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Geology of the Ely Trough Iron-ore Deposits

The Orebodies at Ely, Minnesota, are Replacement Deposits Inclosed in a Greenstone Trough under a Cap of Jaspilite

BY GLARENCE E. ABBOTT*

The lenticular body of iron formation and its including walls of greenstone at Ely, Minn., has been termed the "Ely trough." It has a northeast-southwest trend, parallel to the longitudinal axis of the Vermilion range. Longitudinally and transversely its structure is synclinal. Transverse sections show that it is characteristically U-shaped at some points. This is especially true of its western portion, where the Chandler and Pioneer deposits are located. Here in places the bottom of the trough has been reached, showing that greenstone forms the impervious basement.

To the east, in the Zenith, Sibley and Savoy mines, the greenstone walls and included iron formation dip at a high angle. Both east and west ends of the trough are canoe-shaped, the west end pitching east and the east end pitching west. At the Zenith, and about midway in the trough, is an anticline, subordinate in nature. This anticline separates the Zenith ore deposit in two portions, one upon either limb. It also has separated the trough longitudinally into two great synclines, one between the Pioneer and Zenith, the other between the Zenith and Savoy.

The ores of the district lie at or near the bottom of the trough and upon the impervious basement of Ely greenstone.

Note—Abstract by D. E. Woodbridge of a paper read by title at the summer meeting, 1906, of the Lake Superior Mining Institute.

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At only one point of the trough did the ore reach the surface, at the west end of the Chandler deposit. As a result of the trough's steep pitch to the east the orebody rapidly passed under the capping of jaspilite, and all the orebodies lie beneath a jaspilite capping. In the upper portions of the trough, and nearer the surface, the jaspilite lies in contact with the greenstone; lower down the ore is in direct contact with greenstone. Horses of greenstone are present in the orebodies in a number of cases. These can, in almost every case, be traced into the foot wall, showing that their presence in the orebody is due to infolding.

At the east end of the area, while the formations form a pitching trough, the structural conditions have been formed in a different manner.

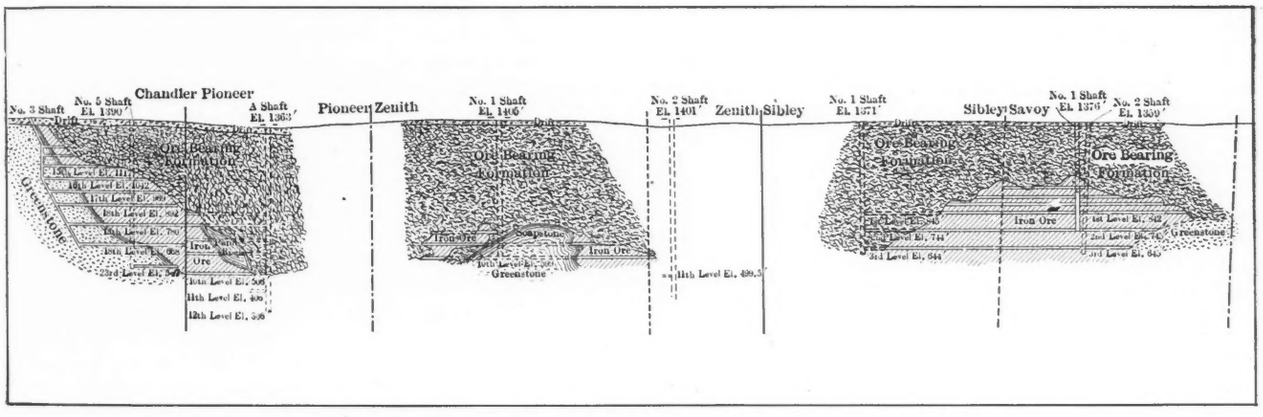
The Chandler-Pioneer Body

The Chandler-Pioneer orebody is the largest yet developed in the area. It occurs at the bottom and comes part way up the sides of the eastward pitching trough. The inclosing walls are of greenstone, as is also the impervious basement upon which the ore lies. The rocks have been closely folded and as a result many irregularities in structure occur.

The north and south walls at one point in the Chandler dip at an angle of about 70 deg. to the north. Farther east, in the same orebody, the south wall becomes more inclined, while the north wall dips at a high angle to the south.

In many cases the intense folding has caused a reversal of dip of the walls. These points are illustrated in sections A—B, C—D and E—F. These sections also show an increased depth to the trough as it pitches east. The longitudinal section illustrates this fact very clearly.

One especially interesting feature is the presence of a number of subordinate rolls at or near the bottom and sides of the trough. In all cases they are protuberances from the inclosing walls of greenstone. On section A—B the subordinate anticline is very prominent. This has separated from the orebody a small lens of ore. Infolding probably explains its occurrence. Where examined underground it lay between two walls of greenstone, and was very compact in structure.



LONGITUDINAL SECTION—CHANDLER, PIONEER, ZENITH, SIBLEY, SAVOY MINES

No paint rock was present, the ore being in direct contact with the greenstone. This subordinate roll in the Chandler can be traced into the Pioneer workings where it has become of great importance. Here it entirely separates a small orebody from the main body. It may eventually cut out this orebody entirely, as did a similar roll in the upper workings, and connect with the south foot wall.

Conditions of Formation

The north and south walls of the trough are of greenstone altered to soap rock or paint rock. The soap rock is the altered equivalent of the greenstone and grades into it in most every case. At the

contact of the ore and the soap rock the soap rock is very schistose and shows slickensides, while the ore is generally much broken. There is at many points along the contact a considerable thickness of brecciated matter. This consists of fragments of paint rock included in the ore.

The jaspilite being a much more resistant rock, did not break and crush as readily as the greenstone. This, together with the slickensides, indicates that great movements have taken place at the contact of the two formations. The plane of contact has afforded ready access to descending waters. As a result the greenstone has altered to soap rock, and iron oxide has been infiltrated, giving the soap rock a chacteristic red color.

Lying next to the soap rock is the ore; above the ore is the capping of jaspilite. The contact of the ore and jaspilite is very irregular. Jasper bunches project into the orebody at many points. Both ore and jasper have been much broken and crushed. This is due to the forces which produced the folding and formed the trough in which the ore lies.

The banding in the ore is very similar to that of the jasper; in fact, there is a gradual change from merchantable ore to lean ore and from lean ore to jasper. In general the brecciated ore has been recemented by iron oxide and to all appearances is massive in structure.

The Zenith Orebodies

The Zenith orebody lies between two walls of greenstone dipping at an angle of about 75 deg. to the north. The north and south walls are approximately parallel. More intense folding has taken place at this point in the trough than at the west end in the Chandler-Pioneer properties.

The relations of the greenstone, paint rock, ore, and jasper are in general similar to those at other points of the area.

There are two separate orebodies in the Zenith mine. These orebodies are separated by an anticline which has had considerable influence upon their deposition. The axis of this cross-fold lies approximately in an east-west direction. The orebodies appear to be upon either limb. The first orebody found in the Zenith was that lying upon the south limb of the anticline. As depth was reached, this orebody was found to follow down this limb until at the tenth level it is some 300 ft. west of where it was first found in the old upper workings.

Development work has shown that this anticline has a core of greenstone which has altered to soap rock upon either limb and upon its crest. The jaspilite capping lies immediately upon the crest.

The main orebody of the Zenith was located by means of diamond drills from the bottom levels near the shaft. It lies upon the north limb of the anticline.

Both bodies lie mainly upon the foot-wall side of the formation. The main orebody occupies the full width between walls as increased depth is reached. The ore lies higher up on the foot-wall than upon the hanging-wall side. It is quite evident that the major circulation of descending water was upon this side of the fold, and because of this more work of concentration was accomplished.

The soap rock is also much thicker upon the foot wall, showing that descending waters have been unusually active at that point. The main body is pitching to the east under the jaspilite capping. From the ninth to the tenth levels it has gained nearly 500 ft. As to whether it will eventually connect with the Sibley deposit, we are not certain. Everything points to that conclusion, however.

The ore of the Zenith mine does not contain much more than 2 per cent. of lump ore. In its iron content and structure it is probably the best iron ore that the Oliver Iron Mining Company is producing.

The Sibley-Savoy Deposit

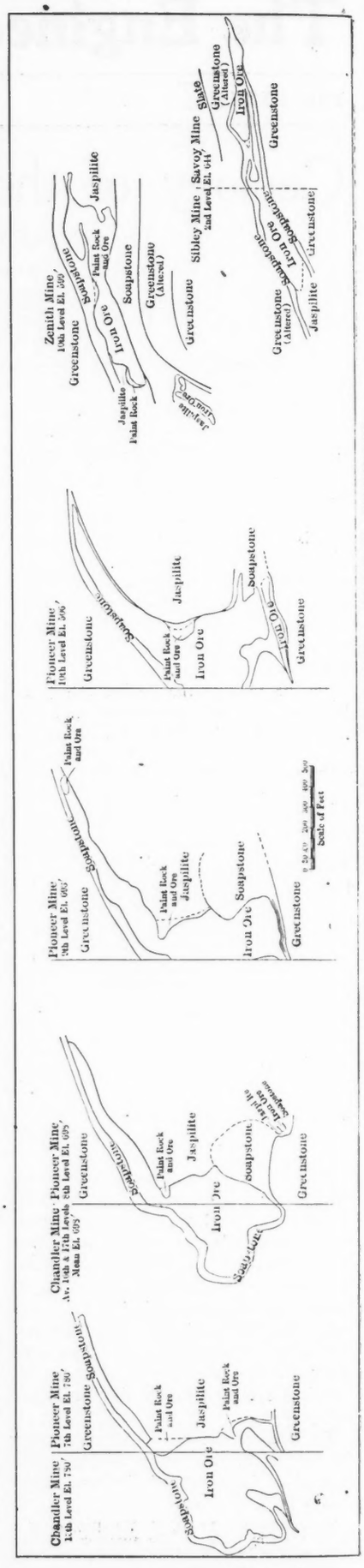
The Sibley-Savoy ore deposit lies in a westward pitching trough. The inclosing walls are of greenstone, which dip at a high angle to the south. Here, as in the Zenith, the rocks have been closely folded.

The ore lies mainly upon the foot-wall side, but with increased depth occupies the full width between the walls. The orebody itself is lenticular in shape, being about 150 ft. wide in places and narrowing to nothing at the east end. At this point the foot and hanging walls came together like a V and the ore pinches out. The main body, and that from which the most ore has been mined, lies upon the Savoy side, but with increased depth the greater orebody will no doubt be found upon the Sibley property. The Sibley deposit is rapidly gaining to the west under the heavy capping of jaspilite.

In the mines of this district red paint rock, or soap rock highly impregnated with iron, is considered to be a favorable sign for ore. The absence of this at the east end of the Savoy merely emphasizes the barrenness of the formation at this point of the deposit.

The ore in the Savoy is harder and more compact than that in the Sibley. Pillars 15 ft. square stand without crushing, while in the Sibley a pillar of that size would stand for but a short time.

As stated above, this orebody, especially in the Savoy mine, is pitching to the south at a high angle. Facts seem to point to a rapid flattening of this angle, approaching nearer 45 deg. In the bottom of the Savoy mine is a long, narrow lens of greenstone and paint rock. This seam, or lens, first appeared in the second-level workings. It seemed to be a projection from the foot wall. As depth was reached it grew to be of more importance, until upon the third level it has completely divided the orebody into two portions. Fu-



LEVELS OF CHANDLER, PIONEER, ZENITH, SIBLEY, SAVOY MINES, GEOLOGICAL FORMATIONS

ture developments may show it connecting with the foot wall, or it may continue as a narrow sheet. Facts seem to point to its connecting with the foot wall throughout its entire length.

Origin of the Deposit

At the contact of the ore with the hanging wall in the Sibley mine, the banding of the ore is approximately parallel to the dip of the soap rock. At this point the paint rock and ore are intimately associated, there being a considerable amount of brecciated matter composed of pieces of ore, jasper and paint rock. In some places the ore lies against a clean face of paint rock, its bedding planes being parallel to the dip of the paint-rock hanging wall. The paint rock always shows slickensides, an indication of the great movements that have taken place at these points.

In the Savoy and Sibley deposit a large amount of iron carbonate is found. This occurs as yellow and reddish crystals in the cavities and seams in the ore. It has in many cases recemented the brecciated ore as the old fracture planes may be easily seen. This carbonate is clearly of secondary origin.

It is very evident from a study of the sections through the Ely trough that the contact of the iron formation and the greenstone has strongly influenced the concentration of the ores. These planes of weakness were the means by which the descending waters reached the bottom of the trough.

The formation of the orebodies as a result has been dependent upon this means of ready access to the iron formation. Where the descending waters converged and met at the bottom of the trough in the Chandler-Pioneer deposit, there the largest orebodies were found. This is true to within certain limits, there being in a number of cases a pinching of the walls with an enlargement of the orebody below.

Abundant circulation of water for a long period of time, together with ideal structural conditions, has made the concentration of the ores in their present position a possibility.

The relations of the orebodies to the trough are very definite in that they conform very closely to it in outline. They have evidently been deposited in their present positions after the main period of folding had been finished. However, some of the ores and most of the jaspilites are now, or have been, in a brecciated condition. It is plain that movements have taken place while they were near the surface, and that considerable movement was necessary, as both ore and jaspilite are exceedingly hard when in massive state.

Evidences of Movements

I do not believe that great movements of the rocks of the trough have taken place since the formation of the orebodies in the present positions. There are in many places along the contact of the iron formation and the Ely greenstone considerable amounts of fragmental material. This material consists chiefly of pieces of soap rock and ore, with a matrix consisting of a mixture of both. The soap rock was formed by alteration of the greenstone; this alteration must have taken place while the orebodies were being formed in their present position, for it was at that time that circulating waters were most active at the contact.

If these movements took place after the alteration to soap rock no angular pieces would be present, as it is a very soft rock. It is therefore evident that the fragments of greenstone were detached from the wall and placed in their present position before they had altered to soap rock.

Where we find the ore lying against the soap rock without fragmental matter, although the soap rock shows slickensides it is evident that the movements causing the slickensides occurred previous to the alteration of the soap rock, and, therefore, also before the main concentration of the ore. If the waters were descending, as seems to be now proved in general, alteration was first begun at the contact of the iron formation and the greenstone.

As the great thickness of soap rock on the hanging- and foot-wall sides of the trough must have been formed contemporaneously with the ore, it is evident that any movements tending to strain and fracture the ore would have caused a different state of affairs than we now find at the contact. In most cases the banding and fracturing of the ore is similar to that of the jaspilite.

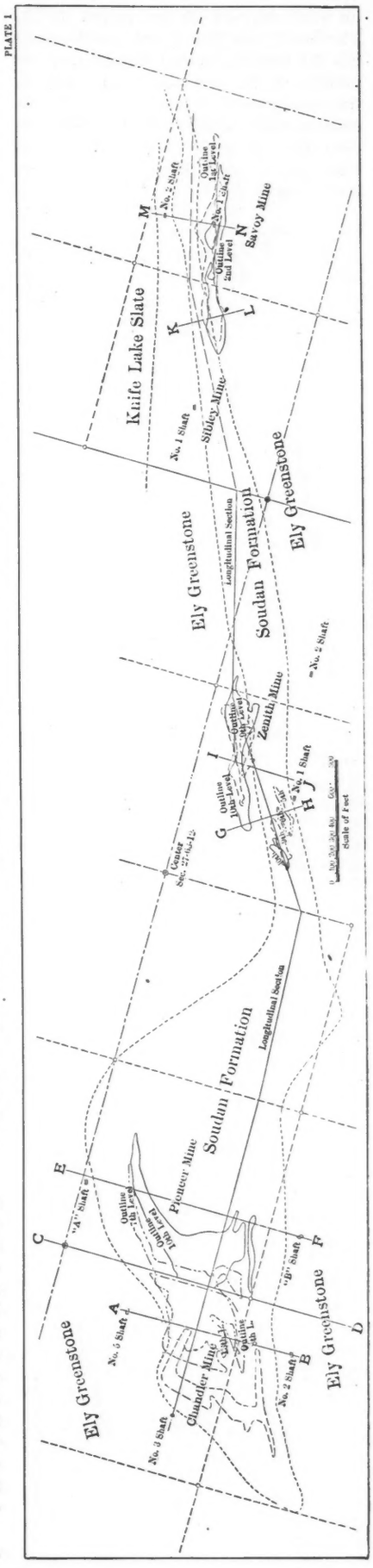
It seems evident that the main fracturing of the ore formation occurred previous to the formation of the orebodies in their present positions, for they now rest in places most favorable for the circulation of underground waters. Any great movements would have changed these positions. The ores have been formed by a process of replacement, and they retain, as a whole, practically the same structure as that existing in the jaspilite at present.

Replacement Deposits

The iron formation and the inclosing greenstones were at one time deeply buried. That the iron formation was in the zone of flowage is evidenced by the intricate folding it has undergone without a sign of fracture. From the zone of flowage the rocks were elevated to the zone of fracture for ore and jasper; here they were subjected to further movements and were crushed and broken. This brecciation increased the openings in the iron formation, and thus afforded an easier access to the circulating waters. As a result infiltration and recementation took place, and the brecciated ores are now cemented by hematite, calcite and siderite.

The iron ores are replacement deposits.

PLATE I



GEOLOGICAL MAP OF THE ELY DISTRICT, MINNESOTA

Wherever actual contacts with the jaspilite were observed the ore graded into it. The ore in the Sibley and Zenith mines has the mashed, banded structure so noticeable in the iron formation. This is true to a greater or less extent in the remaining mines of the district. Thus it is clear that the rock from which the ore was derived by a process of replacement was a banded rock.

Infolding or Interbedding

About 1300 ft. south of No. 2 shaft, Savoy, a vertical drill hole passed through 85 ft. of ore at a depth of 1253 ft. Midway in this ore was a seam of altered greenstone 13 ft. thick. This orebody lying so far south of the Savoy deposit, and buried under such an enormous thickness of greenstone, seems to indicate that it has been interbedded rather than infolded.

In the Zenith mine, drilling done to a depth of 700 ft. below the tenth level also reveals some startling facts. The iron formation and greenstone form a fold shaped like the letter J. The formations dip to the north at a high angle until, at a depth of 400 ft. below the tenth level, they turn back upon themselves, rise toward the north to a point 70 ft. below the tenth level and 400 ft. north of where the hanging wall is encountered on that level.

To explain this occurrence by infolding must necessarily involve a very complicated series of movements of the formations. As in the Savoy, the facts seem to point to interbedding rather than to infolding. In both deposits long seams of altered greenstone are encountered in the orebody. In the Savoy especially we have a seam that has divided the orebody into a north and south lens. This, as in the drill hole mentioned above, is evidence of interbedding.

It may be asked how it is possible that infolding could have occurred at one end of the trough and interbedding at the other, it all being in a continuous iron formation. Such an occurrence could easily occur without violating geological principles. It is evident that after the interbedding of the iron formation at the east end of the area that great movements took place. This is evident because of the position of the slates and their dip to the south. It is certain that nowhere in the Lake Superior region has there been folding that will enable us to explain the relations of the different formations at the east end of the Ely trough.

Direction of Water Circulation

Conditions in pre-glacial and glacial times were very different from those existing today, and it is certain that the concentration of the ore was well along in those periods. A study of the topography of the area does not enable one to form an opinion as to the possible depth of the effect of circulating waters.

Circulation of underground waters at all points observed in the Ely trough is downward. The Pioneer mine, whose workings are below those of the Chandler, to the west, is pumping practically all the water of that deposit. This does not average much more than 400 gal. per min. At the east end of the trough we have a somewhat similar state of affairs. The Sibley and Savoy bottom workings are about upon a level. The east end of the Savoy, and especially near the converging walls of greenstone, is very wet.

This indicates that the main circulation of water is now down the end of the canoe-shaped trough. The Sibley shaft is, however, very wet compared with the Savoy, and all the water from both properties is pumped through this shaft. At the Zenith less water is being pumped than at the Pioneer; this is also true of the Sibley. When the orebody is tapped from Zenith No. 2 shaft, a much larger flow than now encountered in No. 1 shaft is expected. In all of the properties the main circulation of water is upon the foot-wall side of the formation.

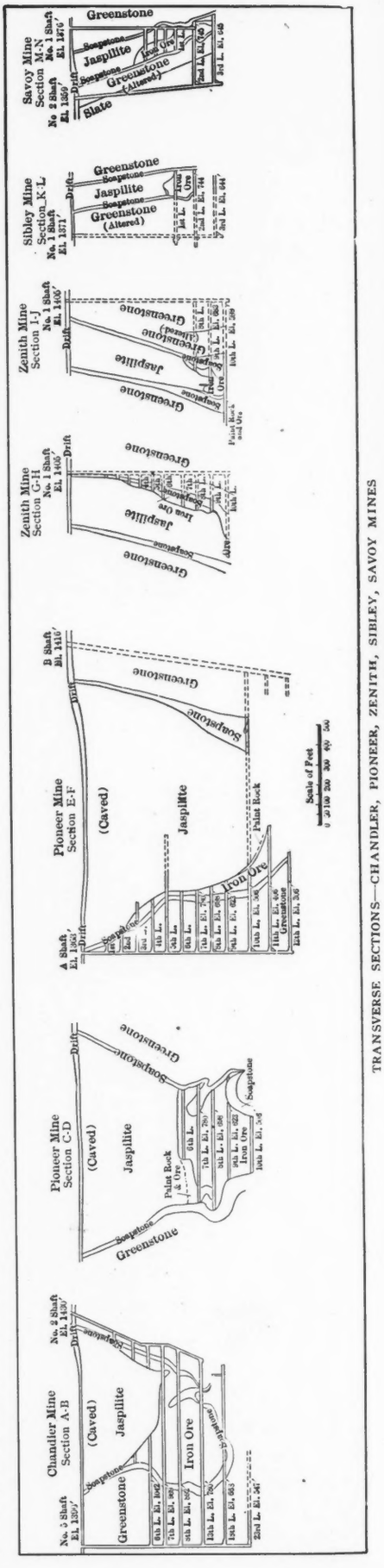
It is evident from the above facts that the flowage of underground water at present is very small compared with what must have circulated at one time. We may assume, however, that present-day circulation is in practically the same channels as during the formation of the orebodies.

Explorations

It may be said that the Vermilion range is the most difficult to explore of any of the iron-bearing districts in the Lake Superior region. From a study of the deposits of the Ely trough it is possible to arrive at a few conclusions regarding exploration. In the first place, the iron formation and adjacent formations should be mapped in a careful manner, with their strikes and dip. When possible, a careful magnetic survey should be made, showing the lines of maximum variation. This sometimes enables the iron formation to be traced under the heavy covering of glacial drift encountered at so many points. The iron formation, where of considerable width—is most favorable for exploration, although the smaller exposures should not be wholly neglected.

As shown in the maps and sections the iron formation is about 1400 ft. wide at one point in the Ely trough, yet it narrows to scarcely 150 ft. at its east end. Good deposits of ore were found at the narrowest point of the formation.

As shown in the cross section of this area, the orebodies lie in pitching troughs with impervious basements. Where the ends of the formation can be found they should be carefully examined for evidences of such structure. At only one point in the Ely trough did the ore reach the surface. This occurred at the west end of the Chandler mine. The remain-



TRANSVERSE SECTIONS—CHANDLER, PIONEER, ZENITH, SIBLEY, SAVOY MINES

ing deposits of the area were found beneath a heavy capping of jaspilite, varying from 300 to 800 ft. in thickness. It is, therefore, not probable that all of the ore deposits yet to be discovered will be found at or near the surface.

VERTICAL DRILL HOLES PREFERABLE

In the early days considerable drilling was done at the narrow east end of the Ely trough. Low angle drill holes were put down. Those holes, in most cases, were located on either the foot- or hanging-wall side and passed from foot to hanging through jaspilite. As is seen from the cross section, they cut the formation above the main ore. Ore was encountered, but it was mainly small bunches in jaspilite and not a main body.

It is, therefore, evident that exploration should be done by means of long, high angle holes, as the orebodies in almost all cases lie at considerable depth. Low angle holes are drilled with considerable difficulty, owing to their liability to cave readily. To ream a hole and case it is very expensive. In most cases vertical holes can be sunk with far better success.

The Savoy main orebody was discovered by means of a vertical drill hole, and its extension to the south was located in the same manner. The explorer should aim to prove the formation at considerable depth, as it is evident that the orebodies lie at or near the bottom of the troughs. Some explorers claim that steeply inclined drill holes are liable to follow a seam of ore, and thus give inaccurate information.

As the iron formation of the Vermilion range has been folded in a most intricate manner, that a drill hole should encounter a continuous seam of ore is highly improbable.

Lehigh Coal and Navigation Company

This company owns a large estate in the Lehigh district of the anthracite region. It also owns the Lehigh and the Delaware Division canals, and the Lehigh & Susquehanna Railroad. The railroad, however, is leased to the Central Railroad Company of New Jersey. The property also includes a large interest in the Lehigh & Hudson River Railroad.

The gross earnings of the Lehigh & Susquehanna Railroad were $7,611,667. There was a decrease due to the stoppage of anthracite mining in April and May.

The income account for the year was as follows:

Lehigh coal lands	$851,307
Railroads	2,305,053
Miscellaneous	213,267
Total	$3,369,627
Less loss on canals	37,885
Net earnings	$3,331,742
Interest, rentals, taxes, etc	$1,327,131
Depreciation and sinking funds	319,163
Total charges	$1,646,294
Surplus	$1,685,448

From this dividends were paid of 8 per cent. on the stock, amounting to $1,387,604 leaving a surplus of $297,844 for the year.

The coal mined and shipped was as follows:

	1905.	1906.	Changes.
Coal shipped	2,428,304	2,383,256	D. 45,048
Used at mines	223,234	277,835	I. 54,601
Total	2,651,538	2,661,091	I. 9,553

The coal consumed by the company and its tenants in mining operations was 10.4 per cent. of the production, as compared with 8.4 in 1905. This increase is due to the fact that the consumption of fuel to make steam for pumping, etc., continued while the collieries were idle during the strike and no coal produced. The smaller sizes are used for this purpose, and a large proportion of the amount used was waste coal that could not be sent to market. The output per day of 10 hours was 9920 tons, and the average time worked by each colliery was 229.5 days of 10 hours each, or 255 days of 9 hours each, the present working day. The cost of mining and preparing coal was $1.72 per ton, a decrease of $0.03 compared with 1905.

The report says: "During 1906 improvements under way were pushed vigorously and others undertaken, all of which will ultimately lead to an increase in the production of coal. The amount expended on colliery improvements during the year was $442,476. Out of the current earnings of the company $200,000 has been charged off for depreciation. Capital charges under the head of coal improvements have been increased by the sum of $242,476. During the period of eleven years there has been expended on new collieries, additions and betterments the sum of $2,740,409, of which $1,659,203 was charged off out of the net earnings and $1,081,206 added to capital account.

It is proposed to drive a tunnel from high-water mark on the Lehigh river, near Mauch Chunk, in a southwesterly direction, a distance of 7500 ft., to a point of intersection with the Buck Mountain or one of the underlying coal seams. From this point, a drainage gangway will be extended westward in one of the coal seams, from which connections will be made with all the collieries now in operation on the company's property between Mauch Chunk and Tamaqua. The tunnel and gangway will have a descending grade to the Lehigh river for every 100 ft. The distance from the outlet of the tunnel to the western extremity of the drainage gangway will be about 12 miles. Six collieries will be placed above water level, and in five others pumping will be reduced vertically an average of about 360 ft.

"Plans have been prepared for the construction of the main tunnel, starting on the Lehigh river at the junction with Nesquehoning creek, near an old site known as Lausanne, at a level of 546 ft. above tide. The main tunnel, the drainage gangway and the connecting tunnels call for 24,000 ft. of tunnel and 54,000 ft. of gangway, making a total of nearly 14 miles. The total cost is estimated to be something over $700,000. It is believed that the direct saving at the present time in the cost of mining coal will be nearly $150,000 per year. In addition, the amount to be saved annually in freedom from drown-outs, while a difficult one to state absolutely, will, in the course of years, represent a very large sum of money. Work on the tunnel was started in July last. It will take several years to complete.

"The operation of our canals shows a loss for the year of $37,885, which is $11,305 less than for the year 1905. The results are still very unsatisfactory. Some extraordinary expenditures are responsible for part of this loss, the largest item being the rebuilding of the Taylorsville aqueduct, at a cost of $10,588. In the last few years over $600,000 has been expended out of surplus earnings in rebuilding and making substantial repairs. Plans are now under discussion for enlarging this portion of the company's business, and the sentiment is to give them favorable consideration, provided the probable returns will justify the very large expenditure required.

"During the year improvements have been made on the property known as the Ballstown Yard, situated on the Delaware river front, to enlarge the coal storage plant at that place and give additional facilities for unloading canal boats and distributing coal. When this plant is completed it will be possible to increase the traffic over the canal during the navigation season, as room will be provided for storing more coal for distribution during the winter months. In addition to increase in business, it is believed the facilities will decrease the cost of handling the coal. There is a frontage on the river of 450 ft. In addition to the unloading facilities now planned, it is possible to build two large modern piers for general merchandise purposes. These piers, being located on the deep-water channel, would be in demand, and would add to the facilities so badly needed in the harbor of Philadelphia."

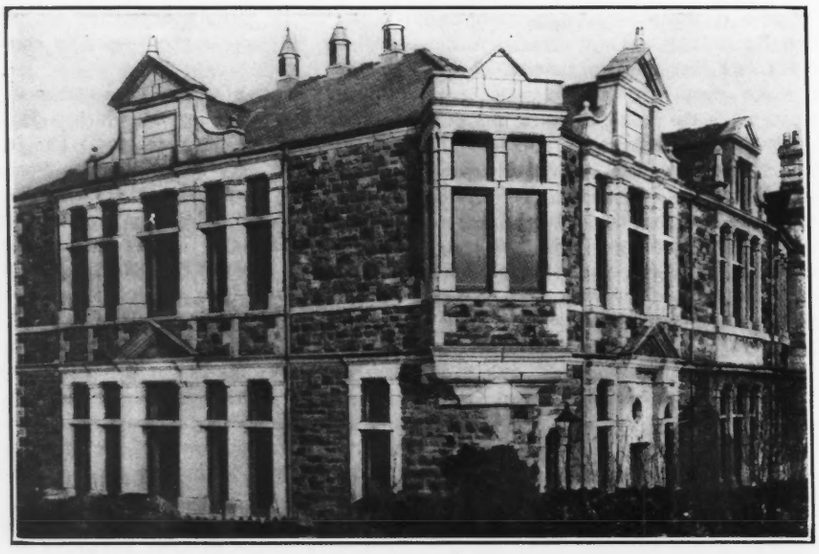
Depth of Death Valley, Cal.

The Geological Survey has just completed a line of spirit levels through Death Valley, California, and has ascertained that the depth of that area is not so great as was supposed. Preliminary figures give for the lowest point a depth of 276 ft. below sea level. Bennetts well, which is near this point, is 266 ft. below sea level. Previous estimates of the depth of Death Valley based on barometer readings gave for the lowest point figures varying from 250 to 450 ft. below sea level.

The Mining School at Camborne, Cornwall

By Edward Walker

Though mining in Cornwall has been under a cloud during the last 20 years, and progress in general has lagged behind, there is one institution which is not open to this reproach. I refer to the mining school at Camborne. Its progress during recent years has been a matter of congratulation and affords a proof that the Cornishman is not such a slow and backward individual as some of his unkind critics would paint him.



THE CAMBORNE MINING SCHOOL

Like many institutions of this character, the Camborne mining school is an outgrowth of other things. It is now over 50 years ago since Sir Charles Lemon attempted to found a mining school at Truro. His efforts were not successful. A few years afterward, viz., in 1859, a committee of local and other gentlemen interested in mining, among whom was the late Robert Hunt, formed the Miners' Association for the purpose, among other things, of establishing courses of lectures at various centers in Cornwall, and for 20 years this particular scheme was worked with satisfactory results.

Some of the lecturers have subsequently risen to fame, such as Richard Pearce, late of Colorado and now connected once more with Cornish mining and metallurgy, Sir Clement Le Neve Foster, J. H. Collins and Benedict Kitto.

In 1877 these lecture courses became centered at Camborne by the building of a metallurgical and chemical laboratory by Mr. Basset, and it is this event which is officially considered as the foundation of the school. In 1882 a school building and lecture rooms were erected, and in 1890 a new wing was built.

Perhaps the most important step was taken in 1897, when the eastern portion of the South Condurrow mine was leased and made into a medium for teaching mining in all its operations, as well as surveying and ore dressing. This mine is now known as the "King Edward Mine." For many years J. J. Beringer, well known as author of the "Textbook of Assaying" which bears his name, has been principal of the school and head of the departments of chemistry, metallurgy, assaying, mineralogy and geology.

The mining, surveying and ore-dressing departments have been in the charge of William Thomas and Benjamin Angwin. Recently William Thomas has resigned in order to take up the management of the Botallack mine now being reopened, and he is to be succeeded by James G. Lawn, who has for some time held a similar position at the South African School of Mines, and is the author of the book on "Mine Accounts and Mining Bookkeeping."

The growth of the school has been continuous, and the number of students has increased from 80 ten years ago to 230 last session. There are also mining schools at Penzance and at Redruth. These have not flourished like that at Camborne, and they ought to be and very likely will eventually be amalgamated with their more robust brother.

The course of study at the Camborne school extends over three years. In some cases, where the student can satisfy the authorities that he has efficient preliminary training, the courses may be taken in two years. In no case can the diploma of the school be awarded to a student who has spent less than two whole years there. The courses include mining, assaying, surveying, ore dressing, metallurgy, geology, mineralogy and crystallography, physics, chemistry, mathematics, pure and applied, mechanics, mechanical-laboratory work, mechanical drawing, electrical engineering, ambulance and mining hygiene.

During the three years constituting the school course two days a week are spent at practical work at the mine. In the first year special attention is given to driving in hard and soft ground by hand tools, stoping operations, and sampling. The second year's course includes timbering and the use of machine drills. The third year's work consists of a study of ore dressing and mill practice. Concurrently with practical work there are series of lectures on mining to extend and elucidate the knowledge gained at the mine, and the courses on mining also include lectures and practical work on geology and mineralogy. Mine surveying is dealt with during the second year, and metallurgy and assaying during the third.

