements in the inventors' process for reducing tin from its ores by means of producer gas. (Brit. No. 22,162 of 1906; Nov. 9, 1907.)

### ZINC

**EXTRACTING ZINC FROM RESIDUES.** R. W. E. MacIvor and M. Fradd, London, Eng. Extracting zinc from distillation residues by heating with calcium chloride and sulphuric acid and throwing down the oxide from the resulting zinc chloride solution by the addition of lime. (Brit. No. 21,440 of 1906; Oct. 26, 1907.)

**ORE TREATMENT.** H. L. Sulman, London, England. Improvement in the process described in 21,672 of 1906, whereby the zinc is precipitated as monosulphite by blowing air through the solution of bisulphite. (Brit. No. 22,534 of 1906; Nov. 9, 1907.)

**ORE TREATMENT.** H. L. Sulman, London, England. Roasting complex zinc ores, extracting with sulphurous acid and precipitating as insoluble monosulphite by the addition of zinc oxide to the solution. (Brit. No. 21,672 of 1906; Nov. 9, 1907.)

### MINING—GENERAL

**HOISTING SKIP CARS—Means for Varying the Force of Counterweights for Hoisting Skip-Cars.** Alexander E. Brown, Cleveland, Ohio, assignor to Brown Hoisting Machinery Co., Cleveland, Ohio. (U. S. No. 868,639; Oct. 22, 1907.)

### ORE DRESSING

**BALL MILLS.** B. Brendel, Berlin, Germany. Improvements in ball mills with the object of keeping the material well distributed. (Brit. No. 29,311 of 1906; Nov. 2, 1907.)

**BUDDLE—Round Buddle for Dressing Ores.** Albert Demuth, Laurenburg-on-the-Lahn, Germany. (U. S. No. 869,883; Nov. 5, 1907.)

**GYRATORY ORE CRUSHERS—Crusher-Head for Gyratory Ore-Crushers.** Charles W. Gutzzeit, High Bridge, N. J., assignor to Taylor Iron and Steel Co., High Bridge, N. J., a Corporation of New Jersey. (U. S. No. 870,952; Nov. 12, 1907.)

**ORE-CONCENTRATING TABLE.** Frank E. Shepard, Denver, Colo., assignor to Denver Engineering Works Co., a Corporation of Colorado. (U. S. No. 869,860; Oct. 29, 1907.)

**ORE CONCENTRATORS.** Feed-Box for Ore-Concentrators. William L. Card and Frank S. Card, Denver, Colo. (U. S. No. 869,293; Oct. 29, 1907.)

**ORE REDUCTION PLANT.** R. Stanley, Nuneaton. A plant consisting of a series of rolls and screens for reducing gold and other ores. (Brit. No. 25,530 of 1906; Nov. 2, 1907.)

### METALLURGY—GENERAL

**COMBUSTION BOMB—Bomb for Use in Metallurgical Operations.** John O. Bardill, Herculaneum, Mo. (U. S. No. 868,904; Oct. 22, 1907.)

**ROASTING SULPHUROUS ORES—Method of Roasting Sulphurous Ores.** Adolf Saverberg, Aachen, Germany. (U. S. No. 870,690; Nov. 12, 1907.)

**SULPHIDE ORE TREATMENT—Process of Desulphurizing and Reducing Sulphide Ores.** Eduard Dedolph, Marysville, B. C., Canada. (U. S. No. 870,668; Nov. 12, 1907.)

### MINING MACHINERY AND APPARATUS

**FUSES—Method of Manufacture of Fuses for Mines.** Louis Lheure, Paris, France. (U. S. No. 869,219; Oct. 22, 1907.)

**HAMMER-DRILL.** Alfred E. Johnson, Denver, Colo., assignor to Her Rock Drill Manufacturing Co., Denver, Colo. (U. S. No. 870,178; Nov. 5, 1907.)

**HYDRAULIC ROCK-DRILL.** Georg E. Gjuke, Trelleborg, Sweden. (U. S. No. 869,893; Nov. 5, 1907.)

**MINE CAGE SAFETY DEVICE.** A. Hiegemann, Altendorf, Germany. A spring buffer fixed at the bottom of mine shafts to prevent the mine cage coming to the bottom with a blow. (Brit. No. 26,718 of 1906; Nov. 2, 1907.)

**MINE CAGE SAFETY DEVICE.** A. R. Lee, Manchester, England. A safety apparatus for supporting mine cages when the hauling rope breaks. (Brit. No. 28,516 of 1906; Nov. 2, 1907.)

**MINE CAGE SAFETY DEVICE.** J. Stifter and A. Hahn, Essen, Germany. Improved safety device for preventing mine cages falling when the hauling rope breaks. (Brit. No. 9108 of 1907; Oct. 26, 1907.)

**MINE-CAR.** Eugene C. Callahan and Frank L. Callahan, Terre Haute, Ind. (U. S. No. 870,542; Nov. 12, 1907.)

**MINE LOCOMOTIVE BRAKE—Brake for Mine-Locomotives.** James F. Flynn, Pardus, Penn. (U. S. No. 869,077; Oct. 22, 1907.)

**MINER'S CANDLESTICK.** Guy D. Neill, Denver, Colo. (U. S. No. 870,638; Nov. 12, 1907.)

**MINER'S DRILL.** George F. Weiss, Springfield, Ill., assignor to Black Diamond Coal-Drill and Tool Co., Springfield, Ill., a Corporation of Illinois. (U. S. No. 871,013; Nov. 12, 1907.)

**MINER'S LAMP.** Phillip Birch, Pittsburg, Penn. (U. S. No. 869,049; Oct. 22, 1907.)

**MINER'S PICK.** William Donaldson and Elmer E. Donaldson, Moingona, Iowa. (U. S. No. 871,058; Nov. 12, 1907.)

**MINING MACHINE.** Edwin R. Merrill, Columbus, Ohio, assignor to Joseph A. Jeffrey, Columbus, Ohio. (U. S. No. 870,116; Nov. 5, 1907.)

**ROCK-DRILL and Other Percussion Tool.** Thomas Warsop, Coniston, England. (U. S. No. 870,653; Nov. 12, 1907.)

**ROCK DRILL BITS.** J. R. Wilson and F. R. Thackrah, Johannesburg, South Africa. Improved holder for the bits of rock drills. (Brit. No. 21,677 of 1906; Nov. 2, 1907.)

**ROCK-DRILL-FEED MECHANISM.** Thomas Turner, Ottumwa, Iowa. (U. S. No. 869,278; Oct. 29, 1907.)

**ROCK DRILLS.** J. B. Marshall, Broken Hill, N. S. W. Improvements in percussive rock drills chiefly dealing with the valve and the shape of the piston. (Brit. No. 21,666 of 1906; Oct. 19, 1907.)

**SAFETY LAMPS—Apparatus for Testing Miners' Safety-Lamps.** Evan C. Davies, Taylor, Penn. (U. S. No. 869,066; Oct. 22, 1907.)

### FURNACES

**ELECTRIC FURNACE CHARGING.** A. Petersson, Alby, Sweden. Improved method of continuously charging electric smelting furnaces. (Brit. No. 5657 of 1907; Oct. 19, 1907.)

**ELECTRODE FOR ELECTRIC FURNACES.** H. Rochling, J. Schoenawa and W. Rodenhauser, Volklingen, Germany. An improved electrode for electric furnaces in which the resistance of the material to be treated is used for melting it. (Brit. No. 11,917 of 1907; Oct. 26, 1907.)

**GAS FURNACES.** A. Degras and P. Schmidt, Hanover, Germany. Improved gaseous furnaces for metallurgical use. (Brit. No. 27,564 of 1906; Oct. 19, 1907.)

## Personal

Mining and metallurgical engineers are invited to keep **THE ENGINEERING AND MINING JOURNAL** informed of their movements and appointments.

Fred. H. Nye, of Idaho Springs, Colo., is making a business trip to Eastern points.

George W. Teal, of Boulder, Colo., has been examining mines in the Salmon City district, Idaho.

E. W. Dickerson, of Idaho Springs, Colo., is making an examination of mines in Cobalt, Ontario.

James McAdam, of New Haven, Conn., has been in Gilpin county, Colo., looking over mining interests.

George W. Cooper, of Georgetown, Colo., has returned from a visit to the East on mining business.

W. R. Burke, manager of the Alton Mining Company, at Nederland, Colo., has returned from a business visit to Kansas City.

A. E. Healy has been appointed manager of the Inter-Ocean Mining Company at Sunshine, Boulder county, Colorado.

F. B. Close, until recently general manager of the Helvetia Copper Company, Arizona, is in Sonora, Mexico, on professional business.

G. M. Gouyard, of Denver, Colo., has moved to New York. He will have his office with the Douglas Copper Company, at 42 Broadway.

Charles Berryman has been appointed superintendent of the Roman Eagle and Thunderbolt mines at Jamestown, Boulder county, Colorado.

L. C. Lennox, manager of the Country Boy Gold Mines Company, at Breckenridge, Colo., has left on a trip to the Hawaiian islands.

A. C. Wart has accepted the position of professor of mining in the University of Wyoming, at Laramie, Wyo., and has entered on his new duties.

Gen. Frank Baldwin, of Denver; P. O. Parkort, of Trinidad, Colo., and H. L. Stevens, of Boulder, Colo., have been making an extensive examination of the anthracite coalfields in Routt county, Colorado.

G. M. Dyott has resigned his position with the Westinghouse Electric and Manufacturing Company, and has opened an office in the Westinghouse building, Pittsburg, Penn., as engineer, making a specialty of electric locomotives and electrically operated mining machinery.

The first nomination submitted for president of the Canadian Mining Institute for the ensuing year is that of George E. Drummond, of Montreal. Mr. Drummond is well known and highly esteemed by Canadian mining men, and has been a prominent member of the institute since its organization. He is one of the largest

manufacturers and importers of iron and steel in the Dominion; he is president of the Canada Furnace Company and the Londonderry Iron and Steel Company, and is connected with other important undertakings.

## Societies and Technical Schools

*Tri-State Mining Association*—This association assembled in regular session at Dubuque, Iowa, Friday, Nov. 22. There was a large attendance of operators, capitalists and others interested in the lead and zinc mining industry of the Upper Mississippi Valley. Much enthusiasm, valuable talks and royal treatment made this the most successful meeting yet held by the association. All members shared in the optimistic belief that the money stringency and untoward conditions now generally prevailing throughout the country, which have carried down the market value of lead and zinc ores, are only temporary in effect and that within a very brief period confidence will be restored and prices regain their former level. Two regular sessions were held at 10 a.m. and 2 p.m., respectively. The program for the afternoon and more important session was as follows:

Address of welcome by Mayor H. A. Schunk, of Dubuque.

Judge Wm. Spensley, Galena, Ill. "How can the Mining Interests of the Tri-State District be Conserved."

Francis A. Harper, Chicago, Ill. "Legal Questions in Mining."

R. I. Dugdale, Platteville, Wis. "The State School of Mines."

W. G. Swart, Denver, Colo. "Electro-Static Separation."

James W. Murphy, Congressman Third District, Wisconsin. "The Development of the Platteville District."

In the evening a banquet was tendered the members of the Tri-State Association by the Dubuque Club and the Dubuque Commercial Club.

## Industrial

The Bruner Steel Wagon Company, Wapakoneta, Ohio, has increased its capital to \$100,000, owing to the increase of business.

The Hoskins Company, Chicago, doubled its output of "Brownite" cupels in October, and reports heavy sales during the present month also.

The Ball & Wood Company, New York, and Elizabeth, N. J., has added to its engine business the manufacture of air compressors of new and advanced type, having many improvements in details.

The Meade testing laboratories have been established at Nazareth, Penn., especially for the inspection and testing of cement. Richard K. Meade is director, and Clarence E. Kline, engineer of tests.

The "Pilot" iron-body gate valve is an

addition to the list of steam specialties manufactured by the Wm. Powell Company, of Cincinnati. It is a strong, compactly built valve with details carefully worked out.

The Allis-Chalmers Company, of Milwaukee, has been awarded the gold medal for electric generators and motors, issued by the authorities of the Jamestown Exposition. A second gold medal has also been granted for the good judgment and taste shown in the design and erection of the exhibit.

F. W. Braun, Los Angeles, Cal., has been awarded a gold medal at the Jamestown Exposition for the exhibit of metallurgical laboratory appliances in great variety. A large new building for the manufacture of these appliances is to be erected at Los Angeles, and the new branch factory in San Francisco has already been completed.

The Wisconsin Engine Company, at Corliss, Wis., which has built some large Corliss steam engines, is now building gas engines for all services in sizes from 400 to 5000 h.p. The engines utilize natural gas, producer gas, coke-oven gas or blast-furnace gas in the Otto cycle (four-cycle), and are of the horizontal tandem and twin-tandem double-acting type. This company controls the Sargent patents on internal combustion engines and has employed Charles E. Sargent as the engineer of its gas-engine department.

## Trade Catalogs

Receipt is acknowledged of the following trade catalogs and circulars:

The Hathaway Gyrotory Mill Company, Denver, Colo. Prospectus. Pp. 22, paper, 8x10½ inches.

The Goheen Manufacturing Company, Canton, Ohio. Tests of the Spreading Power of Paints. Pp. 8, illustrated, paper, 6x9 inches.

Mummert, Wolf and Dixon Company, Hanover, Penn., U. S. A. Plurality Die Bolt Cutter. Pp. 16, illustrated, paper, 6x9 in.; August, 1907.

Rockwell Engineering Company, 26 Cortlandt street, New York. No. 9. Rockwell Heating Machines for Annealing, Hardening, Tempering, Coloring, etc. Pp. 8, illustrated, paper, 6x9 inches.

Sprague Electric Company, 527-531 West 34th street, New York City. Bulletin No. 108. Electric Dynamometers for Testing Gasoline Engines. Pp. 7. Bulletin No. 108. Electric Dynamometers for Printing, Electrotyping, Stereotyping and Binding Machinery. Pp. 74. Bulletin 230. The Electric Equipment of a Modern Factory. Pp. 19. Bulletin No. 231. Direct Current Motor Equipment for Single or Double Magazine Mergenthaler Linotype Machines. Pp. 7. All illustrated, paper, 8x10½ in.; August and September, 1907.

# Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives  
at Denver, Salt Lake City, San Francisco and London

## REVIEWS OF IMPORTANT EVENTS

### San Francisco

Nov. 20—In addition to the copper mines in California which have closed down owing to the low price of the metal, numbers of gold properties which have been in course of development have also temporarily ceased operation by reason of the prevalent financial stringency. The number of these idle mines is, however, not large, and when money is easier most of them will be started up again.