WORKED-OUT TIN LODE, KING EDWARD MINE, CAMBORNE

The notable points about the course are, first, that more of the instruction is given in the mine field and laboratory than in the class room, and secondly, that the courses dealing with allied or collateral subjects such as electrical and mechanical engineering, mathematics, physics and chemistry are specially designed for the requirements of the mining man and metallurgist.

Henri Moissan *

The death of Henri Moissan deprives France of one of her most distinguished contemporary chemists. Born in Paris in 1852, he studied at the Museum of Natural History, and in 1879 became connected with the School of Pharmacy, where he became professor of toxicology in 1886, and of mineral chemistry in 1889. In 1900 he was appointed professor of general chemistry at the Sorbonne and also director of the Institute of Applied Chemistry. One of the earliest achievements that brought him fame was the isolation of the element fluorine in the free state—a problem which had attracted the attention of many chemists before him, though with little success. This he accomplished in 1886 by electrolyzing a solution of potassium fluoride in anhydrous hydrofluoric acid at a temperature 23 deg. below zero Centigrade. Having obtained the element, he carried out an exhaustive study of its properties and those of its compounds, and his results were collected in a book on "Le Fluor et ses Composes," which he published in 1900.

Among other things, he thought it might be possible to utilize its extraordinary active powers of reaction for the production of carbon in the crystalline form—or, in other words, diamond—and attempted to gain this end by means of two gaseous fluorides of carbon which he found he could readily prepare; but the decomposition of these compounds only yielded lampblack instead of the hoped for diamond. His experiments, however, led him to take up the methodical study of carbon in its three varieties and to investigate the condition under which they are transformed one into the other. He thus came to recognize that high pressure is necessarily for the preparation of the crystalline variety, and to obtain this pressure he took advantage of the property possessed by molten iron of increasing in volume as it passes from the liquid to the solid state. He also took advantage of another property of molten iron, that of dissolving a large quantity of carbon; this carbon, at ordinary pressures, is deposited from the solidifying iron as graphite, but he hoped that by the aid of high pressure he would obtain it as diamond.

To melt his iron and carbon, however, he required a very high temperature, and as a convenient means of obtaining this he was led to the development of the electric furnace, with which also his name is specially associated. He melted iron and sugar-charcoal in a carbon crucible at a temperature of some 4000 deg. C., and then suddenly plunged the crucible in cold water. The result was that the outer solidifying skin of iron formed a rigid envelope, and that enormous pressure was set up in the interior as the inner liquid became solid. The carbon, as he expected, separated from the iron in the crystalline form, and thus he was enabled to produce real diamonds—exceedingly small, it is true, but still possessing the density and other characterictics of the natural products of Brazil or Kimberley.

He was further able to use the electric furnace—on which he published a book, "Le Four Electrique," in 1897—for a large extension of our knowledge of chemical action at high temperatures. Thus he succeeded in melting a great number of substances which had previously been regarded as infusible, and in reducing with carbon refractory oxides such as lime and silica to their elementary state.

He was also able to prepare many new compounds, especially carbides, silicides and borides, including calcium carbide, which was obtained almost simultaneously by him and by Willson in America in 1892. Prof. Moissan was well known in England. He gave a lecture on the isolation of fluorine at the Royal Institution in 1897, and the day afterward that substance was reduced to the liquid state by him and Sir James Dewar in the Royal Institution laboratories, where, also, some years later it was obtained as a solid and shown to react violently in that condition with liquid hydrogen. In 1905 he was elected a foreign member of the Royal Society, and last year he again gave a lecture at the Royal Institution demonstrating the volatilization of gold and other metals by the aid of the electric furnace. It was only last year, too, that the fifth and last volume appeared of an exhaustive "Traité de Chimie Minérale," which was brought out under his direction and which was intended at once to give a complete picture of the state of knowledge of inorganic chemistry and to point out the gaps that remain to be filled by future investigation.

*From the *London Times*.

KING EDWARD MINE AND SOUTH CONDURROW, CAMBORNE

Steel Production in Germany

The output of the German Steel Syndicate during 1906, according to the *Iron and Steel Trades Review*, amounted to 11,079,000 tons of finished and semi-finished products, being an increase of 2,127,048 tons over 1905. The production of tubes advanced 45 per cent.; forgings, railway axles, etc., 31 per cent.; bars, 29 per cent.; plates, sheets, shapes, and semi finished steel, each 22 per cent.; rolled rods and wire, 21 per cent., and railway material, 19 per cent.

Although the number of workmen in the Broken Hill district, New South Wales, is larger than at any previous period, it is still considerably below existing requirements, and operations are thereby impeded at several of the mines.

The Tavener Process for Gold Slimes

The Cost of Producing Gold Bullion from a Clean-up on the Rand by this Smelting Process is Less Than 4d per Fine Ounce

BY L. A. E. SWINNEY

The following notes on the smelting of zinc-gold-slimes, from drying the gold slime to the ultimate production of the gold bullion were compiled at one of the largest mines on the Rand, and represent the actual smelting of a "clean up" from start to finish. The figures pertaining to a specified smelt are given, which are taken as representing the average.

Drying of the Gold Slime

The filter press was at first held at a pressure of 80 lb. during the pumping in of the slime, and at half-cock and 40-lb. pressure during the second press, so that the slime should not be forced too far into the meshes of the filter cloths, and could be distributed evenly from the sides inward. One press and a half were obtained, and the cakes were duly detached from the frames into barrows resting on the tray underneath, and then taken into the smelting-house.

The cakes of slime were placed in cast iron trays 3x2 ft.x5½ in., and dried in the drying furnace (Fig. 1). The slime was dried at a uniform heat until it was slightly caked on the surface and all available moisture had been expelled. A slight crust of Zn SO_4 and Ca SO_4 was, as usual, found on the surface of the dried slime, which was shoveled from the trays into zinc pans, in which it was weighed when sufficiently cool, and then dumped into a conical heap on the cement floor. A sample of the slime was taken from the heap, and run down in pots to determine approximately the quantity of gold which might be expected from the smelt.

Assay of Sample

The sample weighed 14.58; and the following flux was used: PbO, 29 oz. + 2 oz. cover = 31 oz. PbO = 28.52 oz. Pb; C(on the PbO), 2.9 oz.; Na_2CO_3, 2.175 oz.; $H_4B_2O_7$, 5.0 oz.; SiO_2, 3.625 oz.; MnO_2, 4.35 oz.; Fe (on the PbO), 2.90 oz.

The lead bullion obtained weighed 34 oz., and, after granulation, was sent up to the assay office for assay, the return giving 6.523 per cent. Au. This was at the rate of 15 per cent. Au in the slime taken. A mean of two assays averaged 15.5 per cent. fine gold in the slime.

The heap of dried slime was then thoroughly mixed with the fluxes by continual shoveling and forming into cones.

Fluxing on a Large Scale

The total weight of dried slime obtained was 22,996 oz. The cyanide department called for 3150 oz. Au (3200 oz. approx.). Now the lead bullion obtained from the smelting should contain about 10 per cent. Au for successful cupellation in this process, and also to secure a good pour, therefore the weight of Pb bullion required = 32,000 oz. Pb. It being near enough to assume PbO the same as Pb, 29,000 oz. PbO are required, 3000 oz. PbO being used as a cover. Approximately, therefore, 120 per cent. PbO is required as a flux.

The weight of slime obtained from the 1st press was 12,975 oz., and the quantity of flux needed was calculated on this amount, and was as follows: PbO, 15,570 oz.; C, 1557 oz. (10 per cent. on the PbO); first press 55 per cent. assay slag, 7136 oz.; Fe, 1946 oz.; SiO_2, 3243 oz.

The carbon used was in the form of coal, the iron as tin-plate scrap and old tins cut up into small pieces, the SiO_2 as clean sand from the tailings dump, and the slag as common green slag from the assay office. The total weight of slime from the second press was 10,021 oz.; of this total 2741 oz. were smelted with the first press charge given above. The flux necessary for this extra amount was then calculated, and weighed as follows: PbO, 2741 oz.; C, 274 oz.; part of second press 55 per cent. slag, 1507 oz.; Fe, 356 oz.; SiO_2, 685 oz.; 3000 oz. PbO cover.

The double charge was smelted in the large pan furnace. The remainder of the second press, 7280 oz. (10,021—2741) was mixed with the requisite flux and smelted in the small pan furnace. The following weights were used: PbO, 7280 oz.; C, 728 oz.; part of second press 55 per cent. slag, 4004 oz.; Fe, 946 oz.; SiO_2, 2820 oz.; 2000 oz. PbO cover.

Smelting Flux and Slime

The mixed flux and slime was thrown upon the pan of the furnace, where previously the lead bullion obtained from the preceding by-product smelt had been placed. In one instance this bullion weighed 7483 oz., and contained 28.73 oz. fine gold. The fire was then lighted, and the reduction commenced. Only 5 per cent. of the iron was added with the original flux as a rule, the remaining 8 per cent. being added when the reactions were practically at an end. The cover of litharge was used to prevent any escape of the fine charge up the flue.

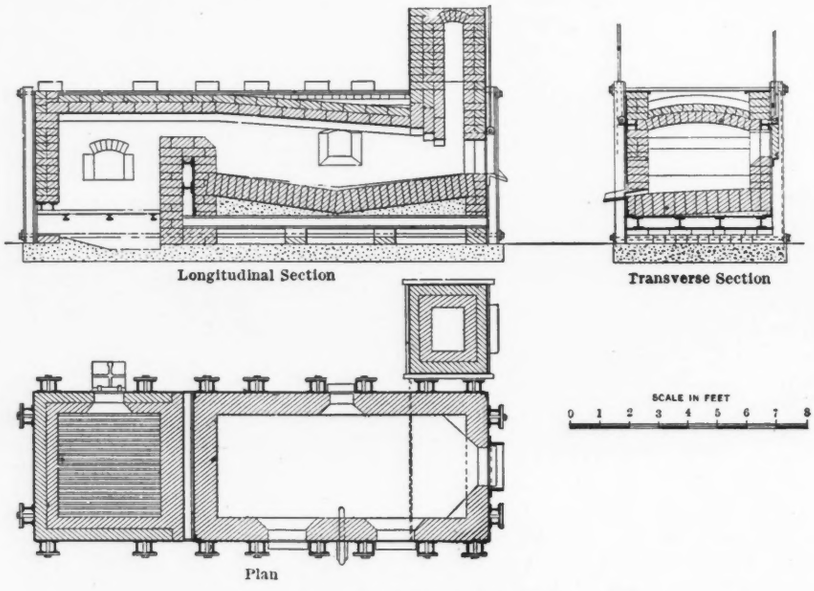


FIG. 1. PAN FURNACE FOR DRYING SLIME CAKES

When the surface of the molten mass was fairly quiet the iron was added in two charges, one closely following the other. From this point (4:30 p.m.) onward, the temperature was maintained fairly high and constant. The slag was rabbled from time to time to ascertain the progress of the reactions and the fluidity of the charge, and at 7 p.m. the tap-hole door was raised, coal thrown on to the fire, and the slag rabbled off into slag pots of 240 lb. capacity. From time to time during the skimming, the door was closed, to raise the temperature, and prevent the slag from becoming too pasty.

Four pots of slag were obtained which

Note—Abstract from a paper read before the Institution of Mining and Metallurgy, London, Nov. 15, 1906.

were too rich to throw away, since they contained a fair proportion of small lead metallics, and were therefore retained for the next smelt. Slag which assayed under 1 oz. was sent to the slag dump. Samples of the slag were assayed after each smelt.

A sample of the lead bullion was taken in a long-handled ladle, just before tapping, and granulated before being sent to the assay office. The furnace was cooled down toward the end to make the slag pasty and render the last portion capable of being easily rabbled off.

The tap hole was opened at 8:30, and the lead bullion tapped into a small pot fixed on a movable pivot with a long spout resting on wheels, so that the issuing lead could be directed into the molds in front of the spout. These molds were arranged in sets of five, and the lead was allowed to run into a ladle first, before directing it into the next set, to avoid loss by spilling.

Samples were taken on a shovel as the slag fell into the slag pot, and thrown into a bucket of water to granulate it. The last three pots of slag were generally retained for the by-products smelt, and were not sampled.

When the tapping was finished, a plug of wood was inserted into the tap-hole, followed by a plug of clay. These plugs were opened with hot irons at the commencement of the tap.

Results of the Smelt

(a) Large Pan Furnace—

Started 2 a.m.; tapped 3:30 p.m.; 14 cwt. of coke used; three pots of slag sampled, 17 bars of lead bullion cast from which was obtained 19,682 oz. lead bullion. assaying 9.225 per cent. fine gold = 1895 oz. gold.

(b) Small Pan Furnace—

Started 6 a.m., tapped 5 p.m.; 2 pots of slag sampled, 9 bars cast, from which was obtained 8522 oz. Pb bullion, assaying 14.918 per cent. fine gold = 1271.3 oz. gold.

As a rule about 1100 lb. of slag were obtained from a charge smelted in the large furnace. The bars of lead bullion were put aside for treatment in the cupellation process, any matte obtained at the end of the cast being broken up and treated in the by-products smelt.

Cupellation

The cupels should be made so that the bone ash scarcely binds when compressed in the hand. The bone ash is bought ready screened in 80 and 40 mesh sizes. Water and caustic potash are added and the bone ash screened through a 64 mesh screen, the cupel being made from the sieve product.

About 3000 oz. of bone ash are used for making a cupel, mixed with 14 lb. KOH and about 9 per cent. of water. The cupel is made on an iron slab laid perfectly level on a masonry foundation. The bone ash is rammed securely round the base of the "test" as it rests on the slab, and also underneath the crossbars on the bottom as much as possible.

The bottom of the "test" is well covered and trampled in by Kafirs. Next the ash is put in to half fill the "test," and is tamped down until quite hard, this being repeated until the whole of the "test" is full. The well of the cupel is then chiseled out at 3 in. from the edge, 14 in. from the breast end, and 4.5 in. deep.

A slope of about 75 deg. at the breast end is made and 4 tapping holes are drilled through in the breast at any convenient distance from the end and from each other. A carefully made cupel should last during two cuppellations.

Fire in the furnace was started and when the cupel was hot enough, the bars of lead were fed in from the channel at the back until it was almost on a level with the top of the breast. The "gate" was cut down to the level of the lead and leading to No. 1 taphole, and the blast was turned on from the tuyere at the back, and the litharge driven off into the slag pot underneath.

A plug of bone ash was inserted into the gate, and a ladle full of flux thrown on the surface of the gold, the flux being composed of 10 parts borax, 5 parts sodium carbonate, and 3 parts silica. The plug was removed, the blast turned on, and the molten slag fell into the pot. Directly the slag ceased to come away, the blast was turned off, the "gate" plugged up, and the doors were closed.

After a short interval the still plastic gold was broken up with bars, and the pieces were thrown into empty slag pots where they were broken up small enough to go into the Cornish crucibles in the small pot furnaces, where the gold was melted up.

Melting the Gold

A little flux was put on the bottom of the hot crucibles, and the broken pieces were placed on top until the pot was full. When the gold was thoroughly fused, and at a high temperature, the top slag was thickened by throwing in a little bone ash, stirring with a skimming rod, and knocking off the pasty mass into a bucket of water. All the slag was removed in this manner, and a second addition of about half a scoopful of flux was made.

When the slag became thoroughly molten, the pot was poured into a rectangular mold. When cool the mold was plunged into water and the bar detached, the slag which was knocked off the bar, together with the rest of the slag, going into the slags or by-products smelt. The gold bar was then cleaned by boiling in dilute HNO_3, dried, stamped with the name of the mine and its number, and taken up to the assay office to be sampled.

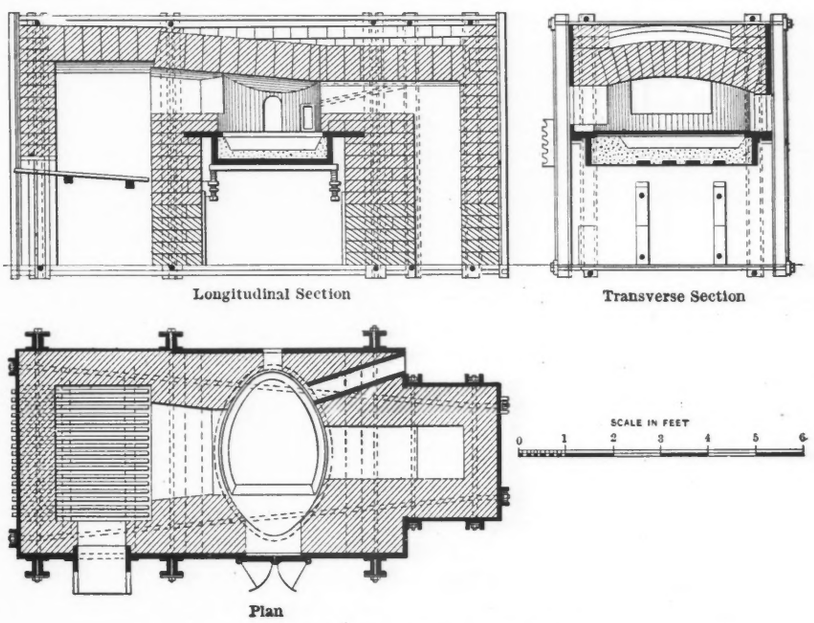


FIG. 2. CUPELLING FURNACE

ANALYSIS OF THE SMELT.

Material.	Oz. or Per Cent.
Slime.	
Weight	22,996 oz.
Assay Value	15.5 per cent.
Fine gold contents	3564.38
Litharge.	
Weight used	30,591
Weight recovered	22,879
Weight lost	7,712
Weight Pb. required	28,143
Lead Bullion.	
Weight received	28,522
Assay value	9.255 per cent. / 14.918 per cent.
Fine gold contents	3166.425

Battery Number.	Average Bullion Weight.		Fineness of Gold.	Weight of Fine Gold.
	Before Smelti'g.	After Smelti'g.		
	Oz.	Oz.		Oz.
88	925	916.179	862.5	790.204
89	925	926.414	861.5	798.106
90	1,007	971.843	858.0	833.841
91	995	974.179	857.5	835.358
Totals...	3.852	3.788.615		3,257.509

By-Products Smelt

This smelt was a clean-up of all the residues, slag, etc., from the operations already described; in fact, everything suspected to contain gold was included in the charge. A characteristic charge follows: One barrow full of matte, old slag, part of a cupel (studded with gold beads) from previous cupellations, sweepings from the extractor house, gold metallics from the cupels, assay office, etc. (amounting to 67.8 oz.), 10 per cent. carbon (coal dust), 3642 oz. clean lead from stock, 3000 oz. of litharge.

The furnace was filled as full as possible, the fire started, and the charge run down. A shovelful of old tins was added with the first part of the charge which was run down, and with each succeeding part. The slag was skimmed off from the surface of each charge when the reactions were finished and the next charge added. The furnace was started at 6:30 a.m. Jan. 11, and was tapped at 10:30 a.m., Jan. 12, 1906. Twenty-four sacks of coal were used, and 15 pots of slag were sampled before sending to the dump. This slag assayed 6 dwt. per ton.; 9504 oz. lead bullion were obtained, assaying .562 per cent. fine gold = 53.41 oz. fine gold.

Smelting Costs

The following table represents the total cost of clean-up and smelting, and includes the labor. The costs were worked out on the basis of ounces produced.

Coal.....	813.58
Borax....	827.67
Litharge.	265.91
Bone ash.	336.75
Coke, etc.	176,10
Labor....	8,640.00 (1 white man at £30 per month, 2 Kafirs at £6)
	11,160.01d.

Total cost of 2,959.351 oz. = 3.77d. per fine oz.

Electrical Equipment for Port Henry Iron Mines

The new power plant, designed by H. C. Pelton, consulting engineer, New York, which Witherbee, Sherman & Co. is erecting on the Lake Champlain shore at Port Henry, New York, furnishes an interesting example of the application of electricity in mining. Owing to the fact that the principal shafts of the mines are scattered over a considerable area, electricity has been found to be the most flexible form of power transmission. Power for this purpose is generated at present both by water and steam.

The new power house which is being built at Port Henry is about six miles from the mines, and will be interconnected with the other sources to supply the increasing demand for power. The station is to be built of monolithic reinforced concrete. The stack will also be constructed of this material. Portland cement will be used, mixed with tailings from the mines.

The main building containing the boilers is 107x51 ft., while the turbine-generator room measures 39x56 ft. and extends at right angles from the center of the main structure. By making use of the Curtis turbine much floor space is saved and the building is very compactly constructed.

Steam will be generated by four 500-h.p. Babcock & Wilcox boilers, arranged in pairs on either side of a 175-ft. stack, which occupies about the center of the powerhouse. There is space for two more boilers of the same capacity, one at the side of each pair.

The boilers are hand fired, and coal is conveyed to each by a car on a track running the length of the building. This car is filled from an overhead hopper through a hinged chute. The hopper is filled by a vertical bucket conveyor which carries the coal from a pit filled directly from cars outside the building.

The generating equipment comprises an 800-kw. Curtis steam-turbine generator which will deliver current directly to the line at a potential of 6600 volts and 25 cycles. The compactness of the vertical unit has permitted a remarkably economical disposition of machinery in the generating room. Space is left for the installation of a second turbine which will probably be installed at once.

The switchboard is located in a gallery with a reinforced-concrete floor. On this floor is placed also the motor-driven exciter sets, and space is available for two frequency changer lighting sets. A supplementary exciting unit is provided by a 25-kw. horizontal Curtis steam-turbine generator. The entire electrical equipment for this power house will be furnished by the General Electric Company.

The Cement Industry in 1906

The following statement, issued by the United States Geological Survey, shows the approximate production of hydraulic cements in the United States for the calendar year 1906.

This statement is exact within a small fraction of one per cent. and is issued in advance of the annual report on the production of cement which is now being prepared in that Bureau. The returns on which it is based are complete with the exception of those from four small plants.

The total production of all kinds of hydraulic cement in 1906, including portland, natural-rock and Puzzolan cements, was 50,027,321 barrels, valued at $54,015,713.

Of the above total amount of cement manufactured in the United States in 1906, 45,610,822 barrels were portland cement, with a value of $51,240,652; 3,935.275 barrels were natural-rock cement, with a value of $2,362,140; and 481,224 barrels were Puzzolan cement, valued at $412,921.

Prices were good in 1906, and showed an advance over those of 1905. The total production of cement in 1905 was 40,894,308 barrels, valued at $36,012,189. Comparison of totals for 1905 and 1906 shows an increase in 1906 of 9,133,013 in production and $18,003,524 in value.

The Quincy Mining Company

The report of the Quincy Mining Company for 1906 states that the board of directors authorized an increase in capital amounting to 50,000 shares, par value $25. From the sale of 10,000 shares at $70 each, 800 acres of land were bought from the Arcadian Copper Company for $750,000.

The workmen received two increases of 5 per cent. each, the latter being given voluntarily by the company.

The financial report follows:

Jan. 1 to Sept. 30.	Total.	Per Lb.
Sales of copper (11,237,716 lb.) .	$2,097,409	18.66c.
Mining expense....	1,176,689	10.47
Smelting, transportation, etc.	79,868	0.71
Oct. 1 to Dec. 31. .		
Sales of copper (4,957,122 lb.)...	$1,061,602	21.42c.
Mining expenses.....	485,831	9.80
Smelting, transportation, etc.	34,700	0.70
Total sales of copper (16,194,838 lb.).....	$3,159,011	19.51c.
Interest and real estate.	27,411	.....
Increase in capital stock, 10,000 shares @ $70.....	700,000	.....
Total receipts.....	$3,886,422	23.99c.
Mining expenses.....	$1,662,520	10.265c.
Smelting, transportation, etc.	114,568	0.707
Taxes in Michigan.....	47 288	.....
Construction at mine.....	110 000	0 679
Construction at smelting wks.	28,560	0.114
Deferred interest.....	15.046	.....
Purchase of Arcadian land....	750,000	.....
Total expenses....	$2,728,482	16.84c.
Net income.....	1,157,939	7.15
Balance Jan. I, 1906.....	$1,312,592	
Total surplus.....	$2,470,531	
Less dividends paid.....	1,250,000	
Carried forward.....	$1,220,531	

Mining was interrupted early in February and during March by underground disturbances or so-called "air-blasts" which caused levels to be distorted, tracks to be torn up and pipe lines, wiring and electric haulage systems to be badly injured. The disturbances came from a combined hanging- and foot-wall movement causing shafts Nos. 7, 2 and 6 to be crushed so that skips could not be operated at the time.

Equipment at No. 8 shaft, including the new steel rock-house was completed May 10. The whole surface equipment was overhauled and put in repair. New pipelines, mill and smelter equipment, including two 16x32-in. Sturtevant crushing rolls at No. 2 mill, mine buildings and other improvements have been added.

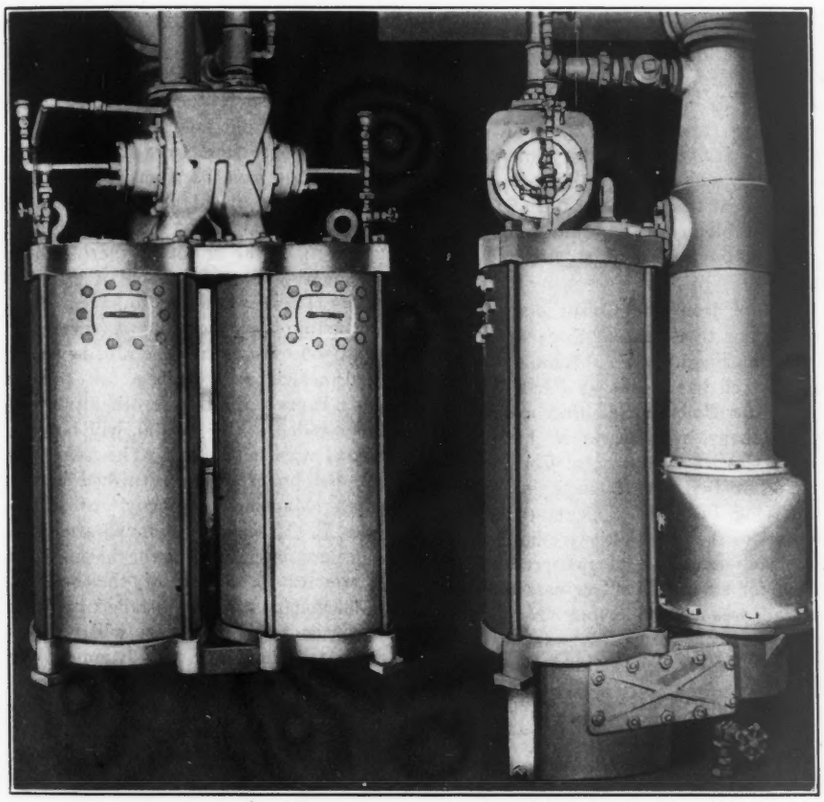
The total mineral smelted for the year was 28,794,724 lb., an increase of 2,288,356 lb. over 1905. Dividends amounted to $1,250,000 and the payments were made quarterly instead of semi-annually as heretofore.

Recent prospecting in the northwest part of India has, according to a United States consular report, disclosed a number of veins of asbestos.

The Starrett Air-lift Pump

The Starrett pump shown in the accompanying photographs, Figs. 1 and 2, has been in operation for some time in the Ward shaft on the Comstock Lode, Nevada, at the 2350-ft. level. This is the first use of this pump for mining purposes. Receiving compressed air through a 2-in. valve at a pressure of 50 lb. per sq.in. it pumps 300 gal. of water per minute to a hight of 250 ft. The water pumped has a temperature of 169 deg. F. and carries fine gravel which, it is said, does not injure the pump in the least.

The Starrett pump employs a new principle, or rather an interesting combination of two old principles. It lifts the water by the direct pressure of compressed air, and when a head of water equal in weight to the air pressure has been created in the discharge pipe, air entering the lower part of the column reduces the weight and causes a second upward flow by the well known principle of air-bubble expansion.



FIGS. 1 AND 2. STARRETT PUMP, FRONT AND SIDE VIEW

Method of Operation

The working of the pump is simple and highly ingenious. A reference to the illustrations will show the principles involved.

Take a pressure of air of 20 lb. per sq.in. Referring to Fig. 3, 20 lb. of air pressure at *a* will force 40 ft. of water through the lower check valve *b*, causing an equilibrium. The 20 lb. of air pressure then passes through the air jet *c*. The weight of the water in the discharge pipe at *c* is less than at *b* by the difference between *b* and *c*. The jet of air forces or lifts the column of water to the overflow.

The moment there is an overflow from the discharge pipe, the weight on the check valve *b* is reduced, and the exact amount of water that will counterbalance the overflow is admitted. Thus the pump can never overload itself, but the flow of water into the discharge pipe is automatically regulated by the air pressure. The 20 lb. of pressure lifts but 40 ft. of water, consequently, instead of a solid column, there is but 40 ft. of water in the discharge pipe, the remaining space being taken up by the air rushing upward at increased speed expanding in its course in accordance with Marriotte's law.

Instead of carrying a heavy load slowly the pump lifts several light loads in rapid succession, the amount of water discharged depending upon the pressure and quantity of air used.

With a double pump, one having two pump chambers or cylinders, the water is made to flow in a continuous stream by means of a device, called a shifter, which automatically turns the air from one cylinder into the other, there being no apparent break in the discharged column of water. The pump proper consists of two chambers or cylinders, top and bottom castings, and inlet and outlet check valves. The pump cylinders can be made of No. 18 steel hydraulic riveted pipe, which is guaranteed to stand a pressure of 150 lb. per sq.in., for it would not be necessary to carry a higher pressure than that even for a 1000-ft. lift.

Fig. 4 represents a two-cylinder Starrett pump, having a discharge pipe nearly equal in size to the pump-cylinders. Its

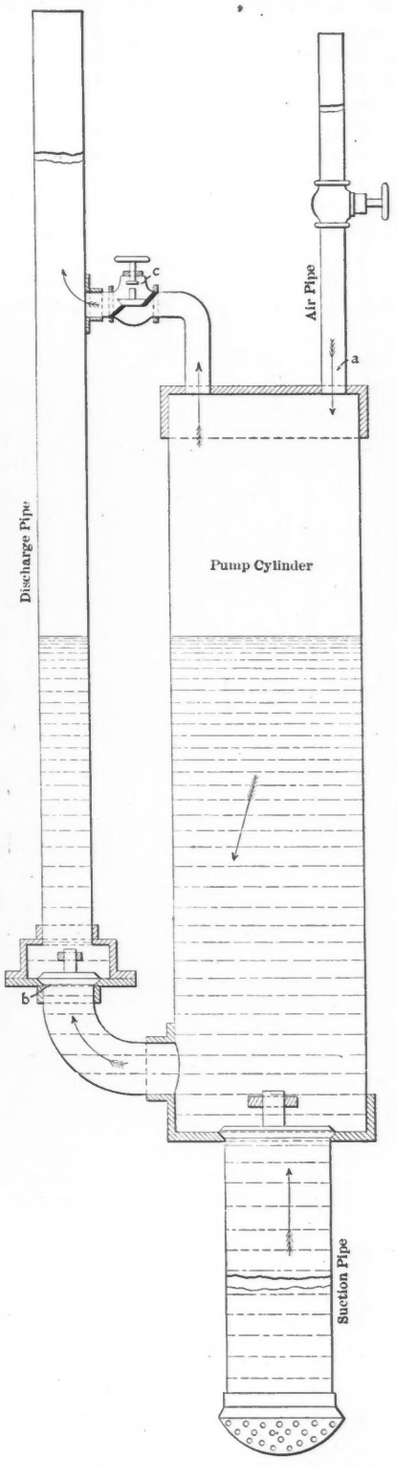


FIG. 3. STARRETT SINGLE-CYLINDER PUMP

operation is as follows: While the air from the compression stroke of the compressor is entering pump chamber 3 through air inlet 1, into the shifter and through the air passage 2, forcing the

water through the discharge valve 10 into the discharge pipe 11, a partial vacuum is produced in pump chamber 3a, which causes the water to enter through suction pipe 6 and inlet valve 5a. At the same time air is forced into the discharge pipe 11 through the air-jet pipe 12 and adjustable check valve 9. It is by check valve 9 that the air pressure and also the amount of water admitted into the discharge pipe are regulated and controlled.

When the water is nearly all forced out of cylinder 3, an open float 4 settles upon a nut 13 adjusted on the rod 8, opening the check valve 7 and admitting air into shifter through the passage 14a, permitting the pressure to throw the piston in

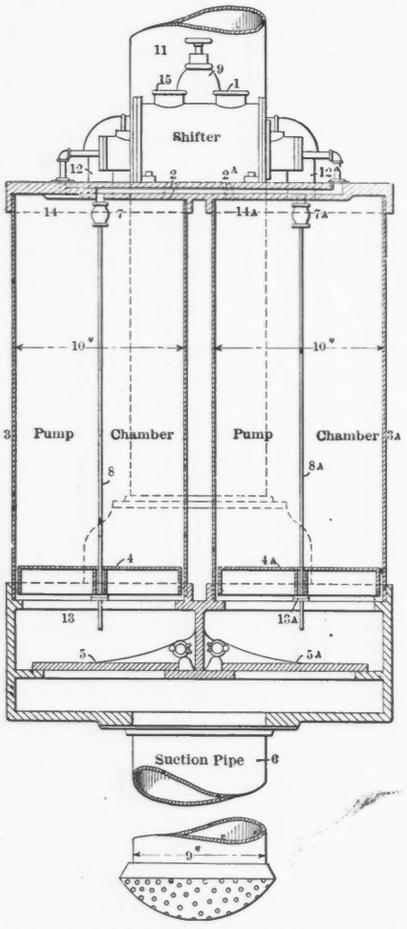


FIG. 4. TWO-CYLINDER PUMP WITH SHIFTER

the shifter to the right. The shifter piston has a movement of only one inch.