John A. Britton, of San Francisco, has applied for patents on three mining claims which are within the limits of the forest reserve in Plumas county, and testimony is being taken as to the legality of the locations. W. C. Robertson, forest ranger, testified that the land is not mineral-bearing—at least not to a sufficient extent to make it a paying property for mining by any method. Now it happens that Mr. Britton has had much experience in mining, and why he should want to patent mineral lands in Plumas county which are not mineral lands, is yet to be proved. The point to be noted, however, is the adverse testimony of a local forest ranger, who takes upon himself the task of certifying that the land in question will not pay to mine. Why should a Government official, supposed to be an expert in timber and trees, be expected to know whether or not a mine will pay, simply because it happens to be in a forest reserve?

At Sacramento Hill, near Placerville, Eldorado county, Thomas Swansborough has a gang of men at work building a tramway to convey quartz rock to the railroad station, whence it will be shipped to San Francisco to be crushed and used in making glass. It is stated that a contract to deliver 40,000 tons in five years has been made. Most of the sand used in making glass in California comes from Monterey, San Francisco and Alameda counties, but several shiploads arrive every year from Antwerp.

The closing down of the big smelter at Bingham, Utah, on account of the affirmation of the United States Circuit Court of the injunction against the company in the case instituted by people claimed to have been damaged by smelter fumes, is considered rather fortunate by the people at Kennett, Shasta county, California. It is expected that the ores from Bingham and Tintic will be sent to Kennett for reduction, while the Bingham mines are temporarily closed down.

Wm. C. Rose, of Goldfield, Nev., has bonded for \$20,000 the Mount Pleasant

mine at Grizzly Flat, El Dorado county, including the mill and other machinery, the water rights and wood for timbering.

Threatened renewal of labor troubles in the Randsburg district, Kern county, or belief that new labor troubles were about to occur, is alleged to have been responsible for the closing down of the Degolia & Atkins tungsten mine at Atolia.

The Dannenbroge, Jefferson and Pennsylvania quartz claims at Brown's Valley, Yuba county, which have produced more or less in the past, but have only been worked intermittently are now being developed at depth. Charles D. Lane is putting down a 3000-ft. shaft to open all three of these claims on an extensive scale.

There is a likelihood that the Young American quartz mine of Sierra City, which was at one time many years ago one of the largest and most profitable mines in Sierra county, will be re-opened by Charles R. Thompson and others, of Sacramento.

Some Tonopah, Nev., men are in Los Angeles, getting assistance to a plan to appeal to Congress, to suspend for this year the annual assessment work on mining claims, owing to lack of coin among the miners. The governing board of the Los Angeles Stock Exchange passed a resolution asking the California senator and the congressman from that district to support the idea.

The Mountaineer Mining Company, which, with its recent acquisitions has the largest quartz holdings of any company in Nevada City, not excepting the Champion, is perfecting the plans to inaugurate next spring extensive development. It now owns  $2\frac{1}{4}$  miles of claims along the continuous ore-belt on which the original Mountaineer mine is located, extending from the Oustomah mine, operated by Hayes Brothers, of San José, on the north nearly to the Mayflower at Canada Hill.

Wm. G. Mobley & Co., of New York, have purchased the Mayflower quartz and gravel mine in Nevada City district. The mine has a shaft 700 ft. deep, a fine hoisting and pumping plant and a 20-stamp mill. It is situated at Canada Hill, two miles southeast of Nevada City and four miles northeast of Grass Valley. It lies some distance below and directly under the Banner division of the South Yuba Water Company's main canal. The tunnel to develop the gravel channel is now 3000 ft. long, and has

500 ft. to run. It has cut several quartz veins in its course.

Two gold dredges that are to cost between \$115,000 and \$125,000 apiece are under construction near Redding, Shasta county, one near Middle creek, three miles north, on the Sacramento river, and the other on Clear creek, near Girvan, four miles south of Redding. One boat will operate on the Sacramento river, dredging the river bottom on the eastern limits of Redding. The other will be operated on the lower stretches of Clear creek.

### Salt Lake City

Nov. 22—S. R. Guggenheim, president of the board of directors of the American Smelting and Refining Company, who has been here within the past week, made a statement emphatically denying the report that the smelters of that corporation in Utah would be closed. On the contrary, he declared that they would be kept going steadily up to their capacity. Mr. Guggenheim called attention to complaints coming from Nevada to the effect that the American company had refused new contracts for ores and answered the charge that an advance of \$3 a ton on Goldfield ores had gone into effect. He denied that there had been any such advance, but explained that new contracts were not wanted at this time because of the lack of furnace capacity. "We are simply running our Salt Lake valley plants to the limit," said he, "and to accommodate some of the mining companies with which we already have contracts, we are treating the ore at our Colorado plants at the same rate that we are here in the Salt Lake valley. Of course, it costs the customer the extra difference in freight from Salt Lake to Colorado."

As far as the smoke question is concerned, the American company is practically immune from further difficulty owing to the operation of the modified decree obtained when differences were adjusted with the farmers who appeared as plaintiffs in the case which resulted in a decision against the smelters. This agreement permits a continuance of the operations of the lead smelter at Murray; whereas the copper smelter at Garfield has never entered into the controversy. The modified decree provides:

"First—That the American Smelting and Refining Company shall be permitted to operate its smelter at Murray with its present number of furnaces, the same being nine in number, with the under-

standing that another can be added to this battery if the needs require the same.

"Second—That instead of being restricted to roasting and smelting no ores containing over 10 per cent. sulphur, the company is permitted to roast ores containing 25 per cent. sulphur, and to smelt ores which contain more than 10 per cent. sulphur, but which, when mixed with dry ores and fluxes, will not make an average of over 10 per cent. sulphur in the total charge for the furnaces.

"Third—In order to obtain these concessions the American company agreed to send all its furnace gases through a baghouse at low temperature, thus condensing all lead and arsenical fumes, collecting the solid particles or flue dust made in the process of smelting and condensation."

It was also agreed between the company and the farmers that the former would construct in connection with its lead-roasting plant an improved system of flue-dust collecting chambers, and a large chamber, which will so operate as to collect the flue-dust created by the roasters and also cool the gases below condensation point, so as to prevent heated fumes from carrying lead and arsenic out in the air in gaseous shape.

There has been a good deal of talk lately about the closing of the United States smelter at Bingham Junction because the decree of Judge Marshall of the Federal Court of Utah has been upheld by the Court of Appeals at St. Paul. Since the announcement was made by Managing Director Holden that the fires would be drawn as soon as the yards could be cleared of accumulated ore, influences have been at work which will undoubtedly result in obtaining a modified decree similar to the one granted the American Smelting and Refining Company, which will at least permit work in the lead smelter at Bingham Junction. The belief prevails here, however, that there are other reasons than the court decree which have prompted the management to declare its intention to go out of the smelting business in Utah. It is a conceded fact that the company has had several undesirable contracts which it wishes to abrogate, if possible, particularly some calling for the treatment of Tintic lead ores.

### Butte

Nov. 21—Conditions as to operations and production by the Butte mining companies remain as they were a month ago. The November output of the Butte district will be about 8,500,000 lb. of copper. The only change that has been made during the month has been the practical suspension of production by the Butte Coalition. At many of the mines all development work has been stopped, especially at the Amalgamated properties. Sinking on the Badger State of the Boston & Montana has been suspended, but will be

resumed as soon as conditions improve. The company will develop the Jessie vein of the North Butte company which strikes through the Badger State, and the latter is regarded as a certainty instead of a prospect. On the other hand the Greenleaf, which is a prospect, is being developed by the Boston & Montana. The shaft is down 1000 ft., where a station has been cut and pumps have been installed. A crosscut to the south has been started and it is expected that the first vein will be cut within 25 or 30 ft. of the shaft, and the second in about 200 feet. The former was cut in the shaft at a depth of 800 ft., where 2 ft. of it carried rich ore. The first vein, 5 ft. wide, was cut at a depth of 350 ft. in the shaft, and the material in the vein at that point assayed 2 per cent. copper and 4 oz. in silver.

The Boston & Montana is employing about 1450 men at present, 1065 being engaged in mining and 385 in working on the fire in the Leonard and West Colusa. Four shafts are being sunk, or repaired, for the purpose of getting at the fire. One, the Mitchell air shaft, is being sunk almost directly over the fire and is down 800 ft. It will be sunk 100 ft. further, which will take it below the fire. Gambetta No. 1 shaft 300 ft. deep, and Gambetta No. 2, 200 ft. deep, are being sunk east of the Mitchell. Still further east the Minnie Healey shaft, which recently caved its entire depth, is being re-opened and re-timbered, and will also be used to fight the fire. It is the expectation of the management that within a month or six weeks the fire will be pretty well under control. The conditions have already been much improved.

### Denver

Nov. 22—The suit of Josiah Winchester for \$250,000 against A. M. Stevenson, attorney, of Denver, and A. E. Carlton, of Cripple Creek, which was non-suited about a year ago, is now up for a re-hearing; but the case is to be heard by a referee, which position will be filled by Hon. J. C. Helm, formerly chief justice of the Supreme Court of Colorado, an able and greatly respected jurist. Winchester was the lessee who discovered a great bonanza in the Cripple Creek mine known as the Doctor-Jack Pot, and was afterward one of the principal owners. He claims that his attorney, A. M. Stevenson, and A. E. Carlton entered into a conspiracy to ruin him, and he now sues as a poor person, whereas, in the boom days of Cripple Creek, he was a wealthy man.

The Transcontinental Tunnel and Mining Company, which was driving a tunnel through the Main range near Argentine pass, has closed down, after driving about 4000 ft.—with some 3000 ft. to go to complete the bore—and spending in the neighborhood of \$250,000. It is a London company. This is one of the long list of unaccountable proceedings, where large sums

are put into a mining venture by Englishmen solely on the strength of the representations of the vendor, likewise an Englishman, who is appointed manager, and without any investigation by a well accredited and disinterested mining engineer, until the extravagant predictions of revenues fail to materialize. Then they send him, and the bubble is pricked, the result being most disastrous to a lot of unfortunate people who have invested their money.

About a week since, while investigating alleged coal-land frauds near Durango, Colorado, a secret service agent of the Government, named Walker, was killed. The courts are now investigating whether the two men who killed him did so in self defense, or whether it was done to destroy the evidence he was supposed to possess.

A Federal judge in Milwaukee has decided in the case of alleged coal-land frauds in Routt county, Colorado, that Judge Pereles and his associates, of the above city, were blameless. They acquired their holdings through a former Milwaukee man, A. G. Wallihan, and his wife, who settled on these lands 20 years ago, when they were not worth 20c. an acre. They are among the most respected and upright settlers in the State, and Wallihan is known through his book, "Camera Shots at Big Game." It was clearly a case of the accusers committing a crime to prove one which did not exist, the result being an imputation on innocent people, and the stoppage of development work in this coalfield, the product of which the people so much need.

Another combined boring and mucking machine, the owners, of which advertise that with 500 h.p. it will drive an 8-ft. tunnel 100 ft. per day, is to the fore, and the promoters ask for subscriptions to the stock at par. The company formed to manufacture the machine is incorporated for \$750,000. Whether it will do the work claimed, however, remains to be proved.

### Duluth, Minn.

Nov. 23—It has been decided that the Susquehanna mine, of the Buffalo & Susquehanna Iron Company, shall be stripped of its 125 ft. of overburden, the deepest stripping job yet undertaken on the Mesabi range. This mine lies south of the Sellers and close to the town of Hibbing, and the decision to strip complicates the already serious railway problem there. There are several hundred million tons of ore around Hibbing, close to the town, and the railroads are having a time trying to get to the mines without stepping on some other mine. It seems impossible to do this, and the situation is a difficult one. The Sellers has been stripped the past 10 months till the town is close to the edge of the pit; a few more yards and it will begin to fall in. Indeed, many buildings have already been moved. The extension of this stripping will take one

of the large city schools, the offices, warehouses and shops of the Oliver Iron Mining Company, many business houses, hotels, etc. And this extension is sure to come in a short time, probably next year.

Near Amasa the Verona Mining Company (Pickands, Mather & Co.) will do extensive exploration. About fifteen years ago J. Parke Channing, then mine inspector, did work there in the hope of finding a continuation of the bessemer lens of the Mansfield, but unsuccessfully. Now, on account of changed conditions in the iron trade, the territory is considered most promising. Both diamond drilling and sinking will be carried on there. The same company is sinking a shaft in the Felch Mountain district, near the Calumet mine, where low-grade ore has already been found at the depth of 135 ft. At 150 ft. the formation will be crosscut. In Atkinson township, Iron county, where little prospecting has been done, the same company will explore a large tract it has under option. A shaft is being sunk and considerable machinery is on the ground. The Buckholz exploration, Iron River, was taken over by the company some weeks ago. This property joins the Beta mine of the Mineral Mining Company, and a shaft has been sunk. This the new operators will enlarge and deepen, cross-cutting at depth. This is the first property Pickands, Mather & Co. have taken in that district.

A movement may develop at the close of navigation to close underground mines for the winter. The Oliver Iron Mining Company, for instance, can produce all the ore the Steel Corporation can want by operating its open pits during the summer and by running its underground mines only in the same period. So much do the open-pit mines produce in excess of the underground, that the latter cut comparatively little figure. The ratio of production of open pits is rapidly increasing, too. Winter work in underground mines is rather costly; it includes in addition to tonnage hoisted, a lot of dead-work, etc., and it is safe to estimate the cost of all ore taken from underground and placed in stock on Lake Superior in the winter at not less than \$1, aside from royalties. The figure, when old range mines are included, will be more than that. This money is usually borrowed, either directly or indirectly. Large stripping operations, especially those of the Oliver Iron Mining Company, are likely to be maintained, but most of the stripping contractors will lay off their crews as soon as the frost becomes a serious obstacle. There is likely to be comparatively less cessation of these various operations, both in mining and development, on the Menominee than on any other Lake Superior district.

Robert Whitesides, of Duluth, has the Prickett lands, near Amasa, in Iron county, Mich., Menominee range, and is preparing to explore on a liberal scale.