Hans C. Behr, in Bulletin No. 9, of the California State Mining Bureau, gives the efficiency of the Starrett system as 50 per cent. at the compressor, and a net efficiency of 35 per cent. The cost for repairs and replacements is small, for there are no rings, packing, lining, piston or rods. It requires no lubrication and demands little attention. There is no vibration and it requires no foundations. It works effectively when suspended by chains immersed in water.

The pump is manufactured by the W. G. Leale Company, San Francisco, Cal.

Treating Cobalt Ores

SPECIAL CORRESPONDENCE

A report just issued by Dr. Eugene Haanel, Dominion superintendent of mines, on the "Present and Prospective Output of the Cobalt District," embodies the results of an investigation by Dr. Haanel, involving a visit to all the important shipping mines for the obtaining of information. The shipments of ore during 1906, as compiled from returns furnished by the Timiskaming & Northern Ontario Railway, are given at 738.46 tons; but this does not include many of the December shipments. A summary of ore shipped, as obtained from managers of mines, gives a total of 4584.84 tons, but this includes in some cases all shipments made since the beginning of operations. The approximate value is given at $4,283,369. The prospective shipments for 1907, according to information furnished by 16 mines, are 12,003 tons of an approximate value of $12,530,152. This output, says the writer, will be materially increased by the shipment from some of the mines now under development, and the removal of embargo on mines now under litigation.

The ore from the Cobalt district was shipped for treatment to three firms—the American Smelting and Refining Company, which has works at Perth Amboy, N. J.; the Balbach Smelting and Refining Company, at Newark, N. J., and the Orford Copper Company, at Copper Cliff, Ont. The two former have no process for saving the cobalt, nickel or arsenic contents of the ore. They are both extensive lead smelters and the process employed for saving the silver contents is to use lead ores as a collector. No detailed description of the process was available, nor could anything be learned by Dr. Haanel as to the costs of extraction.

The American Smelting and Refining company charges $10 per ton dry weight for treatment, and pays for 94 per cent. of the silver contents, at New York quotations, as given on date of assay. The Balbach Smelting and Refining Company receives silver ore if not too high in arsenic, the charges for smelting being arranged on a sliding scale, graded from $6 per ton on ore running 400 oz. per ton, to $2 per ton on ore above 700 oz. to 800 oz. per ton. On higher grade than this there is no smelting charge. The company pays for 93 per cent. of the silver contents at New York market price. Both companies accept the sampling of Ledoux & Co. as a basis of settlement.

The Orford Copper Company pays both for silver and cobalt, but not for nickel or arsenic contents. The company was unwilling to give any description of the process of treatment. The smelting is done at Copper Cliff, Ont., resulting in a partial silver recovery together with a high silver-bearing speiss which is shipped to Camden, N. J., for further treatment. The payment for silver is on a graduated scale from 94 per cent. of the New York official rate on the silver content of ore carrying 4000 oz. per ton or over, to 80 per cent. on ore of between 150 and 300 oz. to the ton. Cobalt is paid for on a similar plan, the rate being $30 per ton of ore containing 12 per cent. cobalt and over; $20 per ton of ore containing 8 per cent. cobalt and over; and $10 per ton of ore containing 6 per cent. cobalt and over.

The Anglo-French Nickel Company, of Swansea, Wales, has made application for Cobalt ores for the purpose of making an experimental investigation with a view of saving full values of their contents. The net return of all the metallic contents, after deducting cost of extraction, will be given to the senders.

The large smelter for the treatment of Cobalt and other ores now being erected by the Montreal Reduction and Smelting Company, at Trout Lake, near North Bay, Ont., is progressing toward completion. Six buildings have been put up, comprising over 43,000 ft. of floor space, and a battery of boilers of 600 h.p. installed. In the largest of the buildings there will be four smelting furnaces, each of 250 tons capacity. These it is hoped to have in operation within two months. A reverberatory of 500 tons capacity is also being installed, which will suffice for present needs. From time to time other furnaces will be added. The smelter will be fully equipped with machinery. The heavy engines and boilers were furnished by the Jenckes Machine Company, of Sherbrooke, P. Q., being constructed after special designs by J. H. Brown, the manager and principal promoter, of the smelter. The machinery already installed has cost $350,000, and the total cost will be over $1,000,000. There are two dynamos, one for lighting and the other for special concentration work, the latter weighing 60,000 lb., and containing 480 miles of wire. The concentrator machines for the treatment of low-grade ores are of 250 tons capacity. A dust chamber or large tunnel 500 ft. long and 5½x7 ft. in section, built from the extreme end of one of the buildings, will retain and purify the poisonous gases and utilize the by-products in the form of chemicals. Slag will be made into pressed brick, and the silicate produced from some ores into silicate brick. The smelter is on the direct line of the Timiskaming & Northern Ontario Railway, and about 100 miles from Cobalt. The coke and coal used will be brought from West Virginia. Three metallurgical experts: G. A. Duckworth, of Swansea, Wales; Martin Peschel, of Freiburg, Germany, and A. Alonzo, of Spain, have been engaged. From 75 to 100 men will be employed and the capacity will be 3000 tons of ore per day.

Roasting for Magnetic Concentration of Zinc Ores

A Comparison of Work of Cylindrical Furnace Commonly Used in Southwestern Wisconsin with That of a New Circular Table Roaster

BY FRANK H. TREGO*

Attempts at the separation of the iron sulphide from the blende of the Wisconsin ores met with no commercial success until 1901. Before this, Blake's work at the Helena is the only one deserving of mention. Blake's process, by which the FeS_2 was desulphurized, changed the physical properties of the marcasite so that its subsequent separation by gravity became possible.

Upon beginning operations, the writer decided to erect a mill and roasting plant for a complete concentration of the zinc ores. This plant was located at Meekers Grove, Wisconsin, and was completed in the spring of 1902. The plant was made up of the following equipment: A three jig concentrating mill of the Joplin type, containing 17 cells, on which no ore was cleaned coarser than 3/16-in. mesh. The concentrates were drawn from the cleaner jig at 3/16 to ⅛ in., and from the sand jig at ⅛ in. to dust. These two groups were delivered into separate bins so that they could be handled separately in the roasting department.

The Original Plant

The roasting and separating plant contained one cylindrical furnace of the type shown in Fig. 1, 19 ft. long by 6 ft. in diameter, riding upon small rollers, 20 in. in diameter, which by means of the friction against the riding rings of the kiln, turned the shell at any desired speed. Gear wheels and belt were used to drive the rollers.

The cylinder had a pitch of about 8 in. in 20 ft. toward the fire-box end, and was revolved at a speed of forty revolutions per hour. The stack was at the high end, and the ore was fed in at this end by means of a helicoid conveyer working in an iron pipe. The ends of the cylinder were reduced in size, thus causing the ore to remain about 14 in. deep at the lower or discharge end.

Air was forced through a conduit 4x4 in. in the bridge wall of the fire box, and during its passage was heated by the high temperature of the fire brick comprising the wall. This hot air was conducted into the furnace over the ore and under the flames from the fire box, in order that it might be fairly pure when coming into contact with the ore in process of roasting, so that the maximum amount of oxygen might be made use of in oxidizing the FeS_2 for the purpose of producing a magnetic oxide.

The ore was delivered in a constant stream from the lower end of the furnace into another helicoid conveyer and transported to an elevator which delivered it to a bin lined with fire brick; whence it was fed to the magnetic separator, where the magnetic oxide was picked out by the electromagnets and the clean blende delivered to the bins.

Previous to the addition of the air blast, the furnace could not be made to give anything like satisfactory results. However, when the oxygen control was introduced, fairly satisfactory results were obtained by check assays and careful supervision. The following results were obtained in 1903 after the problem had been worked over for nearly a year. The average assay of the concentrates for nine months showed 27.7 per cent. Zn and 23.8 per cent. Fe; that of finished material, 58.7 per cent. Zn and 2.9 per cent. Fe; the average run per 24 hours during the same period was 28.3 tons. The plant consumed 12 h.p. and the apparatus was cumbersome, heavy and costly.

The plant equipped with a furnace of the cylindrical type was found to have an efficiency of from 65 to 75 per cent., the 25 to 35 per cent. loss being distributed between the tailings and the stack dust. The dust was worthless, having been drawn out of the kiln before receiving enough heat to oxidize the iron. It contained from 20 to 25 per cent. zinc; the tailings from 4 to 7 per cent. zinc; and the middlings from 9 to 13 per cent. zinc.

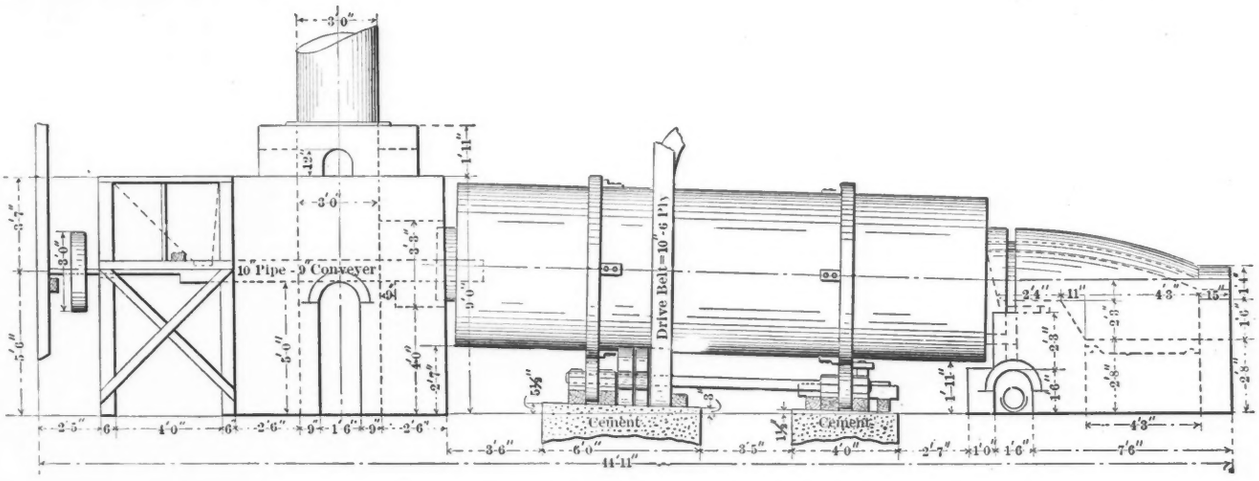


FIG. 1. SIDE ELEVATION OF CYLINDRICAL FURNACE

Introduction of Table Roaster

After the abandonment of Mine No. 1, I patented a furnace which was evolved from the study of the good points as well as the shortcomings of the old cylindrical type. With the new furnace, the efficiency was found, by repeated tests, to be from 70 to 90 per cent., the increase being due entirely to the kiln improvements. It was also found that the stack dust was of high grade in zinc and was sufficiently roasted to be passed through the magnetic separator and finished with the regular run of ore. The common practice is to re-mill the middlings, and allow them to be roasted again in company with fresh concentrates.

A brief description of this roasting furnace is as follows: Referring to Fig. 2, the fire is built upon the grate bars *a*

*Consulting engineer, Platteville, Wis.

and the gases pass over the bridge wall *b* into the space under the hood which covers the hearth. The hearth *c* is covered with one thickness of fire brick *d*, and is supported by a 20-lb. steel rail *g* fastened in a circle to the lugs underneath the table *c* This rail travels in the grooved trolleys *e*, which are supported by the concrete pillars *p*, and which are propelled by the shafting and beveled gearing *f*. By the friction of the trolleys against the rail, the table is caused to revolve around the central pillar of fire brick which rises through the hole in the center.

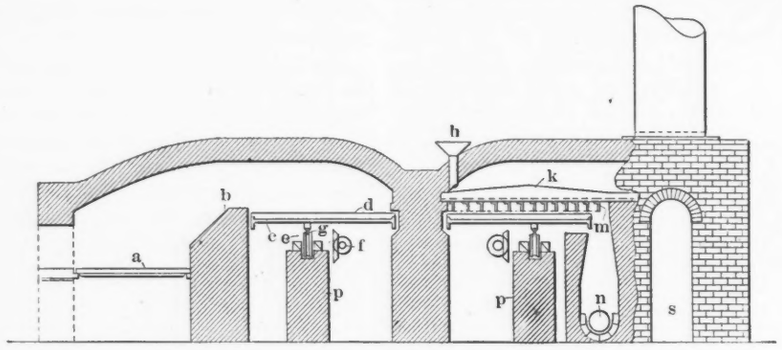


FIG. 2. SECTION, TREGO FURNACE

The gases from the fire in striking the arched hood, and also the central fire-brick pillar, are deflected downward and also divided so that they spread, covering the entire surface of the hearth, and pass out of the port on each side of the beam *k* into the smoke stack.

The ore to be roasted is fed into the hopper *h* in a steady stream. It falls before one of the plows *m* attached to the beam *k* and is thus moved away from the center the distance of the first plow from the second. As the table revolves, the furrow of ore is carried around until it meets the second plow, and is again turned over. This operation is repeated 12 or 13 times, or until the last plow scrapes the ore off the edge of the table, when it falls into the conveyer *N* to be carried away and cooled.

The hood over the table is built of fire brick covered with common brick. Air ports are cut into the hood just above the level of the table for the admission of oxygen to the heated ore. It is important that this oxygen enter above the heated ore but underneath the fuel gases, for thus it escapes the reducing action of the products of combustion, and comes in contact with the roasting ore at a temperature sufficient for the replacement of the sulphur.

Advantages of the New Furnace

These air ports have a double advantage. Not only can the admission of air be controlled, but the ore can also be watched constantly, so that the man in charge can make any change in his furnace temperature which may be required. After making a change in fire or feed, it is necessary to wait three or four minutes before the fluctuation of the temperature becomes appreciable. The entire roast is under absolute control at all times. In regulating the temperature of a cylindrical furnace the results cannot be seen for a considerable time. With the revolving hearth, the entire roast occupies from eight to nine minutes, and if the operator is not satisfied with the appearance of the ore inside of the furnace, he can see his final results without a serious delay.

The furnace is built high enough from the floor to admit of access underneath for oiling, and also for free circulation of air which keeps the table from becoming overheated.

Fine ore or dust carried into the smoke-stack is largely collected in the dust chamber *s* and is removed through the door shown in Fig. 2. The plows *M* are hung directly behind the central pillar, so that the burning gases, in passing out of the chimney ports on each side of the plows *M*, do not come into sufficient contact with them to warp them. It has not been found necessary to use water-cooled plows. The plows are constructed of steel angles, supported by a specially designed T-beam *k*.

None of the parts above the table is in motion. All of the brickwork is stationary and subjected only to the ordinary stresses incident to the masonry of furnace structures. The opening from the fire box into the hood is the entire width of the grate surface and 18 in. high. It is not contracted and the flames are not retarded.

Fig. 2 is a cross section through the fire box and smoke-stack. Fig. 3 is a plan and partial section of the level of the table. A 30-ton furnace requires only 0.7 h.p. to drive the mechanism. Several entire roasting and electromagnetic separating plants using this furnace have been built, the entire plant, including furnace, separator, elevators, conveyers, shafting, etc., requiring only 4 h.p. for operation. A 12-foot circular hearth handles 30 tons of sulphide concentrates, assaying 25 per cent. Fe in 24 hours.

Besides the cheap operating expense there are many advantages in regard to construction costs. The castings are much lighter and simpler than in the old style. In the cylindrical type the moving parts weigh 40,000 lb., while with the new machine the figure is reduced to 8000 lb. Erection is only a matter of a short time, while the transportation question presents no difficulty in the roughest country, owing to the small bulk of the iron parts. The difference in the initial cost is close to $2000 in favor of the new furnace.

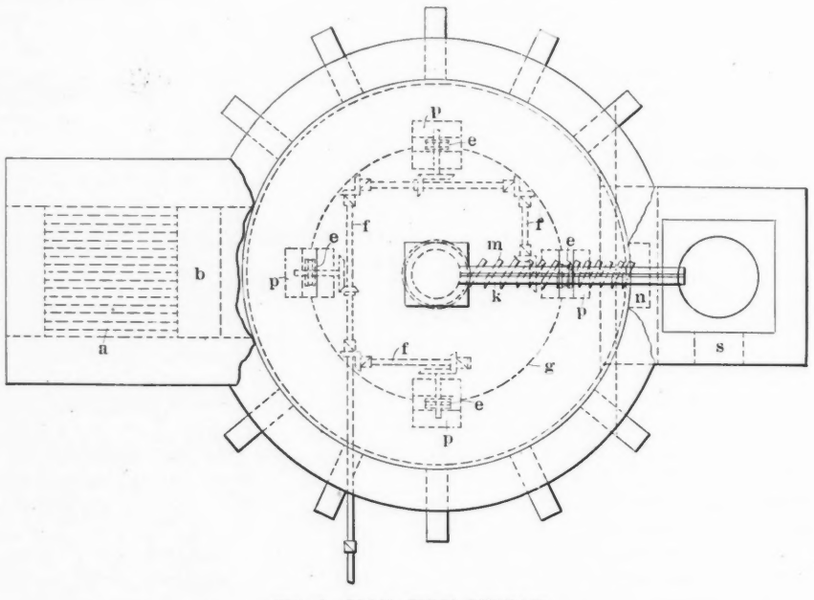


FIG. 3. PLAN, TREGO FURNACE

The following account covers all expense of operating the table furnace for 24 hours, the feed for that period being 30 tons:

2 bosses at $3.25	$6.50
2 feeders at $2.00	4.00
2 tons coal at $4.00	8.00
Oil	.50
Repairs	1.00
4 h.p. at 3c. per horse-power hour	2.90
	$22.90 = 73.3 per ton

The following table shows the character of the ore treated and the efficiency of the new roaster:

NO. I. PLATTE ORES.

Assays.	Raw.	Roasted.	Taili'gs and Middlings.	Finish'd.
Zn	41.7	44.1	11.7	60.6
Fe	15.6	16.8	44.2	3.1
Pb	1.4	1.5	0.8	2.7
$CaCO_3$	2.5			
CaO		1.8	2.1	2.9
S	37.9	31.9	30.8	31.8
$ZnCO_3$	13.25		7.7	

Coal consumption, 133 lb. per ton of raw ore.

In three tests of different ores treated in quantity the average loss of zinc was 30.9 per cent. and the recovery 69.1. The loss due to the furnace alone averages 12 per cent.

Comparing the expense accounts of the two furnaces, it appears that the cost of operating the cylindrical roaster is from $1.50 to $1.90 per ton, while with the new design 70c. covers all expenses.

Cost of operating cylindrical type, capacity, 25 tons per 24 hours:

2 bosses @ $3.25....	$6.50
2 feeders @ $2.00....	4.00
2.5 tons of coal @ $4.00	10.00
13 h.p. @ 3c. per horse-power-hour ..	9.75
Oil	.50
Repairs, per 24 hours, approximately	5.00
	$35.75 = 1.43 per ton.

The cost per ton runs all the way from this up to $2.50 per ton according to efficiency of the men and character of the plant. In many installations of this type the breakdowns are frequent enough to cause the cost per ton to run very high.

The cost of the table furnace alone, erected in Wisconsin, not including the building, machinery nor separator, should run about $2400, whereas the cylindrical type will cost in the neighborhood of $4200. Owing to the smaller space required by the table furnace, there is also a difference of about $400 in the building where both structures are along the same lines in class of material, etc. The value of the separator as generally used is from $1300 to $1800 installed.

One of the mines here recently purchased a cylindrical kiln and plant complete at a cost of $9000. This would give us the itemized cost about as follows: kiln complete $3200; separator $1800; building (iron in this case) $1000; miscellaneous machinery, etc., $500; and profit $2500.

The table furnace with plant complete, I have built for the following cost: kiln complete $1900; separator $1800; miscellaneous machinery, $400; building $900; and profit $1500. The plant was completed and ready to operate within 28 days from signing of contract.

NO. 2. TEST OF PLATTE ORES

	Raw.	Roasted.	Taili'gs and Middlings.	Finish'd.
Zn	30.0	50.5	7.8	59.5
Fe	20.8	19.8	47.1	3.0
Pb	1.3	1.4	0.8	2.5
$CaCO_3$	2.4			
CaO		1.8	2.0	
$ZnCO_3$	9.3		7.9	
S	39.4	32.9	31.6	32.7

The coal consumption was 125 lb. per ton of raw ore.

In the ore tested in Nos. 1 and 2, it was found that $ZnCO_3$ (drybone) was present in considerable quantities, and under a magnifying glass it showed the usual spongy texture, the cavities containing FeS_2. This FeS_2, being oxidized in the furnace, was picked out by the electromagnets and carried into the tailings and the zinc oxide with it.

Another cause of considerable zinc in the tailings was the "chatty" condition of the raw ore (zinc and iron in physical combination) which condition was due entirely to faulty milling. The ore was not sufficiently ground to separate the two minerals, and the zinc was picked out by the magnets with the piece of iron to which it was attached.

NO. 3. TEST. COARSE ORE FROM HOSKIN MINE.

	Raw.	Roasted.	Taili'gs and Middlings.	Finish'd.
Zn	36.1	40.6	11.8	59.9
Fe	19.8	18.7	42.5	3.6
$CaCO_3$	2.9			2.5

The coal consumption was 121 lb. per ton of raw ore.

NO. 4. TEST. FINE ORE FROM HOSKIN MINE.

	Raw.	Roasted.	Taili'gs and Middlings.	Finish'd.
Zn	31.3	34.8	10.4	55.2
Fe	21.8	21.8	45.4	3.8
$CaCO_3$	4.4			
CaO				4.2

The consumption of coal was 136 lb. per ton of raw ore.

NO. 5. TEST. STANDARD LEAD AND ZINC SMELTING AND MINING COMPANY.

	Raw.	Roasted.	Taili'gs and Middlings.	Finish'd.
Zn	23.5		8.3	53.9
Fe	22.7			3.4
$CaCO_3$	12.5			
CaO				10.0

This ore was entirely unsized.

It will be observed that, regardless of the percentage of iron in the raw material, the process removed in each case a sufficient amount to produce a finished ore of a 3.5 per cent. Fe grade, showing an efficient separation of the pyrites and marcasite from the blende. Its excellence is apparent when one considers that the blende often contains as high as 2.8 per cent. Fe. The percentage of CaO in the finished product of necessity affected the percentage of Zn and was found materially to affect the coal consumption.

The efficiency of the process may be seen from the following table, giving the weights involved in tests Nos. 1, 2 and 3.

COMPARISON OF THREE TESTS

Test 1.	Raw.	Flue Dust.	Finished.	Loss of Zinc.	Recovery of Zinc.
Assay.....	41.7 Zn	52.1 Zn	60.6 Zn		
Weights.....	19,907	185	8.570	36.3%	63.7%
Test 2.					
Assay.....	30.0 Zn	42.8 Zn	59.5 Zn		
Weights	19.669	420	7,470	21.7%	78.3%
Test 3.					
Assay.....	37.3 Zn	48.1 Zn	60.0 Zn		
Weights.....	19,867	260	7,860	34.6%	65.4%
			Average....	30.9%	69.1%

This table covers the entire process. Large losses are sometimes due to the electrical separator adjustment, or ignorance as to its proper management. The losses due to roasting alone are shown below:

LOSSES DUE TO ROASTING

Test 1.	Raw.	Roasted.	Loss.	Recovery of Zinc.
Assay.....30.5 Zn		35.2 Zn		
Weights ..3270		2495	11.8%	88.2%

In all of these tests the iron tailings and middlings were considered as lost, whereas it is the practice at some of the smelters, where they are using this preliminary treatment, to make a further recovery of zinc by treating the middlings.

It is now evident that the production of volatile matter can be greatly augmented by the method of firing; and, in addition to this, there should be some attention given to the quality of coal used. It has been found, after several trials, that a satisfactory fuel is "Indiana Block," the analysis of which is as follows:

Fixed carbon 45.0	per cent.
Ash 7.8	per cent.
Volatile matter.....45.8	per cent.
Moisture 0.7	per cent.

This coal is relatively low in percentage of fixed carbon, but where its advantage at once becomes evident is in its large quantity of volatile matter. In addition to these facts we find that the calorific value of this coal is approximately 14,000 B.t.u., which compares favorably with that of the more expensive grades, so that there are combined here a fair heat-giving capacity with a high percentage of volatile matter.

As before stated, the coal is not relied upon alone for heat, the other factor in the roast being a variable dependent on the percentage of replaceable sulphur in the ore. A direct comparison was made of iron of different grades, in which the replaceable sulphur of the iron ranges from 15.8 to 27.7 per cent., with a corresponding lowering in coal required.

Iron.	Coal per Ton of Ore.
15.8 per cent.	133 lb.
20.8 "	125 "
27.7 "	107 "

The iron percentage is not, however, at all times the absolute criterion of the heat production of the ore, from the fact that the consumption is somewhat affected by the quantity of gangue present in the ore, and by the proper sizing of the raw material.

From an engineering aspect, the rate of combustion in the fire chamber is quite satisfactory. Aside from the losses of heat due to the improper supply of air at all times incident to roasting or firing, there enters the important factor of radiation. It is considered the best practice in this respect to obtain a rate of from 8 to 10 lb. of coal per sq.ft. of grate area per hour, and with this rate one can expect as satisfactory temperatures as with a much more rapid combustion. The actual con-

sumption on the grates falls within this limit.

Approximately the kiln temperatures are 500 deg. C. and 800 deg. C. respectively, the cylindrical kiln being 300 deg. C. above that of the table hearth.

Few mills in this district recover more than 60 per cent. of the zinc values unless the mine run is very rich (over 10 per cent.), and few roasting plants reach 75 per cent. efficiency; therefore the final recovery stands near 50 per cent. of the zinc values in the mine run. Very few of the mine owners take the trouble to ascertain what sort of work their plants are doing, and it never occurs to them that they are not saving in the neighborhood of 90 per cent. of the zinc.

Erosion Lines in Snow

By Robert N. Bell*

The accompanying interesting photographs of snow corrugations were taken at South mountain, Owyhee county, Idaho. The condition shown is unusual, at least in this region. The views were taken by Henry Kehoe, superintendent of the Bagdad Chase Mining company, which is developing an extensive silver-lead-zinc property at this point.

RESULT OF QUIET RAIN ON FOUR FEET OF SOFT SNOW OVERLYING THREE FEET OF OLD SNOW

The snow condition illustrated was induced by 24 hours of heavy rain immediately succeeding a continuous snowfall, unaccompanied with wind, that lasted three days, and during which 4 ft. of snow fell upon 3 ft. of well packed old snow.

While the corrugation lines, which developed in a day on a smooth surface, in general conform to the natural drainage declivities of the mountain, they deflect materially at some points and were probably in a measure induced by the rough wind-blown surface of the underlying old snow.

EROSION LINES PRODUCED BY RAIN IN SOFT SNOW

*State inspector of mines, Boise, Idaho.

Mining in Manchuria

The following summary of a report on the mines of Manchuria made by a representative of a Tokio newspaper is furnished by Consul-General Straight:

The northern part of Manchuria abounds in minerals, principally gold, both quartz and placer, silver, copper, lead and iron. Thus far the average annual output has amounted to $10,000,000, some of the mines being operated by the Chinese officials, but most of them by native companies and small capitalists. A large part of the deposits has not yet been touched.

The territory drained by the Huifaho and to the north of that river is rich in gold, both quartz and placer, silver, lead, copper and coal. This is true also of the district to the east of the Tunghuachiang (Sungari river). This mineral wealth is made accessible by the Yalu, Tunghuachiang (Sungari), Nenchiang, Hailungchiang and Liao rivers and their tributaries. The construction of the Changchun-Kirin Railway will also greatly facilitate the development. The operation of the mine at Tienpaosan was about to be undertaken by Americans, but the project was abandoned on account of the Russo-Japanese war. The viceroy of Kirin then canceled their claim and the mine is now being operated by the bureau of mines of Hungchung with Chinese capital. The same is true of the gold mine at Chiapikou, which was originally operated by the Russian government, 20,000 coolies being employed, but is now in the hands of the Chinese.

The United Copper Company

A circular recently issued to stockholders gives the net earnings for the 13 months ending Jan. 31, 1907, at $6,050,473. Dividends paid were $4,237,500, leaving a balance of $1,812,973. Adding the balance brought forward from 1906, made a total surplus of $5,640,132 on Jan. 31. The property owned by the company includes all the capital stock of the Montana Ore Purchasing Company; 95 per cent. of the stocks of the Nipper Consolidated, the Minnie Healey, the Corra-Rock Island, and the Belmont copper companies; 10 per cent. of the stock of the Butte Coalition Company. There are also smaller investments in other companies, including the Ohio Copper, the Stewart, the Bingham Consolidated, the Lexington, and the Davis-Daly Estates.

It is stated that the Italian railway authorities intend to substitute petroleum for coal on all the lines, and that consequently the Government will reduce the import duty on petroleum.

The Extraordinary Faulting at the Berlin Mine

The Berlin Gold Quartz Mine, Nevada, Shows the Result of Remarkable Movements after the Formation of the Vein

BY ELLSWORTH DAGGETT*

The Berlin Gold Quartz Mine is situated in Nye county, Nevada, on the west flank of the Shoshone range, about 40 miles south and 30 miles west from the town of Austin, the county-seat of Lander county. The distance from Austin is about 60 miles by stage-road.

The outcrop of the vein, at the top of the incline-shaft, is situated just at the base of the mountain proper, almost exactly at the intersection of the mountain-side with the gravelly bench that slopes for about three-quarters of a mile to the flatter sage-brush plain, or desert valley, below.

Original Condition of the Vein

Comparatively little evidence of relative motion of one wall of the vein upon the other is to be found—a fact indicating that during the formation of the vein, and prior to the extensive movements herein described, little disturbance had taken place. No evidence whatever of metasomatic origin has been observed. On the other hand, occasional occurrences of comby structure, in which the compact, seldom showing the friable, fissured, or shelly structure often to be found in quartz veins.

The course of the vein is northeast and southwest, and its average dip about 45 deg. to the southeast.

The Berlin vein, prior to the extensive faulting described in this paper, was tolerably uniform in size, course and dip, and perhaps, on the whole, rather more regular than the average of gold-quartz veins.

It appears to have been a fissure filled with qnartz, and may be said to have originally been in shape, structure and origin, a typical "old-fashioned" fissure-vein of the books.

Throughout the entire field covered by the underground works of the Berlin

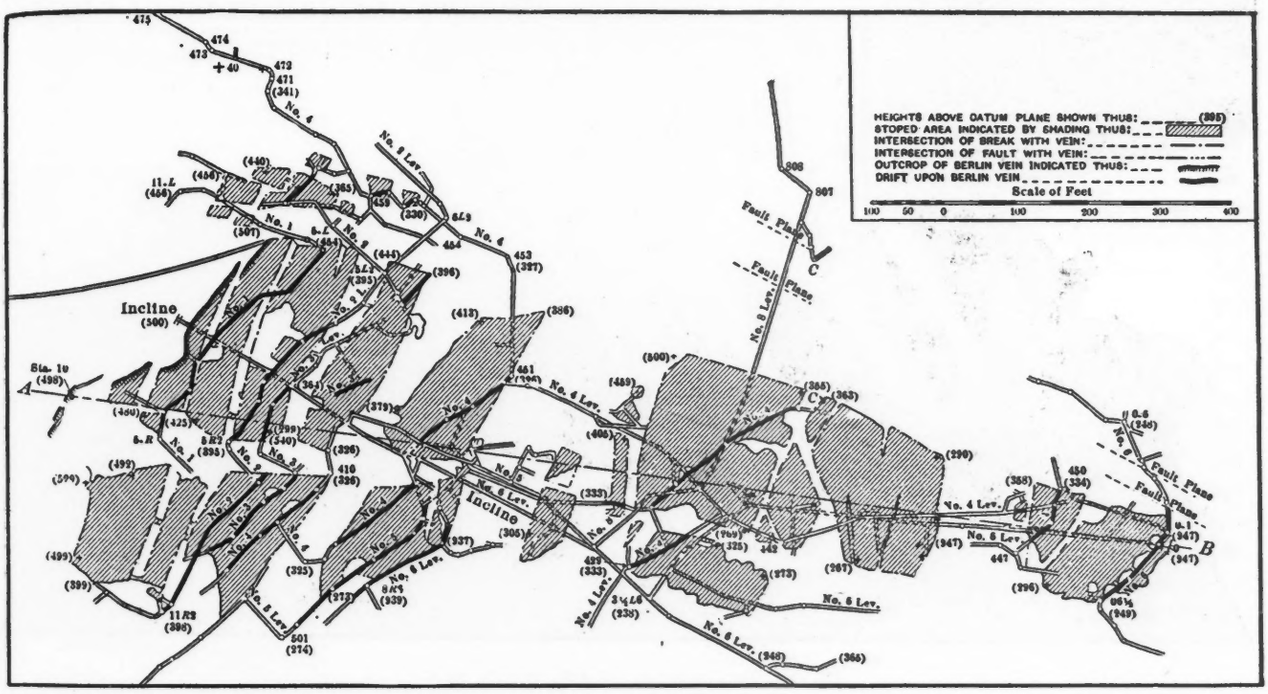


FIG. I. PLAN OF UNDERGROUND WORKING OF THE BERLIN MINE

The vein itself consists almost entirely of quartz, with perhaps 2 per cent. of sulphide of iron, copper, lead, zinc and antimony, and perhaps a trace of some of the compounds of tellurium with gold and silver, although none of the latter have been as yet positively identified.

The relative proportion, by weight, of silver and gold in the ores, varies in different parts of the vein, from 12 silver for 1 of gold, to 7 silver for 1 of gold.

The quartz vein-filling is usually frozen fast to the walls, and is very hard and

Note—Paper to be presented at the New York meeting of the American Institute of Mining Engineers, April, 1907.

*Mining engineer, Salt Lake City.

axes of the quartz crystals are at right angles to the plane of the vein, rather indicate deposition from solution in a pre-existing fissure.

Spurs, or branches, and small parallel veins, while not entirely absent, are not thus far numerous, and not extensive enough to possess any marked practical importance.

The thickness of the Berlin vein varies from a few inches to 8 ft., but, over far the greater portion of the explored area, is tolerably uniform at from 2 to 3 ft., measured normal to its plane. The average thickness of quartz thus far stoped, as determined by all available measurements, is a little less than 2.5 feet.

mine, the rock is andesite, which is, however, in places, locally so altered by compression or movement as to change considerably its appearance and structure. Some very limited chemical changes may also have occurred in places, by reason of which the above-given classification might, to a small degree, fall short of completeness.

The Workings

The underground workings, including the stopes, of the Berlin mine, as existing July 1, 1906, are shown in plan in Fig. 1, which is a reduced copy of the working-plan of the mine, from which, for the sake of plainness, most of the survey-

lines, station numbers and hights above the datum-plane have been omitted.

The stopes, shown by the shaded areas, have in general the form of a more or less irregular parallelogram, suggesting at a glance the extensive faulting in two directions, to which the vein has apparently been subjected.

The orebodies, properly enough called segments, are usually terminated on all sides by fault-planes. Those on the east and west sides, though just as truely fault-planes, have been locally called breaks, which term will be retained in this paper for the sake of identification.

The lines bounding the segments, as projected on the plane of Fig. 1, are mainly lines of intersection of the faults and breaks with the vein, and their projections do not at all represent the true course of either the fault-planes, the break-planes, or the vein.

ginal figures in Fig. 2 show the hights above the datum-plane.

The plane of this section was carefully chosen so as to avoid the faults, and Fig. 2, considered by itself, shows only the disturbances apparently due to the breaks.

Dislocated Segments

The light dotted line passing out through the surface-line may be considered as an elevation, showing the minimum hights which the segments could have occupied prior to the faulting herein considered. The actual hight from which the present segments have dropped to their present position may have been several times as great, as shown by the dotted lines.

Nor is it yet certain whether the movement was due to the subsidence of the northwest or to the elevation of the southeast portion.

shown in Fig. 3, which, moreover, represents that portion of the fissure system which may be regarded as best known from the present developments.

If we imagine that, in the field covered by Fig. 3, the accidents of erosion had left the surface about at the plane of the No. 4 level, then the heavy black lines would represent the actual surveyed outcrop of a single vein that, before the faulting here described, was probably as regular, as uniform in strike and dip, as nearly in a true plane, and generally as free from eccentricities as the average quartz vein.

So far as my observation goes, this situation is without parallel in quartz mining.

The Mode of Faulting

It was at first supposed that the north and south fissures or breaks, dipping

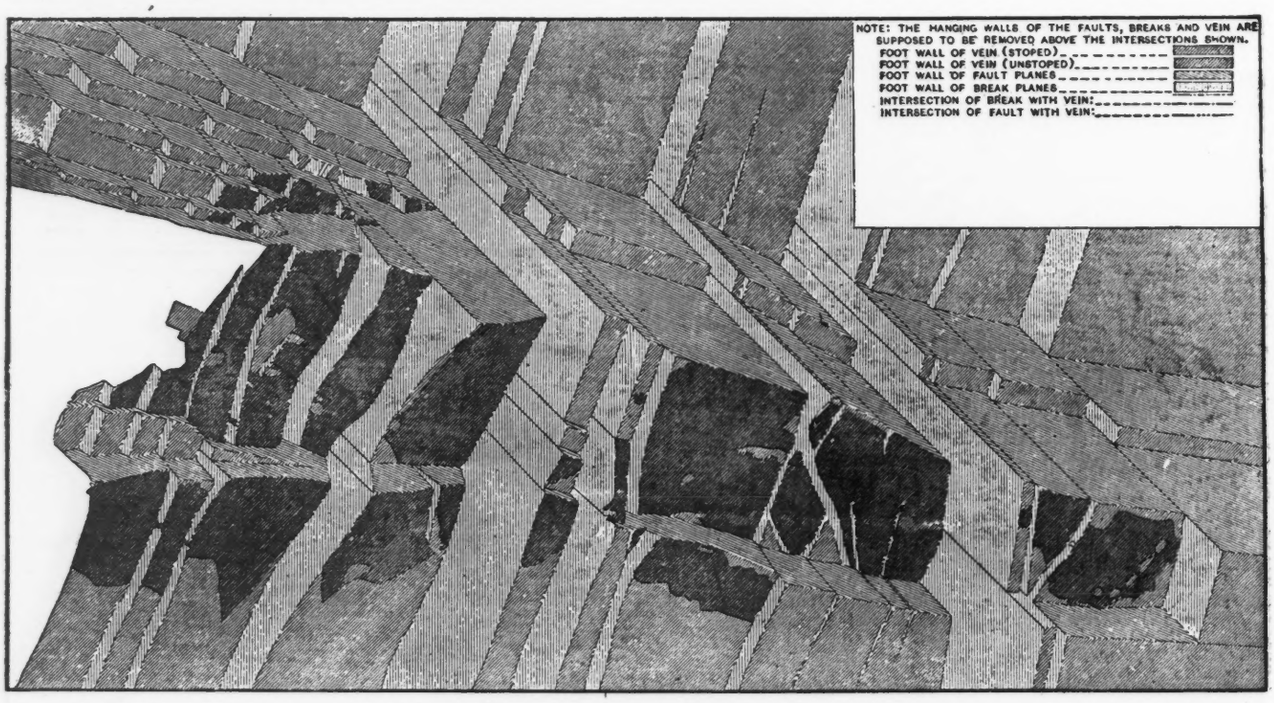


FIG. 1 A. STRATIGRAPHY OF THE BERLIN MINE

In Fig. 1, the hights shown in brackets refer to a datum-plane 500 ft. below the top of the Berlin incline-shaft. The hight of No. 8 level at the shaft is 137 ft. Figures not inclosed in brackets represent survey stations. The stopes, where limited by full lines, are not cut by faulting fissures, but end on account of poor or thin ore, or some similar reason.

Fig. 2 is a vertical section along line *A B* of Fig. 1 through Station 10, on the surface at the outcrop of the vein, and Station 0, on the No. 6 level, as shown in Fig. 1. In this section those portions of the Berlin vein actually stoped out are shown as a solid black line, while the probable position of the unstoped vein is indicated by two parallel lines. The mar-

Among many sections made in studying the Berlin underground work, there is one nearly parallel to section *A-B*, but further north, which shows it possible to drive a flat, incline-shaft, straight in line and grade, that would cut the vein no less than eight times.

Fig. 3 is a horizontal section, showing the intersection of the Berlin vein and of the break- and fault-fissures with the average plane of the No. 4 level, the average hight of which is about 165 ft. below the top of the incline-shaft, or 335 ft. above the datum-plane. The true course of the vein—viz., northeast and southwest; of the breaks, nearly always north and south; and of the faults, about north 60 deg. west., is therefore correctly

about 45 deg. west, had first been formed and had faulted the pre-existing vein, and that subsequently a pair of fissures had occurred, each with one or more branches having a general course about north 67 deg. west, and a dip of 63 deg. north 22 deg. east, cutting and faulting both the vein and the breaks. But as developments progressed, and additional intersections of the breaks and faults were found, or indicated, it was observed that in several instances the faults were cut and faulted by the breaks.

In the case of the so-called north fault, shown in Fig. 1, the segments of the Berlin vein, from its outcrop for a distance easterly of about 1300 ft., have been cut off. It was for a time believed that the

south branch of this fissure was a continuous fissure, cut by the No. 4 level at its east end, near survey station 450, and in the north branch of the No. 4 level, near station 459, and again near station 454. But a consideration of the position of the surveyed and known lines of intersection of the fault with the vein forming the north boundaries of the stopes, shows that these intersecting lines were very far from being in the same plane, and that a single fissure, to have contained them all, would have had to be extremely —in fact, impossibly—crooked and irregular.

The conclusion was therefore forced that some of the larger breaks had faulted also the north fault, as well as the vein, and that, instead of one continuous fissure, with a course north 67 deg. west, there were several fissures with an average course of about north 60 deg. west, and a dip north 30 deg. east, of about 63 deg. from the horizontal.

If we assume that the planes of the break-fissures were in fact parallel to each other, and that the same was true of the fault-planes; that every fissure of each system has been cut and faulted by at least one fissure of the other system, and that the material fissured was rigid, incompressible and inelastic, it would appear that the line of any movement produced by gravity, or by an uplift from any cause, would necessarily be in both planes, and therefore in the line of the intersection of the two planes.

Now, in fact, the planes of neither the breaks nor the faults are exactly parallel. It is not known that every plane of each system has been cut or faulted by one or more planes of the other system. Moreover, andesite is far from rigid, being compressible, and capable of great distortion. Just so far, however, as the conditions existing in the Berlin field approach the hypothetical conditions outlined above, might we expect the direction of the movement to conform more or less closely to the direction of the intersection of the average fault- and break-planes.

the break the edge of a strong, faulting fissure, striking about north 60 deg. west; and dipping 60 deg. northerly. In this fissure, with some coarser material, was a layer of about 1 ft. of stiff blue clay, evidently the product of attrition. This layer of clay, without any parting whatever, and about uniform in thickness, was continuous around the sharp angle into the break, and up in the break to the quartz remnant, precisely as a layer of lubricant might be found in the V-groove of a planer. It no doubt continues up to the fault-plane on the north, and there turns down into it. Just southeast of point *C* a careful examination of the root and the floor of the stope showed that no sign of fissure existed in the foot-wall of the break. The fault-fissure at *C* is nearly enough in the plane of the fault, which cuts off on the north the next westerly stope, practically to identify it. On the hanging wall of the break, within a few inches of the sharp intersection of the

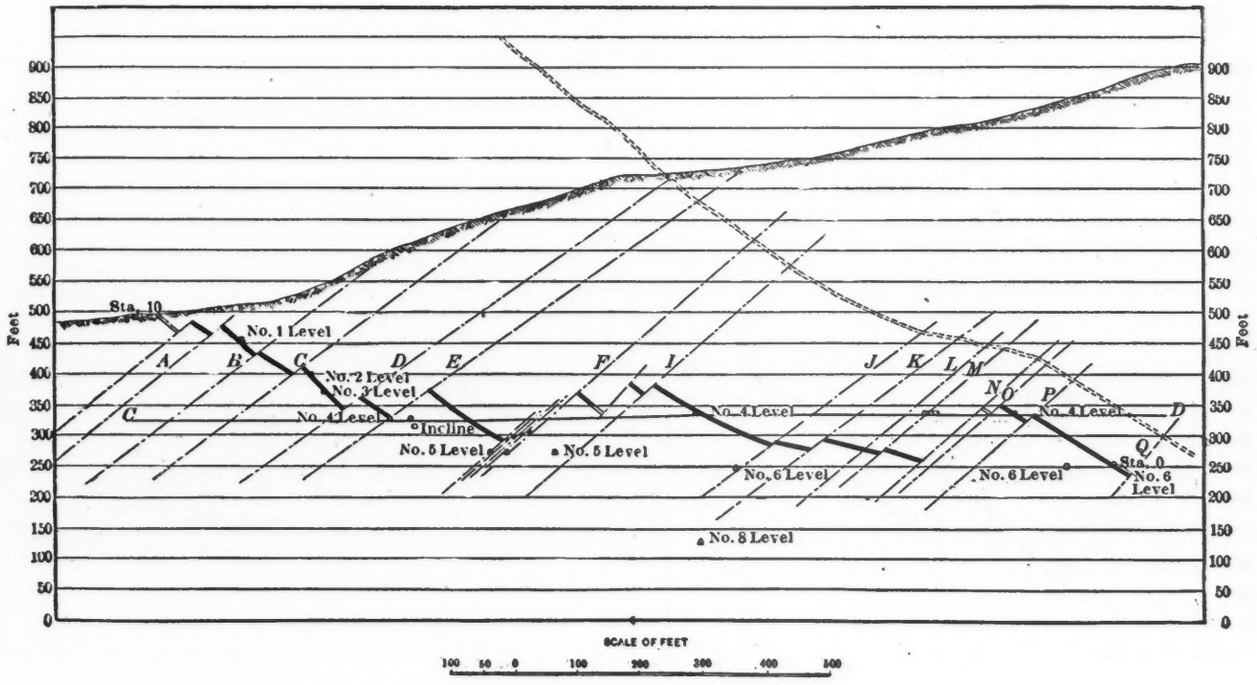


FIG. 2. VERTICAL SECTION ALONG LINE *A B* OF FIG. 1

In practical mining the main object is, of course, to find and extract the ore as cheaply as possible. It is not often that exposures interesting stratigraphically are incidentally made, or that special work for such a purpose is warranted. In the present case, while in many, perhaps in a majority of instances, the faults do cut and fault the breaks, there is no such uniformity as would enable us to establish the relative age of the two fissure systems. In fact, there are enough instances actually exposed, or undoubtedly indicated, of the breaks cutting and faulting the faults, to make it tolerably certain that the fissures of both systems originated at the same time, and in all probability from a single force.

Movement Upon Two Planes

Fig. 4 represents a very interesting occurrence, having a significant bearing on this point, which was recently uncovered by the accidental scaling-off of some slabs of clay and gouge in the northwest corner of the second large stope from the east end of the mine. The ore was stoped up to break *J*, but in the north corner, not quite to the fault-plane—perhaps to within 4 or 5 ft. of it. At point *C*, 12 or 13 ft. along the break southwesterly from the little corner of remaining quartz, there was plainly exposed in the hanging wall of fault and break, are lines of motion parallel to the fault-plane.

The above conditions indicate that the movement of the north country was one movement, upon both planes at the same time, and therefore in the direction of the line of intersection of the two planes.

Intersections

In Fig. 1A are shown the intersections, known and assumed, of the faults and breaks with the vein and with each other, and the entire hanging-country above these intersections is supposed to have been removed.

Figs. 1 and 1A were made about the middle of 1906, and represent the works and known or assumed intersections as

of that date. One exception to this latter statement is, that the raise from the No. 8 level encountering ore at point *C* was begun and completed subsequent to the introduction of the lines of intersection.

Intersections of faults and breaks, where not surveyed and known, were then supposed to have the direction north 45 deg. west; and the average angle of the intersections of the vein with the breaks was taken as north 20 deg. east.

Some careful estimates, made since the preparation of Figs. 1 and 1A, and involving all of the principal vein and fault intersections, including both north and south faults, show these intersections to have an average direction of north 81 deg. west.

A revised consideration of the breaks shows that the more important breaks other of 92 deg. and 88 deg., the upper angle being 92 deg. The line bisecting the obtuse angle between these planes runs south 12.5 deg. east, and dips in that direction 57 deg. from the horizontal. If these calculations be correct, this is the theoretical direction of the pressure or force which produced the two systems of fissures, here called breaks and faults. The existence, before erosion, of a rock-mass, known to be several hundred, possibly several thousand, feet in thickness would, through the weight of such a mass, supplemented by some lateral pressure, easily account for the fissuring; and gravity alone might be sufficient to explain the movement.

Practical Considerations

The miner, however, is more interested in the direction and extent of the movement, than in the question, just how it was produced.

In prospecting for the continuation of the Berlin vein, north of the north fault, the problem is complicated by the fact that the break-fissures found in either wall of any of the faults, do not necessarily correspond in their relation to each other with those in the other wall.

The same is also true of the faults. Thus, in the slab of andesite between the breaks *F* and *I* (see Fig. 2) are two known faults, and, in all probability, a third fault. At least two of these, if continuous, should be shown in the large open stopes on either side, but they are not to be found there.

It is also true that the north fault is probably nowhere in this field a single fault, but that the total movement has been upon two or more nearly parallel fissures, with a slab, or several slabs, of rock, and a segment, or several segments, of vein between them. Moreover, the vein as a rule, though not always, is uniform in direction and size; hence the identification of the opposite ends of a fault crossing any particular portion is not generally to be expected.

Three occurrences of the Berlin vein, beyond the most northerly known branch of the north faulting fissures, are known.

At a point 800 ft. north and 900 ft. west of the top of the incline, but not shown in the drawings, is a segment of the vein, developed by a short tunnel and a shallow incline. This segment is cut off by an abnormal fault, striking north 48 deg. east, and dipping about 80 deg. southeasterly, developed by the innermost 100

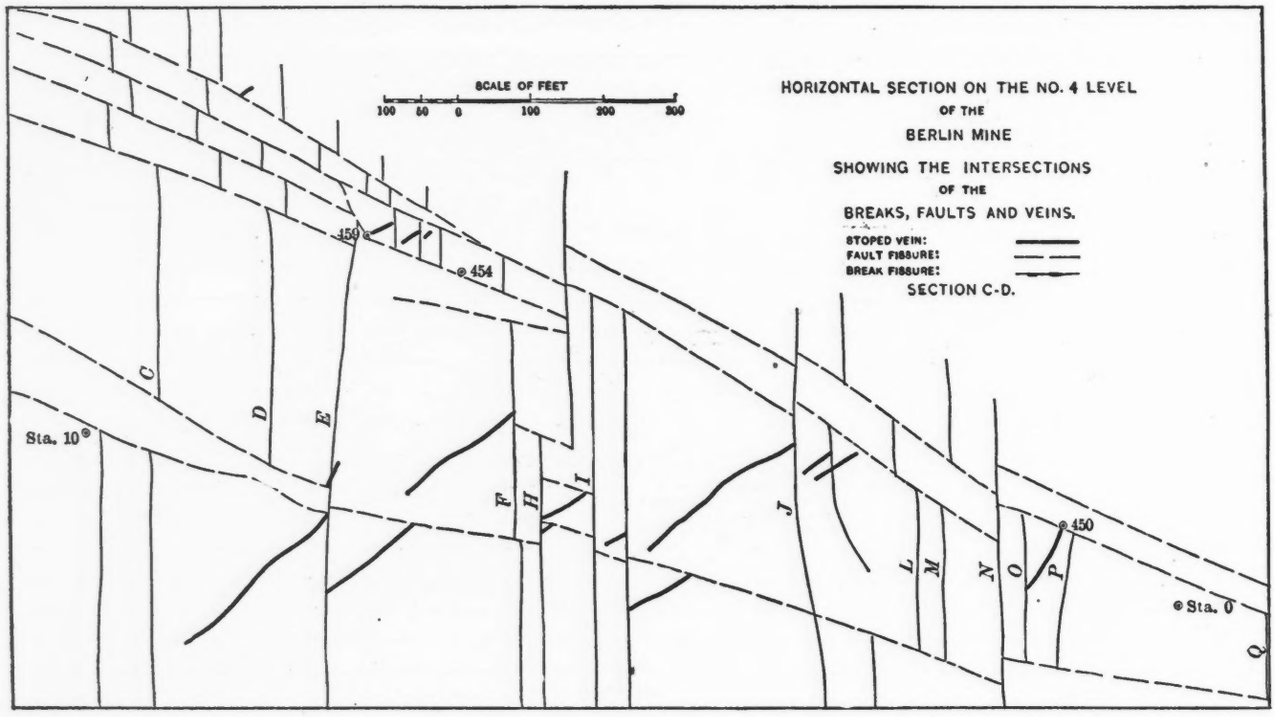


FIG. 3. HORIZONTAL SECTION OF NO. 4 LEVEL

have an average dip of 40 deg. west with a strike, as near as may be north and south.

Taking the average course of the vein as north 45 deg. east, and its average dip at 45 deg. southeast, we may, with the average surveyed and known intersections given above, and the known dip of the faults—viz., 63 deg. from the horizontal—determine the average strike of the faults. This has been thus found to be north 59 deg. west.

The intersection of these planes of the average fault and break, as given above, strikes north 43 deg. west, instead of 45 deg. as shown in Fig. 1, and dips in that direction 29.5 deg. from the horizontal. The planes of the average fault and break, as given above, make angles with each

ft. of the lower tunnel, which is driven upon it. The movement here has been in the opposite direction from other faulting movements shown, and the vein from which the segment at the surface has been cut off has not been found, but is still below the bottom of the lower tunnel.

There is also at the same place an aba northwesterly course, and a dip of about 45 deg. northeast. This may be the southern edge of a series of reverse faults, with a reverse displacement of the vein.

Some work on the No. 8 level, east of point *C*, done since the preparation of Fig. 1, also indicates one or more faults with reverse displacement; but these are as yet not well enough defined to be described here.

Position of the Ore

On No. 4 level, at a point marked (+ 40) in Fig. 1, is the south edge of a segment of ore which has been followed northeasterly, and upward for a few feet. The total movement of the north country, which has here been upon three, possibly upon four, presumably parallel fissures, indicated by this occurrence, is, as nearly as can be determined, about 400 ft. in the direction north 45 deg. west, at an angle of about 30 deg. from the horizontal. The total vertical component of the above movement is about 200 feet.

The vein at point (+ 40) was found by drifting along the most northerly branch of the north fault and breaking into its hanging-wall.

The third ore-occurrence, sought for by raise at *C*, and found since the intersection lines in Fig. 1A were outlined, is at Station *C*, in the raise from No. 8 level, at which point the intersection of the vein with a break was found 55 ft. above the level. Here also a normal segment starts off. Although it has been temporarily interrupted further north, by a reversed fault, it is without doubt a continuation of the vein from the northwest corner of the most easterly segment of the mine.

Opposite this point is doubtless a double fault with an intervening segment, as shown in Fig. 1A.

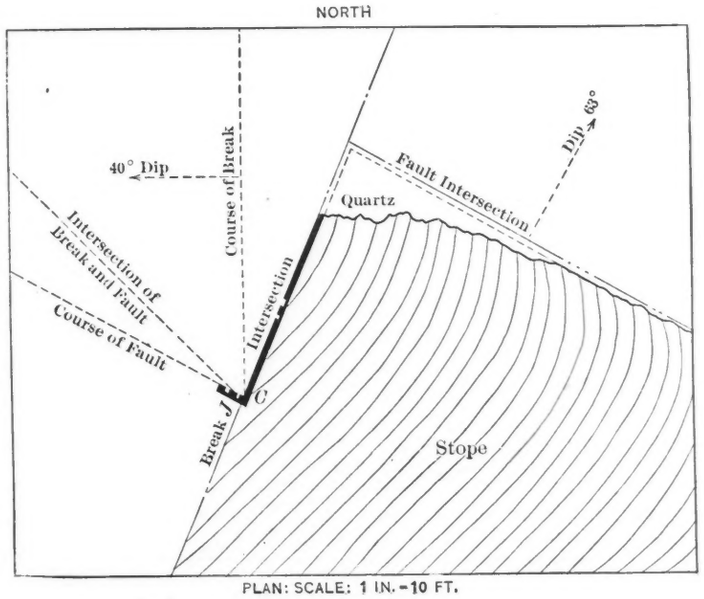


FIG. 4

This ore-occurrence indicates a total movement of the northwest country north 45 deg. west, and at an angle of depression of 33 deg., of 420 ft., and a total vertical drop of about 220 feet.

The position of the ore at point *C* was therefore 20 ft. further in the line of the movement and had 20 ft. more vertical displacement than is indicated at the ore-occurrence at (+ 40) on the No. 4 level. It was, however, the probable extent of the movement, as indicated by the ore found at No. 4 level, that suggested the raise from No. 8 level by which the vein was recovered.

There are exposed in the stopes of the Berlin mine many instances of breaks and faults which fade or run out to nothing, one of which, not shown in the drawings, but clearly enough in evidence in the mine, is found in the southwest corner of the second stope from the east end of the field. In this case the break, normal in its planes, intersections and in all other respects, begins with a mere seam in the foot-wall of the stope, increases for 20 ft. or so to a point where the vein displacement is about 4 ft., then decreases for 20 ft. to a feather edge, leaving no noticeable fissure beyond its ends in the roof or floor of the stope.

One is here impressed with the fact that fissuring and faulting is the habit of the rock mass. In this connection is perhaps worthy of illustration an observation, shown by sketch in Fig. 5, of the freshly uncovered side of the No. 4 level then being driven. A quartz veinlet, about 1 in. in thickness, was in a few feet faulted normally three times, and by reverse faulting twice, between the roof and the floor of the level.

The bright, white quartz against the dark andesite told its story as though just from the press.

In Figs. 1 and 1A an attempt is made to

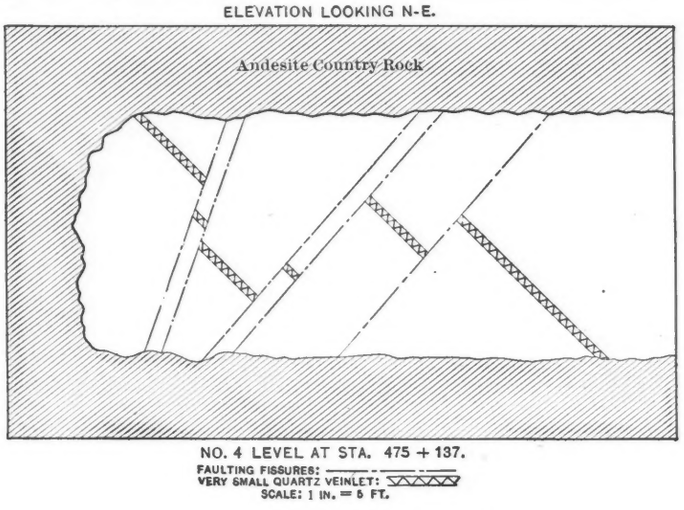


FIG. 5

show pictorially the underground works and stopes, and in the two together the relations of the works on the Berlin vein and the breaks and faults which have disturbed it. In this illustration all that is really known of the matter has been found in the underground works shown in Fig. 1. The structure remote from the underground works is entirely assumption, based, as far as possible, upon the known ground as it existed in the middle of 1906.

From a practical standpoint the extraordinarily disturbed condition of the rocks in the Berlin mine is very unfortunate. Without attempting to give details, it is evident that the prospecting and developmen of the vein in such a broken country must be unusually troublesome and expensive.

Capacity of the Washoe Smelitng Works

An illustrated pamphlet prepared by members of the Anaconda Copper Mining Company staff gives a series of totals showing the magnitude of the operations at that plant. The following are the requirements for a period of 24 hours: Ore treated, 10,000 tons; lime rock from quarries, 2300 tons; coke used, 650 tons; coal for reverberatories, 500 tons; coal for power, 500 tons; water, per minute, 35,000 gal.; men employed in and around Anaconda, 3000; monthly payroll, about $300,000.

Effects of Acceleration on Winding Torques

A Test of the Tarbrax Electric Winding Plant Showed a Variation from 15 to 45 Kw. in Power Taken and 48 1-4 Per Cent. Efficiency

BY GEORGE NESS

The force required to produce any given acceleration being designated F, the acceleration by a, the mass moved by M, and its weight by W, and the acceleration produced by gravitation g, then:

$$\frac{F}{W}=\frac{Ma}{Mg}\times\frac{a}{g};$$

and

$$F=\frac{Wa}{g}. \qquad (1)$$

Let u be the velocity at the beginning of any second of time; v, the velocity at the end of that time; and S, the space passed through in the time under consideration; then:

$$v^2=u^2+2aS;\ v^2-u^2=2aS;$$

and

$$\frac{v^2-u^2}{2}=aS.$$

Multiplying both sides by the mass, $\frac{W}{g}$, then:

$$\frac{W(v^2-u^2)}{2g}=\frac{WaS}{g}.$$

And from equation (1) it follows that:

$$\frac{W(v^2-u^2)}{2g}=FS. \qquad (2)$$

FS represents the pull, F in pounds (to produce the given acceleration throughout the seconds of time in question), multiplied by the space S passed through in feet, giving an acceleration-torque FS, in foot-pounds. To obtain the total energy in foot-pounds developed in this time, the static torque w (weight in pounds to be lifted) multiplied by S, the space passed through, has to be added. And therefore:

$$\frac{(F+w)S}{550}=\text{h.p.}$$

Allowing 80 per cent. for the efficiency of conversion, then:

$$\frac{(F+w)S\times 100}{550\times 80}=\text{h.p.}$$

to be developed by the winding-engine.

The left side of the equation (2) is the more suitable for use in connection with electrical winding, and gives the energy exerted in producing acceleration during any second of time in terms of the initial and final velocities.

Let W be the weight in pounds of the masses to be accelerated; w the weight in pounds or unbalanced load to be raised; u the initial velocity in feet per second; v the terminal velocity in feet per second; a the acceleration in feet per second; and g, 32.2. The total torque T is equal to the sum of the acceleration-torque and the static torque, that is:

$$T=\frac{W(v^2-u^2)}{2g}+wS$$
$$=\frac{W(v^2-u^2)}{2g}+\frac{w(v^2-u^2)}{2a};$$
$$=\frac{Wa+wg)(v^2-u^2)}{2ag}. \qquad (3)$$

A correction will have to be made for the weight of the rope wound on and paid out during the interval, if the rope be unbalanced.

To illustrate the resultant acceleration-torque at the peak-load, assume any mass, M, to be uniformly accelerated to a constant maximum speed of 25 ft. per second, then the results recorded in Table I will illustrate the relative energy necessary during the last second of the acceleration-period dependent upon the time employed in attaining the maximum speed. The curve (Fig. 1) illustrates these results as recorded in Table I.

From Table I will be seen the great increase of energy required to produce rapid acceleration, the peak-load being reached at the end of the acceleration period. From this instant only the static torque requires to be dealt with; and this is constant until the beginning of the retardation period, neglecting the difference in pull due to unbalanced ropes.

TABLE I. RELATIVE ENERGY REQUIRED DURING THE LAST SECOND OF THE ACCELERATION-PERIOD

Acceleration Period.	Acceleration per Second.	Velocity at Beginning of Last Second.	Velocity at End of Last Second.	v^2-u^2	Relative Energy to Produce Acceleration.
	(a)	(u)	(v)		
Seconds.	Feet.	Feet.	Feet.		
25	1.00	24.00	25	625 — 576.00	49.00
20	1.25	23.75	25	625 — 564.06	60.94
15	1.62	23.38	25	625 — 546.62	78.38
10	2.50	22.50	25	625 — 506.25	118.75
5	5.00	20.00	25	625 — 400.00	225.00
1	25.00	0.00	25	625 — 0.00	625.00

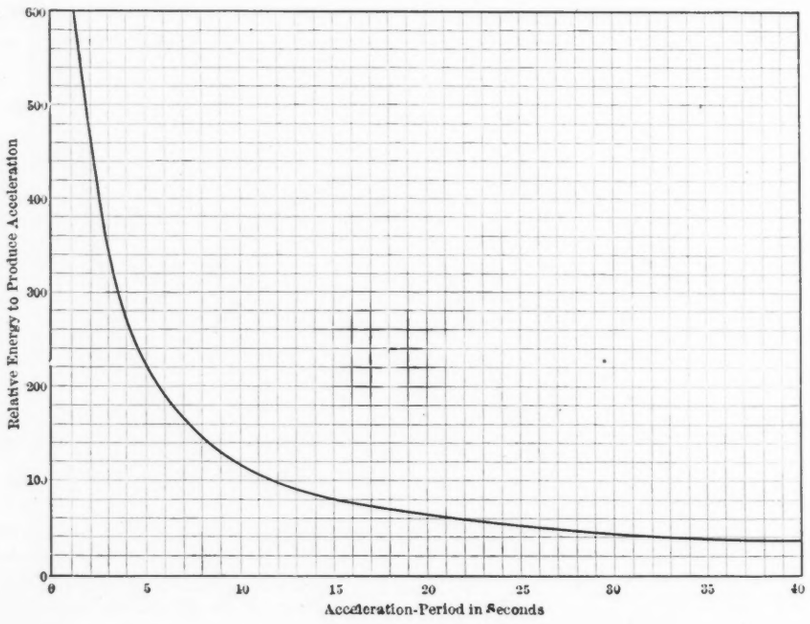


FIG. I

Electrical Winding

There is no class of work which presents more obstacles to electrical application than that of winding from mines. The erratic nature of the load, the variations in speed, and the frequency of starting, stopping and reversal, combined with the necessity for absolute control, constitute a grouping of conditions which, in the earlier days of electrical science, would have been declared insurmountable. Apart altogether from the difficulties of winding, the question of the power factor is

Note—From the transactions of the Mining Institute of Scotland, Vol. 29, December, 1906.

one that has to be considered very carefully from the point of view of efficiency.

In the case of the plant of the Tarbrax Oil Company, Ltd., at Tarbrax, when it is worked to its maximum, there will be a torque varying from zero to about 280 h.p. thrown on and off every half minute or so. It is only by some such steadying or balancing system as has been introduced that a steady voltage could be maintained in the main circuit, from which both power and lighting are taken.

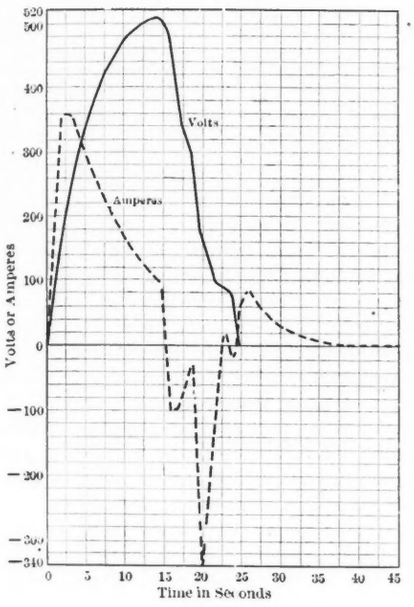


FIG. 2

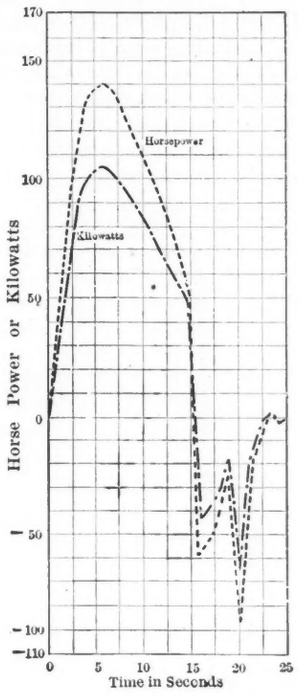


FIG. 3

TABLE 2. TESTS OF ELECTRIC WINDING-PLANT

Time.	Wattmeter Readings.	Power-consumption.	Time.	No. of Winds.	Power-consumption.		Average No. of Winds per Minute.
					Per Minute.	Per Wind.	
A. M.	Units.	Units.	Minutes.		Units.	Units.	
10.40	00907.0	....	..	..	.....	.....	.....
11.00½	00916.6	9.6	20½	20	0.474	0.480	0.987
11.20	00924.9	8.3	19½	15	0.420	0.554	0.759
11.40	00936.4	11.5	20	19	0.575	0.605	0.950
12.00	00944.1	7.7	20	14	0.385	0.549	0.700
P. M.							
12.20	00953.9	9.8	20	18	0.490	0.545	0.900
12.43	00961.8	7.9	23	15	0.343	0.526	0.655
1.00	00970.4	8.6	17	16	0.506	0.537	0.941
Totals and averages.....		63.4	140	117	0.455	0.541	0.840

Records of a Test

In the beginning of July, 1906, R. D. Munroe carried out a series of tests with a view to ascertaining the efficiency of the plant under working conditions, and I was enabled to make close observations as to the working of the plant. Representatives were also present on behalf of the Tarbrax Oil Company, Ltd., and of the contractors who laid down the plant.