### Toronto

Nov. 22—A movement is on foot among the leading mine owners of Cobalt for a general reduction of the rate of wages. The McKinley-Darragh, one of the mines which accepted the union schedule, has already made the reduction. As surface work has generally been discontinued in addition to large reductions in the numbers employed underground no difficulty in getting men at the reduced rate is anticipated. The Nipissing mine recently laid off about 100 men, and the camp is full of unemployed miners.

The latest phase of the difficulty over the title of the Cobalt Lake Mining Company is the signing of a petition to the Provincial Government of Ontario, by a number of shareholders who ask for the return of their money invested, at the rate of 85c. per share, which was the market price of the shares before the litigation commenced. It is alleged in the petition that the title to the property is not registered, that on the contrary a caution is registered showing an adverse claim, and that the provincial act, passed to validate the title, had the opposite effect by casting a doubt upon it which injuriously affected the value of stock.

The mining industry in Hastings county, Ontario, has now a fair prospect of obtaining cheap power owing to the practical extinction of the lumbering industry on account of the exhaustion of the timber about the head waters of the Moira river and some of the tributaries of the Trent. The lumber operators are offering to sell their dams and other improvements at a reasonable figure. A local committee has the matter in hand.

Judge Dugas, who returned to Montreal a short time ago from Yukon Territory, estimates that the gold output this year will hardly exceed \$3,000,000. The decline is due to the exhaustion of the Bonanza, Hunker, Eldorado, Dominion and other rich creeks, although the Guggenheims are working old claims in the hope of making them remunerative by modern machinery. Much attention is being directed to promising copper discoveries at White Horse and Williams creek.

It is announced that some of the mine owners of Cobalt have adopted a policy of retrenchment and will considerably curtail operations owing to the difficulty of disposing of their ore to the smelters. Owing to the uncertainty of the financial situation and to the fall in the price of silver the smelters are refusing to accept ore consignments. The Trethewey mine will lay off the night shift, reducing its force to 25 or 30 men. A. W. Johnson, vice-president of the Canadian Copper Company, was in Toronto this week in conference with representatives of the Buffalo, Kerr Lake and Right of Way mines, in reference to the treatment of ores at the Copper Cliff smelter.

### London

The firm of Fraser & Chalmers is a sort of national institution in the mining world of London, and the activity or otherwise of the shops is a good criterion of the condition of the metalliferous mining industry centering around London. The report of the firm for the year ended June 30 last is therefore interesting reading, as usual. The directors state that there has been a distinct falling off in business received from South Africa during the year, owing to the absence of any extensive new construction work at the mines. On the other hand, orders from several other parts of the world have come along in an encouraging manner. The net profit for the year has been £44,738, which is only £4068 less than the year previous, when several important installations of plant in South Africa had brought substantial profits. Out of this dividends of £44,100 have been paid, which is at the rate of 10 per cent. on the capital of the company. Considerable additions to the machine shops are being made, for the purpose of extending the manufacture of steam turbines, and it is expected that the expenditures in this direction will be met without the issue of much new capital. The works are fully occupied, and there is no lack of new orders. The company does not depend solely on its own manufactures, but also does a good business as agent for specialties from America and elsewhere.

The immense advantage a chemical company derives from an elastic variety of output is seen in the case of the Castner-Kellner Alkali Company. Last week I mentioned the difficulties of a similar company, the Electrolytic Alkali Company, whose sole products are soda crystals and bleach, both open to the unmerciful competition of stronger firms with greater variety of product. The Castner-Kellner Alkali Company has had a fairly prosperous career for eight years or so, and it has distributed dividends. Owing, however, to the continual issues of new capital for improvements, modifications and extensions, it has been difficult to tell what is its exact financial position. For some time the company has known well enough that soda and bleach cannot be relied on forever, and it has been on the lookout for other outlets for chlorine and soda compounds. Several chlorine propositions were tried, but failed. At last came the opportunity of producing metallic sodium and selling it to somebody who wanted it on a large scale. This customer is the Cassel Cyanide Company, of Glasgow, formerly the Cassel Gold Extracting Company, which now manufactures sodium cyanide. The profits have jumped up in a manner surprising to the outsider, or casual observer, and now amount to over £100,000 a year, a figure which is very nearly double what it was in 1905-6. The directors are still extending the scope of the company's operations.

# Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

## THE CURRENT HISTORY OF MINING

### General Mining News

*Republic Iron and Steel Company*—T. D. Guthrie, president of this company, spent the past week in the Birmingham district looking over the properties of the company. He announces that there will be no change in the policy of the company. Mr. Guthrie announced a reorganization of the officers of the company in the Birmingham district, as follows: W. A. Green, treasurer and auditor, to be in charge of affairs; Dwight S. Guthrie, manager of sales; B. F. Tyler, purchasing agent and manager of commissaries; W. H. Johnston, assistant traffic manager; F. B. Keiser, general superintendent of blast furnaces; W. Wuthenow, general superintendent of rolling mills; W. J. Penhallegon, superintendent of ore mines and quarries.

### Arizona

*Consolidated Arizona Smelting Company*—Judge W. M. Lanning in the United States Circuit Court at Trenton, N. J., has appointed J. Kearney Rice, of New Brunswick, receiver for this company and the Arizona Smelting Company, one of the associated corporations. The liabilities of the company are said to aggregate \$1,500,000. Of the authorized capital stock of \$17,500,000, \$16,000,000 is stated to be outstanding, the amount issued having been increased last spring to acquire 480 shares of Arizona Exploration Company, 432 shares of De Soto Mining Company stocks and \$445,000 of De Soto bonds. The company's assets, including practically the entire share capital of the controlled companies, are valued by President Elliott as follows: Arizona Smelting Company (capitalized at \$150,000 stock and \$240,451 bonds), valued at \$1,000,000; De Soto Mining Company, \$100,000; Humboldt Ore Company, \$100,000; other assets, \$1,000,000; total assets, \$3,200,000. President Elliott is said to own \$5,770,000 of the capital stock and to have personally indorsed notes of the company for \$465,000.

*Imperial*—It is expected that the smelting works of this company will be completed about the end of the year. The plant, which includes converters, is of 500 tons daily capacity.

*Mowry*—Operations at this property have been suspended. But little has been accomplished during the last three years in opening the mine away from the old workings of Lieutenant Mowry. There have been gross extravagance and mismanagement by the present company.

*Hardshell-Flux*—These mines in the

Patagonia district are reported to show large bodies of lead-silver ore. Development work is proceeding in a careful, conservative manner.

*Tombstone*—Developments are reported to be not entirely satisfactory. The mines have been unwatered to the 1000-ft. level, but it is necessary to pump 3300 gal. per min. to keep the workings unwatered and it is feared to extend the workings much lest the volume of water increase greatly. Explorations in the upper levels have not yet disclosed any important new ore-bodies.

### GRAHAM COUNTY

*Arizona Copper Company, Ltd.*—This company reports the production of its work at Clifton in October at 1438 short tons of copper.

*Campbell Group*—The new wagon road to these claims is completed and shipments to the Shannon and Douglas smelters have been resumed.

*Detroit Copper Mining Company*—On Nov. 10 the company started the smelter which had been shut down since the first of the month. A new air-lift at the concentrator is almost completed. One-half of the concentrator has been shut down at various times due to lack of power. The company has been doing a great deal of prospecting on the Santa Rosa property in search of the Coronada vein. An orebody consisting mainly of chalcocite was found before work was discontinued. A new electric hoist is on the ground ready to be installed when work is resumed.

*Home Copper Mining Company*—This property, a few miles northeast of Morenci, is shut down. The directors have advertised for bids for putting down a 1000-ft. diamond drill hole.

### California

#### HUMBOLDT COUNTY

*Gold Bluff*—This company has leased its dredge for working black sand at Union Bluff to H. Leighton and E. Capps for five years. The property consists of 194 acres of gold-bearing sands and gravel on the coast line.

#### INYO COUNTY

*Casa Diablo*—The turbine and electric generators are being installed on this property and will soon be ready to furnish power for the mill. Ore is being blocked out and hoisted. Some good ore has been found on the mountain, but this

vein has not been cut by the tunnel. An air compressor and drills will be installed.

#### MADERA COUNTY

*Chiquita Mining and Power Company*—This company has been organized to work 16 claims on the headwaters of the San Joaquin river. H. Dumont Smith of Kinslie, Kansas, is president of the company and C. A. Telfer, of Fresno, secretary. A gang of men is working on a tunnel on one of the ledges, and buildings have been put up to house the men his winter.

#### MONO COUNTY

*Sunny Jim District*—In this district the Tyler Gold Mining Company has purchased the Florence, Masonic, Queen, Scout, Tyler and Hamilton claims. The Sunny Jim Gold Mining Company has bought the Uncle Sam, Optimo, Sunny Jim, Satellite, Chicago and Missing Link claims.

#### NEVADA COUNTY

*Bear River Consolidated*—This company is in 265 ft. with its tunnel on a 6-ft. ledge prospecting on Bear River. There is plenty of water power available.

*Ideal*—This company, operating the old Lincoln mine on Little Deer creek, is putting up the building for its new hoisting works. H. H. Hicks is superintendent.

*Pine Hill*—It is expected that this copper mine, 12 miles south of Grass Valley, will soon resume operations under charge of J. A. Robles.

*Searchlight*—This Wisconsin company operating in Eureka district, is opening the old Searchlight mine, and has an equipment of machinery on the way, to sink a 500-ft. shaft.

#### PLACER COUNTY

*Rawhide*—The new pay-shoot found in this mine is promising to be richer than any heretofore found on the property.

*Southern Cross*—Ten stamps have been added to the mill of this mine on the American river, below Towle.

#### PLUMAS COUNTY

*Indian Valley*—This company has added materially to its holdings near its original location, and has bonded a number of other claims.

*Red Mountain*—This company at Spanish Ranch is installing a new 10-stamp mill

on the mine formerly known as the Shenandoah.

*Savercool*—Tests are being made of the ore and sulphurets of this mine near Greenville, to determine the best method of saving the values. The vein is a wide one.

#### SAN LUIS OBISPO COUNTY

*Van Ness District*—The Van Ness Mining Company owns 12 claims on Morro creek, and is getting ready to ship copper ore. At Torro creek in the same district, some 20 individuals are developing copper claims.

#### SANTA CLARA COUNTY

*Quicksilver*—Mrs. Maggie Brainard, H. K. & L. W. Wolcott, and H. C. Davey have commenced work on a new quicksilver mine on the Brainard ranch near Guadalupe.

#### SHASTA COUNTY

*Milkmaid*—The Western Exploration Company has taken a bond on this mine at French Gulch, and made the second payment. Some high-grade ore is being shipped to the smelter.

*Niagara*—This property, at French Gulch, now owned by the Black Tom Gold Mines Company, of Chicago, has suspended operations temporarily, but the company promises soon to provide the necessary funds to resume operations.

#### SIERRA COUNTY

*Alaska*—At this old property, Pike City, electric power is now operating an extensive plant recently installed. The mine has been considered the wettest one in the State, and several operators have failed to keep the water out. An abundance of electric power is expected to keep the mine dry.

#### TRINITY COUNTY

*Mountain Boomer*—Superintendent Wm. Montgomery, who has a bond on this New River property, has a gang of men doing development work and driving tunnels.

*Utica and Buckeye*—These groups at New River have been bonded to Goldfield, Nevada, men who will keep men at work all winter.

#### TUOLUMNE COUNTY

*Badgad-Chase Mining Company*—This company, owning the Soulsby mine, is running a drift north through new ground on the 500 level. A crosscut has been driven west 300 ft. to the Wheal Perrin claim and good ore has been found.

*Kanaka*—Machinery has been shipped from the foundry to this mine at Groveland, and the mill will shortly be completed.

*Number Nine*—The Calumet-Greenwater Gold Mining Company has bonded this

mine near Big Oak Flat and will shortly begin active work upon it.

### Colorado

#### BOULDER COUNTY

*Baxter*—New machinery and new buildings are being put up by the Columbia Lode Mining Company at Jamestown.

*Concord*—Missourians have purchased this property at Wall Street for a consideration of \$40,000. A ten-stamp mill with Wilfley tables is to be installed.

#### CLEAR CREEK COUNTY

*O'Donnell*—E. S. James, of Denver, has purchased this group near Dumont, and Denver men will finance the project. J. W. Smith, formerly of Cripple Creek, has been appointed superintendent.

*Silver Ring*—Missouri capital is interested in the enterprise and John Larson, Idaho Springs, Colo., has been appointed manager. The Easterners have a lease and bond on the property for \$25,000.

*Smuggler*—Illinois people have become interested in the purchase of an interest for \$6000 and will purchase the Smuggler to-stamp mill. Property is located in Moon gulch. George M. Ashmore, Rollinsville, Colo., is manager.

#### GILPIN COUNTY

*Black Hills & Denver*—A strike of telluride has been made in the main shaft. The company figures on new mill machinery in the near future. L. A. White, Tolland, Colo., is manager.

*Calhoun Tunnel and Mining Company*—A large Webster, Camp & Lane electric hoist and pump is to be installed at the 1000-ft. station, to be used in sinking the shaft to the lateral depth of the Newhouse tunnel. Electric power will be supplied by the United Hydro-Electric Company, of Clear Creek county. H. C. Eastman, Central City, Colo., is manager.

*Ralls County*—Hart & Pearl, of Denver, have taken a lease and bond on this mine on Quartz hill, and the property is under the management of R. A. Hart, Central City.

#### LAKE COUNTY—LEADVILLE

*Dinero Tunnel*—This tunnel, Sugar Loaf, has been driven into the mountain side for 1600 ft. and still has 1500 ft. to go before the Dinero veins are cut. Several veins have already been cut, but none of them have been prospected. The officials of the company are at loggerheads, and two boards of directors are claiming control of the finances of the company; one is the Woodward faction, the originators of the enterprise, and the other is the Smith-Hubbard faction. Woodward has begun proceedings against the Smith-Hubbard people, so the courts will settle the validity of the claims.

*International Mining Company*—The shaft of this company in the Ten Mile

section has reached a depth of 1300 ft., and has opened three distinct orebodies, the last to be cut being the old Robinson shoot. Preparations are now being made to develop and stations are being cut at the different levels. The ore opened is a good grade of lead-zinc.

*Tip Top*—This property was secured on lease by James B. McDonald and associates several weeks ago. When McDonald was making an examination of the property previous to securing the lease, he found in many of the old stopes large quantities of reddish-brown material that had been left standing; he took liberal samples of the material and had it assayed. It proved to be carbonate and silicate of zinc. He is now shipping from the old workings 20 tons daily of this material, and there is enough in sight to keep him busy shipping for the next two years without any development work. The adjoining property, the Last Chance, is under lease to Charles H. Collins and associates, and they have a large body of the same ore.

*Weston Pass*—The work at present being carried on at the Ruby and Colin Campbell is developing this section. The incline shaft at the Ruby has opened a good body of lead-silver ore and shipments are going out regularly. From the bottom of the shaft at the Colin Campbell drifts were run and a similar body to that found in the Ruby has been opened, and shipments are going out. Arrangements have been made to continue the work at both properties during the winter.

#### SUMMIT COUNTY

*Moscow*—The McKinley Gold Mines Company, with headquarters in Kansas City, Mo., has purchased this group of mines for a reported sum of \$75,000. The company proposes to carry on heavy developments in the Montezuma district.

#### TELLER COUNTY—CRIPPLE CREEK

Mining conditions still continue to improve in the Cripple Creek district. Treatment rates have been lowered recently and it is understood that a decrease has been granted on freight rates on the lower grade of ores. A number of new leases have been started up and several others will start very soon. A shortage of ore cars is reported on account of the increased production. A number of old-time mining men are returning to the district.

Work is going on as usual on the drainage tunnel. It is now in about 1000 ft. The rock is at present very hard and the progress of the tunnel is not rapid. The installing of the hoisting plant at the intermediate shaft is complete and sinking has commenced. This shaft will cut the tunnel at about 700 ft. in depth. A number of claims along the right of way of the tunnel have recently been taken up by the tunnel people.

The Florence & Cripple Creek Railroad

is handling, on an average, 20 cars of ore a day bound for the Union plant of the United States Reduction and Refining Company, at Florence. The reduction of rates recently made by this company has stimulated the handling of low-grade ore.

*Abe Lincoln*—A considerable amount of ore is being shipped from this property, which is worked under lease by John Sharpe and associates. A number of sub-leases are also being worked. The property belongs to the Stratton estate and is in Poverty gulch close to the town of Cripple Creek.

*Black Belle*—The property of this company is to be divided into blocks and let out to leasers. It is situated on Beacon hill close to the property of the El Paso. Newt. Wilson, of Cripple, is in charge.

*British American*—This company, operating on the south end of the Dante claim on Bull hill, has just paid a dividend of \$6000 to the five stockholders. Within two months the monthly dividend has increased from \$1000 to the last disbursement.

*Little Clara*—The production of this property is reported as a little over \$40,000 for the month of October. The property is operated by the Little Clara Leasing Company and belongs to the Work company. This is the same property that yielded high returns to Marsh & Hodges about a year ago. H. D. Thompson, of Cripple Creek, is in charge of the property.

*Ophir*—A hoist and boiler are being installed at the new shaft on this property. This shaft is being sunk vertically to cut the vein at considerable depth, to replace the crooked incline now in use. James F. Smith, of Cripple Creek, is in charge of the work.

*Portland and Strong*—The huge pumps of these mines have been started and three shifts will be employed to facilitate the unwatering. On the Portland property there are three pumps at work and on the Strong there are two. From all appearances there are two water courses in these workings. Manager Kurie reports the water as receding rapidly.

## Idaho

### BLAINE COUNTY

*Croesus*—This mine and mill, near Hailey, have been shut down, partly on account of a short supply of coal, and partly because of some dissatisfaction among the miners, because they were unable to get their pay in cash.

*Eureka*—At this mine, near Hailey, Superintendent Sawyer has let a contract to sink the main shaft 300 ft. deeper. The work will be done during the winter.

### ELMORE COUNTY

*Monarch Mining Company*—Good progress is being made on this company's new concentrating mill at Atlanta. It is

expected that it will be ready for use in January.

### OWYHEE COUNTY

*Potosi*—This old mine, near Silver City, is being reopened by a new company, which bought the property two years ago. An air compressor, pumps and drills have been put in and new buildings erected.

## Illinois

*Consolidated Zinc Company*—This company has been organized by Chicago capitalists, with Frank Nicholson, of Joplin, Mo., as president, to take over a large number of mines in Wisconsin and elsewhere. The properties have been reported upon by R. N. Dickman, of Dickman & McKenzie, of Chicago. It is proposed to build zinc and lead smelting works.

## Michigan

### COPPER

*Isle Royale*—The three new shafts, Nos. 4, 5 and 6, are in promising ground. No. 5 shaft is down approximately 100 ft.; of this distance, 70 ft. was through overburden, but the remainder is passing through rich copper-bearing rock. No. 4 is also down about the same distance and is bottomed in good stamp rock and some mass copper. No. 6, the deepest of the new openings, is down about four levels. Drifts have been run from the upper levels and good stamp rock is being hoisted.

*Michigan*—The "C" shaft of this property is down nearly to the tenth level and the formation is becoming more uniformly mineralized.

### TUSCOLA COUNTY

The shaft sunk by Handy Brothers, near Akron, has reached the coal, and entries are being driven. Shipments of coal will be begun soon.

## Missouri

### JEFFERSON COUNTY

*Virginia*—This mine is being reopened by H. J. Cantwell, of St. Louis. A good streak of galena ore has been opened by a shaft at the south end.

### JOPLIN DISTRICT

*Gamecock*—L. P. Benna, of Carthage, reports striking sheet ground in every drill hole on the ground of this company east of Wentworth.

*Rathbone Mining Company*—This company, composed of Springfield men, has leased land from R. B. Boyd and associates near Sarcoux and will begin drilling at once.

*Sadler Lead and Zinc Company*—The property of this company, south of Duenweg, comprising 220 acres, has been sold to Judge Howard Gray, of Carthage, for \$40,000.

*New Strike*—A strike was made on the 80-acre farm of Thos. Cone, of Preston. The drill showed 8 ft. of zinc ore.

*Stock Exchange*—The Joplin Stock Exchange has elected the following officers: President, B. W. Lyon; secretary, Clay Gregory; treasurer, T. W. Cunningham; manager, James Gallagher.

*Hazel Dell Mining Company*—This new Oklahoma corporation has started operations in Searcy county, northern Arkansas, a few miles north of Gilbert. So far 120 acres have been thoroughly prospected and zinc ore shows in nearly every prospect.

### ST. FRANCOIS COUNTY

*Federal*—Mining operations are going on in a very much restricted way. A test is shortly to be made with the Gordon one-man drill.

*Doe Run Lead Company*—Work on the 2000-ton mill at Flat River has been temporarily suspended. Only the foundations had been completed and the old mill at Doe Run will continue to handle the ore.

*St. Joe Lead Company*—Work on the new gas producer plant for furnishing power to the Bonne Terre mill is still under way, having been contracted for some time ago. All other new construction, however, has been discontinued and half the roasting furnaces at Bonne Terre have been blown out. The Savelsberg process is being tested at the smelting works.

## Montana

### BUTTE DISTRICT

*Boston & Montana*—On this property mining is at present confined to the Mountain View, East Colusa, and to the Pennsylvania above the 600-ft. levels, the three mines combined producing between 1000 and 1100 tons per day. The Boston & Montana is also in possession of the Alex. Scott shaft belonging to the Butte-Montana company, and is sinking it 200 ft. deeper and making connections between the shaft and the West Colusa workings for the purpose of ventilation. The Boston & Montana gets the benefit of the connections and the Butte-Montana the benefit of the development work. Connections have already been made at the 700 and 900 levels and another is being made at 1000 ft. At the Mountain View connections with the High Ore mine of the Anaconda company have been made at a depth of 220 ft. for the purpose of drainage.

*Butte & Bacorn*—This company, in its



drift on one of the veins of the Calumet at a depth of 1000 ft., has come into several small veins running northwest and southeast, which seem to unite with the east and west vein. The new veins carry some good ore.

*North Butte Extension*—This company is crosscutting at the 300 and has cut one vein within 55 ft. of the shaft. The vein was an unexpected one; it is 15 ft. wide and assays about 1 per cent. copper and some silver.

*Pittsburg & Montana*—According to official advices from this company, it has resumed operations and is running its smelter to the full furnace capacity, treating its ore by the same process used when the smelter was in operation before. It will be remembered that its plant was closed down during the spring of 1906, because the production of the mine was then only about 100 tons of ore per day. Since then, and until the present time, the company's ore has been treated by the Washoe company at Anaconda. This was a good arrangement for Pittsburg & Montana as long as its production was small, but when the output reached 350 tons per day and the large body of ore on the west side of the property and the 15-ft. vein on the 800-ft. level were developed, the reason for shipping ore no longer existed. Recent published statements regarding the amount of money spent upon an experimental furnace, and the rebuilding of the plant, are without foundation. The company's product is being treated by the same process as it was during the operation of the plant in 1905-1906, and it is using now, as it did then, the Baggaley process, eliminating entirely water concentration and calcination in roasting furnaces. The report current that the company is rebuilding its smelter is incorrect and is probably due to the fact that it is planning to add large furnaces, capable of melting 500 tons of ore per day, and another converter, in order to provide for present production. The buildings were originally constructed so that additional furnaces and converters could be installed without disturbing or changing other portions of the plant.

## Nevada

### NYE COUNTY—BULLFROG

*Backbone*—A number of men have been engaged to develop this property, which is located about 1½ miles from the Shoshone in a northeasterly direction. A rhyolite dike traverses the ground, and numerous shallow cuts and shafts have satisfied the manager, Philip Starr, that he has the making of a mine.

*Granite Contact*—The 300 ft. tunnel on No. 5 claim has been completed and the management is now engaged in starting a crosscut to determine the width of the vein.

*National Bank*—Rich ore is being raised from the bottom level, and ore of shipping grade is being quarried in the open cut situated on the vein outcrop about 230 ft. north from the shaft.

*Shoshone*—A partial clean-up at the new mill resulted in a gold brick weighing 344 oz., valued at \$6000. The mill continues to run satisfactorily. Two shifts are employed in the mill and are handling about 140 tons a day on the average a week. It will be another month before the mill will be running up to its capacity. Three shifts are working in the big shaft, which is within about 5 ft. of the 600-ft. point. Two shifts are working on the various levels, stoping and developing.

*Tramps Consolidated*—Sinking is being continued in the winze at the Denver, a depth of 240 ft. having been reached below the fourth tunnel level. The drifts on the 200-ft. level are continuing to expose milling values.

### NYE COUNTY—TONOPAH

*Belmont*—It is reported that a rich strike has been made in the 800-ft. level in the Occidental claim at a point about 800 ft. southeast of the Desert Queen shaft, and about 400 ft. from the side line of the Rescue mine. The diamond drill prospecting the deep levels from the 900-ft. level has reached a point 220 ft. below that level, and 1120 ft. below the surface; the ground is found at this depth to be greatly disturbed and broken up.

*Blair*—This old mine, situated about 20 miles west of Tonopah, is in active operation again, and immense reserves of ore of milling grade are being opened up. The new mill is nearing completion and twenty of the hundred stamps in the mill have been running pretty steadily.

*Extension*—Good progress is being made in the crosscut to the north on the 1050-ft. level. The formation is improving steadily and numerous stringers carrying good values are being encountered. Stoping is progressing on all levels above the 600-ft. level.

*Midway*—Mining operations are chiefly confined to drifting and raising work on the large vein recently cut at the 800-ft. level. Regular shipments of high-grade ore averaging 200 tons per week are being made from the vein in the 435-ft. level.

*Mother Lode*—This company has for the past month been actively developing its group of nine claims situated about 2½ miles west of Tonopah. The shaft, which was down 200 ft. when work was suspended last year, will be sunk to the 500-ft. point before crosscutting begins. The shaft is double compartment and well timbered, and is now being equipped with a new gallows frame and a 40-h.p. hoist.

*West End*—The station at the 320-ft. level in the new double-compartment working shaft has been completed. It is 18 ft. high and 20 ft. long and is provided with a double track for switching ore-

cars. The cage for the new shaft will be in place soon, when sinking will be resumed. For the present all waste will be hoisted through the new shaft, while the ore will be raised through the old shaft.

## Pennsylvania

### BITUMINOUS COAL

M. A. Throop, of Earlston, has bought from the Peabody estate 2800 acres of coal land in the Broad Top region. It is understood that he will open a mine and build a number of coke ovens.

## South Dakota

### LAWRENCE COUNTY

*Wasp No. 2*—Electric equipment has just been added and the 200-ton mill will resume operations.

*Globe*—The new 200-ton electro-chemical mill was recently tested. This is the only mill of its kind in the Black Hills.

*Custer Peak*—A Wiswell mill is being made over into a Chilean and a test treatment plant being erected.

*Arkota*—A \$6000 hoist and supplementary machinery and drills have been installed and the shaft will be sunk to quartzite.

*Minnesota Mines Company*—President F. E. Little, of Minneapolis, announces that the new 200-ton cyanide mill will be ready within the next 30 days. The mine is to be unwatered and the shaft continued from the 165-ft. depth.

### PENNINGTON COUNTY

*Mariposa*—The main working tunnel is in 800 ft., and will tap the vein at the 600-ft. depth. A number of high-grade assays and free-gold specimens are reported.

*Grand View*—The damaged machinery which closed the property some weeks ago has been repaired and the work will be resumed at once.

*Hymalulu*—Superintendent Bennett has installed new machinery and will push the tunnel deeper and then commence opening up the property.

*Crown*—Several new orebodies have been opened. An extension of the old tunnel cut the vein at the 130-ft. depth and showed rich gold ore.

*Burlington*—New machinery is all in and extensive development work will be started immediately.

*Eagle Mountain*—Machinery from adjoining properties has been moved over and Colonel Clark has started work on the copper property.

*Ivanhoe*—The Sunrise and Pontiac groups have been purchased from Charles Upham and associates for \$3000. There are well developed claims showing gold values of from \$10 upward.

*Provident*—A carload of amblygonite was shipped this week to Omaha and another will be ready within 10 days. Manager Davis reports new bodies of mineral.

### Canada

#### BRITISH COLUMBIA—BOUNDARY DISTRICT

*Granby Consolidated*—The shut-down at these mines is now nearly complete. How long it will continue is uncertain, much depending on the disposition of the men to come to terms with the management.

#### BRITISH COLUMBIA—SIMILKAMEEN DISTRICT

In response to a petition from Princeton, Similkameen, the Dominion minister of mines has intimated that the request for an official examination of and report on platinum deposits in the Tulaheen section of the district has been referred to the officers of the department and that an effort will be made to comply with the request made. The only important examination and report yet made was that of Prof. Jas. F. Kemp, of Columbia University, New York, for the United States Geological Survey, the results being given in Bulletin No. 193.