Previous to the test, all the instruments to be used were carefully calibrated.

On the three-phase line at the switchboard, an integrating wattmeter of the Ferranti type, No. 95,743, was inserted, and connected up to the neutral point. By this means, the total units delivered to the winding system during the test were measured. A Thomson direct-reading wattmeter was also inserted into one of the phases. By means of these instruments, the whole power absorbed by the main fly-wheel motor dynamo, including the power for excitation, was measured over the time occupied by the test.

Instantaneous readings were occasionally taken from the Thomson wattmeter, showing the power that was being absorbed at any particular period, thus enabling the power factor to be arrived at, by comparison with the readings on the volt-meter and ampere-meter at the same moment. In the circuit between the fly-wheel dynamo and the winding motor, continuous recording ampere-meters and volt-meters of the Nalder-Thomson type with center zero position were inserted, and a complete register of the current direction and potential during the different winds was obtained.

The test was started at 10:40 a.m., and continued until 1 p.m., and readings were taken at intervals from the different instruments.

During each wind about 12½ cwt. of shale were raised, the winding plant being operated at about half the normal output for which it was designed. Table 2 records the readings of the Ferranti integrating wattmeter. These results show that throughout the tests the average power consumption was 0.541 unit per wind; and, allowing 12½ cwt. for each wind, this shows a power consumption of 0.866 unit per ton of shale raised during the test.

The diagrams obtained from the recording instruments in the continuous-current circuit between the fly-wheel dynamo and the winding motor are more or less similar in character. For the purpose of calculation, diagrams of the volt and ampere records have been selected (Fig. 2). From these, a combined diagram (Fig. 3) was prepared, which showed the total power given out during the wind to be 1,140,412.5 watts, while from the winding motor when acting as a dynamo, 203,000 watts were returned to the fly-wheel motor, giving a total consumption of 937,412.5 watts, and this is equal to 0.2603 unit per wind, representing an efficiency of 48¼ per cent.

Current Taken

The winding-motor torque attained the maximum in 5½ sec. after the start of the wind, when the output was 104 kw. or 140 h.p. At the end of 15 sec., no further power is taken from the fly-wheel motor; reversal of the current direction occurs at the end of 15½ sec.; and, at the twentieth second, there is a maximum of 646 kw. or 86.6 h.p. being returned by the winding motor to the source of supply. At the end of the twenty-fourth second, the current rises in a positive direction and at the end of the twenty-sixth second, it has reached a maximum of 85 amperes, gradually dying away until at the end of 42 sec. it has reached a zero value. The voltage, however, has become zero at the end of the twenty-fifth second, so that there is no loss of power (Fig. 2). This rise of the ampere curve is probably due to residual magnetism, and it is merely referred to, as previous to making an analysis of the ampere diagram, it gave the impression that a loss of power was occurring.

The power taken to run the fly-wheel motor generator from the three-phase mains varied from 15 to 45 kw. This shows greater unsteadiness than was anticipated, but it is explained by the automatic slip-resistance having been designed for the absorption of a greater maxmum power, in the raising of two cars from the mine, instead of one as at present. Owing to the load being small, the power factor is also adversely aeffected, varying from 0.67 to 0.84, and having an average of about 0.7. The low power factor necessarily lowers the efficiency of the plant, but with a power factor of 0.9 the efficiency would be relatively high.

With reference to the working of the winder, it ran smoothly and so quietly that it was practically impossible to tell whether the winding drum and motor were at rest or in motion, unless the eye was turned upon them. The manipulation is simple and easy. The men in charge show complete confidence, and there is no hint of nervousness in the handling of the machine, which is under the most perfect control.

The fly-wheel motor generator produced no undue vibration at any alteration of velocity and the bearings were cool. The entire electrical plant was satisfactory, and the commutation was sparkless during the whole course of the trial.

TABLE 3. ESTIMATED COST OF AN ELECTRICAL WINDING-PLANT

Generators (including stand-by set), switchboard, buildings, boilers, brickwork, chimney and cabling		£8,500
One-third of this amount is charged against the winding-plant		£2,833
Winding-plant, foundations, and buildings		2,800
Total capital charges		£5,633
Depreciation and interest on capital, £5,633 at 10 per cent. per annum		£563
Do., per week of 11 shifts of 8 hours each	£10 16s.	6½ d.
Do., per shift of 8 hours	£ 0 19s.	8.2d.
Do., taking rated output of 640 tons in 8 hours, per ton		0.368d.
Oil and waste, including power-station charges, per week	£0 15 0	
Wages of winders, per week	3 0 0	
Proportion of power-station wages chargeable against winding, per week	1 0 0	
Total	£4 15 0	
Do., per ton		0.260d.
Coal, 4 pounds per unit, at 6s. 8d. per ton		0.140d.
Total cost of shale raised, per ton		0.768d.

The question of the cost of winding by electrical means is most important. In the present instance we have arrived at the exact consumption in Board-of-Trade units to wind a ton of material at a certain speed, with an efficiency which must improve as the output is increased to a nearer approximation of the rated tonnage per shift.

In regard to the commercial aspect, there are no figures available, but table 3 contains an estimate of the cost of an installation of similar power which will serve as a guide and can be used as a basis for the consideration of each individual case.

This estimate includes the cost of 3000 ft. of cabling, all the necessary spare parts and also a stand-by set. This last item, for ordinary purposes, might be considered unnecessary when spare parts are kept, as the best makers will undertake to deliver duplicate parts within 24 hours. If the standing charges of a stand-by set are deducted from the above estimate, with a corresponding reduction of the capital charges of the power station and switchboard, a deduction of $5000 might be made in the proportionate and therefore total charges against the winding plant, giving a saving of $500 per annum in depreciation and interest, or 0.14c. per ton, thus reducing the total cost to 1.396c. per ton of shale wound from a depth of 420 ft., with a total output of 640 tons per shift of 8 hours. The efficiency, however, at the rated output must necessarily be somewhat higher than the assumed, which is based on the records obtained during the test, but this will only lower the fuel cost per ton, the standing charges remaining constant.

A System of Coal-mine Accounting

By F. A. Hill*

It is within the province of an engineer to know thoroughly a mine-accounting system, and not depend upon accountants or auditors for methods that will give the engineer the absolute knowledge needed in operating a mine. He should know that careful check is kept upon employees, as well as upon supplies going into the mine.

The following system for checking employment of labor and its distribution into the various mining accounts has been evolved by the writer, and is now in use in two mining properties.

The proper distribution of accounts cannot be laid down by hard and fast rules for any given property. Each property is a rule in itself, as regards the particular knowledge that the engineer or manager should have of his costs.

The following distribution is in use in one mine and has proved satisfactory. In another property, a much more extensive distribution has been followed, which has also proved satisfactory.

DISTRIBUTION OF MINE ACCOUNTS

RENTON MINE

MINING

1 Miners' car price.
2. Laborers in breasts.
3. Timber in breasts.
4. Sharpening tools.

TRANSPORTATION

6. A Drivers, pushers, riders.
6. B Motormen and hoistmen.
6. C Miscellaneous.
7. Stable expense of all kinds.
8. A Power station wages.
8. B Fuel.
8. C Lubricants and waste.

DEADWORK

10. A Labor driving gangways, airways and timber for same.
10. B Labor maintaining gangways, airways and timber for same.
10. C Laying new track, ties, making frogs, switches and any extra work outside of maintenance.

PREPARING AND SHIPPING

11. A Labor engaged in handling coal and refuse at tipple.
11. B Washing coal.

MAINTENANCE OF EQUIPMENT

12. A Car repairs labor.
12. B Car repairs material.
13. Repairs to steam plant, boilers, etc.
14. Repairs to electric plant.
15. Repairs general machinery.

MAINTENANCE OF WAY AND BUILDINGS

16. Track repairs, labor and material.
17. Building repairs, labor and material.

GENERAL EXPENSE

18. Salaries of officers and clerks.
19. Salaries in general office.
20. Miscellaneous office expense.
21. Insurance and taxes.
22. Miscellaneous.

The above constitute the general operation and expense for cost of producing coal.

DEVELOPMENT AND PLANT

23. Development.
24. New machinery and cars.
25. New buildings.

NOTE—A charge of 5c. per ton for plant account and 2½c. per ton for development account is made each month and included in miscellaneous under general expense. This is a fixed charge and will be continued until those accounts are closed.

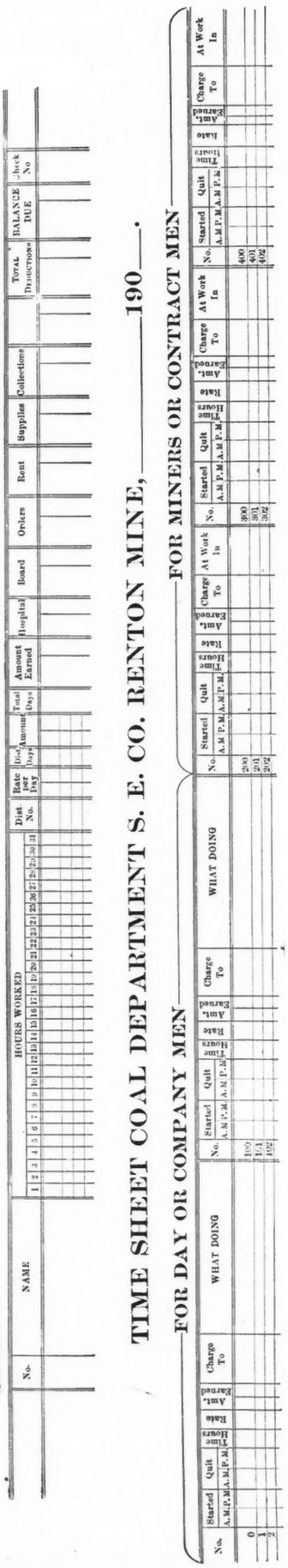
CHECK BOARD

A 5/8-inch cut-steel check with the numbers from 1 to 500 are first prepared. Then a board large enough to be properly spaced with nails driven in at equal distances, so that the numbers can hang in rotation, then the check clerk can, at a glance, take off any check from the board. Oftentimes, the superintendent desires to know how many men have gone into the mine. He goes to the check office, looks over the board, and if his day employees are grouped in lot numbers and his miners in another lot of numbers, he tells at a glance how many men are in, and can very closely figure how many tons of coal he will probably produce for the day's run.

Another check is that it is an absolute certainty that no men are left in the mine. Men may be at work in dangerous places and not show up at the proper hour. This causes everyone connected with the operation to wonder whether anything is wrong in that portion of the mine where the men have been at work If the missing men are miners, it is almost certain that some accident has happened, and they have not been able to reach their comrades. Assistance can be rendered, or the men can be traced at once. If company men, the probabilities are that the over-man will have the knowledge that the workmen have been detained on some over-time work.

In an explosion, or where any large number of men are engaged in any portion of the mine which may be cut off for some unknown cause, it is an absolute certainty, when the check board is examined, who the men are and where they have usually been employed; for, with this system, each employee soon knows its value to him—knows that if he does not report off from his work and deliver his check to the clerk, he has no time marked up for him for that day; hence, all are prompt in calling at the check office when coming from or going to their work. Again, it is not necessary for anyone to remember that John Jones worked 26 days, and has only 25 marked on the sheet.

*Consulting engineer, Seattle, Washington.



PAY ROLL CANADIAN AMERICAN COAL AND COKE COMPANY, LIMITED

SHEET NO. MONTH OF 190

No.	NAME	HOURS WORKED 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	Dist. No.	Rate per Day	Dist. Days	Amount	Total Days	Quit A.M. P.M.	Amount Earned	Hospital	Board	Orders	Rent	Supplies	Collections		Total Deductions	BALANCE DUE	Check No

TIME SHEET COAL DEPARTMENT S. E. CO. RENTON MINE, 190.

FOR DAY OR COMPANY MEN FOR MINERS OR CONTRACT MEN

No.	Started A.M. P.M.	Quit A.M. P.M.	Time Hours	Rate	Amt. Earned	Charge To	WHAT DOING	No.	Started A.M. P.M.	Quit A.M. P.M.	Time Hours	Rate	Amt. Earned	Charge To	At Work In
0 1 2 3 4								100 101 102							
								200 201 202							
								300 301 302							
								400 401 402							

Each day sheet stands for itself, and if he neither reported in or out for the day, it is an absolute certainty, after this check system has been in vogue for two months, that he was not at work.

THE DAILY TIME SHEET

The foundation of all labor and salaries connected with the mining operation is the time sheet, which is in use at two different properties. The sheet is ruled with 100 lines, and divided into 5 parts, 100 numbers in each part, making 499 numbers, which represent 499 names of employees.

The method employed is to have each employee go to the check office when he reports for work, ask for and receive his check, a 5/8-in. cut washer, with his number upon it; the time is put on the sheet when the check is given out. When the check is returned, the time is again put down and the kind of work upon which he was employed for that day. The following day, the check clerk works up the hours employed and amount due, together with the distribution number of the work at which the man was employed. When completed, he takes off of the sheet and tabulates the amount in dollars and cents after each distribution, totaling the whole, adds to it the number of tons of coal extracted, and such other information as the manager, engineer or superintendent may desire, from which the manager can tell exactly in dollars and cents the cost per ton of the labor for that day.

The time sheet then goes into the office, the pay-roll clerk enters the time on his pay-roll sheet, the five small lines for each number representing different distribution that the employee may be engaged upon. Hence the pay-roll sheet is a daily time-book of the mine employee, no matter on what work engaged. At the end of the month, the total time for each distribution is carried out on its proper line and column, and the pay roll must balance for the various distributions, and a perfect system is then had of the cost of the operation for all labor for the month. In practice, the daily report handed the manager will nearly balance the totals for the month.

If carefully and accurately worked up, it will, of course, absolutely check. This method keeps the time of the contract miner, as well as the day employee, and the mine foreman's book, in the distribution of his labor for the various contractors, must tally with this time sheet.

All coal-mine managers are familiar with the various methods of keeping miners' or contractors' time, and many of them know that when they depend upon the foreman's book for the distribution of the work among the miners, many errors are made. This time can be taken from the time sheet and put into the mine foreman's time-book for his miners at the various places or breasts, pillars, gangways, entries, or any specified contract place where the particular number or man may be at work during any day of the month; hence it will be seen that the distribution for each contract place is perfectly kept, and the office accountant can work this up without fear of error.

At the end of the month a report is made of the contract work in each particular place, regardless of the contractor; the total number of cars from a specified place, if a car price; the total number of tons, if a ton price from that particular place is recorded. The pay roll must then balance with the total contract work, and the total day's work of company men, making a check on the pay roll itself, or of its distribution. John Jones may have 26 days' work. It may apear in five different lines on the pay roll, or in five different distributions; yet his total time appears at so much per hour or day, and his total time, plus the total contract time, no matter how many men may have been engaged upon the contract work, will equal the total pay roll.

The general mine accounting is to be kept by the voucher system, and the pay roll is vouchered the same as for any supplies purchased, or for any supplies given out.

The method used for supplies is to use a blotter for each month in the storeroom. Pages are headed by the various accounts to which supplies may be charged out. On a requisition from the superintendent to the storekeeper, is the number of the account to which the supplies or stores must be charged. The supply clerk then puts on the blotter the requisition number, and the goods delivered under the head of the distribution number to which the account goes. At the end of the month, this is added and charged up by a voucher, crediting supplies and debiting the various mine accounts. The accompanying illustration shows the style of pay roll and time sheet used.

Anthracite Waste, and the Philadelphia Water Supply

Anthracite coal operators claim, in connection with the report of the Philadelphia water commission, that the dumping of coal dirt into the head waters of the Schuylkill river is not a menace to the city of Philadelphia, which derives its water supply from the river. They declare that elaborate precautions are now being taken to prevent the dirt from being washed from the culm banks into the river, and that in another year, there will be no cause of complaint from this source. They also contend that the sulphurous water from the mines is absolute death to the countless disease germs, which would otherwise be washed down the river from the sewage of the many towns and cities.

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

On slope haulage when cars run down by gravity, the outside rail of any curve should be raised at the foot of the slope; an elevation of 2 to 3 in. works well at this point, while with rope and motor haulage, the maximum elevation is 4½ in.

In the installation of steam engines the nearer the engines are to the boilers the better, as the condensation losses will be less, and there is also the economy in first cost arising from fewness of pipes and in maintenance due to the smaller number of joints.

A 1-in. wire rope generally lasts long enough to raise 1,000,000 tons of coal up a 10 per cent. plane and about ½ mile long. The ordinary life of a wire rope is from 1½ to 4 years, according to the amount of work and improvements connected with the use of the rope.

When the angle of drive is greater than 60 deg., much trouble is likely to ensue. Vertical drives should always be avoided, as the belts or ropes tend to fall away from the lower pulley, and slipping becomes serious. If a vertical drive is absolutely necessary, a tightening arrangement must be provided.

In one instance it was found that moist sand occupied more space and weighed less per cubic foot than dry sand. A moist sample was taken from a bank 12 hours after a shower and weighed only 84.5 lb. per cu.ft., while a dry sample from the same bank weighed 107 lb. This fact must be taken into account when proportioning cement.

The pitch of anthracite coal chutes which are lined with sheet iron, should be as follows: For egg or broken, 2½ in. per ft.; for stove and chestnut, 3½ in. per ft.; for pea, 4½ in. per ft.; for buckwheat, 6 in. per ft.; for rice, 7 in. per ft.; and culm, 8 in. per ft. The angle of coal chutes should be from 35 to 45 deg. for the run-of-mine of bituminous coals; if the coal is wet, the angle should always be greater. Coarse coal will slide on a less incline than slack or culm.

According to Luke Grant in the *Industrial World* (March 16, p. 9) the number of deaths in Illinois due to shot explosions in the last 18 months is greater than before the enactment of the shot-firers law, and the miners themselves admit that some amendments to the law are necessary. Twenty-seven men have met death in firing shots since this law was enacted, and most of these deaths were due to bad shots placed by miners who knew that they were taking no chances themselves, as another man would have to fire them.

In respect to the relative cost of iron and wooden wagons for coal haulage, J. Gerrard states (*Min. Eng.*, London, Vol. XI) that iron cars cost somewhat more than wooden cars of the same size, but that the annual cost of repairs for the iron cars is much less than for the wooden ones. The figures are as follows: Wooden cars cost £2 apiece, whereas iron cars cost £2 7s. 6d. Annual repairs for iron cars are figured at 3s. 9d., while the cost of repairing wooden cars is put at 5s. 7d.

In proportioning lime to cement the method of measurement should be clearly understood. The volume of ordinary lime or quicklime increases in slacking to about 2½ times its volume measured loose in the lime cask; the exact increment depends upon the chemical composition, and the purity of the lime. The weight of lime paste is about 2½ times the weight of the same lime before slacking. Hydrated lime powder occupies more space than the quicklime from which it is made.

The most important thing to remember in firing a boiler is the regulation of drafts and the thickness of fire. An insufficient air supply causes imperfect combustion, and an excessive air supply results in too great dilution of the gases of combustion; in either case it tends to cool the furnace. The hottest fire that can be made is one in which the supply of air is enough in excess to insure perfect combustion and no more. When the gases of combustion contain 4 to 8 per cent. of free oxygen the hottest fire is obtained.

The proper elevation of an engine is one of the important points to consider, when determining its location. It is well to remember that if the condenser is to properly receive its supply, the injection should never be more than about 15 ft. above the lowest water level. This means that the vacuum in the condenser must be about 7 lb. per sq.in., before the water will enter the condenser. In order to get the condenser low enough, it is sometimes necessary to place the air pump far below the engine-house floor, and to have a long connecting rod to the air-pump rod.

The flushing of culm in anthracite mining practice permits most of the pillars to be robbed and at the same time prevents the roof from coming down. The pipes used to carry the water and culm are from 4 to 6 in. in diameter and are generally made of wrought iron. The life of the pipe depends on the nature of the water used and the material treated; with fresh water and very fine culm, a pipe will last nearly 2 years; when the culm ranges in sizes all the way to chestnut, a pipe will last about 10 months, while if ashes are mixed with the culm, 6 months will be the average life of the pipe.

In building a concrete dam in a mine where the water contains acid, it must be remembered that the acid will attack the cement and natural disintegration will surely follow. If the dam is to be for standing water, a partial wall of limestones built inside the dam, will lengthen the life of the stopping, as the acid will attack the limestones, and thus weaken the chemical activity of the acid in the water. That cement richest in lime decomposes most easily in the acid water. Sand containing a large proportion of fine grains should never be used in concrete or mortar for acid water constructions.

Ropes with 19 wires per strand are the most pliable and best adapted for hoisting. The others are stiffer and better adapted for guys, etc. For the safe working load, take one-fifth to one-seventh of the breaking load, according to speed. Hemp-center rope is more pliable than wire-center. Wire rope must not be coiled or uncoiled as hemp rope. Avoid untwisting and short bends. In order to preserve wire rope, use raw linseed oil, which may be mixed with an equal volume of Spanish brown or lamp black. For underground and wet places, use a mixture of one bushel of fresh slacked lime and some sawdust to one barrel of tar; boil the mixture and apply it to the rope while it is hot.

In view of the recent frightful accident from an explosion of gas in one of the coal mines at Reden, near Saarbrücken, Germany, which killed 150 miners, it is interesting to learn what progress has been made during the past 25 years in securing the lives of men employed in Prussian coal mines against the dangers from such explosions. The Prussian authorities have so improved the appliances needed in coal mining and have adoped so many precautionary measures to protect the lives of miners that while on the average 571 miners out of every million annually lost their lives during the decade 1881—1890, this record has been steadily reduced until in 1905 only 29 perished from explosion by fire damp. This shows what intelligent, systematic and persistent effort can and does accomplish in saving human lives from danger and accident.

Placer Claims above Minidoka Dam

A report on placer claims above the Minidoka dam was recently made at the request of the Reclamation Service by L. C. Gillett and W. L. Walker, under the direction of Dr. David T. Day, of the United States Geological Survey, and is now on file in the office of the Reclamation Service, in Washington. The investigation of this ground was undertaken in order to ascertain its mineral value before it became submerged by the backwater of the Minidoka dam. A plan to dredge this ground has lately received considerable attention from promoters, and already one company has been organized and several claims near the lower end of the backwater have been purchased with a view to the installation of a dredge.

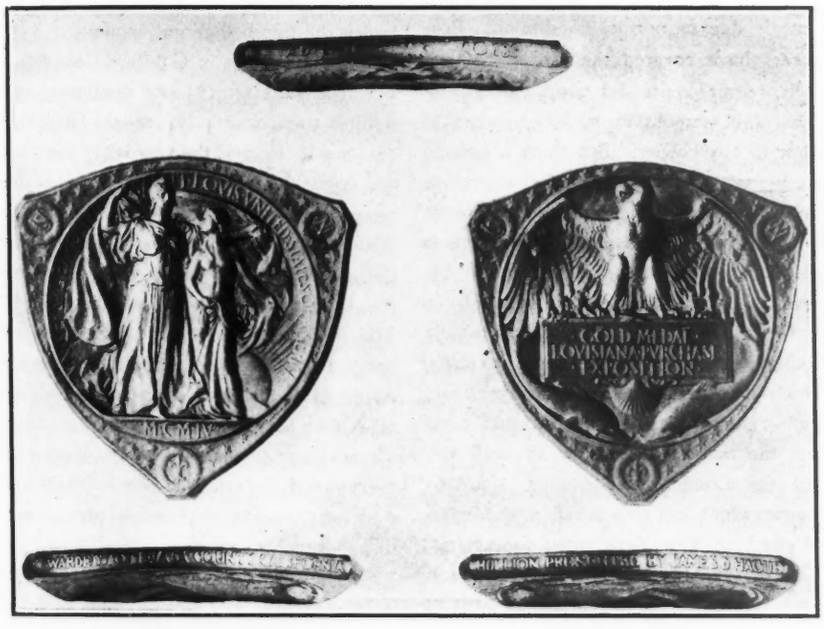
The claims prospected were those designated by D. W. Ross, supervising engineer of the Reclamation Service, and were situate along the Snake river, above the Minidoka dam, which is six miles south of the station of Minidoka, Idaho.

The prospecting was accomplished by means of test pits, panning, and sampling, the samples taken being shipped to Portland, Ore., for treatment and assay. The number of test pits dug was 129. It was found that in general the values were concentrated in the bottom of the loam and the upper portion of the underlying gravel. This surface soil or sandy loam ranges in thickness from 2 to 12 ft. The gold was everywhere of such fine flour-like particles that a large percentage of it passed through a 150-mesh screen. Occasionally, the values for individual pits averaged for the entire pit as high as $2.31 a cu.yd., but the more common values ranged from 5 to 20c. a cu.yd., while very few pits were absolutely barren of values. No other minerals of any commercial importance save gold were found.

Gold Medal for Mining Exhibit of Nevada County, Cal.

Through the courtesy of James D. Hague we are enabled to publish the accompanying illustration of the beautiful gold medal awarded for the mining exhibit of Nevada county, Cal., at the Louisiana Purchase Exposition in St. Louis.

The medal weighs 9 oz. and was made of bullion which is the usual product of one of the oldest mines in Nevada county, the North Star. The bullion is 849 fine in gold, and 139 fine in silver. The medal was struck at the United States mint at Philadelphia. The chasing and lettering of the rim was applied in New York before the interesting award was sent to its final destination.



MEDAL AWARDED FOR NEVADA COUNTY MINING EXHIBIT

Metal Production of Colorado

The metal production of Colorado for the year 1906 is reported as follows by E. L. White, commissioner of mines:

	Quantities.	Values.	Per Ct.
Gold, oz.	1,092,827	$22,588,734	51.4
Silver, oz.	12,725,882	8,499,744	19.4
Lead, lb.	105,984,540	5,666,993	12.9
Copper, lb.	9,565,319	1,844,002	4.2
Zinc, lb.	85,488,901	5,298,602	12.1
Total values		$43,898,075	100.0

Values are based on the average market prices of the different metals during the year. The zinc production is figured on the actual spelter recovered. By counties the four larger gold producers in order were Teller (Cripple Creek), San Miguel, Gilpin and Lake. Teller county reports 673,949 oz., or over 60 per cent. of the total. The chief silver producers were Lake, Pitkin, San Miguel and Mineral counties. The same counties were the chief lead producers. In copper, Lake and San Juan led; while in zinc, Lake county furnished 82 per cent. of the total. In total values, Teller county (Cripple Creek) stood first with $13,976,069, almost entirely in gold; while Lake county (Leadville), with a more diversified production, reports a total of $11,737,875. San Miguel was third, with $3,966,182; Pitkin fourth, with $2,646,869; while Ouray, with $2,030,627, was fifth in order.

Copper Production of the World

Statistics of production of copper in the world for the past three years have been compiled by A. Hirsch & Son, Halberstadt, Germany. Included in the circular, which we have received through the courtesy of L. Vogelstein & Co., are also statistics relative to consumption, exports and imports of the principal copper-consuming countries with special reference to the trade in the raw or partly manufactured metal in Germany. The following table shows the annual production of the world in metric tons:

COPPER PRODUCTION OF THE WORLD

	1904.	1905.	1906.
United States	366,522	397,545	417,411
Spain and Portugal	50,000	48,000	51,000
Mexico	52,500	60,000	60,000
Chile	33,000	33,000	30,000
Japan	32,000	31,400	37,000
Germany	24,500	25,500	26,200
Canada	21,500	24,000	24,000
Australia	30,000	35,000	43,000
Peru	7,000	8,000	11,500
Russia	10,700	9,000	10,000
Cape-Colony	7,250	9,000	8,500
Norway and Sweden	6,000	6,000	6,500
Italy	3,250	3,300	3,100
Newfoundland	2,000	2,200	2,500
Bolivia	2,000	2,000	2,000
Austria-Hungary, incl. Servia and Bosnia	1,500	1,500	1,500
Turkey	1,500	1,400	1,000
Other countries	1,300	1,000	1,500
Total	652,522	697,845	736,711

There was an increase in the total production in 1906, of 5.6 per cent. over the previous year, the United States leading with 19,866 tons or 51.1 per cent. of the whole; Australia followed with 20.5 per cent. increase, and Japan was third with 14.4 per cent.

PRODUCTION OF ELECTROLYTIC COPPER IN THE UNITED STATES

Year.	Total Copper, Production and Imports.	Exports to Europe.		Casting Copper.	Lake Copper.	Total Electrolytic Copper.
		Pig Copper.	Matte.			
1904	446,432	20,143	466	25,000	78,000	322,823
1905	491,756	14,953	50	35,000	85,000	356,753
1906	521,875	12,989	534	40,000	85,000	383,352

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Contents

The Commercial Situation

As we reported last week there has been a weakness in copper, which was even then distinctly manifest. This has continued during the week just closing, and there has been a panicky condition in the general stock market. Liquidation in the stock market appears to have been overdone. The bear movement, inaugurated for manipulative purposes, has evidently gone further than its promoters contemplated, and many standard stocks are now selling at prices on which their dividends make a comparatively large return. From present indications there is no reason to anticipate reductions in the dividends.

With respect to copper, the slight decline is due to normal conditions. Producers have covered the largest part of their requirements for April, May and June, and temporarily no one appears to want to buy copper. But there are some producers who want to sell, wherefore there are lower offerings to tempt consumers. However, some of the largest producing interests profess, and we believe hold sincerely, the utmost confidence in the situation, and stand firm at their asking price of 25¼c. delivered 30 days, which is equivalent to about 25c. cash, and so long as they maintain that position the market cannot go off very far, and the London market for standard copper, which has only a reflex, sentimental effect on New York, must rise again.

It is probably true that there has been some slackening in the industrial activity of this country, but so far as that has been manifest it is merely a relief from the high tension at which we have been working, and will be a beneficial result rather than otherwise. It will be a good thing all around if we can get down somewhat from the dangerously high level at which we have been during the last few months. Because there has been a little recession in the price of copper, it does not mean that there is to be a slump in that metal, and the marking down in the prices of the stocks of the copper-mining companies has been absurd. When the price of copper rose above 18c., the prices of the stocks rose little or none, but now when there has been a little recession from the price of 25c., the value of the stocks has gone off in large slices. When people have got over their fright, a little calm reflection will show the irrationality of the situation. We have confidence in the soundness of the general business conditions, and in particular as to the position of copper.

The Labor Troubles at Goldfield, Nevada

Late reports from Goldfield, Nevada, promise an early cessation of hostilities in the new labor trouble which has brought the camp to the verge of civil war. The odd feature of the difficulty is that the ancient and perennial question of labor versus capital has nothing to do with it. It is a war of labor against labor, and the capitalists and employers occupy the unenviable position of non-combatants between the two belligerent armies.

Wages are high in Goldfield, and hours of labor satisfactory; the employers are willing to arbitrate or to do anything reasonable to get their work done, and are doing their best to promote peace between the warring factions. The trouble is one between rival labor organizations, the American Federation of Labor and the Industrial Workers of the World. The miners, it seems, are mostly members of the latter organization and are trying to induce workmen in other lines of skilled labor to join their own union. Things came to such a pass last week that everyone went armed, every office and store was guarded, and mines prepared to suspend operations.

The business and industrial interests of Goldfield are in harmony in desiring peace. Considering the extraordinary prosperity of the camp it would be strange if they were not. The men who pay the wages can exert a powerful influence, and it seems probable that their efforts to arbitrate between the unions will succeed.

Pennsylvania Coal

The State of Pennsylvania last year produced a little over 49 per cent. of the total output of the United States. In previous years it has furnished over one-half of the total, but the advance of mining in West Virginia and in some of the Western States has been on a scale which slightly reduced Pennsylvania's proportion, though the State made a moderate gain. The production of the State is divided into two great branches, largely

distinct in their character and the demand they meet—the anthracite from the eastern portion, and the bituminous coal from the central and western sections. While the final report for 1906 has not yet been issued, we have now the reports from all the mine inspection districts, the totals of which give the actual output for the year.

In 1905 the total anthracite mined was 70,220,554 long tons; equal to 78,647,020 of the short tons generally used in the coal reports. In 1906 there was a loss in the output, the causes of which have been heretofore explained; briefly put, they were the difference between miners and operators early in the year, and the carrying over of large stocks accumulated in anticipation of trouble. The quantity mined in 1905 was 64,410,327 long tons, or 72,139,566 short tons; a decrease of 6,507,454 short tons, or 8.3 per cent. For the reason already given, it is probable that the actual consumption in 1906 varied little from that of the previous year.

In bituminous coal, on the other hand, there was an important gain. The total for 1905 was 119,361,514 tons; while for 1906 the inspectors' reports give a total of 129,532,991 tons, showing an increase of 10,171,477 tons, or 8.5 per cent. Labor troubles affected the bituminous mines, but for a short time only; and the brief cessation caused was followed by increased production, in response to an active demand. It may be mentioned here that our estimate of the bituminous output, published in the JOURNAL of Jan. 5 last was 129,500,000 tons; this estimate differing from the actual figures by only 32,991 tons, or 0.025 per cent.

The total output of the State therefore, notwithstanding the loss in anthracite, advanced from 198,008,594 short tons, in 1905, to 201,672,557 tons in 1906; a gain of 3,663,963 tons, or 1.9 per cent. This approaches nearly to the coal production of Germany, and exceeds largely the total reported by any other country in the world, except Great Britain.

The Canadian Ministry of Mines

Formal notice has been given of the introduction in the Dominion Parliament, at Ottawa, of the bill to establish a department of mines, under a responsible minister, which has been for some time under consideration. The bill provides for the transfer to the new department of the Geological Survey, and also of the Mines Branch, formerly under the ministry of the interior, but recently transferred to the ministry of inland revenue. The new minister will have control of all matters relating to the mining industry. The department will comprise two main branches, the geological and the mines branch, each of which will be under the control of a director with a deputy minister over both.

While in the older provinces of the Dominion the mining lands are under the control of the provincial governments, which regulate all matters pertaining to mining, in the newer provinces of Manitoba, Saskatchewan and Alberta, and in the territories, the Dominion owns the public lands and has full jurisdiction. The creation of the new department, it is urged in favor of the bill, is demanded by the expansion of the mining industry, and the result will be to increase the amount of educational and supervisory work, and extend the scope of the present branches having it in charge. It is understood that Hon. William Templeman, who represents British Columbia in the Cabinet, and is at present the head of the inland revenue department, will be the first Minister of Mines.

The Reclamation Service

The Reclamation Service has been entirely separated from the Geological Survey, a separation which we are glad to record, for we have long advocated this division, which we believe necessary for the good of the Geological Survey. Frederick H. Newell, chief engineer of the Reclamation Service, has been appointed director of the service, an appointment which we are also pleased to record, for our criticisms of the service as a part of the Geological Survey have never referred to Mr. Newell's work, which has always been of a high value and character.

The new director is a native of Pennsylvania, and a graduate from the engineering department of the Massachusetts Institute of Technology, being a member of the class of 1885. He later took a postgraduate course in hydraulic engineering, and upon the completion of his studies entered practical service connected with the problems of irrigation in Colorado. He joined the Irrigation Survey in 1888, as hydraulic engineer, and when the Reclamation Service was established, in 1902, by act of Congress of June 17, he was appointed chief engineer.

The appointment will receive the approval of everyone who has been associated with Mr. Newell, and of everyone who knows the character of his services. He brings to his new duties a wide grasp of practical details and the trained, analytic mind of a thorough man of science.

The Mining Index

Our readers will notice this week the resumption of the usual list of the patents relating to mining and metallurgy. Hereafter notes of the new patents bearing upon this industry will be published once a month in a form under which they can be properly classified as to subject, which will assist in reference. However, brief abstracts of the more important patents will be published from time to time in the main part of the paper.

The index to the literature of mining and metallurgy, published monthly in the JOURNAL, has met with general appreciation, if we may judge from the number of orders for papers referred to therein and the requests that the index be reprinted on single sheets, so that sections may easily be cut out for filing in note-books, etc. For the latter purpose we sugggest an extra subscription, which will make available both sides of the pages, and will be cheaper than the price at which reprints could be supplied. This index contains monthly upward of 250 references, and makes our readers conversant with the appearance of almost everything in the technical press that is of importance in connection with geology, mining, metallurgy, chemical engineering, etc.

IF CONTRIBUTORS WILL kindly mail their photographs in flat packages, either mounted or between cardboards, they will eliminate a source of frequent annoyance, trouble and loss. Photographic views deserve considerate treatment. The sun gives a truthful picture without bias or preference; a single view often gives more real information than could be compressed into a page of type. Photographs, like all things precious, are perishable. Then why fold them or roll them up roughly and consign them to the mercy of the mail bag without protection or support?

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

Ungava District Not in British Columbia

Permit me to call your attention to an error on page 190 of the JOURNAL of Jan. 26, 1907. In the article entitled, "A Notable Exhibit of Rare Minerals," line 15 from the bottom reads "probably some from as far as Ungava district, in British Columbia." Ungava district happens to be the northeast part of the Dominion, and incidently of the main land of the continent, while British Columbia is the extreme southwest province of the Dominion. Of course, the words "in British Columbia" should not appear at all. The collection of specimens which Dr. Kunz sent to this country for examination contained no specimens that were considered to have come from there, unless he sent more than one collection.

ALFRED W. G. WILSON.

Montreal, Feb. 26.

The account of the exhibit of minerals was published on the authority of the secretary of the institution in which the collection was shown. It was a stenographic error which placed Ungava district in British Columbia and not Dr. Kunz.

Genesis of Ores of the Cobalt District

In the discussion of his paper on the genesis of the ores of the Cobalt district, presented at the Toronto meeting of the Canadian Mining Institute, Prof. Van Hise said that the metallic silver was due to secondary enrichment.

His argument was based on the general principle that all veins have a zone of secondary enrichment, and when this zone is passed the ore becomes poorer. This is true of veins occurring in countries where there has not been a great amount of glaciation. In Ontario and particularly in the Cobalt district, glaciation has removed several hundred and possibly thousands of feet of the surface, and the veins as they outcrop at present are but the remains of larger ones that have been glaciated off.

SILVER PRESENT AT CLOSE OF GLACIAL PERIOD

There has been very little oxidation or secondary enrichment since the glacial period as evidenced by the metallic silver at the outcrop presenting glacial striæ just as plainly as the rocks in which it is or was inclosed. Mr. Timmins, of the La Rose mine, and I were shown a vein of metallic silver 2 to 6 in. wide outcropping on the hill back of the mine. The clay loam had been stripped off and for a distance of 200 ft. the metallic silver presented all the glacial markings as plainly as the inclosing Huronian rocks.

This is conclusive proof that the silver was there at the close of the glacial period and it is very unlikely that it could have been formed from secondary enrichment during the glacial period.

In the sulphide deposits of the Sudbury region, the zone of secondary enrichment is entirely absent, having been cut off during the glacial period, and sufficient time not having elapsed since that period to produce another. The sulphides are at the surface only covered by a few inches of gossan. As the same general conditions prevailed at the Cobalt district during the glacial period it is reasonable to assume that whatever zones of secondary enrichment have existed in the veins that they have been removed, and that the ores as mined a few feet below the surface are in the same condition in which they were deposited.

THE REDUCING AGENT

It therfore becomes necessary to account for the deposition of metallic silver from ascending hot solutions in order to explain the presence of the metallic silver in these ores. Its presence requires an explanation that is sound from a chemical standpoint and not subject to the accidental introduction of reducing matter from the surface.

The writer opposed the explanation by secondary enrichment and suggested the presence of graphitic deposits along with the ore due to the decomposition of hydrocarbon gases associated with the mineralizing solutions at the time the ore was deposited. These hydrocarbons would act as powerful reducing agents on the silver salts and precipitate metallic silver during the time of mineralization. Professor Miller stated that such carbonaceous or graphitic deposits were present, and were associated with the ores; some of this material being piled on the dumps at the mines.

This evidence was further strengthened by the information furnished by Messrs. Coste and Ingall that in the Silver Islet mine, near Port Arthur, hydrocarbon gases were encountered in the lower levels in sufficient quantity to burn under rock pressure. It was also stated that metallic silver was found in the bottom of the mine at a depth of 600 ft. As the glaciation was fully as great in that region as in the Sudbury district it seems improbable that secondary enrichment could account for the metallic silver in the Silver Islet mine.

The ores of that mine and of the Cobalt district are said to be practically the same in character, and the conditions in each case point to the deposition of metallic silver contemporaneously with the other minerals. It is therefore probable that metallic silver will be found associated with the other minerals to the greatest depth to which the mines may be worked. I pointed out that chloride is the form in which silver is usually found when it has been deposited by secondary enrichment. Professor Beck objected to this on the ground that in many cases metallic silver has been found where all the conditions pointed to its being deposited as a result of secondary enrichment as it was not found below that zone.

While this may be true it does not disprove the contention, and it is probable that in the veins in which the metallic silver terminated with the zone of secondary enrichment, that there were no hydrocarbon gases associated with the mineralizing solutions at the time of deposition.

I offer the suggestion that the presence of graphitic deposits on the walls of a vein together with carbonaceous material in the vein associated with the ore in evidence that at the time of mineralization hydrocarbon gases were associated with the solutions. It is also possible that this same principle of reduction during the deposition may account for the metallic copper in the Lake Superior region.

It would be interesting to know if such graphitic stains and carbonaceous deposits are associated with the Lake Superior copper ores.

HIRAM W. HIXON.

Victoria Mines, Ontario, March 13, '07.

Electric Smelting of Lead Ore

Will you kindly inform me if the electrical smelting of lead ore has been successfully accomplished on a commercial scale. R. P. F.

Pictou, Nova Scotia, March 14, 1907.

So far as we are aware, the electrothermic smelting of lead ore is nowhere practiced on a commercial scale.

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. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

ALUMINUM

ALUMINUM HYDROXIDE—Production of Aluminum Hydroxide. Chemische Fabrik Griesheim Electron, Frankfort, Germany. (Brit. No. 13,970 of 1906; Feb. 16, 1907.) Extracting hydroxide of aluminum from bauxite by caustic alkali at atmospheric pressure and at a temperature ranging from 180 to 500 deg. C.

CEMENT

KILN—Dry Kiln. La Fayette Moore, Jacksonville, Fla., assignor to L. Moore Dry Kiln Co., Jacksonville, Fla. (U. S. No. 846,044; March 5, 1907.)

KILN—Rotary Cement Kiln and Fuel Feeder therefor. Charles A. Matcham, Allentown, Pa. (U. S. No. 847,257; March 12, 1907.)

KILN—Rotary Kiln. William R. Warren, New York, N. Y. (U. S. No. 847,859; Mar. 19, 1907.)

COAL AND COKE

COAL AND ORE HANDLING—Means for Loading and Unloading Coal and Other Minerals. Cuthbert Burnett, Durham, England. (U. S. No. 845,217; Feb. 26, 1907.)

COAL SCREENING and Grading Apparatus. Joseph Rapp, Collinsville, Ill., assignor of one-fourth to Louis F. Lumaghi, Collinsville, Ill., and one-fourth to Joseph D. Lumaghi, St. Louis, Mo. (U. S. No. 846,140; March 5, 1907.)

COAL WASHER. Joseph Rapp, Collinsville, Ill., assignor of one-fourth to Louis F. Lumaghi. Collinsville, Ill., and one-fourth to Joseph D. Lumaghi, St. Louis, Mo. (U. S. No. 846,141; March 5, 1907.)

COAL WASHER — An Improved Coal Washer of the Type on which a Vibrating Pan is Used. Heyl & Patterson, Pittsburg, Pa. (Brit., Nos. 1936 and 1942 of 1906; Feb. 23, 1907.)

COKE—Process of Coking Coal. Samuel B. Sheldon, Buffalo, N. Y. (U. S. No. 846,958; March 12, 1907.)

COKE-FURNACE. Samuel B. Sheldon, Buffalo, N. Y. (U. S. No. 847,614: Mar. 19, 1907.)

COKE MANUFACTURE—Process for Utilizing Close-burning Coal Dust for Making Metallurgical Coke or Other Kinds of Coke. Gaston de Veina, Paris, France, assignor to Arthur Stanley Riggs, East Orange, N. J. (U. S. No. 847,134; March 12, 1907.)

COKE OVENS—Apparatus for Charging Coke Ovens. Frederic W. C. Schniewind, Everett, Mass., assignor to United Coke and Gas Co., Charleston, W. Va., and Philadelphia, Pa., a corporation of West Virginia. (U. S. No. 845,719; Feb. 26, 1907.)

COKING OVEN. Louis J. Hirt, Brookline, Mass. (U. S. No. 847,001; March 12, 1907.)

PEAT—Process for Charring or Carbonizing Peat. Martin Ekenberg, Stockholm, Sweden. (U. S. No. 847,748; Mar. 19, 1907.)

PEAT DRIER. Benjamin F. Lambert, Anderson, Ind. (U. S. No. 846,574; March 12, 1907.)

SAFETY LAMP — Miners' Safety Lamp. Emil Piepenbring, Dortmund, Germany. (U. S. No. 846,050; March 5, 1907.)

SAFETY LAMPS—An Improved Friction Device for Igniting Miners' Safety Lamps. P. Wolf, Zwickau, Saxony. (Brit. No. 5374 of 1906; Feb. 23, 1907.)

COPPER

ALLOY. F. Dannert, Berlin, Germany. Obtaining an alloy of copper and lead by introducing into molten copper a mixture of a lead oxide and powdered glass. (Brit. No. 8894 of 1906; Feb. 16, 1907.)

COPPER-REFINING FURNACE. Ralph Baggaley, Pittsburg, Pa. (U. S. No. 846,891; March 12, 1907.)

EXTRACTION OF COPPER—Process of Extracting Copper. Oscar Frölich, Berlin, Germany. (U. S. No. 846,657; March 12, 1907.)

SILICATE OF COPPER—Process for the Treatment of Silicate of Copper. George H. Waterbury, Denver, Colo., assignor to Los Angeles Metals Extraction Company, Los Angeles, Cal. (U. S. No. 847,448; Mar. 19, 1907.)

GOLD AND SILVER

AMALGAMATION—Amalgamator and Concentrator. Julius A. Jean, Denver, Colo., assignor of one-half to George A. Moors, Denver, Colo. (U. S. No. 847,077; March 12, 1907.)

AMALGAMATION—An Improved Method of Circulating Gold-bearing Pulp over Amalgamating Plates Arranged in a Tank. B. G. Jayne and C. M. Knight, New York. (Brit. No. 17,699 of 1906; Feb. 23, 1907.)

CYANIDE PROCESS—Machine for Cleaning Covered Filters. Hiram W. Blaisdell, Los Angeles, Cal. (U. S. No. 845,746; March 5, 1907.)

CYANIDE PROCESS—Machine for Cleansing Filter Beds. Hiram W. Blaisdell, Los Angeles, Cal. (U. S. No. 845,744; March 5, 1907.)

DREDGES — Upper Tumbler for Dredges and the Like. Samuel L. G. Knox, Milwaukee, Wis., assignor to The Bucyrus Company, South Milwaukee, Wis., a corporation of Wisconsin. (U. S. No. 845,795; March 5, 1907.)

EXTRACTION OF GOLD. James W. Worsey, St. Helens, and Edwin Hoal, Liverpool, England. (U. S. No. 846,768; March 12, 1907.)

HYDRAULIC MINING — Gold-saving Apparatus. James H. Leggett, Oroville, Cal. (U. S. No. 846,483; March 12, 1907.)

PARTING GOLD—Process of Separating Gold from Silver and Other Metals. Donald Clark, Bairnsdale, Victoria, Australia. (U. S. No. 845,853; March 5, 1907.)

PRECIPITATION—Zinc Shavings Device. T. Meyer, Zurich, Switzerland. Improved apparatus for producing zinc shavings. Brit. No. 1066 of 1906; Feb. 16, 1907.)

IRON AND STEEL

ALLOY — Self-hardening Alloy of Steel. James Churchward, New York, N. Y. (U. S. No. 845,757; March 5, 1907.)

ALLOY—Steel Alloy and its Manufacture. James Churchward, New York, N. Y. An alloy consisting of steel, nickel, manganese and titanium, in substantially the proportions specified. (U. S. No. 846,979; March 12, 1907.)

APPARATUS for Transferring Metal Blooms, etc. Edwin E. Slick, Pittsburg, Penn. (U. S. No. 12,620, reissue; March 19, 1907.)

BLAST FURNACE—Charging Apparatus. Thomas F. Witherbee and John G. Witherbee, Port Henry, N. Y. (U. S. No. 845,601; Feb. 26, 1907.)

CASE-HARDENING. Adolph W. Machlet, Elizabeth, N. J. (U. S. No. 847,588; Mar. 19, 1907.)

CONVERTION OF IRON—Process of Converting Iron Castings into Steel or Malleable Iron. Mary A. Hunter, Philadelphia, Pa. (U. S. No. 846,031; March 5, 1907.)

CORROSION — Preventing Iron Surfaces from Rust by Treating Them with Dilute Solution of Phosphoric Acid. T. W. Cosiett, Birmingham. (Brit. No. 8667 of 1906; Feb. 23, 1907.)

CUPOLA FURNACE. Benjamin D. McCormick, Akron, Ohio. (U. S. No. 847,097; March 12, 1907.)

DRY AIR BLAST—Air-blast Drier. John Beernink, Milwaukee, Wis. (U. S. No. 845,047; Feb. 26, 1907.)

DRY AIR BLAST—Process of Drying Air for Blast Furnaces. Nathaniel T. Bacon, Peacedale, R. I. (U. S. No. 847,273; March 12, 1907.)

DRY-AIR BLAST APPARATUS. L. Block, New York, N. Y. Improved apparatus for removing moisture from air used in metallurgical operations. (Brit. No. 800 of 1906; Feb. 16, 1907.)

DRY-AIR BLAST APPARATUS. W. H. Webb, W. G. Brettell and A. J. Adamson, Liverpool. Improved cooling apparatus for removing moisture from air used in metallurgical operations. (Brit. No. 960 of 1906; Feb. 16, 1907.)

FURNACE GASES—Apparatus for Removing Impurities from Furnace Gases. Ralph Baggaley, Pittsburg, Pa. (U. S. No. 846,815; March 12, 1907.)

OPEN-HEARTH FURNACES—Improved Pouring Spout. J. A. Drain, Pittsburg, Pa. An improved pouring spout for open-hearth furnaces, so that a big charge can be poured into more than one ladle. (Brit. No. 19,616 of 1906; Feb. 16, 1907.)

ROLLING MILL—Mill for Rolling Annular Articles. Casimir von Philp, Bethlehem, Pa., assignor to Bethlehem Steel Co., South Bethlehem, Pa., a corporation of Pennsylvania. (U. S. No. 846,942; March 12, 1907.)

ROLLING MILL—Universal Rolling Mill. Victor Chartener, Pittsburg, Pa. (U. S. No. 846,825; March 12, 1907.)

ROLLING MILLS—Hotbed for Rolling Mills. Edwin E. Slick, Pittsburg, Pa. (U. S. No. 846,761; March 12, 1907.)

TEMPERING BATH for Steel. James Churchward, New York, N. Y. (U. S. No. 845,755; March 5, 1907.)

WIRE — Incandescent Lamp Attachment. S. O. Cowper Coles, London. A wire intended as a substitute for platinum for use in electric incandescent lamps, consisting of pure iron, first tinned and then covered with aluminum. (Brit. No. 10,622 of 1906; Feb. 16, 1907.)

LEAD

LEAD PRODUCT. John W. Bailey, New York, N. Y., assignor, by mesne assignments, to United Lead Company, a corporation of New Jersey. (U. S. No. 846,384; March 5, 1907.)

MICA

MICA SHEETS—Process of Making Artificial Mica Sheets. Edward Cooper. Newton Lower Falls, Mass. (U. S. No. 847,910; Mar. 19, 1907.)

NICKEL

ORE TREATMENT—Process of Treating Nickel Ores, etc. Ralph W. E. MacIvor, London, England, assignor to Metals Extraction Corporation, Limited, London, England, a corporation. (U. S. No. 846,492; March 12, 1907.)

PETROLEUM

DRILLING—Well-drilling Machine. Geo. N. Thomas, Pacific, Mo. (U. S. No. 846,165; March 5, 1907.)

OIL WELLS—Rope-grab for Oil or Other Drilled Wells. Lawrence Stephens, Macksburg, Ohio. (U. S. No. 846,157; March 5, 1907.)

REFINING—Separating Low-boiling Products from the Burning Oil Distillate of Petroleum to Raise the Fire Test Thereof. Herman Frasch, New York, N. Y., assignor to Standard Oil Co., Bayonne, N. J., a corporation of New Jersey. (U. S. No. 845,456; Feb. 26, 1907.)

REFINING — Steam Still for Petroleum. Herman Frasch, New York, N. Y., assignor to Standard Oil Co., Bayonne, N. J., a corporation of New Jersey. (U. S. No. 845,735; Feb. 26, 1907.)

QUICKSILVER

MERCURY - CONDENSER. Conrad F. Brown, San Jose, Cal. (U. S. No. 847,547; Mar. 19, 1907.)

MERCURY RETORT AND FURNACE. Conrad F. Brown, San Jose, Cal. (U. S. No. 847,399; Mar. 19, 1907.)

SMELTING—Furnace for Reducing Cinnabar Ore. Charles F. Burgess, Yreka, Cal. (U. S. No. 845,690; Feb. 26, 1907.)

RARE METALS

METALLIC LAMP FILAMENTS. J. Lux, Vienna, Austria. Method of forming exceedingly thin filaments of molybdenum or tung-

sten for use in electric lamps. (Brit. No. 7189 of 1906; Feb. 16, 1907.)

SULPHUR

SMELTING—Sulphur-smelting Apparatus. Edward F. White, Easton, Penn. (U. S. No. 847,869; Mar. 19, 1907.)

METALLURGY—GENERAL

ALLOY—Metal Alloy. Arthur E. Hobson, Meriden, Conn., assignor to International Silver Co., a corporation of New Jersey. (U. S. No. 846,851; March 12, 1907.)

FLUE DUST—Method of Recovering Values from Flue Dust. Ralph Baggaley, Pittsburg, Pa. (U. S. No. 846,818; March 12, 1907.)

METALLIC OXIDES—Process of Making Metallic Oxides. John W. Bailey, Jersey City, N. J., assignor, by mesne assignments, to United Lead Co., a corporation of New Jersey. (U. S. No. 846,444; March 12, 1907.)

METALLIC SULPHIDES—Process of Reducing Metallic Sulphides. Edward L. Anderson, St Louis, Mo., assignor, by direct and mesne assignments, of one-half to himself and Harvey Atchisson, St. Louis, Mo., and one-half to John H. Miller and Chalon G. Cloud, McLeansboro, Ill. (U. S. No. 846,642; March 12, 1907.)

ORE TREATMENT — Method of Treating Ores. William Kemp, Tucson, Ariz. (U. S. No. 846,216; March 5, 1907.)

SULPHIDE ORES — Process of Smelting Sulphide Ores. Corydon W. Munson, Toledo, Ohio. (U. S. No. 846,498; March 12, 1907.)

SULPHIDE ORES — Process of Treating Sulphide Ores. Otokar Fronek, Cleveland, O., assignor to the General Laboratory Co., a corporation of Ohio. (U. S. No. 845,868; March 5, 1907.)

WASTE HEAT OF SLAG—Method of Generating Steam from Waste Heat of Slag. Ralph Baggaley, Pittsburg, Pa. (U. S. No. 846,817; March 12, 1907.)

MINING MACHINERY AND APPARATUS

BORE-HOLE SURVEYING INSTRUMENT. Instrument for Surveying Bore-holes. Percy E. Lewis, Johannesburg, Transvaal, assignor of one-fourth to Luther Cyril Franck, Johannesburg Transvaal. (U. S. No. 845,875; March 5, 1907.)

CENTRIFUGAL PUMP — Centripetal-Centrifugal Pump and Condenser. Roscoe S. Prindle, New York, N. Y., assignor of one-half to Charles H. Tompkins and Vincent C. Tompkins, New York, N. Y. (U. S. No. 845,816; March 5, 1907.)

CONVEYER. John F. Doehle, Plainfield, N. J. (U. S. No. 846,402; March 5, 1907.)

CONVEYER APRON. Emil Schaffner, Wimbledon, N. D. (U. S No. 845,269; Feb. 26, 1907.)

CONVEYERS—Tripper or Deliverer for Conveyers. Clarence K. Baldwin and Lincoln Moss, New York, N. Y. (U. S. No. 347,309; Mar. 19, 1907.)

DRIER—Sand and Mineral Drier. Marguerite Schaeffer, Indianapolis, Ind. (U. S. No. 847,513; Mar. 19, 1907.)

DRILL—Mining Drill. Jasper N. Rickles, Altoona, Ala. (U. S. No. 845,898; March 5, 1907.)

DUMPING BUCKET. Louis A. Lehmann, New York, N. Y. (U. S. No. 846,800; March 12, 1907.)

HOISTING AND CONVEYING APPARATUS. Thomas S. Miller, South Orange, and Joseph H. Dickinson, Montclair, N. J. (U. S. No. 846,042; March 5, 1907.)

HOISTING APPARATUS—Safety Arrangement for Hoisting Apparatus. Wm. Thornber, Johannesburg, Transvaal. (U. S. No. 846,807; March 12, 1907.)

MINE CAGES—An Improved Grip for Suspending Mine Cages on Guide Ropes in Case the Hauling Rope Breaks. F. Pratt, Glamorgan. (Brit. No. 14,011 of 1906; Feb. 23, 1907.)

MINE CAGES—Emergency Rope for Mine Cages. A. Braunig and G. Schmidt, Goritz, Germany. Providing a second drum and winding rope for mining cages in case of emergency, should the usual hauling rope break. (Brit. No. 9013 of 1906; Feb. 16, 1907.)

MINE CAGES—Safety-clutch for Mine Cages, Lifts, Hoisting-skips, etc. William M. Hodgson, Kimberley, Cape Colony. (U. S. No. 847,773; Mar. 19, 1907.)

MINE ELEVATORS—Detaching Cone for Mine and Other Elevators. George Killian, Scranton, Pa. (U. S. No. 845,177; Feb. 26, 1907.)

MINE ELEVATORS — Safety Device for Elevators. George R. Layman, Lincoln, Ill. (U. S. No. 847,083; March 12, 1907.)

PICK. Andrew C. Pitman, Gary, W. Va. (U. S. No. 845,574; Feb. 26, 1907.)

PICK. Thomas A. Lutz, Winburne, Pa. (U. S. No. 845,427; Feb. 26, 1907.)

ROCK-DRILLING MACHINES — An Improved Standard for Supporting Rock-drilling Machines. The Hardy Patent Pick Co. and W. Blears, Sheffield. (Brit. No. 7235 of 1906; Feb. 23, 1907.)

ROCK-DRILLING MACHINES—Drill or Bit Rotating Mechanism for Rock-drilling Machines or Engines. Henry Heilman and Lewis C. Bayles, Johannesburg, Transvaal. (U. S. No. 845,952; March 5, 1907.)

ROCK DRILLS — Apparatus for Making and Sharpening Rock Drills. Gilbert Glossop, Leeds, England, assignor of one-half to Thos. Henry Bradbury, Leeds, England, and one-half to Andrew Makie Niven, Robert Niven and John Wylie Craig Niven, Johannesburg, Transvaal. (U. S. No. 12,614; March 5, 1907.)

ROCK DRILLS—Means for Circulating a Cooling Medium in Gas-actuated Rock Drills. Otho C. Duryea, Los Angeles, Cal., assignor to National Gas Drill Co., Los Angeles, Cal., a corporation of California. (U. S. No. 846,407; March 5, 1907.)

ROCK DRILLS—Valve for Percussive Rock Drills. Albert W. Daw and Zacharias W. Daw, London, England. (U. S. No. 847,739; Mar. 19, 1907.)

SHAFT SINKING—Apparatus for Sinking Shafts. Ralph Baggaley, Pittsburg, Pa. (U. S. No. 846,816; March 12, 1907.)

SURVEYING INSTRUMENT. Philip Ferber, Hoboken, N. J., assignor to the Keuffel & Esser Co., Hoboken, N. J., a corporation of New Jersey. (U. S. No. 846,989; March 12, 1907.)

METALLURGICAL MACHINERY AND APPARATUS

BLOWER. William W. Green, Niles, Mich., assignor to Garden City Fan Co., Chicago, Ill., a corporation of Illinois. (U. S. No. 846 844; March 12, 1907.)

BRIQUET MACHINES—Feeder for Briquet Machines. Karl P. Hangi, New York, N. Y. (U. S. No. 845,299; Feb. 26, 1907.)

GAS PRODUCER. Henry K. Cowen, Chicago, Ill., assignor to International Harvester Co., a corporation of New Jersey. (U. S. No. 845,163; Feb. 26, 1907.)

PRODUCER-GAS APPARATUS. Harry F. Smith, Lexington, Ohio. (U. S. No. 846,357; March 5, 1907.)

PRODUCER-GAS PLANT. Peter Eyermann, Beloit, Wis. (U. S. No. 847,054; March 12, 1907.)

FURNACES

ELECTRIC FURNACE. Basilius von Ischewsky, Kiew, Russia. (U. S. No. 847,003; March 12, 1907.)

ELECTRIC FURNACE. Le Roy W. Stevens, Syracuse, N. Y., assignor to Advance Furnace Co. of America, Utica, N. Y. (U. S. No. 846,521; March 12, 1907.)

HEATING FURNACE—Continuous Heating Furnace. Harry Parrock, Youngstown, and Willis McKee, Elyria, Ohio; said Parrock assignor to said McKee. (U. S. No. 846,506; March 12, 1907.

MELTING AND CONVERTING FURNACE—Improved Form of Portable Melting and Converting Furnace for Steel and Other Metals. L. Rousseau, Paris. (Brit. No. 12,729 of 1906; Feb. 23, 1907.)

ORE FURNACE—Apparatus for Treating Materials. Charlie E. Mark, Chicago, Ill. (U. S. No. 846,588; Mar. 12, 1907.)

ORE-ROASTING FURNACE. George H. Franklin, Boulder, Colo. (U. S. No. 847,756; Mar. 19, 1907.)

ORE SMELTING FURNACE. Harrison B. Meech, New York, N. Y. (U. S. No. 847,962; Mar. 19, 1907.)

PYROMETER. John F. Hammond, Brewster, N. Y., assignor to S. S. White Dental Manufacturing Co., Philadelphia, Pa. (U. S. No. 846,998; Mar. 12, 1907.)

REVERBERATORY FURNACE—An Improved Reverberatory Furnace for use in Connection with Gaseous Fuel. F. Cotton, Hornsby, New South Wales. (Brit. No. 1770 of 1906; Feb. 23, 1907.)

ROASTING FURNACES—Improvements in Roasting Furnaces. A. Ducco, Turin, Italy. In rotating ore roasting furnaces, means for preventing the access of air when the ore enters. (Brit. No. 5997 of 1906; Feb. 16, 1907.)

ORE DRESSING MACHINERY

CRUSHING—Ore Crushing and Grinding Mill. Augustus L. Engelbach, Denver, Colo. (U. S. No. 845,067; Feb. 26, 1907.)

CRUSHING MORTAR AND SEPARATOR. Hugh R. Logan, Carson, Nev. (U. S. No. 847,016; Mar. 12, 1907.)

CRUSHING ROLLS, IMPROVED. C. C. Lane, Los Angeles, Cal. A crushing machine in which the crushing roll frame is made up of sections and the plane of each crushing roll is adjustable relativeiy to the tread upon which they travel; the improvement consisting in making the sections composing the frame with toothed outer edges so as to form a composite gear wheel, and in distributing the traveling crushing rolls in balanced banks; also on making the rolls to travel over steel rings and embedding their foundations in concrete. (Brit. No. 19,946 of 1906; Feb. 16, 1907.)

CRUSHING ROLLS—Improved Methods of Fixing Hardened Steel Rollers on Rolls for Crushing Ore and Stone. C. H. Darbishire, Penmaenmawe. (Brit. No. 22,078 of 1906; Feb. 23, 1907.)

DISTRIBUTING DEVICE for Ores. Joseph E. Kennedy, New York, N. Y., and Francis J. Hobson, Guanajuato, Mexico. (U. S. No. 846,792; Mar. 12, 1907.)

MILLING—Feeding Device for Ball-Mills. Max F. Abbé, New York, N. Y. (U. S. No. 845,992; Mar. 5, 1907.)

ORE CLASSIFIER and Feeder. Michael Christmann, Leadville, Colo. (U. S. No. 845,395; Feb. 26, 1907.)

ORE-CONCENTRATOR. Alonzo C. Campbell, Asheville, N. C. (U. S. No. 847,236; Mar. 12, 1907.)

ORE-CONCENTRATOR. Michael Christmann, Leadville, Colo. (U. S. No. 845,396; Feb. 26, 1907.)

ORE REDUCTION—Apparatus for Disintegrating Soft Middlings. John M. Case, Louisville, Ky., assignor to J. M. Case Mill Mfg. Co., Louisville, Ky.; a corporation of Kentucky. (U. S. No. 845,851; Mar. 5, 1907.)

PULP SCREEN ROLL. Alfred M. Meincke, Winchester, Mass. (U. S. No. 847,352; Mar. 19, 1907.)

SETTLING-TANK. John M. Callow, Salt Lake City, Utah. (U. S. No. 845,520; Feb. 26, 1907.)

STAMP-MILL STAMP-HEAD. Martin P. Boss, San Francisco, Cal. (U. S. No. 847,397; Mar. 19, 1907.)

INDUSTRIAL CHEMISTRY

ALUMINA MANUFACTURE—Process for Removing Silica from Aluminate of Soda in the Manufacture of Alumina. Compagnie des Produits Chimiques d'Alais, Salindres, France. (Brit. No. 27,290 of 1906; Feb. 23, 1907.)

CALCIUM PEROXIDE—Process of Making Calcium Peroxide. Otto Liebknecht, Frankfort-on-the-Main, Germany, assignor to The Roessler & Hassiacher Chemical Company, New York, N. Y., a Corporation of New York. (U. S. No. 847,670; Mar. 19, 1907.)

CARBON BISULPHITE—Apparatus for Making Bisulphite Liquor. John C. Murray, Bangor, Me., assignor of one-third to George C. Crafts, Bangor, Me., and one-third to George W. Fortier, Orono, Me. (U. S. No. 846,499; Mar. 12, 1907.)

FERTILIZER and Process of Making Same. Carleton Ellis, White Plains, N. Y. (U. S. No. 847,749; Mar. 19, 1907.)

PHOSPHATES—The Manufacture of Mono-Calcium Meta-Phosphate from Tribasic Phosphate of Lime by Roasting with Carbonaceous Matter. M. Walkey, London. (Brit. No. 13,882 of 1906; Feb. 23, 1907.)

PIGMENTS—Apparatus for the Production of Pigments. Clinton P. Townsend, Washington, D. C., assignor to Elmer A. Sperry, Cleveland, Ohio. (U. S. No. 846,526; Mar. 12, 1907.)