The Great Northern Railway Company has extended its railway system to the lower Similkameen and now has continuous connection from Spokane, Wash., through the Boundary district of British Columbia to Keremeos. Grading northward to Hedley is the progress.

#### NEW BRUNSWICK

*Minto Coal Mines*—It is reported that scarcity of labor is greatly hampering production from this field.

#### NOVA SCOTIA

*Nova Scotia Steel and Coal Company*—The old No. 2 colliery which has been shut down since 1904 is expected to be reopened at once.

#### ONTARIO—ALGOMA DISTRICT

*Hermina Mining Company, Ltd.*—This company owns 1250 acres of mineral land in Salter township. The mine is located about 4.5 miles from the village of Massy and will be connected with the Canadian Pacific railroad by a spur now building. Two shafts and several pits have been sunk on the lodes. One is down 350 ft. but work has been discontinued. The second has been sunk vertically to a depth of 434 ft., and a third will be sunk at a point 1000 ft. west on what is known as the Duluth claim. The veins are wide on the surface and increase in width at several hundred feet in depth. Samples taken from the third and fourth levels assay from 6.5 to 15 per cent. copper. A shipment of 70 tons showed a copper content of from 9 to 13 per cent. Capt. James Chynoweth,

of Calumet, Mich., recently examined the property for the company.

#### ONTARIO—COBALT DISTRICT

*Ore Shipments*—Shipments of ore for the week ending Nov. 16, were as follows: City of Cobalt, 101,230 lb.; La Rose, 619,000; McKinley-Darragh, 121,270; Nipissing, 182,460; total 1,024,060 pounds.

*Clear Lake*—The shaft on the property, east of the Nipissing and north of the O'Brien, which is being put down with a steam plant, has reached a depth of 115 feet.

*Columbus Mine*—A 4-in. vein of cobalt has been cut at a depth of 160 ft. in a crosscut 40 ft. from the main shaft.

*Kerr Lake Crown Reserve*—President Carson and several directors recently visited the property for the purpose of outlining a policy of development. The lake has been lowered 4 ft. and a large vein, running from the Silver Leaf property, has been traced by cross-trenching.

*Cleveland*—The gas-producer plant recently installed at this mine, is found to work satisfactorily. The plant has a capacity of 400 h.p., of which only one-half is required by the company. A portion of the surplus is let to a company for lighting the town of Cobalt. Work is progressing night and day on two shafts. No. 11 or Bailey shaft is down 80 ft. and No. 8 shaft is down about 60 feet.

#### ONTARIO—HASTINGS COUNTY

*Diamond*—This gold mining property has been sold to New York and Boston parties, under option, and operations on a large scale will be undertaken.

### Mexico

*Tepezala*—The copper mines of the Guggenheim Exploration Company have followed other mines in the district and have closed down. Practically all of the copper mines in Mexico of the Guggenheim company and the American Smelting and Refining Company are now closed.

#### CHIHUAHUA

*Lluvia de Oro*—Machinery for a complete power plant has been purchased for the mines near El Fuerte. It consists of a 500-kw. Allis-Chalmers steam turbine, direct-connected with an alternating-current generator for operation at 60 cycles, three-phase and 600 volts.

*Santa Eulalia*—This camp continues to ship about 20,000 tons of silver-lead ore monthly. The tonnage will be increased to 30,000 tons per month as soon as the smelter in Chihuahua is in operation.

*La Republica*—J. W. Malcolmson, manager of the mining department of the United States Mexican Trust Company, reports that the vein on the 300-ft. level of this mine in the Rayon district is 8 ft. wide and averages 272 oz. silver per ton.

#### DURANGO

*Velardena*—The Terneras and the Copper Queen mines in this district have been closed down indefinitely. No cause is assigned for the suspension, which throws 1000 miners out of work. The Terneras is a silver-lead property. The output of this mine and the Copper Queen has been so great that it is said the smelting works at Velardena were erected primarily to treat the ores from these mines.

#### GUADALAJARA

*San Marcos Mining Company*—This company has been organized to develop about 100 pertinencias on the Tepehuaje mountain in the Etzetlan district. The ore carries copper.

#### SONORA

*Cienquitea*—This copper mine at Sahuaripa, recently shipped 12 tons of 50-per cent. matte carrying more than 1000 oz. silver produced in two wood-burning reverberatory furnaces.

*Dorocea*—This group of five claims in the Magdalena district including the workings six miles from Puertecitos, has been sold to the Fay Cananea Copper Company.

*Moctezuma Copper Company*—The Risdon Iron Works has shipped 70 Risdon-Johnston concentrators to the property at Nacozari. This order constitutes the entire equipment of the new 1200-ton mill now under construction by the company.

#### ZACATECAS

*Bcnito Juarez*—A 20-stamp mill is crushing 50 tons of ore per day for cyaniding. The capacity is to be increased.

### Africa

#### TRANSVAAL

Gold production in October is reported at 553,553 oz. fine gold, of which 532,993 oz. came from the mines on the Witwatersrand, and 20,560 oz. from outside districts. For the 10 months ended Oct. 31 the total output was 5,318,057 oz. fine gold, or \$109,924,238; of this total, 5,127,328 oz. came from the Witwatersrand, and 190,729 oz. from outside districts. The total for the 10 months in 1906 was 4,703,077 oz.; showing an increase of 614,980 oz. this year.

#### WEST AFRICA

Gold production in October is reported at 24,013 oz. bullion, being 600 oz. less than in September, but 3064 oz. more than in October, 1906. For the 10 months ended Oct. 31 the total was 178,127 oz. bullion in 1906, and 240,692 oz. in 1907; an increase of 62,565 oz. The bullion reported in 1907 was equal to \$4,673,056, or 226,080 oz. fine gold.

# Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

## QUOTATIONS FROM IMPORTANT CENTERS

### Coal Trade Review

New York, Nov. 27—Financial conditions are at last beginning to affect the coal trade in the West. A disposition to go slow is becoming apparent, and the closing, or partial closing, of factories is having an effect on the demand for steam coal. In many places operators have had trouble in securing currency for pay-rolls, and this has caused dissatisfaction among the miners. Car supply is generally good for the season, and there are fewer complaints than usual.

The anthracite trade is steady and there seems to be no complaint among operators. The demand is, apparently, fully up to the supply.

The bituminous trade is quieting down not only locally, but in nearly all territories throughout the East. Producers are catching up rapidly and there does not seem to be the scarcity of coal which has existed heretofore. Contractors have all along been taking larger amounts on their contracts than their monthly proportion called for. This puts the consumer in an independent position and extra supplies of coal are not now being called for. However, there have been no cancellations on contracts as yet, and a considerable volume of coal is being sent forward.

There seems to be a continued tendency for labor to make a demand for an advance in wages. This movement may have been begun previous to the present business depression and many producers believe this to be the case. It is not a time to make demands of this kind, and the disposition of the operators is to handle the situation with a strong hand and to make no concessions.

#### COAL TRAFFIC NOTES

Shipments of Broad Top coal over the Huntingdon & Broad Top Railroad for the year to Nov. 16 were 864,369 tons.

Shipments of bituminous coal and coke over various railroads in western Pennsylvania and West Virginia for the nine months ended Sept. 30 are reported as follows, in short tons:

	Coal.	Coke.	Total.
Balt. & Ohio.....	19,679,207	4,324,069	24,003,276
Buff., Roch. & Pitts.	5,330,921	464,285	5,795,206
Penn. lines, N.Y. Cen.	6,175,515	60,063	6,235,578
Pitts. & L. Erie, ....	8,184,959	3,986,341	12,171,300
Norfolk & Western..	9,135,512	1,929,130	11,064,642
Total.....	48,506,114	10,763,888	59,270,002
Total, 1906.....	49,873,092	9,885,443	59,758,535

The total increase this year was 5,512,527 tons, or 10.3 per cent. In addition to the tonnage reported above, the Baltimore

& Ohio carried 646,482 tons of anthracite in 1906, and 713,774 tons in 1907; an increase of 67,292 tons.

The coal tonnage over the roads in the Ohio Coal Traffic Association for the nine months ended Sept. 30 was as follows, in short tons:

	1906.	1907.	Changes.
Hocking Valley.....	2,865,877	2,975,528	I. 109,651
Toledo & Ohio Cent..	1,296,425	1,348,064	I. 51,639
Baltimore & Ohio....	1,362,758	1,686,756	I. 323,998
Wheeling & L. Erie, ..	1,544,418	2,560,135	I. 1,015,717
Cleve., Lorain & Wh.	1,491,192	2,161,212	I. 670,020
Zanesville & Western	837,088	1,200,012	I. 362,924
Toledo Div., Pen. Co.	1,651,072	1,707,145	I. 56,073
L. Erie, Alliance & Wh.	514,067	919,551	I. 405,484
Marietta, Col. & Clev.	8,645	22,816	I. 14,171
Total.....	11,571,542	14,581,219	I. 3,009,677

The total shows an increase this year of 25.1 per cent.

The Southwestern Interstate Coal Operators' Association reports coal tonnages for the eight months ended Aug. 31 as follows, in short tons:

	1906.	1907.	Changes.
Missouri.....	1,440,536	1,776,335	I. 335,799
Kansas.....	3,031,564	4,146,205	I. 1,114,641
Arkansas.....	950,935	1,482,765	I. 531,830
Indian Territory....	1,481,514	1,892,565	I. 411,051
Total.....	6,904,549	9,297,870	I. 2,393,321

The total gain was 34.7 per cent. The production last year was interrupted by strikes.

### New York

#### ANTHRACITE

Nov. 27—The anthracite market shows considerably more strength for all grades of coal. Egg size, which has heretofore been dull, is now more active, and the demand for the other prepared sizes and for steam coal is good. Buckwheat No. 1 is stronger than the other small coals. Stocks are not excessive, and the hard-coal market is in a strong condition. Prices are quoted as follows: Broken, \$4.50@4.75; egg, stove and chestnut, \$5; pea, \$3.25@3.50; buckwheat No. 1 \$2.75@3; buckwheat No. 2 or rice, \$2.15@2.25; barley, \$1.75, all f.o.b. New York harbor.

#### BITUMINOUS

Business is quieting down to a marked degree, and this is especially apparent in the local market, which is dull and inclined to be weak. Prices for good grades of steam coal are \$2.70@2.75. Other grades range around \$2.85@2.90, New York harbor.

Trade along the Atlantic Seaboard is fairly active and the far East is taking on considerable coal for spot delivery. Shipments for the future are not developing especially well. Water freights to ice-

making ports have been rather high, vessels having chartered at \$1.50@1.60 from New York and \$1.70 from Philadelphia to such places as Plymouth and Kennebec river points. Along the Sound the demand is fairly strong, and the better grades of coal are being demanded. Consumers seem to be willing to pay high freight rates in order to get what they want, and this trade is principally influenced by a lack of vessels.

Transportation from mines to tide is fairly regular but is inclined to be somewhat slow. Car supply is irregular, one day showing a plentiful supply, the next no cars at all.

The Coastwise vessel market is characterized by a dearth of small light-draft vessels, whereas large craft are in fairly good supply. Freight rates are as follows: From Philadelphia to Boston, Salem and Portland, \$1; to Portsmouth, \$1.05@1.10; to Newburyport and Lynn, \$1.25; to the Sound, 85@90c.; to points further East than Newburyport the rate depends upon the needs of the consumer. Freight rates from New York harbor, on large vessels, are 85@90c. to points around the Cape. To shoal-water ports small craft are being chartered at \$1.25. New York harbor freights are 25c. per ton.

### Birmingham

Nov. 25—The coal production in Alabama has at last been reduced; several mines have been closed down or are running slack. The Southern Steel Company has closed down the Virginia City mines while the Tennessee company has closed some of the mines in the Blue Creek region. The shutting down of more than half a dozen furnaces, rolling mills and other industries where large quantities of coal are used has had its effect on coal production. It is not believed there will be a general resumption of work in the coalfields until after the new year starts in.

The coke trade is also a little quiet and the production is off.

### Chicago

Nov. 25—Depression continues in the coal market. Weakness is pronounced in coals from mines east of Indiana, notably smokeless and Hocking. Coals from Illinois and Indiana mines are not so over-abundant, but sales are greatly lessened by the closing or lessened operations of manufacturing and other industrial plants.

Illinois and Indiana coals bring \$2.15@3 for lump, \$1.75@2.25 for run-of-mine, and \$1.15@1.40 for screenings. The demand for prepared sizes is not yet strong, because of mild weather.

The market for Eastern coals has been weak because of over-shipments necessitating sales at sacrifice prices to escape heavy demurrage charges. Hocking can be had in almost any quantity at \$3.40@3.50. Smokeless—standard Pocahontas and New River—sells a little above or below the \$3 mark for run-of-mine. Youghiogheny and Pittsburg No. 8 are steady, though not in large demand, the former at \$3.25 for ¾-in. and the latter at \$2.95 for 1¼-in.

Anthracite sells steadily, though the demand is not heavy.

### Pittsburg

Nov. 26—For the first time in several months there has been a full supply of railroad cars and most of the mines in the Pittsburg district have been operating to capacity for nearly a week. Despite the closing of a number of mills, prices remain fairly firm, quotations ranging from \$1.40@1.50 for mine-run coal at mine. Most of the sales during the past week have been made at the minimum price. The river coal trade continues in excellent shape. Another rise in the rivers today enabled shippers to send out about a dozen tows of coal to southern ports.

*Connellsville Coke*—The slump in coke has been serious, and as a result production has been greatly curtailed. At the close of last week less than one-half of the 25,000 ovens in the upper and lower Connellsville fields were in operation and this week several thousand additional ovens were put on the inactive list. There are no prices on furnace coke, as demand has entirely fallen off. It is reported that some lots of furnace coke have been offered as low as \$2 a ton. Foundry coke is still in demand by some foundries that are operating and have not covered for their requirements. Prices, however, have declined and quotations for prompt shipment are \$2.75@3, although it is reported that sales have been made at a lower figure. The *Courier* in its weekly summary gives the production in both fields at 263,628 tons. The shipments aggregated 9648 cars, distributed as follows: To Pittsburg, 3592 cars; to points west of Connellsville, 5323 cars; to points east of Connellsville, 733 cars. The production and shipments for this week likely will be cut in half.