PIGMENTS—Process for the Production of Pigments. Clinton P. Townsend, Washington, D. C., assignor to Elmer A. Sperry, Cleveland, Ohio. (U. S. No. 847,032; Mar. 12, 1907.)

SULPHUR—Manufacture of Alumina and Alkali Compounds of Sulphur. Adolf Clemm, Mannheim, Germany. (U. S. No. 845,854; Mar. 5, 1907.)

SULPHURIC ACID—A Concentrator for Sulphuric Acid, in which the Acid, in the Form of a Fine Spray, Meets an Upward Current of Hot Gases. A. Gaillard, Barcelona, Spain. (Brit. No. 12,538 of 1906; Feb. 23, 1907.)

SULPHURIC ACID—Apparatus for Desulphurizing and Agglomerating Pyrites-Cinder, etc. Rowland F. Hill, New York, N. Y., assignor to General Chemical Company, New York, N. Y., a corporation of New York. (U. S. No. 847,410; Mar. 19, 1907.)

SULPHURIC ACID—Purification of Sulphuric Acid. Vero C. Driffield and Frederick W. Wright, Liverpool, England, assignors to United Alkali Co., Limited, Liverpool, England. (U. S. No. 846,288; Mar. 5, 1907.)

Personal

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

T. R. Miller, of Denver, is at present in New York.

James E. Kulyn, of Reno, Nev., has gone to Chicago on mining business.

B. C. Austin is superintendent of the Santa Ysabel mine at Quartz, California.

F. W. Lukins has resigned as general manager of the Illinois Collieries Company.

E. W. Sebben, of Denver, has gone to Utah where he has some examinations to make

Godfrey D. Doveton has returned to Denver from a four months' engagement in Mexico.

Joseph Porter is superintendent of the Bonanza King mine, at Trinity Center, California.

Clarence K. McCornick has been elected president of the Balaklala Copper Company, of California.

We shall be obliged if A. N. Palmer, who recently favored us with a contribution, will communicate his address.

Frank A. Maxwell, United States deputy mine surveyor, of Georgetown, Colo., is in Denver on important business.

R. B. Brinsmade left St. Louis, March 19, for the Southwest, to examine mines in northern New Mexico and Arizona.

C. S. Pierce is now superintendent of the Soulsby mine, at Soulsbyville, Cal., for the Bagdad-Chase Mining Company.

Frank H. Probert has returned to Los Angeles, Cal., from Montana, where he has been making some mine examinations.

A. E. Keables, president of the Security Investment and Mines Company, of Denver, is in the East on important business.

S. F. Shaw is now superintendent of the concentrator for the Granadeña Mining Company, of Santa Barbara, Chihuahua, Mexico.

Francis L. Robbins, formerly president of the Pittsburg Coal Company, will become president of the Illinois Collieries Company on April 1.

William R. Boggs, Jr., manager at Maroma for W.B. A. Dingwall, of Matehuala, San Louis Potosi, Mexico, is in the United States on a short vacation trip.

J. de F. Junkin, Jr., of Coalgate, I. T., general manager of the Coalgate Company, is spending several weeks in New York, on business.

David H. Lawrance, of Denver, has just returned home from a month's trip to Nevada, where he visited some of the principal camps of the State.

John Knox has been appointed underground mining superintendent for the Calumet & Hecla. He is a graduate of the Michigan College of Mines.

George G. Matchett, secretary of the Dominion State Mines Corporation, of Farmville, Va., will be in Philadelphia from April 1 to April 6, inclusive.

Edward J. Porteous, late of Los Angeles, Cal., is now engineer in charge of the Rogue River and Development Company's mines, at Marial, Curry county, Oregon.

E. M. McIlvain, formerly president of the Bethlehem Steel Company, has been elected president and general manager of the Robins Conveying Belt Company, New York.

O. E. Jager has left Humboldt, Ariz., temporarily, taking a three months' engagement with the Garretson-Sahuaripa Company at La Calera, district de Sahuaripa, Sonora, Mexico.

Walter Fitch, of Salt Lake City, Utah, formerly general superintendent of the United States Mining Company, has been appointed superintendent of the mines of the Calumet & Hecla.

Walter F. Lineberger, of the firm of Lineberger & Rone, Torreón, Cohuila, Mexico, spent some time recently, examining properties in the new zinc district at Musquiz, Coahuila, Mexico.

T. H. Drummond, of the Newhouse engineering staff, has been appointed assistant superintendent of the Nipissing mines at Cobalt, Ont. W. H. Linney remains in charge of the mining operations.

Carl Scholz, president of the Rock Island Coal Company, has been going over the Chicago, Rock Island & Pacific lines in the Indian Territory, with officers of the road, arranging to provide for storage of coal for next winter.

John L. Gans, of Uniontown, Pa., has been appointed general manager of the Pittsburg Coal Company, and will have charge of the new proposed extensive coke operations of the company with headquarters at Brownville, Pennsylvania.

Obituary

Nikolas Sokolov, one of the most eminent of Russian geologists, died in St. Petersburg, Feb. 2—15. He was chief of the Geological Committee of Russia and a prominent member of the Imperial Academy of Sciences.

The recent death of E. E. Burlingame, the leading assayer of Denver for more than 30 years, was a shock to his many friends. He had for a long period enjoyed the thorough confidence of the mining community by his skill and accuracy in metallurgical experiments. As far back as 1868 he was territorial assayer.

Henry M. Chamberlayne, superintendent of the Selova mines of the Crescent Coal Company, at Warrior, Ala., was shot and killed in a fight at that place, March 18. His assailant was also killed. Mr. Chamberlayne was 40 years old; he was born in Richmond, Va., but had been in the Birmingham district, engaged in coal mining, for 16 years past.

Spaulding K. Wallace died at his home in Steubenville, O., March 15, from pneumonia. Mr. Wallace was born in Pittsburg in 1845 and removed to Wheeling, W. Va., when a boy, engaging in the iron business in a minor capacity, but advanced rapidly and for some years was president of the Jefferson Iron Works, Steubenville, O. He was a man of high mental endowments and was recognized for many years as one of the leaders in the iron industries of the Ohio valley. He retired from active business several years ago.

Industrial

The Allis-Chalmers Company, Milwaukee, Wis., has opened a new branch office in New Orleans in the Godchaux building.

Zenith furnace at Duluth, Minn., was blown out on the last day of the month, and will be out for a short time in order to make repairs.

The Michaelsen Mineral Concentrator Company, Howe, Neb., has been organized with an authorized capital of $250,000 to manufacture concentraters and mining machinery. The incorporators are L. Coeur, J. W. Mayer and J. T. Cox.

Victor M. Braschi & Co., of the City of Mexico, announce that, to handle their increasing business in the north of the republic in power, electrical, mining and metallurgical machinery, they have opened a branch in Torreon, Coahuila, in charge of Charles F. Parker, as manager.

The Buffalo Copper and Brass Rolling Company, Buffalo, N. Y., has been incorporated with a capital stock of $800,000 by Robert L. Fryer, George A. Ray, Franklin D. Looke, William K. McFarlin, Edwin H. Thomas, Robert S. Cox and Albert E. Jones. A rolling mill for the manufacture of sheet copper will be erected; also a wire mill.

The Columbia Engineering Works, Portland, Oregon, having discontinued the engineering and machine-shop departments and having specialized on the manufacture of steel castings and steel logging blocks and tools, has adopted the more appropriate name of the Columbia Steel Company. It has also enlarged capacity and facilities for making all grades of steel castings.

The Ashland Fire Brick Company, Ashland, Ky., has booked a number of large orders recently, including several open-hearth furnaces for Gary, Ind.; furnace linings for Goshen, Va.; Ashland, Ky.; Columbus, O.; Hanging Rock, O.; Jackson, O.; Big Stone Gap, Va.; Lowmoor, Va.; several stoves for South Chicago,

Hanging Rock, O.; cement kilns for Yankton, S. D., and Hildalgo, Mex., in addition to many smaller orders.

C. Tennant, Sons & Co., a new incorporaton of an existing firm, have acquired the business of James Lee & Co., of New York, dealers in heavy chemicals. The last named firm has been dissolved, after a continuous existence of 82 years. The business will be continued at 76 William street, New York. The officers of the new company are Sir Edward P. Tennant, president; John E. Leech and William A. Tennant, vice-presidents.

J. J. McCabe, 14 Dey street, New York, N. Y., is manufacturing a double-spindle lathe which has met with the approval of many mining companies in the United States and Mexico. The lathe is supplied with a 26-in. and a 48-in. spindle which makes it possible to turn large or small work on the same lathe with little adjustment. It is not claimed that the "2 in 1" will take the place of a regular 48-in. lathe, but in repair shops it is very useful and one machine answers for two except for the heaviest work.

Societies and Technical Schools

Washington State Miners' Association—This association, which comprises mining men and mining interests—capitalists, operators, engineers, prospectors, and miners—of the entire State, was formed in the summer of 1906, with the purpose of drawing outside capital to the mineral resources of the State; exposing wild-cats and stock-jobbers; fighting for the creation of an official State Mining Bureau, and the passage of better mining laws; distributing printed data and reports on mineral resources; and of securing aid for the prospector in need of financial cooperation for the development of meritorious prospects. An official monthly paper has just been started by the association, which will be sent to all Eastern parties desiring it. It will be purely a vehicle of information, the main purpose being a detailed exposition of the copper, gold, galena, antimony, silver, tungsten, iron and other resources of the State.

Worcester Polytechnic Institute—The New York alumni held a dinner in New York, March 15, which was well attended. At the close of the dinner Prof. William H. Bristol, of Stevens Institute, gave a demonstration of his recording pyrometer, tracing the heating and cooling curve of antimony and steel on a chart coated lightly with lamp black and co-ordinately arranged so that the temperatures may be instantly read. An interesting feature was the exhibit of a unique electric furnace, operated on an ordinary electric-lamp circuit. This furnace, small enough to fit in one's pocket and capable of operation on a desk, is constructed of quartz, which permits of rapid heating and cooling without danger of short-circuiting through the flaking away of the crucible, as sometimes occurs when ordinary clay is used. Following this demonstration, Dr. William Campbell, professor of metallurgy at Columbia University, gave an interesting talk on "The Microstructure of Steel," illustrated by lantern slides.

Trade Catalogs

Receipt is acknowledged of the following trade catalogs and circulars:

Hart-Parr Company, Charles City, Iowa. Gasolene Engines. Pp. 40, illustrated, paper, 6x9 in. 1907.

Joseph Dixon Crucible Company, Jersey City, N. J The Horse. Pp. 30; illustrated; paper; 4x8½ in. 1907.

Ohio Brass Company, Mansfield, Ohio. Monthly Bulletin No. 7. Pp. 12; illustrated; paper; 6x9 in.; February, 1907.

Samson Manufacturing Company, Denver, Colo. Catalog No. 2. The Samson Crusher. Pp. 8, illustrated, paper, 6x9 in. 1907.

J. Beardshaw & Son, Ltd., Sheffield, Eng. Notes on High Speed Steel. Pp. 32, illustrated, paper, 3x5 in. January, 1907.

Niles-Bement-Pond Company, 111 Broadway, New York. No. 15. Progress Reporter. Pp. 20, illustrated, paper, 9x12 in. March, 1907.

Automatic Oil Cup Company, 155-159 Huron street, Milwaukee, Wis. Bangs Automatic Oil Cups. Pp. 11, illustrated, paper, 6x9 inches.

American Locomotive Company, New York City. Builders of Locomotives for All Classes of Service. Pp. 76, illustrated, paper, 6x9 in. 1907.

Word Brothers, 60 Castro street, San Francisco, Cal. Word Brothers Drill-Maker and Sharpener. Pp. 20, illustrated, paper, 4½x7 in. 1907.

Lane & Bodley Company, Cincinnati, O. Bulletin No. 101. Four Valve Shaft Governor Engine. Pp. 8, illustrated, paper, 6x9 in. January, 1907.

C. T. Carahan Manufacturing Company, 36th and Wazee streets, Denver, Colo. The Murphy Air Hammer Rock Drill. Pp. 35, illustrated, paper, 5x7½ inches.

Green Fuel Economizer Company, Matteawan, N. Y. Catalog 104. Green's Fans, Blowers and Exhausters. Pp. 96; illustrated; paper; 6x9 in. 1907.

H. W. Johns-Manville Company, 100 William street, New York. Catalog No. 302. "J-M" White-Top Asbestos Roofing. Pp. 70, illustrated, paper, 4½x7 in. 1907.

J. Geo. Leyner Engineering Works Company, Denver, Colo. Bulletin No. 510. Leyner Steam and Electric Geared Hoists. Pp. 56, illustrated, indexed, paper, 6x9 in. 1907.

Allis-Chalmers Company, Milwaukee, Wis. Bulletin No. 1050. Alternating Current Generators, Water-Wheel Type. Pp. 20; illustrated; paper; 8x10½ in.; December, 1906.

Abenaque Machine Works, Westminster Station, Vermont. Abenaque Gas or Gasolene Driven Direct Connected Air Compressor Outfits. Pp. 8, illustrated, paper, 6x9 inches.

Byron Jackson Machine Works, 18 Telegraph avenue, Oakland, Cal. Bulletin No. 21. Jackson High Duty Centrifugal and Turbine Pumps. Pp. 20, illustrated, paper, 6x9 in. 1907.

American Concentrator Company, Joplin, Mo. Bulletin No. 10. N. C. Crushing and Screening Machinery. Pp. 16. Bulletin No. 13. N. C. Coal Washing Machinery. Pp. 24. All illustrated, paper, 7x10 inches.

Risdon Iron Works, San Francisco, Cal. Catalog No. 14. Johnston Concentrator. Pp. 36, illustrated, paper, 7x10 in.; 1905. Catalog No. 17. Gold Dredging Machinery. Pp. 60, illustrated, paper, 7x10 in.; 1907.

Jeffrey Manufacturing Company, Columbus, Ohio. Bulletin "B." Grab Bucket Systems for Power Houses. Pp. 12. Bulletin "C." Coal and Ashes Handling Machinery for Power Plants. Pp. 15. Both illustrated; paper; 6x9 in. 1907.

Allis-Chalmers Company, Milwaukee, Wis., Bulletin No. 1415. Allis-Chalmers Style "D" Gates Rock and Ore Breaker. Pp. 27, illustrated, paper, 8x10½ in.; July, 1906. Bulletin No. 1038. Allis-Chalmers Alternating Current Generators. Pp. 24, illustrated, paper, 8x10½ in.; November, 1906.

Construction News

Orient, Washington—An equipment of machinery is to be installed on the Tenderfoot mine. Wm. O'Brien is superintendent. His address is Orient, Ferry county, Washington.

Valley, Washington—The Copper Boy Consolidated Mining and Milling Company intends to install a concentrating mill with a capacity of 50 tons daily. Address at Valley, Stevens county, Washington.

Blount County, Tennessee—The Altoona Mining Company is preparing to develop coal lands, and will need mining machinery, cars, rails and power plant. T. F. Wood, Steiner Bank building, Nashville, Tenn., is president.

Dunellon, Florida—The Florida Phosphate Mining Corporation, a new company, is preparing to mine land-pebble phosphate and will need machinery. F. S. Royster, Norfolk, Va., is president, and Peter N. Gilchrist, Charlotte, N. C., is chief engineer.

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 Francsico

March 21—Negotiations for a smelter site near San Pedro, Los Angeles county, have been successful. It is now understood that the smelter will be built shortly. The Goldfield mine operators who are interested not only have plenty of ready money to carry the plan through, but they control high-grade silicious ores in quantity sufficient to assure large regular supplies. The plant will at first be of 500 tons daily capacity, but this is to be doubled next year. There will also, it is understood, be a copper refinery. In connection with the smelter a sulphuric-acid plant will be installed, which will entirely obviate danger to vegetation from sulphur fumes. The acid produced will be used chiefly for manufacturing fertilizers. Instead of proving a menace to agriculture, the proposed plant will prove a benefit. The site selected is so situated, however, that smoke damage to tillable lands would be impossible, even without this adjunct.

At Engel Brothers' copper properties in Lights cañon, 12 miles from Taylorsville, Plumas county, a crosscut tunnel is being run into the base of Iron Cap mountain. This tunnel is designed to cut the ledge of the Superior mine. This mine gained considerable fame in the early days, because of its yield of massive bornite ore of high grade. Over $30,000 worth of copper was taken out of a "glory hole" on the surface on the side of the mountain, but the development was not continued on account of the distance to market, a long wagon and railroad haul being necessary to get the ore to the smelters; the transportation and smelting charges were too costly to permit of much profit. Engel Brothers secured the mine and have held on to it for nearly 30 years, earning their own backing to prosecute the development by manufacturing butter firkins for farmers of Honey Lake and Indian valleys. They succeeded in doing several thousand feet of development work, principally tunnels, on their two groups of claims, and have finally opened up a big property. Arrangements are now being perfected to secure Eastern capital to open up the mine on a larger scale, and a company has been formed, with headquarters in San Francisco, to incorporate the mine. The getting of the Engel copper mine on a producing basis will bring the Plumas copper zone to the front. With the completion of the Western Pacific, the prospectors see deliverance from unfavorable circumstances. The copper zone embraces the Indian Valley region, which includes the Ward creek, Lights cañon, Mountain Meadows and Shoofly copper districts and embraces an area of mountainous country, drained by Indian creek, 60 miles long and 15 miles wide.

Salt Lake City

March 23 — The management of the Ohio Copper Company has let a contract to the Minneapolis Steel and Machinery Company, through G. W. Pope, the Salt Lake representative, for the construction of a concentrating mill which will start off with a capacity of 2000 tons per day. The Ohio is controlled by F. Augustus Heinze and associates. The plant is to be ready for commission by the end of the year.

The Bingham Argentine Copper Company, recently organized to operate in Bingham, is preparing for a campaign of development. The corporation owns ground in the vicinity of the Bingham-New Haven and the Utah Consolidated, The officers are: A. T. Wright, of Ogden, president; John Dern, vice-president; L. H. Farnsworth, treasurer; William Iglehart, of Salt Lake, secretary.

Dividends have been declared by several Tintic mines for payment this month. They are: Beck Tunnel Consolidated, $40,000; Grand Central, $15,000; Victoria, $3000.

The Columbus Consolidated Mining Company, operating at Alta, Utah, has posted its second quarterly dividend. The amount is 20c. a share, or $60,000. Payment is to be made April 6.

The first two sections of the Utah Copper Company's new Garfield mill will probably begin on ore next week. This is the first of the concentrating plants at Garfield to go into commission.

The Jennie Gold Mining Company, operating at Gold Springs, Utah, has won in a suit involving title to its property. The case has been pending in the courts for several years and the victory is complete for the mining company.

The management of the Newhouse Mines and Smelters Corporation, operating the Cactus copper mine in Beaver county, has decided to increase its working force by 60 or 70 men. This is in line with the policy outlined some time ago to increase the output of this mine. The mill is handling close to 1000 tons of ore daily.

The consolidation of the Bingham Standard and the Bingham Central mines in Bingham has been arranged. A new holding company, to be known as the Bingham Central Standard Copper Company, is to be formed with a capital stock of $5,000,000, divided into shares of $5 each. Of this, 200,000 shares are to go into the treasury and the remaining 800,000 shares are to be divided equally among the original companies. Shareholders of the Bingham Central are to receive share for share in exchange, while the Bingham Standard shareholders will get one share in the new company for two in the old one. The Bingham Central will settle its own indebtedness of $250,000, while the Standard's indebtedness of $125,000 will be met by the sale of 250 bonds of $500 each. Samuel Newhouse will be president of the new holding company.

On account of the washouts on the San Pedro, Los Angeles & Salt Lake Railroad in southern Nevada the Bamberger Delamer mines at Delamar, Nev., have been closed. The company is unable to get coal to keep its power plant in operation.

Butte parties have closed a deal for the purchase of the properties of the Bingham Copper Hill and the Midland Mining Company in the camp of Bingham, and a new corporation, to be known as the Bingham-Butte Copper Company, will be organized. The two groups comprise about 250 acres, there being 14 patented claims. The new owners will undertake the development of the ground without delay.

A special meeting of shareholders of the Silver King Mining Company has been called for April 10, at which time a proposition to effect a consolidation with the Keith-Kearns Company will come up for consideration. Both corporations are operating at Park City, and it is proposed to organize the Silver King Amalgamated Mines Company, with 1,250,000 shares of the par value of $5 each. The 150,000 shares of the original Silver King Company will go into the new company on the basis of $25 each. The Keith-Kearns Company will be allotted 1,500,000 shares of the capital stock, which is on the basis of $7.50 a share for the original stock. To meet the deferred payments on the McGregor properties acquired by the Silver King some time ago, as a means of settling litigation, 100,000 shares of the new stock are to be sold at par. The Addenda group of claims owned by former Senator Thomas Kearns, according to the proposed plans, will be turned into the combination in consideration of the issue of 15,000 shares. With the distribution of stock completed, there would be left in the treasury 61,000 shares. The com-

bined properties would cover 1165 acres.

The Utah Copper Company has filed an amendment to its articles of incorporation raising the capital stock from $6,000,000 to $6,600,000.

Denver

March 22—Judge Lewis, of the United States District Court at Pueblo, has refused the Carnegie Steel Company permission to amend its complaint in the famous suit against the Colorado Fuel and Iron Company for infringement on the so called Jones mixer patent.

It is reported from reliable sources that Jacob B. McKennan, who has for some time past been general manager of the Minnequa steel plant, may be the late Frank J. Hearne's successor as president of the Colorado Fuel and Iron Company. Mr. McKennan had large experience in Illinois, before being appointed to his present position.

At a depth of about 750 ft., a large deposit of coal has been discovered only nine miles northwest of Denver. It is probably an extension of the coal measures at Leyden, where the deposit was thick at 680 ft. depth.

The entire force of the Denver mint is employed at present with the coinage of 6,200,000 half-dollar pieces for Mexico; the dollar pieces are coined at New Orleans.

In the Southwestern part of the State several snowslides have lately done more or less damage. A couple of days ago, near Ophir, on the Rio Grande Southern, two loaded freight cars of a train, coming down the mountain, were struck by an avalanche and carried down a steep gulch. The balance of the train remained in the track.

The labor situation at Goldfield, Nevada, has during the past week become so serious that C. E. Mahoney, acting president of the Western Federation of Miners, has left Denver to take personal charge of the interests of the Federation at that point.

After being idle for several months the plant of the Western Iron Mills, Denver, will start up again; a reorganization of the company owning the same has been effected under the management of M. T. Whitehead, formerly connected with the Carnegie works, and F. S. Rutherford, formerly with the Youngstown Steel and Tool Company. The Western Iron and Steel Company has been organized for the purpose of leasing the plant. About 100 men will be employed and the capacity will be about 200 tons a day.

One of the largest orders ever placed in Denver for metallurgical machinery was booked by the Colorado Iron Works for a corporation in New Zealand, within the past few days. It is a contract for a 200-ton copper-smelting plant and the estimated cost will be about $125,000. It will take about five months to manufacture the machinery.

After a long argument on the motion for a change of venue in Moyer-Haywood case in Boise, Idaho, the case was concluded yesterday and Judge Wood announced that he would render his decision on March 25 next.

Scranton

March 26—The 32 collieries of the Philadelphia & Reading Coal and Iron Company were closed during the past week, for the purpose of restricting the output.

Three hundred employees of No. 8 colliery of the Lehigh Coal and Navigation Company, in Panther creek, went on strike on Saturday. The reason assigned was that the company refused to discharge a non-union man.

The Coaldale co-operative store, established under the direction of John Mitchell by the United Mine Workers, has proved to be a money maker. It has more than 500 regular customers, and sells the goods cheaper than the competing merchants, yet has declared dividends averaging 12 per cent. since the store was opened.

While strenuous efforts are being made by the bituminous operators to defeat the bill in the State legislature for a tax of 3c. on anthracite coal and 2c. on bituminous coal, the anthracite operators are diffident, stating that if the tax is imposed it will simply result in the price of coal being raised.

Because the Kingston Coal Company installed some labor-saving machinery at its No. 2 breaker at Plymouth, there are 3500 miners and laborers on strike. About 1500 men employed at No. 2 colliery first left work, and since then the men employed at the other two collieries went out on a sympathy strike.

For the first time since 1902 the Lehigh Coal and Navigation Company is storing marketable sizes of coal at its yards at Hauto, along the Tamaqua branch of the Central Railroad of New Jersey. The reasons given are a poor market and scarcity of cars.

In the Schuylkill-Dauphin district, according to the mine inspector's report, one life was lost for every million tons of coal mined. The production was 2,205,192 tons, while the fatalities were 16 and the non-fatal accidents were 60 in number.

Representative Dempsey, of Lackawanna county, has introduced a bill in the State legislature, providing damages for death of men employed in the coal mines. The basis of compensation is the number of children who may be solely dependent upon the workman at the time of his death from injuries, and it fixes the amount at from $750 to not more than $1500. This will apply in the event that a brother is the sole support of the family.

Representative Garner has introduced a bill to increase the number of mine inspectors from 20 to 30. They are to be divided as follows: First district, 9; Second district, 7; Third district, 1; Fourth district, 7; Fifth district, 4; Sixth and Seventh, 1 each.

Complaining that the company was violating the award of the anthracite commission by compelling them to do extra work without actual compensation, 100 miners went on strike at the No. 6 colliery Lansford, of the Lehigh Coal and Navigation Company.

London

March 19—Tin interests everybody, and in addition to new developments in Cornwall and the East, attention is being paid to some of the Spanish deposits. A group named the Sultana, situated in the Province of Orense, have been acquired by a syndicate of London, Paris and Manchester men and floated as the Arnoya Mining Company Ltd. According to Mr. Wickersheimer, a French Government engineer, the lodes are extensive, and considerable work has been done on them already. The tin occurs as oxide, in conjunction with arsenical pyrites, but it is stated that the amount of arsenic is relatively small. The estimates of the extent and richness of the orebodies are somewhat general in character. One lode is said to contain 300,000 tons averaging 5 per cent. of tin oxide, which in itself should yield a fortune to somebody. It is stated also that the coarse granite and quartz forming the vein matter are very friable, and can be mined without explosives. I can only say that I hope the sanguine expectations of the directors will be realized.

The Oroville Dredging Company, Ltd., is a corporation formed under the laws of Maine, but the shares are largely held here, the company having been floated under the auspices of the Venture Corporation in 1905. The company was a consolidation of four local dredging companies working on the Feather river near Sacramento. The capital is $3,500,000. The shares were all issued as fully paid, and have stood steadily at or about par, $5. So far five dividends at the rate of 2½ per cent. have been paid, and a sixth will be distributed next month. Complete reports are given by Mr. Hammon relatively to the work done and profits earned, but as these are considerably behindhand in publication, they are not of much current interest. I may note, however, that the total cost of working per cubic yard is 6.21c. and the returns 14.75c., leaving a profit of 8.54c. per cubic yard. During the year ended June 30, 1906, the ground dredged was nearly 5,000,000 cu.yd. or nearly 100 acres, to a depth of 30 ft.

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

Arizona

GILA COUNTY

Dripping Springs Mines and Smelters—This new company is capitalized for $5,000,000, comprising 500,000 shares of the par value of $10 each, and its officers are: C. E. Finney, president; F. L. Wright, vice-president; E. W. Brooks, treasurer; Robert K. Porter, secretary and assistant treasurer; R. D. O. Johnson, manager of mines. The above, with Judge R. E. Sloan and Paul Burks, constitute the board of directors.

The properties of the company are located in the Banner mining district, about 25 miles south of Globe, 10 miles from Kelvin, and adjoining the mines and smelters of the Saddle Mountain Mining Company. The nearest railroad station and post-office now is Winkelman, about 7½ miles distant. The property is 3 miles from the railroad and the Gila river. The smelter site is about 2½ miles from the mines. The country is open and lends itself to the installation of a wire tramway from the mines to the smelter. The smelter site is located close to the railroad and the Gila river, affording transportation and water for smelting operations. The company controls what has been known as the O'Carrol property, consisting of 60 claims, with a total area of 1200 acres, and has located 300 acres of Government land on the railroad and the Gila river, to be used for the smelter site. Such invesigations as have been made indicate the existence of a large body of ore, running from 2 to 10 per cent. copper. The ore carries enough silica, lime and iron to make it self-fluxing and can, it is believed, be so mined as to send to the smelter a product averaging 5 per cent. copper. The property has been divided into five sections, or units, and the company is now doing preliminary work necessary to the running of two tunnels on the orebodies in the western unit. Each tunnel is to be about 2000 ft. in length with a shaft to a depth of 600 ft. About $30,000 will be expended on mine equipment, such as compressor and drill plants, hoists, etc., so the work of opening up and blocking out ore will progress as rapidly as possible. The machinery plants will be enlarged as work progresses. A wire tram is projected from the mines to the smelter, to be installed while the smelting plant is under construction. A modern smelting plant of 500 tons daily capacity is also projected, to be built as soon as ores have been blocked out in quantities sufficient to provide 500 tons of ore daily for a period of one year or more. The smelting plant will be planned for 1000 tons daily capacity, so that an extension can be made to take care of this tonnage of ore as soon as it is blocked out.

Arkansas

BOONE COUNTY

Arkansas Zinc and Lead Company—This company has been organized, to operate the old Denison mine and mill, near Harrison.

California

NEVADA COUNTY

Walcott—This gravel claim, near Nevada City, has been sold at sheriff's sale to Albert Matteson.

English Mountain—This mine, between Graniteville and Meadow lake, formerly a producer, is to be re-opened under new management.

Rogue Copper Mines—Thos. A. Varden has started men at work on these mines, near Spenceville, under superintendence of M. Dougherty. The 1800-ft. tunnel is to be extended.

Norambagua—This mine, at Grass Valley, has been sold by G. H. Root and Geo. Campbell to Philip Knapp, representing Pittsburg men.

PLUMAS COUNTY

Nevada Development Company—This company is about to conduct extensive operations on the Minerva Bar and Horse Shoe Bend placers on the middle fork of Feather river, below Nelson Point. A. M. Tong is superintendent. The company is composed of Arizona men.

SHASTA COUNTY

Brunswick—The new 10-stamp mill of this mine, near French gulch, has been started up. The mine is owned by W. D. Lacy, of New York, who will employ 40 men. Electrical power is used.

Washington—On Webb ledge on this property at French gulch high-grade ore has been struck. The mine is now owned by E. E. Egley and A. S. Mitchel.

White Oak—This mine, in Lower Springs district, has been sold to F. H. Griffith, representing an English company.

SISKIYOU COUNTY

Oregon Water Power and Mining Company—This company, whose property is near Happy Camp, intends putting in a higher ditch, as the present system of ditches is too low to cover much of the available ground.

TRINITY COUNTY

La Grange—This company has bonded the Hammer property on South fork of Trinity river. It is a hydraulic proposition.

Bonanza King—The mill has been reopened and will start up at once on this mine at Trinity Center. Jos. Porter, superintendent.

TUOLUMNE COUNTY

App—A very rich strike has been made in this well-known property, over $25,000 having been taken out in two days. The mine is owned by W. A. Nevills.

Bagdad-Chase Mining Company—This company is re-opening the old Soulsby mine, at Soulsbyville, with C. S. Pierce in charge.

Santa Ysabel—This company is re-opening the mine of the same name at Quartz, with B. C. Austin as superintendent.

Lyon Gold—This company is working the Ida Klein mine at Stent, with J. N. Lynn as superintendent.

Colorado

LAKE COUNTY—LEADVILLE

Buckeye—In this mine, Fryer hill, the lessees are upraising in the body of iron to catch the carbonate shoot that is supposed to lie on top of the iron, and also driving the north drift ahead. The Deer Lodge, east of the Buckeye, has resumed work and the shaft will be sunk deeper.

Bug Gold—Another car was recently shipped to Denver from the mass of low-grade material in this property, English gulch, to determine the advisability of erecting a mill. The returns give $20 per ton; another car will be shipped soon, and if the values are near the first, the company will erect a mill in the spring. The property is owned by Milwaukee people.

Cleveland—A tunnel is being driven on this claim, California gulch, to open a known body of zinc; a few days ago a body of copper ore was unexpectedly opened; the tunnel will be driven to the zinc shoot and when that is cut the copper channel will be prospected.

Eclipse—This claim, Empire gulch, cuts into the Arizona placer, and from time to time some work has been done on it without results. A few months ago Pres-

ton Rawson and associates secured a lease on the ground and started a new shaft; after going down 38 ft. a body of ore 6 ft. thick and 14 ft. high, was opened, which netted $20 per ton. The gangue matter is a carbonate of lime which is a desirable smelting product. On account of the condition of the roads it is impossible to ship the ore. The sudden death of Rawson last week has temporarily closed the property.

Garbut—This property, Breece hill, has resumed operations. The shaft is down 700 ft., and in the lower levels there is a good body of copper sulphides.

Helen Gould—In this group, East Tennessee park district, the late strike gives numerous fine samples. No ore will be shipped until the spring on account of depth of the snow.

Hopkins Tunnel—Shanahan and partners are driving a tunnel on Mount Sheridan, located above timber line, and have opened a 3-ft. vein of galena. On account of the state of the roads the ore is being stacked on the dump until spring opens. Mt. Sheridan is the dividing line between Lake and Park counties. The ore was caught on the Lake county side.

Little Evelyn—This company has secured 63 acres of ground in South Evans gulch, including the Boulder shaft, and is under the management of Timothy Kyle. A new plant of machinery is being installed.

Lord Byron—On this property, Iowa gulch, operated by the Foxy Grandpa Mining Company, a new shaft was started and after going down 30 ft. a body of mineral was encountered carrying silver, zinc and copper. The peculiar part of the strike is the copper, as this mineral has never been found before in the section in paying quantities.

Moyer—This mine, property of the Iron Silver Mining Company, Iron hill, is producing 9000 tons per month of lead, copper and zinc sulphides. From development work on the Tucson, the extension of the Moyer shoot, 50 tons daily are being shipped from drifts and upraises.

Umatilla—This company owns a group of five claims adjoining the Continental Chief, at the head of Iowa gulch, and during the week a meeting of the stockholders was held in Leadville to plan for the resumption of work.