### Iron Trade Review

*New York, Nov. 27*—The iron and steel markets show little change during the week, and may be expected to remain quiet as at present until financial conditions improve. New business does not come forward, the only sales made being of small quantities to cover immediate

needs. The main interest at present seems to be in the withdrawal of contracts, a movement which has reached some proportions. How far this can be carried is a matter on which manufacturers will doubtless have something to say. The curtailment of production has reached large proportions, and does not yet seem to be at an end. It looks as if there would be no accumulation of stocks, as diminished demand will be promptly met by smaller output.

*Lake Ore Shipments*—Ore shipments from the Lake Superior region are about through for the season. True to its policy, the United States Steel Corporation is operating on the Mesabi range at a maximum, though it already has on the lower lakes more ore than can be consumed, under present conditions, during the next eight or 10 months. This maximum will be maintained until shipments become costly through ice and cold weather, and will then cease altogether. No strenuous efforts are being made to keep docks open, as quite cold weather is coming now—so cold that the ore freezes heavily in transit from mines to docks. There is frost in ore of much moisture when it reaches docks, and steaming has been resorted to. In order to avert re-handling of frozen ore, and the possibility of ore being held in dock pockets all winter, the roads have not been furnishing cars for ordinary shipments until the vessel to carry that special cargo of ore is in the harbor. Two years ago they were badly caught because they forwarded ore to docks as soon as the shipping was on Lake Superior upbound, but there came a storm that wrecked vessels of a capacity for nearly 100,000 tons, and delayed as much more till the dock pockets were filled with ore frozen into solid masses. The November Mesabi business was large, especially from the Duluth, Missabe & Northern road.

### Baltimore

Nov. 26—Imports for the week included 1343 tons ferromanganese and 123 tons ferrosilicon. Arrivals of iron ore were 5000 tons, from Cuba. Among other imports were 3326 bags copper ore and 11,764 sacks silver ore from Valparaiso, Chile.

### Birmingham

Nov. 25—Further curtailment of pig-iron production has taken place in the Birmingham district. The Sloss-Sheffield Steel and Iron Company has blown out two furnaces. The make now is just enough to meet the demand, which is rather weak and the constant cancellation of orders is being felt. The manufacturers in the South are not allowing any accumulation of iron and are not desiring any. Rumors prevail that in the near future two or three of the furnaces of the Tennessee Coal, Iron and Railroad Company at Bessemer will be started up.

Out of five blast furnaces at that place one is in operation, one has fires banked and three are cold. An explosion of a gas stove at the Ensley furnace plant of the Tennessee company, caused a closing down of two of the furnaces. The damage has been repaired. The Southern Steel Company has closed down one furnace recently.

There is still a fairly good demand for cast-iron pipe, steel and other products. The steel plants of the Tennessee and Southern companies are doing well.

### Chicago

Nov. 25—The pig-iron market continues depressed. Practically no sales are being made, except for current needs of the most temporary nature. Melters will not talk of contract requirements in the present state of uncertainty about general business conditions. Their weekly needs are growing smaller with the slowing up of industries dependent on iron and steel.

Quotations on the small lots sold are nominally \$25.50 for Lake Superior charcoal; \$20.50 for Northern No. 2 coke foundry; and \$16 Birmingham (\$20.35 Chicago) for Southern. Above and below these quotations are variations of 50c. or \$1 on many sales and a consumer in real need of iron sometimes pays a higher premium. Everything depends on how great the need is.

Hardly a line of iron and steel products is active. There is a little new business in structural material and in a few steel products.

Coke is inactive. The price of \$5.90 for the best Connellsville remains the nominal quotation, though shaded 25c. for some, if not most, sales.

### Philadelphia

Nov. 27—The closest inquiry among producers of pig iron for this market fails to develop anything of interest. There seems to be a general scare and buyers here are patiently waiting for iron to go still lower. There have been general reductions of wages at the blast furnaces at eastern and middle Pennsylvania, and further reductions will probably be made before the end of the year. Selling prices naturally follow this decrease in cost. Every kind of iron is similarly affected. The range of prices is wider than it has been for a year. There are no inquiries on the market worth noting. The situation is better than it appears on the surface from the fact that the foundries and mills have a great deal of work to do, and they must have the iron to do the work. In a general way, prices have declined about 50c. within a week.

*Steel Billets*—There is a good deal of material due on old contracts. Some readjustments have been made as to prices in consequence of the decline in billets since contracts were placed.

*Bars*—There has been a sharp falling

off in the demand for bar iron in the way of large orders. The local stores are doing a good business in a retail way. Bar iron is selling at 1.75c. Common iron is the subject of more inquiry than any other kind, and some of our mills have good contracts which they are filling.

**Sheets**—The sheet market is on the whole in a satisfactory condition, but there is an absence of large orders. The stores are shipping sheets every day to their customers.

**Pipes and Tubes**—There has been scarcely any business done for a week. Tubes have weakened under the general depression.

**Plates**—Manufacturers of iron and steel plates are in better shape than any others. The car builders have a large amount of work on hand and they are anxious for material. In a small way plates are selling well, particularly boiler plate.

**Structural Material**—Prices remain about where they were a month ago for small orders, but for large orders it is impossible to give quotations.

**Steel Rails**—Orders for light rails are coming along, but not as fast as a month ago. Some orders have been booked this week for export.

**Scrap**—The scrap market is dull and the inducements which some dealers offered to mill owners have not brought any response. The only kind of scrap wanted is steel, wrought and railroad. There is a light movement in the lower grades of scrap, but at a drop of about 50c. per ton.

**Pittsburg**

Nov. 26—While there seems to be some slight improvement in the iron and steel markets, conditions continue decidedly dull in most lines. Among the more important new business booked within the past week was a number of good orders taken by the Westinghouse Electric and Manufacturing Company and the Westinghouse Machine Company, the two concerns that are being operated by receivers. It is announced that the two companies have taken orders lately that aggregate over \$2,000,000. In the iron trade there has been a slight improvement. The finishing mills of the Shenango Iron and Steel Company resumed operations on Monday and the Valley and the Brown-Bonnell works of the Republic Iron and Steel Company are scheduled to resume tomorrow. It is believed the bessemer steel plant of this company will be put in operation again in a few days. The big Homestead works and the Duquesne plant of the Carnegie Steel Company are still in full operation, but there is a slowing down at the Edgar Thomson rail plant. Most of the urgent rail orders will be filled early next month, when the works will be closed for repairs and extensive improvements. It is estimated that several hundred thousand tons of orders for standard and light rails will be carried

over into next year. New business in structural material is still being placed, the largest order being taken by the American Bridge Company. It calls for 2000 tons for bridge work for the Delaware & Hudson Railroad. The plate mills are all busy and will not be able to complete all contracts on the books this year.

**Pig Iron**—The market continues dull, there being no inquiry for any grade except foundry. It is likely that some new business will be placed during the week. Large furnace interests are quoting \$20, Valley furnaces, for bessemer iron, but \$19 and less may be done for prompt delivery. Most of the merchant furnaces in the Valleys are going, but it is believed a large majority will be closed about the middle of December. The Carnegie Steel Company has closed six more blast furnaces, making a total of 30 out and four banked. Of the 95 furnaces of the United States Steel Corporation 55 are now on the inactive list. Quotations on all grades of pig iron are purely nominal, No. 2 foundry being \$19, basic and gray forge \$18, Valley furnaces.

**Steel**—Billets remain unchanged as to quotations, the price named on both bessemer and open-hearth being \$28, Pittsburg, and sheet-bars are still quoted at \$31, but no transactions at any price are recorded. Steel bars are at 1.60c. and plates at 1.70c. There will be no change in the prices of finished steel products this year.

**Metal Market**

**Gold and Silver Exports and Imports**

NEW YORK, Nov. 27.

At all United States Ports in Oct. and year.

Metal.	Exports.	Imports.	Excess.
<b>Gold:</b>			
Oct. 1907..	\$ 3,112,539	\$ 4,480,910	Imp. \$ 1,368,371
" 1906..	7,074,544	27,250,852	" 20,176,308
Year 1907..	52,992,352	35,343,130	Exp. 17,649,222
" 1906..	42,864,506	139,026,869	Imp. 96,162,363
<b>Silver:</b>			
Oct. 1907..	5,053,997	3,566,634	Exp. 1,487,363
" 1906..	3,549,017	3,882,522	Imp. 333,505
Year 1907..	53,024,790	38,054,858	Exp. 14,969,932
" 1906..	48,990,356	36,876,591	" 12,113,765

These statements cover the total movement of gold and silver to and from the United States. These figures are furnished by the Bureau of Statistics of the Department of Commerce and Labor.

**Gold and Silver Movement, New York**

For week ending Nov. 23 and years from Jan. 1

Period.	Gold.		Silver.	
	Exports.	Imports.	Exports.	Imports.
Week.....	\$ .....	12,413,679	\$ 978,490	\$ 18,211
1907.....	34,818,544	49,682,229	47,332,720	2,727,928
1906.....	6,047,734	92,819,867	46,888,961	2,022,873
1905.....	34,592,003	10,514,830	30,859,077	3,879,631

No gold was exported for the week; the silver went chiefly to London. Gold imports for the week were from Great Britain and Germany; silver from the West Indies.

Specie holdings of the leading banks of the world, Nov. 23 are reported as below, in dollars:

	Gold.	Silver.	Total.
Ass'd New York	.....	.....	\$168,799,100
England.....	\$152,428,755	.....	152,428,755
France.....	541,843,100	\$186,827,400	728,670,500
Germany.....	142,860,000	39,590,000	182,450,000
Spain.....	78,045,000	127,885,000	205,930,000
Netherlands....	38,209,000	24,672,500	62,881,500
Belgium.....	16,563,335	8,281,665	24,845,000
Italy.....	190,730,000	23,798,000	214,528,000
Russia.....	625,735,000	24,940,000	650,675,000
Aust.-Hungary..	228,050,000	57,655,000	285,705,000
Sweden.....	20,610,000	.....	20,610,000

The banks of England and Sweden report gold only. The New York banks do not separate gold and silver in their reports. The European statements are from the cables to the *Commercial and Financial Chronicle* of New York.

The movement of gold and silver in France for the nine months ended Sept. 30 was as follows:

Gold:	1906.	1907.
Imports.....	Fr. 380,996,000	Fr. 355,820,000
Exports.....	97,873,000	86,092,000
Excess, imports....	Fr. 283,123,000	Fr. 269,728,000
<b>Silver:</b>		
Imports.....	119,133,000	136,051,000
Exports.....	118,502,000	131,210,000
Excess, imports....	Fr. 631,000	Fr. 4,841,000

Imports of copper and nickel coins were 84,000 fr. in 1906, and 74,000 fr. in 1907. Exports were 160,000 fr. in 1906, and 540,000 fr. this year.

**Silver Market**

**SILVER AND STERLING EXCHANGE.**

Nov.	Sterling Exchange.	Silver.		Nov.	Sterling Exchange.	Silver.	
		New York, Cent.	London, Pence.			New York, Cent.	London, Pence.
21	4.8700	58½	27	25	4.8630	58¾	26½
22	4.8685	58¾	26¾	26	4.8650	57¾	26½
23	4.8700	58¾	27½	27	4.8675	57¾	26½

New York quotations are for fine silver, per ounce Troy. London prices are for sterling silver, 0.925 fine.

Shipments of silver from London to the East are reported by Messrs. Pixley & Abell as follows, for the year to Nov. 14:

	1906.	1907.	Changes.
India.....	£ 13,940,296	£10,133,904	D. £ 3,806,392
China.....	430,700	217,350	D. 213,350
Straits.....	1,750	645,950	I. 644,200
Total.....	£ 14,372,746	£10,997,204	D. £ 3,375,542

Imports for the week were £150,000 from New York. Exports were £2350 to India, £20,000 to the Straits, £117,500 to China, and £6800 to Australia; £146,650 in all.

Indian exchange has fallen off heavily, owing to the absence of demand for money in that country. The offerings for bills were at so low a figure that the India Council rejected them all, and no bills were sold.

**Prices of Foreign Coins**

	Bid.	Asked.
Mexican dollars.....	\$0.48	\$0.50
Peruvian soles and Chilean.....	0.40	0.45
Victoria sovereigns.....	4.83	4.86
Twenty francs.....	3.87	3.92
Spanish 25 pesetas.....	4.78	4.80

## Other Metals

Nov.	Copper.			Tin.	Lead.	Spelter.	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	London, £ per ton.	Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
21	13 @13½	12½ @12½	58½	31	4.20 @4.25	4.85 @5.90	4.70 @4.75
22	13½ @13½	12½ @13	59½	31	4.15 @4.25	4.80 @4.85	4.65 @4.70
23	13½ @13½	12½ @13	.....	31	4.15 @4.20	4.75 @4.80	4.60 @4.65
25	13½ @13½	13 @13½	61½	31½	4.10 @4.20	4.70 @4.75	4.55 @4.60
26	13½ @13½	13½ @13½	61½	31½	4.10 @4.20	4.65 @4.75	4.50 @4.60
27	13½ @13½	13½ @13½	63½	31½	4.10 @4.20	4.65 @4.75	4.50 @4.60

London quotations are per long ton (2240 lb.) standard copper, which is now the equivalent of the former g.m.b.'s. The New York quotations for electrolytic copper are for cakes, ingots or wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary western brands; special brands command a premium.

**Copper**—The American consumers remain out of the market, overlooking the excellent opportunities to secure cheap copper or being prevented from action by the financial situation, and the market is consequently influenced chiefly by the transactions for export. Up to Saturday, last week, there were some large transactions, but since then there has been dullness. However, prices have risen under the small further demand, and for speculative and sentimental reasons. Unfortunately there has been no increase in interest in the market by domestic consumers, and also it appears now as if the foreign consumers had nearly supplied their immediate requirements, their inquiries at present being for deliveries after the end of the year, which producers are somewhat reluctant to supply. Evidently Europe appreciates the advantages of the present market, which America either does not, or cannot. American producers are placing only retail orders and the question of price is for the time being fixed by the developments in Europe which have been dominating the market for some time past. It would seem that both consumers and speculators over there have made up their minds that at a certain price the metal is a purchase. The market closes firm for Lake at 13½@13½; electrolytic in ingots, cakes and wirebars 13½@13½. The average at which business in casting copper was done during the week is 12¾@13c., the closing being 13½@13½c.

The London standard market has been leading the market for refined sorts, and under a heavy business higher prices were established from day to day with hardly any reaction. The close is steady at £63 5s. for spot, £63 10s. for three months.

Refined and manufactured sorts we quote: English tough, £57; best selected, £64; strong sheets, £68.

Exports of copper from New York and

Philadelphia for the week were 4218 long tons. Our special correspondent gives the exports from Baltimore for the week at 1295 tons.

**Copper Sheets and Wire**—The base price for copper sheets is 20c. per lb.; of wire, 16½@16¼c. per lb.

**Tin**—The market in London has shown a rather strong tendency throughout the week, advancing from £135 10s. to £137 10s. for spot, £139 for three months, at the close.

The domestic market has been rather lifeless, consumers buying only their immediate requirements, for which they have to pay a considerable premium. While the import basis for tin is equal to about 30½c. per lb., the holders of stocks which are well concentrated are able to obtain a premium of about 1c. per lb.

**Lead**—The market is weak. Both producers and dealers are anxious to get rid of their accumulation and are willing to make material concessions. However, such demand as exists is of a retail character and competition for business is so keen that even on the small orders placed lower prices are accepted from day to day. The close is weak at 4.10@4.20c. New York. In St. Louis the metal is offered at 4c. without finding buyers.

The London lead market has fairly well held its own and closes steady at £16 15s. for Spanish lead, £16 17s. 6d. for English lead.

**Spelter**—In spite of the lower prices, consumers are entirely indifferent, because their business has fallen off to such an extent that their previous contracts cover their requirements beyond their expectations. Under the circumstances, it is very difficult to find an outlet for the stocks which are accumulating and the market is yielding on the slightest offerings. The close is weak at 4.65@4.75c. New York, 4.50@4.60c. St. Louis.

The European market during the week showed a somewhat better tone and the close is cabled at £21 10s. for good ordinaries, £21 15s. for specials.

Some of the furnaces at Altoona, Kan., were put on dead fire last week.

The new works of the United Zinc and Chemical Company, at Springfield, Ill., have been put in operation. The ore is roasted at Argentine, Kansas.

Some of the smelters at Iola, Kan., united in sinking a deep well to prospect for a lower horizon of natural gas. This well is now down about 2500 ft., but so far has given no encouragement.

By a typographical error it was stated last week that 36 out of the 42 furnaces at Iola were running; 31 is the correct figure.

**Zinc Sheets**—The base price was reduced 50c. on Nov. 25, and is now \$7 per 100 lb.—less discount of 8 per cent.—f.o.b. cars at Lasalle and Peru. The freight rate to New York is 27.50c. per 100 lb.

**Antimony**—The market is weak and trending downward. The metal, for spot delivery, is selling slightly lower in New York than in foreign markets, due to the financial situation here and the necessity to liquidate stocks. Prices are as follows: Cookson's, 10½@10¾c.; Hallett's 9½@9¾c.; ordinary brands, 8¼@8½c. per pound.

**Nickel**—For large lots, New York, the chief producer quotes 45@50c. per lb. according to size and terms of order. For small quantities, 50@65c., same delivery.

**Quicksilver**—New York quotations are \$45 per flask for lots of 100 flasks or over, and \$46 for smaller orders. Retail sales are made at 62@63c. per lb. San Francisco quotations have advanced and are now \$44.50@45.50 for domestic orders; for export nominal, at about \$1.50 lower. The London price is £8 5s. per flask, with £8 3s. 9d. quoted from second hands.

**Bismuth**—The present price of bismuth at London is 6s. 6d. per lb., which price was established July 4; previous to that time the price had been 5s. per pound.

**Platinum**—There are rumors of increased activity in the platinum market, but they seem to have little foundation. Prices have not changed during the week. Quotations are: Hard metal, \$29; ordinary, \$26@26.50; scrap, not more than \$19 per troy ounce.

## British Metal Imports and Exports

**Copper**—Imports and exports of copper in Great Britain for the 10 months ended Oct. 31 were as follows, in long tons, the totals giving the copper contents of all material in long tons:

	1906.	1907.	Changes.
Copper ore.....	80,026	87,790	I. 7,764
Matte and precipitate...	62,257	58,780	D. 3,477
Fine copper.....	60,083	55,914	D. 4,169
Total imp., fine copper.	99,215	94,088	D. 5,127
Exports.....	35,788	42,238	I. 6,450
Re-exports.....	13,005	14,728	I. 1,723
Total exports.....	48,793	56,966	I. 8,173
Balance, imports.....	50,422	37,122	D. 13,300

Of the imports in 1907 the United States furnished 604 tons of matte and 17,602 tons of fine copper; decreases of 4771 tons of matte and 3944 tons of copper as compared with last year.

**Tin**—Imports and exports of tin in Great Britain for the 10 months ended Oct. 31 were as follows, in long tons:

	1906.	1907.	Changes.
Straits.....	29,675	29,630	D. 45
Australia.....	4,064	4,902	I. 838
Other countries...	2,597	2,530	D. 67
Total imports..	36,336	37,062	I. 726
Exports.....	7,083	7,340	I. 257
Re-exports.....	27,049	24,095	D. 2,954
Total exports...	34,132	31,435	D. 2,697
Balance, imp:...	2,204	5,627	I. 3,423

Imports of tin ore and concentrates were 18,346 tons in 1906, and 17,918 tons in 1907; a decrease of 428 tons. Of the imports this year 14,406 tons were from Bolivia.

Lead—Imports and exports of lead in Great Britain for the 10 months ended Oct. 31 were, in long tons:

	1906.	1907.	Changes.
United States.....	15,602	21,234	I. 5,632
Spain.....	92,987	86,648	D. 6,339
Australia.....	44,483	40,445	D. 4,038
Germany.....	14,577	3,559	D. 11,018
Other countries.....	5,594	15,219	I. 9,625
<b>Total imports.....</b>	<b>173,243</b>	<b>167,105</b>	<b>D. 6,138</b>
<b>Exports.....</b>	<b>37,866</b>	<b>37,873</b>	<b>I. 7</b>
<b>Balance, imports.....</b>	<b>135,377</b>	<b>129,232</b>	<b>D. 6,145</b>

The lead credited to the United States is chiefly Mexican lead, refined here in bond.

Spelter—Imports and exports of spelter in Great Britain for the 10 months ended Oct. 31 were, in long tons:

	1906.	1907.	Changes.
Spelter.....	75,101	74,419	D. 682
Zinc sheets, etc.....	15,729	15,764	I. 35
<b>Total imports.....</b>	<b>90,830</b>	<b>90,183</b>	<b>D. 647</b>
<b>Exports.....</b>	<b>6,712</b>	<b>5,126</b>	<b>D. 1,586</b>
<b>Balance, imports..</b>	<b>84,118</b>	<b>85,057</b>	<b>I. 939</b>

Imports of zinc ore are not reported separately.

Quicksilver—Imports of quicksilver into Great Britain, with re-exports of foreign metal, for the 10 months ended Oct. 31 were as follows, in pounds:

	1906.	1907.	Changes.
Imports.....	2,857,892	2,939,796	I. 81,904
Re exports.....	1,777,479	2,061,470	I. 283,991
<b>Net imports.....</b>	<b>1,080,413</b>	<b>878,326</b>	<b>D. 202,087</b>

The quicksilver imported is mainly from Spain and Austria.

**Wisconsin Ore Market**

Platteville, Wis., Nov. 23—General conditions remain about the same as last week. Buyers of low and intermediate grades of zinc ore have practically withdrawn from the market, the tonnage shipments for the week just ended being made up mainly of high-grade or calcined blende, together with a small amount of carbonate. Sales of 60 per cent. zinc ore were made during the week at \$38. No sales of lead are reported.

Shipments from the district for the week ended Nov. 23 were as follows:

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville.....	464,570	.....	.....
Hazel Green.....	327,550	.....	.....
Mineral Point.....	168,000	.....	.....
Livingston.....	140,000	.....	.....
Galena.....	120,000	.....	.....
Linden.....	120,000	.....	.....
Highland.....	66,000	.....	.....
Rewey.....	66,000	.....	.....
Harker.....	65,690	82,700	.....
<b>Total for week.....</b>	<b>1,537,810</b>	<b>82,700</b>	<b>.....</b>
<b>Year to Nov. 23.....</b>	<b>92,970,627</b>	<b>4,570,730</b>	<b>462,360</b>

No shipments were made from Benton, Cuba City and Elmore during the week.

**Missouri Ore Market**

Joplin, Mo., Nov. 23—The highest price paid for zinc was \$40 per ton, the assay base ranging from \$34 to \$38 per ton of 60 per cent. zinc, and all grades averaging \$35.34 per ton. The highest price paid for lead was \$46 per ton,

medium grades ranging from \$40 to \$44 per ton, and all grades averaging \$43.22 per ton.

The decline in lead is credited to the decision of the American Smelting and Refining Company to enter the open market. Two of the purchasing companies withdrew from the market. A large portion of the lead sold was on previous contracts. Several mines resumed operations during the week, the employees accepting a reduction in wages of 20 per cent. for day work and 33 per cent. for piece work. It is reported that a number of additional mines will be re-started Monday, increasing the production from 10 to 20 per cent. for next week.

Following are the shipments of zinc and lead ore from the various camps of the district for the week ending Nov. 23:

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,331,920	534,060	\$ 73,389
Joplin.....	1,971,810	158,090	39,956
Badger.....	1,067,900	.....	21,358
Galena.....	1,068,770	94,810	19,990
Alba-Neck City.....	416,640	.....	8,124
Duenweg.....	353,280	38,950	7,391
Aurora.....	525,600	8,470	7,090
Prosperity.....	250,620	39,980	5,626
Granby.....	467,360	20,000	5,153
Carthage.....	185,310	.....	3,706
Spurgeon.....	261,820	27,860	2,913
Carl Junction.....	117,070	26,800	2,904
Sarcozie.....	128,220	.....	2,307
Wentworth.....	60,070	.....	1,081
Sherwood.....	40,210	9,170	916
Zincite.....	47,080	.....	847
<b>Totals.....</b>	<b>20,289,680</b>	<b>968,190</b>	<b>\$202,751</b>

47 weeks..... 531,766,970 78,685,180 \$14,667,502  
 Zinc value, the week, \$181,828; 47 weeks, \$11,874,557  
 Lead value, the week, 20,923; 47 weeks, \$2,792,945

Average prices for ore in the district, by months, are shown in the following table:

ZINC ORE AT JOPLIN.			LEAD ORE AT JOPLIN.		
Month.	1906.	1907.	Month.	1906.	1907.
January...	47.38	45.84	January...	75.20	83.53
February...	47.37	47.11	February...	72.83	84.58
March.....	42.68	48.66	March.....	73.73	82.75
April.....	44.63	48.24	April.....	75.13	79.76
May.....	40.51	45.98	May.....	78.40	79.56
June.....	43.83	44.82	June.....	80.96	73.66
July.....	43.25	45.79	July.....	74.31	58.18
August.....	43.56	43.22	August.....	75.36	59.54
September...	42.58	40.11	September...	79.64	53.52
October.....	41.55	39.83	October.....	79.84	51.40
November...	44.13	.....	November...	81.98	.....
December...	43.68	.....	December...	81.89	.....
<b>Year.....</b>	<b>43.24</b>	<b>.....</b>	<b>Year.....</b>	<b>77.40</b>	<b>.....</b>

**Chemicals**

New York, Nov. 27—The general market remains quiet and very little new business is being done. New contracts are difficult to place, consumers preferring to buy on the open market for immediate requirement until the situation clears. Tin and antimony products are off. Arsenic is quiet and has reacted to about 6¼c.

Copper Sulphate—The market remains inactive and prices are quoted by the largest interests at \$5.50 per 100 lb. for carload lots and \$5.75 for smaller quantities. Outside dealers, however, are quoting carloads at \$5.25 per 100 lb.

Nitrate of Soda.—The market is quiet

but no material evidences of weakness are apparent. The demand is fair and no excessive surplus of nitrate is reported. There have been a few re-sales at 2.35c., but the general quotations are slightly higher. Current prices are quoted as follows: For spot delivery, 95 per cent., 2.37½c.; for December, 2.40c.; for 1908, 2.42½c.; for 1909, 2.40c. The price for 96 per cent. is 5c. per 100 lb. higher.

British Chemical Trade—Exports of heavy chemicals from Great Britain for 10 months ended Oct. 31 were as follows in cwt. of 112 lb. each:

	1906.	1907.	Changes.
Bleaching powder....	818,410	883,736	I. 65,326
Muriate of ammonia, 101,045	101,045	134,448	I. 33,403
Soda ash.....	1,426,688	1,709,188	I. 282,500
Bicarbonate of soda. 325,283	325,283	385,938	I. 60,655
Caustic soda.....	1,208,883	1,275,890	D. 32,993
Soda crystals.....	148,608	176,501	I. 27,893
Soda sulphate.....	822,397	849,463	I. 27,066
Sulphuric acid.....	80,581	69,121	D. 11,460

Exports of copper sulphate were 40,722 long tons in 1906, and 42,848 tons in 1907; an increase of 2126 tons.

Imports of chemicals and raw materials into Great Britain for the 10 months ended Oct. 31 were, in long tons:

	1906.	1907.	Changes.
Nitrate of potash.....	180,849	199,111	I. 18,262
Nitrate of soda.....	97,701	104,293	I. 6,592
Phosphates.....	368,370	434,452	I. 66,082
Sulphur.....	22,783	14,052	D. 8,741
Pyrites.....	630,850	644,200	I. 13,350
Borax, etc.....	16,830	14,663	D. 2,167

Estimating sulphur contents of pyrites, the total imports of sulphur were 275,123 tons in 1906, and 271,722 tons in 1907; a decrease of 3401 tons.

**Mining Stocks**

New York, Nov. 27—The general stock market continues to show declining tendencies, and the period of liquidation is evidently not yet at an end. As an instance of this it is sufficient to say that United States Steel sold this week at \$23 for the common and \$80½ for the preferred; American Smelting common at \$62¾; Amalgamated Copper at \$46¾. The mining stocks followed the general market in tendency, the copper stocks for the most part losing the small gains made last week and a little more. The market for these shares was dull and trading light. Tonopah stocks were dead for the time being, and Cobalt shares weak on small sales. On the whole, the week showed more losses than gains, but closed with a slightly less despondent tone.

**Boston**

Nov. 26—Another week has shown only small and meaningless fluctuations, depending on the money-market conditions rather than on anything directly affecting the stocks. About the lowest levels were reached on Saturday and Monday; today there has been a slight revival, due chiefly to easier money and lower rates on loans. All reports tell of better conditions throughout the country, of easier feeling,

of encouragement, of lessened use of certificates and other expedients, of early return to direct cash payments, of lower currency premium. There is more encouragement, consequently, in the stock market, more covering, less one-sidedness and bearish control.

Amalgamated Copper rallied from its lowest at \$46.50, to \$48.50 today. Copper Range closed at \$51.50; Calumet & Arizona at \$96; North Butte at \$38.50; Tamarack at \$60. There were sales today of Quincy at \$78 and Mohawk at \$46. Utah Consolidated brought \$32; United States Smelting, Refining and Mining brought \$33.75, with \$36 for the preferred.

The curb market has been dull and weak, with small sales.

STOCK QUOTATIONS

NEW YORK Nov. 26		BOSTON Nov. 26	
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Mine.....	.....	Adventure.....	1 1/2
Am. Nev. M. & P. Co.	.....	Allouez.....	23 1/2
Amalgamated.....	48 1/2	Am. Zinc.....	20
Anaconda.....	32 1/2	Arcadian.....	.....
Balakiala.....	2 1/2	Atlantic.....	.....
British Col. Cop.	3 1/2	Bingham.....	5
Buffalo Cobalt.....	1 1/2	Boston Con.....	9 1/2
Butte & London.....	14 1/2	Calumet & Ariz.	96
Butte Coalition.....	1 1/2	Calumet & Hecla	570
Butte Cop. & Zinc	.....	Centennial.....	.....
Cobalt Contact.....	.....	Con. Mercur.....	.27
Colonial Silver.....	1	Copper Range.....	51 1/2
Cum. Ely Mining.....	5	Daly-West.....	9 1/2
Davis Daly.....	3	Franklin.....	7 1/2
Dominion Cop.....	1 1/2	Greene-Can.....	5 1/2
El Rayo.....	1 1/2	Isle Royal.....	15
Foster Cobalt.....	.62	La Salle.....	9 1/2
Furnace Creek.....	.21	Mass.....	2 1/2
Groux Mine.....	3	Michigan.....	8 1/2
Gold Hill.....	3/4	Mohawk.....	46
Granby, New.....	.....	Mont. C. & C. (new)	.....
Greene Gold.....	3/4	Nevada.....	.....
Greene G. & S.....	3/4	North Butte.....	39
Greenw'r & D. Val.	.75	Old Colony.....	.....
Guanajuato.....	2 1/2	Old Dominion.....	22 1/2
Huggan, Exp.....	115	Osceola.....	.....
McKinley Dar.....	35	Parrot.....	9 1/2
Micmac.....	1 1/2	Phoenix.....	.....
Mines Co. of Am.....	1 1/2	Quincy.....	78
Mitchell Mining.....	3 1/2	Rhode Island.....	2 1/2
Mont. Sh. C. (New)	3 1/2	Santa Fe.....	1 1/2
New Utah M. & S.	2 1/2	Shannon.....	10
Newhouse M. & S.	6	Tamarack.....	50
Nipissing Mines.....	5 1/2	Trinity.....	10 1/2
Old Hundred.....	.....	United Cop. com.	7 1/2
Silver Queen.....	3/4	U. S. Oil.....	.....
Stewart.....	.....	U. S. Smg. & Ref.	33
Tennessee Copr.....	27	U. S. Sm. & Re. pd.	36
Union Copper.....	7 1/2	Utah Copper.....	31 1/2
Utah Apex.....	2 1/2	Victoria.....	.....
West Columbus.....	.11	Washington.....	.....
		Wolverine.....	109
		Wyandotte.....	15

N. Y. INDUSTRIAL		
Comp.	High.	Low.
Am. Agri. Chem.....	.....	.....
Am. Smelt. & Ref.	64 1/2	.....
Am. Sm. & Ref. pf.	86 1/2	.....
Bethlehem Steel.....	.....	.....
Colo. Fuel & Iron	16 1/2	.....
Federal M. & S. pf.	52 1/2	.....
Inter. Salt.....	11	.....
National Lead.....	37 1/2	.....
National Lead, pf.	.....	.....
Pittsburg Coal.....	.....	.....
Republic I. & S.....	.....	.....
Republic I. & S. pf.	58	.....
Sloss-Sheffield.....	31 1/2	.....
Standard Oil.....	398	.....
Tenn. C. & I.....	.....	.....
U. S. Red. & Ref.....	.....	.....
U. S. Steel.....	23 1/2	.....
U. S. Steel, pf.....	82 1/2	.....
Va. Car. Chem.....	14 1/2	.....
Va. I. Coal & Coke	35	.....

ST. LOUIS Nov. 23		
N. of Com.	High.	Low.
Adams.....	.35	.25
Am. Nettie.....	.03	.02
Center Crk.....	2.00	1.50
Cent. C. & C.....	65.00	64.00
C. C. & C. pd.....	76.00	75.00
Cent. Oil.....	105.00	100.00
Columbia.....	4.00	2.00
Con. Coal.....	26.00	24.00
Doe Run.....	130.00	120.00
Gra. Blmet.....	.25	.20
St. Joe.....	14.00	13.00

NEVADA STOCKS. Nov. 27. Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
TONOPAH STOCKS			
Belmont.....	.87	Golden Sceptre.....	...
Extension.....	1.06 1/2	Homestake King.....	.50
Golden Anchor.....	.04	Montgomery Mt.....	.05
Jim Butler.....	.42	Mont. Shoshone C.....	4.00
MacNamara.....	.18	Original Bullfrog.....	.03
Midway.....	.40	Tramp Cons.....	.19 1/2
Montana.....	1.35	MANHATTAN STOCKS	
North Star.....	.08	Manhattan Cons.....	.25
Tonopah & Cal.....	6.87 1/2	Manhat'n Dexter.....	.09
Tono'h Mine of N.....	.36	Jumping Jack.....	.06
West End Con.....	.....	Stray Dog.....	.10
		Indian Camp.....	.05
GOLDFIELD STOCKS			
Adams.....	.05	GREENWATER STOCKS	
Atlanta.....	.22	Furnace Creek.....	.18 1/2
Blue Bell.....	.08	Greenwater & D. V.....	.05
Blue Bull.....	.17	Green 'r Cop. M. & S.....	.05
Booth.....	.15	United Greenw'r.....	.04
Columbia Mt.....	.14	MISCELLANEOUS	
Comb. Frac.....	.86	Golden Boulder.....	.07
Cracker Jack.....	.09	Hayseed.....	.30
Dia'dfield B. B. C.....	.16	Lee Gold Grotto.....	.13
Goldfield Belmont.....	.14	Nevada Hills.....	3 00
Goldfield Con.....	4.00	Nevada Smelting.....	1.12 1/2
Goldfield Daisy.....	.80	Pittsburgh S. Pk.....	1 00
Goldfield Mining.....	.....	Round Mt. Sphinx.....	.30
Great Bend.....	.26	COLO. SPRINGS Nov. 23	
Jumbo Extension.....	.60	Name of Comp.	Clg.
Jumbo Mining.....	.....	Acacia.....	6
Katherine.....	.06	Black Bell.....	.....
Kendall.....	.10	C. C. Con.....	3 1/2
Laguna.....	.....	Dante.....	5
Lone Star.....	.10	Doctor Jack Pot.....	6
Lou Dillon.....	.03	Elkton.....	45
May Queen.....	.05	El Paso.....	30
Mohawk.....	.....	Findlay.....	38
Oro.....	.09	Gold Dollar.....	6 1/2
Red Hill.....	.25	Gold Sovereign.....	.....
Red Top.....	.....	Isabella.....	19 1/2
Roanoke.....	.09	Index.....	.....
Sandstorm.....	.19	Jennie Sample.....	.....
Silver Pick.....	.24	Jerry Johnson.....	6
St. Ives.....	.35	Mary McKinney.....	.....
Triangle.....	.08	Pharmacist.....	2 1/2
BULLFROG STOCKS			
Amethyst.....	.....	Portland.....	95
Bullfrog Daisy.....	.....	Un. Gold Mines.....	4
Bullfrog Mining.....	.04	Vindicator.....	78
Bullfrog Nat. B.....	.09	Work.....	14
Gibraltar.....	.10		
Gold Bar.....	.34		

New Dividends			
Company.	Payable.	Rate.	Amt.
Am. Smelters A.....	Dec. 2	\$1.50	\$255,000
Am. Smelters B.....	Dec. 2	1.25	375,000
Batopilas.....	Dec. 31	0.12 1/2	56,250
Butte Coalition.....	Dec. 15	0.15	150,000
Dolores.....	Nov. 25	0.15	59,395
Federal M. & S. com.	Dec. 16	1.50	90,000
Federal M. & S. pf.	Dec. 16	1.75	210,000
Gen. Chemical, pfd.....	Jan. 2	1.50	150,000
Kendall.....	Nov. 23	0.02	10,000
Lehigh C. & Nav.....	Nov. 27	2.00	693,802
Montezuma M. & S.....	Jan. 10	0.04	40,000
National Lead, com.....	Jan. 1	1.25	186,318
National Lead, pfd.....	Dec. 16	1.75	260,820
N. Y. & Hond. Rosario.....	Nov. 30	0.10	15,000
Rio Tinto, com.....	Nov. 1	0.60	375,000
Rio Tinto, pfd.....	Nov. 1	1.51	4,275,000
Standard Oil.....	Nov. 26	10.00	9,700,000
U. S. C. I. Pipe & Fdy., com	Dec. 2	1.00	125,000
U. S. C. I. Pipe & Fdy., pfd	Dec. 2	1.75	218,750
U. S. Smg., Ref. & Mg., com	Nov. 1	0.87 1/2	304,646
U. S. Smg., Ref. & Mg., pfd.	Nov. 1	0.87 1/2	656,250
U. S. Steel Corp., com.....	Dec. 30	0.50	2,451,513
U. S. Steel Corp., pfd.....	Nov. 30	1.75	6,305,497
Warwick I. & S.....	Nov. 15	0.30	43,674

Assessments			
Company.	Delinq.	Sale.	Amt.
Alpha, Nev.....	Nov. 25	Dec. 17	\$0.05
Cent. Eureka, Cal.....	Nov. 1	Nov. 29	0.01 1/2
Con. Imperial, Nev.....	Nov. 7	Nov. 27	0.01
Crown Point, Nev.....	Nov. 26	Dec. 19	0.10
Del Monte, Cal.....	Nov. 20	Dec. 11	10.00
Emerald, Utah.....	Dec. 14	Jan. 11	0.01
Imlay.....	Nov. 23	Dec. 17	0.01
Julia.....	Nov. 5	Nov. 27	0.03
Little Chief, Utah.....	Oct. 30	Nov. 30	0.01
Mt. Dell, Utah.....	Nov. 19	Dec. 7	0.01
Pacific Tin M. Al'ka	Nov. 30	Dec. 20	0.02
Penn. Con., Cal.....	Nov. 16	Dec. 3	0.10
Provident Oil Mfg., Ca.	Dec. 7	Dec. 27	0.01 1/2
Seg. Belc. & Midas, C.	Nov. 6	Nov. 27	0.05
Scorpion, Nev.....	Nov. 4	Nov. 25	0.02
Sleeping Beauty, Cal.	Oct. 12	Nov. 15	0.05
Stansbury, Utah.....	Nov. 18	Dec. 16	0.01
Ultimo, Cal.....	Dec. 2	Dec. 23	0.05
Union Con.....	Nov. 15	Dec. 6	0.10
Wabash, Utah.....	Nov. 30	Dec. 23	0.03
Wolverine & Ariz., A.	Nov. 18	.....	0.25

LONDON Nov. 27		
Name of Com.	High.	Low.
Dolores.....	£1 0s 0d	.....
Stratton's Ind.....	0 2 9	.....
Camp Bird.....	0 15 6	.....
Esperanza.....	1 10 3	.....
Tomboy.....	1 9 3	.....
El Oro.....	1 1 3	.....
Oroville.....	0 14 3	.....
Somera.....	.....	.....
Utah Apex.....	0 10 5	.....
Ariz. Cop. pfd.....	.....	.....
Ariz. Cop. def.....	.....	.....

Monthly Average Prices of Metals AVERAGE PRICE OF SILVER

Month.	New York.		London.	
	1906.	1907.	1906.	1907.
January.....	65.288	68.673	30.113	31.769
February.....	66.108	68.835	30.464	31.852
March.....	64.597	67.519	29.854	31.325
April.....	64.765	65.462	29.984	30.253
May.....	66.976	65.981	30.968	30.471
June.....	65.394	67.090	30.185	30.893
July.....	65.105	68.144	30.113	31.366
August.....	65.949	68.745	30.529	31.637
September.....	67.927	67.792	31.483	31.313
October.....	69.523	62.435	32.148	28.863
November.....	70.813	.....	32.671	.....
December.....	69.050	.....	32.003	.....
Year.....	66.791	.....	30.868	.....

New York, cents per fine ounce; London, pence per standard ounce.

AVERAGE PRICES OF COPPER

Month.	NEW YORK.				LONDON.	
	Electrolytic		Lake.		1906.	1907.
	1906.	1907.	1906.	1907.		
January.....	18.310	24.404	18.419	24.825	78.869	106.739
February.....	17.869	24.869	18.116	25.236	78.147	107.356
March.....	18.361	25.065	18.641	25.560	81.111	106.594
April.....	18.375	24.224	18.688	25.260	84.793	98.625
May.....	18.475	24.048	18.724	25.072	84.867	102.375
June.....	18.442	22.665	18.719	24.140	83.994	97.272
July.....	18.190	21.130	18.585	21.923	81.867	95.016
August.....	18.380	18.356	18.706	19.255	83.184	79.679
September.....	19.033	15.565	19.328	16.047	87.831	68.375
October.....	21.203	13.169	21.722	13.551	97.269	60.717
November.....	21.833	.....	22.398	.....	100.270	.....
December.....	22.885	.....	23.350	.....	105.226	.....
Year.....	19.278	.....	19.616	.....	87.282	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

AVERAGE PRICE OF TIN AT NEW YORK

Month.	1906.	1907.	Month.	1906.	1907.
January.....	36.390	41.548	July.....	37.275	41.091
February.....	36.403	42.102	August.....	40.606	37.667
March.....	36.662	41.313	September.....	40.516	36.689
April.....	38.900	40.938	October.....	42.852	32.620
May.....	43.313	43.149	November.....	42.906	.....
June.....	39.260	42.120	December.....	42.750	.....
			Av. year.....	39.819	.....