Weston Pass—The southern extremity of the Leadville formation has been overlooked during the past few years, but work is likely to be resumed this spring. The Ruby, the largest developed claim in the section, was last worked by John Walsh, in 1898, when he took out 1500 tons of an excellent grade of galena ore. During the following winter the heavy snows demolished the buildings, and when the snow melted the incline shaft was filled with water; Walsh's associates did not care to go to the expense of rebuilding and taking the water out, and it has remained idle. F. J. McNair has secured an option on the ground and will commence work when the snow disappears.

TELLER COUNTY—CRIPPLE CREEK

Cripple Creek Drainage and Tunnel Company—This is the name of the corporation formed to build the new drainage tunnel. The directors are all mine owners, with E. D. Marr, of Colorado Springs, as secretary. The company is now asking for bids to build 15,000 ft. of tunnel, from the portal to a point near El Paso mine. This will lower the water-level about 750 ft. in the district. An extension of 11,000 ft. to the Vindicator mine, is also proposed.

Georgia

DADE COUNTY

New England Company—This company, owning iron lands in Dade county, has been placed in the hands of a receiver on the suit of holders of $80,000 of its bonds. The company was organized in 1890 and has done no work for several years past.

Indian Territory

CHOCTAW NATION

McAlester Coal and Mining Company—This company, after keeping its mine No. 6 closed for 30 days, on account of a fire, opened the shaft recently. The mine was found to be still on fire, and it was necessary to close the shaft again.

Michigan

KEWEENAW COUNTY—COPPER

Miskwabik—The sale of the Miskwabik property, in Keweenaw county to the Cole-Ryan interests has just been completed. Included in the transfer is an option on 200 acres, adjoining the original property, held by A. A. Guck, Charles Smith, Joseph Busch and others. The shareholders of Miskwabik stock will receive $1.27 per share when the final payments are made April 15. The Kearsarge lode has been found on the property and considerable exploration has been done.

Montana

MISSOULA COUNTY

Monitor—Work has been carried on at this mine, near Saltese, all winter, and development has been considerably extended. Recently a body of copper-gold ore was encountered on the 380-ft. level, the extent of which has not yet been determined. At present the ore has to be hauled five miles to the railroad. A tunnel is to be run in 2000 ft. to tap the orebody.

Nevada

ESMERALDA COUNTY—GOLDFIELD

Red King—Bonanza ore has been cut by the Little Florence Mining Company. The find was made at a point about 600 ft. south of the boundary of the Florence mine in an area known as the Milltown section. Several carloads of ore have been sacked for shipment and some very rich specimens are being obtained. There are a large number of claims in course of development in the vicinity of the Red King and new strikes may be reported at any minute.

St. Ives—The St. Ives leasing company has picked up a new ore-shoot in a drift from the 100-ft. level which assays upward of $1150 per ton. Rich specimen ore is being sacked in three separate portions of the workings.

Combination-Fraction—The Moreton & Beesley Leasing Company has raised 200 tons of high-garde ore for shipment. A new hoist has been installed and a spur to the railroad has been built to facilitate shipment of the ore to the Salt Lake smelters. Regular shipments will be commenced in a few days. A large body of shipping ore has been developed in the mine.

Mohawk-Consolidated—A new strike of great value has been made in No. 1 claim, which lies N.N.W. of the rich ground from which Hayes & Monnette obtained such great wealth recently. The orebody has been penetrated 12 ft. without striking the hanging wall.

NYE COUNTY—TONOPAH

Ore Shipments—Shipments of ore over the Tonopah Railroad from Tonopah for the week ending March 14 were: Tonopah Company, 1225 tons; Belmont, 465; Tonopah Extension, 305; Midway, 70; Montana Tonopah, 175; total, 2240 tons. Additional shipments from Goldfield were 112 tons, making a total of 2352 tons.

West End Consolidated—The new shaft has been sunk to a depth of 40 feet and will be continued with all speed. Owing to the difficulty in securing cars little ore is going forward at present, but the usual quantity of shipping ore is being raised weekly and stored at the surface. Development work is confined to the drift from the 400-ft. level, which is opening up a large orebody of milling grade.

Midway—High-grade ore is being extracted from the 433-ft. level, where the vein averages 10 ft. in width. Operations continue to be hampered by bad railroad facilities and lack of fuel supplies.

Monarch-Pittsburg—The shaft has reached a depth of 750 ft. and will be continued to 1000 ft. before crosscutting is undertaken. The Red Rock Extension Company action, which was commenced against this company in the local court recently, involves a fraction of one of the claims.

Copper Mining—The copper deposits in the vicinity of Sodaville and Mina are at present attracting a considerable amount of attention locally. In the Pilot range, east of Sodaville, the Dunlap mine is being developed by the Brock syndicate, of Philadelphia, and the Stewart property, only a short distance from it, was recently sold to New York capitalists.

West of Mina the Blue Light is rapidly developing, the orebody being 40 ft. wide.

There is news of a copper strike near Acme, a station on the Carson & Colorado Railroad, between Luning and Thorne, and several hundred prospectors have already left to secure locations. The new discovery is in a section of the Walker Lake Reservation, which has attracted a large proportion of the prospectors who entered the territory when it was thrown open last fall.

Pennsylvania

Anthracite Coal

Delaware & Hudson—This company owns and operates its property in the anthracite coal region directly, without the intervention of a subsidiary company. The statement of the coal department for the year 1906 is as follows:

	Total.	Per Ton.
Coal sales	$18,571,342	$3.45
Interest, etc	1,047,864	0.20
Total receipts	$19,619,206	$3.65
Mining and preparing coal	$11,422,316	$2.12
Transportation	5,636,557	1.05
Handling & general expenses	462,971	0.09
Total expenses	$17,521,844	$3.26
Net earnings	$ 2,097,362	$0.39

The averages are computed on the tons sold. The coal sales are made up as follows: At mines, $160,816; to railroad department, $1,178,823; general sales, $16,795,674; coal added to stock, $436,029. Included in mining and preparing coal is $558,821 for coal purchased from tenants and others.

The coal statement for the year is as follows, in long tons:

	1905.	1906.	Changes.
Coal on hand, Jan. 1.	203,176	113,061	D. 90,115
Coal mined	5,695,493	5,401,389	D. 294,104
Total	5,898,669	5,514,450	D. 384,219
Coal sold	5,785,608	5,377,586	D. 408,022
On hand, Dec. 31.	113,061	136,864	I. 23,803

The total coal of all kinds carried on the company's railroads last year was 8,690,000 tons. The account of the estimated coal reserves is as follows: Owned and controlled at beginning of year, 213,168,843 tons; acquired during the year, 34,510; total, 213,203,353; mined during the year, 5,401,389; reserves at close of year, 207,801,964 tons.

Expenditures on improvements in the coal department were $608,810, of which a total of $280,280 was for new breakers and washeries.

Lehigh Valley Coal Company—This company has awarded a contract to Daniel Levan, of Wilkes-Barre, for a new breaker at Jeansville. It has been popularly supposed that all the coal has been worked out of the Jeansville basin, but this company is evidently of opinion that there is sufficient left to justify a large expenditure. This company will also open a large coal operation at Newtown. It owns four miles of the basin from the Swatara tract, near Tremont, eastward to the Star branch, near Branchdale. It is considered one of the best coal properties in the Pottsville basin. The company has already had a trial slope sunk on an overlying red-ash vein at Feger Ridge, about one mile west of Branchdale. This slope penetrated a depth of about 1500 ft., presumably to the basin. It developed a rich seam of coal and by trial made of other seams of coal it is expected that the other measures will prove equally rich. A line for a railroad has been surveyed from the Lehigh Valley, a distance of about two miles. A modern breaker will be built and 40 blocks of houses built. This company will build a washery with a capacity of 500 tons at the Prospect colliery. This culm dump is one of the oldest and largest in the Wyoming valley.

McTurk Coal Company—This company has awarded a contract to George M. Christ, of Ashland, for a new breaker at Girardville, at a cost of $75,000. It will have a capacity of 1000 tons a day and more than 50,000 ft. of lumber will be used in construction. The breaker was designed by Architect Cool, of Scranton, and the machinery will clean all the coal classified separately, the cube coal going through one process and the flat coal going through another. The arrangement of the machinery will save a great deal of labor.

Coke

H. C. Frick Coke Company—This company has planned the erection of four large coke plants during the present year. At York Run the Collier plant is projected with 400 ovens. At Prospect, on the Monongahela Railroad, another plant of 250 ovens will be constructed. The Phillips plant, at Thaw, on the Pennsylvania Railroad, will have 400 ovens instead of 250 as at first planned. At Roncoe, where coal has been mined for some time, 350 ovens will be erected. The company has purchased the surface of the J. Seaton Collier farm of 100 acres in Georges township, Fayette county, and will build the Collier plant, with 500 ovens and 250 houses. The reported price paid for the farm was $100 an acre. The company owned the coal under the land. The company will this summer change many of the oven fronts at its various plants for the purpose of installing coke-drawing machinery. The labor situation has been so acute for several months that the company has decided that the best way to provide against it is to use the patent coke drawer. Large orders for brick and material to change the oven fronts have been placed.

South Dakota

Custer County

Saginaw—This company has been reorganized with I. N. Herber as the new manager. Sufficient capital has been secured to erect a mill. The mine is well developed showing strong gold-bearing veins at 400 ft. depth.

Black Hills Porcelain, Clay, and Marble Company—This company is now patenting its two groups of claims, lying east and west of Custer. This includes the ground upon which valuable deposits of lithograph stone have been found, and also mica deposits.

Lawrence County

Globe—This company has purchased 52 acres of ground adjoining its property. The phonolite vein, one of the company's chief assets, runs through this new ground. A force of men is at work installing machinery as fast as it arrives.

Homestake—A despatch from Deadwood, dated March 26, states that for 24 hours the Homestake mine has been on fire near the 500-ft. level and so far no appreciable gain has been made. In a few hours 200 men were carried out of the mine unconscious, overcome by gas and smoke.

It is impossible to determine the extent of the fire, as at no time have the men got near enough even to tell its exact location. It is feared that it may get into the bulkhead on the 500-ft. level, where there is an immense amount of timber, which would carry the flames to other levels.

Utah

Iron County

Reuben Gold Mines—This company has been formed by a Salt Lake syndicate to develop the Reuben group of five claims. A shaft has been sunk 50 ft. A recent sampling gave returns of better than $30 to the ton. Only the foot-wall is exposed and the width of the orebody has not been determined. Will J. Dooly, of Salt Lake, is president.

Ophir—This property, which is owned by Michigan people, is likely to become active again.

Burro—Leasers are endeavoring to get hold of this property, which was the first mine from which ore was shipped from the Stateline district.

Uvada—An orebody has been encountered in this property which, it is said, bears every evidence of being as important as those opened in the Jenny mine not long ago.

Juab County

Utah Mine—This Fish Springs property is reported to be in excellent physical

condition and is a regular shipper of silver-lead ore.

Carisa Gold and Copper—A new orebody has been opened on the 300 level, the management reporting values running from 9 to 15 per cent copper.

Uncle Sam Consolidated—Ore running from 30 to 40 oz. in silver and 40 per cent. lead has been encountered on the 800-ft. level. There are 4 or 5 ft. of second-class ore showing on this level.

SALT LAKE COUNTY

Utah Apex—This Bingham company is installing a larger hoist at the top of the incline shaft with the view of exploring the ore deposits at greater depth. The Parvenue tunnel adit is in about 2500 ft. and the exploitation of the Leonard fissure, recently cut by this adit, is giving encouraging results.

Phoenix—The lower tunnel adit in this Bingham mine has been completed to 2000 ft., with the face showing strong mineralization. It is expected that an orebody will be encountered within the next 50 ft., when a raise will be made to connect with the upper tunnel. The company contemplates the erection of a new mill this year. Andrew Gebhardt, of Salt Lake, is president of the company.

Tintic Mining and Development—This company has revived the matter of installing an aërial tramway system. The management has experienced so much annoyance during the past year on account of poor ore deliveries to the smelter over the Copper Belt railroad, that it has decided to install its own facilities for transportation.

Virginia

ALLEGHANY COUNTY

Church Quarry and Mining Company—This company has been organized to acquire and develop a large limestone property near Clifton Forge. It is proposed to quarry limestone for flux; also a crushing plant to furnish road metal and ballast, and kilns for making lime. E. W. Church, of Norfolk, Va., is president.

Wisconsin

ZINC-LEAD DISTRICT

Gritty Six Mining Company—The financial difficulties of this company, at Cuba City, have been straightened out. The recent fire which destroyed the entire plant, excepting the roaster and separator-plant building, which is of iron, increased the difficulty somewhat. At a stockholders' meeting, held March 20, an option was given to parties who agree to take in all the old stockholders on a pro-rata basis; an amount of money is to be paid in which will satisfy all creditors. This plan should be satisfactory to all, as it will give all stockholders, who are widely scattered, and who expressed a willingness at a previous meeting to come in on a reorganization, an opportunity to pay in on or before April 9, next. The capitalization is to be cut down and it is proposed to erect a new concentrating plant at the earliest possible moment. A thorough examination of the Gritty Six just previous to the fire showed good development.

West Virginia

RALEIGH COUNTY

Pemberton Colliery Company—This company has been organized to develop a tract of 1800 acres of coal lands in the Shady Springs district. J. E. Summerfield and A. A. Lilly, of Beckley, W. Va., are among the incorporators.

Wyoming

CARBON COUNTY

Penn-Wyoming Copper Company—This company owns the Ferris-Haggerty mine, at Encampment, and was formerly a producer of blister copper. Early in 1906 its smelting works were destroyed by fire and the company made no production in 1906. The works are being rebuilt and it is expected that they will soon be ready for operation again. The present company is the successor of the North American Copper Company, which went into the hands of a receiver.

Canada

ONTARIO—COBALT DISTRICT

March 25—The official statement of ore shipments from Cobalt over the Timiskaming & Northern Ontario Railway for the week ending March 16 is as follows: Buffalo, 101,400 lb.; Nipissing, 319,230; O'Brien, 64,170; Red Rock, 40,000; total, 524,800 pounds.

Buffalo—Three shafts are being worked day and night and development work steadily carried on. No. 6, the main shaft, down 135 ft., has been connected by drifting at the 85-ft. level with shaft No. 5, 360 ft. distant. The latter shaft is put down on two veins which are both yielding well, the wall rock being richer than the ore, being shot with native silver in leaf form. Drifting in several directions from shaft 5 is being done. No. 4 shaft is down 60 ft., silver values at the bottom being high. Machinery for melting metallics and reducing to bullion, which will melt 600 lb. per day, is on the ground ready for installation.

Cobalt Concentrators, Ltd.—A contract has been closed for machinery for the concentration plant, to be erected at some central point in the Cobalt area. The cost of the machinery, which is to operate on the dry process, will be $35,000, and it is claimed that over 90 per cent. of the silver values in low-grade ores can be recovered and a larger percentage of the cobalt.

Temagami Silver—On this company's silver property at Cross lake, in the Temagami forest reserve, development work has been in progress several months. Machinery is being forwarded, comprising a 60-h.p. boiler, six-drill compressor, hoist, and drills. These are being teamed over the ice to the mine.

McKinley-Darragh-Savage—Beginning with June the disbursements will be changed from monthly to quarterly dividends. No dividend will be paid April 1 for that reason. The new machinery is being installed at the property on the lake, the old machinery being removed to the Savage lot.

ONTARIO—EAGLE LAKE AREA

Golden Park—This company is developing a property near the Redeemer mine, Alexander McPhail being in charge of operations. There is a vein of highly mineralized quartz which shows some free gold and is impregnated with copper pyrites.

Africa

CONGO FREE STATE

Despatches from Brussels, Belgium, report that the International Forestry Company, in which American capital is interested, is organizing an expedition to prospect the goldfields believed to exist in the Congo Free State. R. D. Mohun, formerly American consul at Boma, is to have charge.

RHODESIA

Gold production reported in February was 40,482 oz. bullion, being 6566 oz. less than in January, but 2107 oz. more than in February, 1907. For the two months ending Feb. 28, the total was 81,728 oz. bullion in 1906, and 87,530 oz. in 1907; an increase of 5802 oz. The bullion reported this year was equal to 77,902 oz. fine gold, or $1,610,234 in value.

Other production reported this year was 107 tons lead, an increase of 32 tons; 17 tons copper; 1 ton wolframite; 50 tons antimony ore; 1141 tons chrome ore; 17,441 tons coal, a decrease of 3934 tons.

TRANSVAAL

The gold production in February was 493,542 oz. fine, being 44,096 oz. less than in January, but 85,874 oz. more than in February, 1906. For the two months ending Feb. 28, the total was 836,306 oz. in 1906, and 1,031,180 oz. in 1907; an increase of 194,874 oz. Of the total this year 995,874 oz. were from the Witwatersrand, and 35,306 oz. from the outside districts.

WEST AFRICA

Gold production in February was 22,448 oz. For the two months ending Feb. 28, the gold output was 35,854 oz. in 1906, and 47,747 oz. in 1907; an increase of 11,893 oz. this year.

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, March 27—The coal trade in the West has been chiefly moved by the discussion of the railroad-rate question. The agitation started by the Indiana operators, aided by the State Railroad Commission, has resulted in the withdrawal of the order for a 10c. increase on Indiana coal to Chicago. Other questions are still unsettled, including the season rate on coal for shipment up the lakes. With the coming of spring, the railroad transportation conditions are improving, though many complaints are still heard of short supply of cars, and slow movement of coal.

In the East the usual season conditions prevail. The contracting season in the seaboard bituminous trade is on, and is chiefly affected by the advanced railroad rates. The anthracite companies have made the usual 50c. discount on spring trade, to take effect on April 1. The demand for steam coal continues good throughout the Eastern territory.

COAL-TRAFFIC NOTES

Shipments of coal and coke originating on the Pennsylvania Railroad Company's lines east of Pittsburg for the year to March 16 were as follows, in short tons:

	1906.	1907.	Changes.
Anthracite	1,078,692	1,076,228	D. 2,464
Bituminous	7,903,748	7,624,212	D. 279,536
Coke	2,650,697	2,837,412	I. 186,715
Total	11,633,137	11,537,852	D. 95,285

The total decrease shown this year is 0.8 per cent.

The coal and coke tonnage of the Baltimore & Ohio Railroad in January was as follows, in short tons:

	1906.	1907.	Changes.
Anthracite	98,488	108,636	I. 10,148
Bituminous	2,244,691	2,210,206	D. 34,485
Coke	533 953	497,967	D. 35 986
Total	2,877,132	2,816,809	D. 60,323

The total decrease this year was 2.1 per cent.

Coal and coke tonnage of the Norfolk & Western Railway in January was as follows, in short tons:

	Coal.	Coke.	Total.
To Line points	789,686	200,122	989,808
To Tidewater	137,343	13,618	150,961
Total	927,029	213,740	1,140,769
Total, 1906	960,835	220,654	1,181,489

This shows a total decrease of 40,720 tons, or 3.4 per cent., this year.

The Southwestern Interstate Coal Operators' Association gives out the following statement of coal production in January, in short tons:

	1906.	1907.	Changes.
Missouri	349,118	316,925	D. 32,193
Kansas	617,813	567,440	D. 50,373
Arkansas	191,682	216,296	I. 24,614
Indian Territory	315,325	276,875	D. 38,450
Total	1,473,938	1,377,536	D. 96,402

The total decrease was 6.5 per cent. this year.

Shipments of coal over the railroads in the Ohio Coal Traffic Association in January were, in short tons:

	1906.	1907.
Hocking Valley	354,908	348,583
Toledo & Ohio Central	149,584	161,409
Baltimore & Ohio	153,550	183,856
Wheeling & Lake Erie	290,976	307,745
Cleveland, Lorain & Wheeling	243,616	226,483
Zanesville & Western	106,331	123,088
Toledo Division, Penna. Co.	260,662	260,071
Lake Erie, Alliance & Wh'ling.	109,691	108,606
Marietta, Col. & Cleve	.....	1,485
Total, net tons	1 669 318	1,721,326

The total increase this year was 52,008 tons, or 3.1 per cent.

Coal receipts at St. Louis in January were 739,456 short tons in 1906, and 786,280 in 1907; an increase of 46,824 tons, or 6.3 per cent.

Receipts and shipments of coal at Chicago in January are reported as follows, the balance representing approximately the city consumption:

	Received.	Shipm'ts.	Balance.
Anthracite	145,200	88,046	57,154
Bituminous	1,556,118	618,719	937,399
Coke	28,974	27,669	1,305
Total	1,730,292	734 434	995 858
Total, 1906	1,197,626	412.782	784,844

The receipts of bituminous coal this year were from Pennsylvania, 108,648; Ohio, 94,808; West Virginia, 80,925; Indiana, 344,091; Illinois, 927,646 tons.

Coastwise shipments of coal from the principal Atlantic ports in January were as follows:

	Anthracite.	Bituminous.	Total.
New York	1,418,151	1,015,766	2,433,917
Philadelphia	187 506	384,359	571,865
Baltimore	21,251	298,551	319,802
Newport News	.....	145,285	145,285
Norfolk	.....	99,341	99,341
Total	1,626,908	1,943,302	3,570,210
Total, 1906	1,321,061	1,938,592	3,259,653

The total shipments show an increase of 310,557 tons, or 9.5 per cent., this year.

New York

ANTHRACITE

March 26—The hard-coal market has shown considerable activity, especially during the early part of the week, but during the last few days there has been a larger supply, it is reported, of small steam sizes. There has been a number of contracts taken up on the new schedule of prices, and it is expected that beginning with April 1, there will be the usual heavy business for at least three months. It is the general opinion that the supply of small steam sizes will remain short for some length of time, and that the demand will become stronger than ever. This is due principally to the number of isolated power plants in this vicinity which depend upon the smaller sizes for steam generation. The new schedule of prices is as follows: Broken, $4.25; egg, stove and chestnut, $4.50; buckwheat No. 1, $2.50; pea, $3; rice, $1.85; barley, $1.50. The small steam sizes are quoted nominally, and dealers have not so far issued circulars; sales of these sizes are reported to have been made at an advance over the figures given above.

BITUMINOUS

The Atlantic Seaboard soft-coal trade shows considerable activity, and is reported to be moving all the coal that it can acquire before the new schedule takes effect. The car supply is reported to have improved considerably during the past week, with the exception of the B. & O. One producer reports that no manifest has been received for six days.

Trade in the far East is taking care of all the coal that can be secured. Trade along the Sound has fallen off materially during the past three days, due to vessel scarcity.

New York harbor trade was very active during the early part of the week, but the last few days has seen a decided falling off in activity. Prices are quoted at $2.65 @2.70 f.o.b. New York harbor shipping ports for fair grades of steam coal. There seems to be no reason for the present drop in prices, except that the higher prices ruling during the previous two weeks attracted a large quantity of steam coal, both soft and hard, to this market. Transportation from mines to tide is fairly regular, and car supply has improved. There is nothing new to report in the coastwise vessel market. We quote freight rates from Philadelphia on large vessels at $1.10, and discharge to Boston, Salem and Portland. The rate from New York to the same points is 95c. and discharge for small vessels. In both cases the loading and discharging clause is included.

Birmingham

March 25—With a better railroad service the coal production in Alabama is on the increase. The coal producers are yet loud in their complaints as to the transportation facilities throughout this

district. The demand for coal is strong and all depends on the facilities for handling. The labor situation has improved greatly in the past four weeks, several batches of foreign laborers being brought into the district. The Pratt Consolidated Coal Company is beginning to get coal out of new mines in the western part of Jefferson county, as the new extension of the Louisville & Nashville railroad puts on a regular train service. The Alabama Fuel Company, H. F. DeBardeleben, vice-president and general manager, is opening four mines in various parts of the State, with two openings in St Clair county already in daily operation. Several extensive deals in coal properties were reported during the past week. Messrs. Adlers, of Birmingham, are reported to have purchased several thousand acres of coal lands from the State University. Friedman & Rosenau, of Tuskaloosa, are said to have sold something like 600 acres of coal lands in Tuskaloosa county, the price being $10 per acre. Daniel Pierson and associates have changed the name of their corporation to the Pratt Southern Coal Company and have increased the capital stock to provide for extensive development.

Chicago

March 26—The depression in the coal market is being slowly removed, through the restriction of shipments and the clearing of demurrage coal from tracks. With the spring season now practically in full swing, there is a general readjustment of conditions. At the same time it is recognized by the trade that production is above consumption though the prosperity of the country has by no means abated.

Lump and egg are in light demand, of western coals, and sell for $1.85@3; run-of-mine is $1.65@2 and screenings bring $1.25@1.60. The tendency now is, as usual in the spring, toward the greater use of finer coals and the discontinuance of sales of lump and egg.

Eastern coals are in firmer condition than western. Hocking Valley is especially firm, owing to the small supply, which is attributed to transportation difficulties in the mining district. The price of Hocking lump is about $3, some coal from the district selling for 25c. less. Smokeless coals are at $3.35 for run-of-mine, with supplies and sales reported very good. Youghiogheny brings $3.20 for ¾-in. and is in rather light demand. Pittsburg No. 8 is worth $2.75 for ¾-in. and run-of-mine, with the demand light but the market steady.

Anthracite business is very light.

Cleveland

March 26—The coal markets are quiet just now, awaiting the opening of the lake trade. Railways are well stacked up with coal in Cleveland yards and dealers are sacrificing in order to avoid demurrage fees. Pittsburg No. 8 slack has dropped to 75c., against 80@85c. last week, and prospects are for still lower prices for the rest of the week and next. In hard coals there is a strong market, owing to the fact that cars are very scarce. Steel mills are getting all the gondola cars to ship steel, and coal contracts are thus being held up.

There is plenty of coke in the market, especially for spot shipment, at steady prices. Deliveries up to the close of the first half are selling at $3@3.15 and last-half contracts are around $3.20. Floods have had little effect on Connellsville shipments, and local ovens are well supplied. Foundry coke sells at $3.50 to $3.75.

Indianapolis

March 23—Word has been received at the office of the Indiana Railroad Commission that the order for an advance of 10c. a ton in coal rates from Indiana and a part of the Illinois coalfield into Chicago and the Northwest territory, which was to have become effective April 1, has been rescinded. The official notification states that no advance will be made during the coal year from April 1, 1907, to April 1, 1908.

E. J. Knickerbocker, the coal-traffic manager of the Chicago & Eastern Illinois, signed the notification, and also advised J. C. Kolsom, of Terre Haute, president of the Indiana Operators' Association that there would be no advance. The result of the agitation is important to the coal men, as applying to the Chicago and Northwestern territory shipments, and also indirectly affects the coal rate all over the State, especially to the gas belt, for the understanding was that the proposed 10c. advance to Chicago was to be the forerunner of a general advance in the middle West, and the rate to the gas belt was to be boosted next.

Much credit is being given the Indiana Railroad Commission since the action of the railroads is supposed to have resulted directly from the visit of members of the commission, and a few of the Indiana coal operators, to Washington where the delegation conferred with President Roosevelt and the Interstate Commerce Commission.

The gas belt coal rate was the subject of much concern some months ago, when the numerous manufacturers in that territory declared that if the coal rates were increased the manufacturing industries of that part of the State would be practically ruined. The withdrawal of the proposed advance into Chicago is taken to mean that there will be no further steps looking to other advances. In consequence there is great rejoicing in the gas belt.

It is said that the block-coal men are to have their chance next. Four of the prominent block-coal men of the Brazil and Terre Haute district appeared before the Indiana commission this week and asked that the commission use its good offices in an attempt to remove the differential of 10c. a ton in the rate on block coal. The rate on bituminous coal is now 10c. a ton less to Chicago than the rate on block coal. In compliance the commission has sent notices to the general freight agents of the roads directly involved asking them to come to the office of the commission next Tuesday, to meet a committee of the block-coal operators and discuss the subject with a view of adjusting the matter amicably.

Col. W. H. Zimmerman, of Terre Haute, said to the Indiana Commission that the annual consumption of Indiana block coal had fallen from 1,000,000 tons a few years ago, to about 500,000 tons in 1906. Incidents were cited where two mines within 400 yards of each other, one a block-coal mine, and the other a regular bituminous mine, and the rate on the block coal was 10c. higher on the ton than the rate on the bituminous. The object of the conference is to correct this unjust differential.

Pittsburg

March 26—There is a good supply of railroad cars and most of the mines in the district are in full operation. The new local freight rates become effective on Monday, April 1, a reduction of 5c. a ton having been made by the Pennsylvania and the Baltimore & Ohio railroads, and the concession to operators owning individual cars withdrawn. The rate from the mines to Pittsburg will be 33c. on the Baltimore & Ohio and 38c. over the Pennsylvania lines. There was a good boating stage on the rivers and from 3,000,000 to 4,000,000 bush. of coal went to lower ports on Sunday and yesterday. The Monongahela River Consolidated Coal and Coke Company has closed a number of additional large contracts for deliveries extending to April 1, 1908. Among them was 150,000 tons for the Texas & Pacific Railway for delivery at New Orleans. Prices remain firm on a basis of $1.15@1.25 a ton for mine-run coal at the mine. It is expected that the lake shipping season will open about April 15 this year.

Connellsville Coke—Coke prices for prompt shipment have declined and furnace coke is quoted this week at $2.75@3, but for shipment during the last half $3 is the minimum price. Foundry coke for spot shipment is quoted at $3.50@3.75. The *Courier* gives the production in the Connellsville region for both fields for the week ending March 23 at 415,123 tons. The shipments aggregated 14,260 cars, distributed as follows: To Pittsburg, 5432 cars; to points west of Connellsville, 8180 cars; to points east of Connellsville, 648 cars.

Foreign Coal Trade

March 27—The quantity of coal bunkered or supplied to steamships in the for-

eign trade at United States ports in January was 455,939 tons. Adding this to the exports, previously reported, makes 1,217,309 tons of coal sold for consumption beyond the limits of the United States during the month.

Exports of fuel from Great Britain, with coal shipped for the use of steamers in foreign trade, for the two months ending Feb. 28, are reported as follows, in long tons:

	1906.	1907.	Changes.
Coal	7,920,148	9,026,070	I. 1,105,922
Coke	124,390	159,321	I. 34,931
Briquets	228,002	217,520	D. 10,482
Total export	8,272,540	9,402,911	I. 1,130,371
Steamer coal	3,030,350	2,921,323	D. 109,027
Total	11,302,890	12,324,234	I. 1,021,344

The total increase was 9 per cent. The shipments of coal to the United States for the two months were as follows:

	1906.	1907.	Changes.
Atlantic ports	13,570	6,226	D. 7,344
Pacific ports	.....	6,005	I. 6,005
Total	13,570	12,231	I. 1,339

These shipments were light in both years.

The official report of production, just published, gives the total coal mined in the United Kingdom, in mines worked under the coal-mines act, at 236,111,050 long tons in 1905, and 251,050,809 tons in 1906; an increase of 14,939,759 tons, or 6.3 per cent. Some coal operations come under the quarries act as open workings, but the quantity thus obtained is only a few thousand tons. The gain last year was a good one, showing an excellent condition of trade.

Iron Trade Review

New York, March 27—The disturbed condition of the stock exchanges has had some effect on the iron and steel markets, so far as new business is concerned. There is rather a halt in orders, and buyers seem disposed to wait a little before calling for new material. The specifications on contracts, however, continue to come in, and there is no cessation of work at mills and furnaces. The flood damages in the Pittsburg district are being pretty well cleared up, and seem to be rather less than first reports indicated.

The pig-iron buying has not been heavy, being confined largely to small lots wanted to make up deficiencies. In finished material there has also been a halt, which seems to be rather temporary in its character.

Preparations are being made for the opening of the navigation season, and the shipment of ore from the Lake Superior district. Season contracts so far made indicate a very heavy tonnage; in fact, it is expected to exceed even the heavy total of last year,

Production does not keep quite up to the highest level. Many furnaces are feeling the strain of the past year of heavy work, and repairs are needed.

Birmingham

March 25—Alabama pig-iron manufacturers have been besieged lately to furnish every ton of spot iron they could possibly scrape together, but this kind of iron is extremely scarce and many orders, notwithstanding the high premium offered, had to be declined. A well-known iron broker had commissions recently to get several orders of small lots of spot iron and he found the work most difficult. April, May and June iron can be purchased but once in a great while now, and is considered by the manufacturers as spot iron. Every indication in this territory points to advancing quotations for iron during the latter part of the year, No. 2 foundry for delivery during the fourth quarter of the year is being quoted at $18.50@19 per ton and the sales are quite numerous. The stock exchange excitement in the East has had no effect. The manufacturers are working hard to get the railroads to handle the product and to keep up production. During the past fortnight two furnaces have failed, one at Woodward being out entirely for repairs, while one of the Alabama Consolidated Coal and Iron Company's furnaces at Gadsden needed some immediate repairs on the top and had to lose several days time. The make in this territory is off considerably.

The railroad situation in this district is not improved and the outward movement of iron shows but little change. Inquiries are being received in the Birmignham district as to requirements during the latter part of the year which show that there will be a large quantity of iron needed.

No change in conditions in the steel market in this section are reported. There is room for improvement in production. Rolling mills, foundries and machine shops, cast-iron pipe works and other plants continue to do well. At a meeting of the Southern Stove Makers' Association, an advance of 5 per cent. was voted, to go into effect immediately.

Baltimore

March 26—Imports of spiegeleisen for the week were 1010 tons; of ferromanganese, 554 tons. Arrivals of iron ore were three cargoes, 10,074 tons, from Beni-saf, Algeria. One cargo of manganese ore, 5300 tons, was received from Brazil.

Chicago

March 26—Sluggishness marks the iron market. There is little disposition of sellers or buyers to force different conditions than have existed for the last two or three weeks. Small purchases for delivery in the next three months are the rule, only a few lots going to 1000 tons. It appears to be a waiting market for both melters and furnace agents. Yet firmness is apparent; there are no breaks and no hints of breaks in the prices, and both sides profess confidence in the future.

Southern No. 2 for second-half deliveries sells for $18@18.50, with apparently less available than formerly. Northern remains at about $23.50 for similar shipments. For quick delivery iron Southern brings $25.85@26.35, and Northern $25.50 @26. There has been no effect practically on the market from the stock disturbances in New York.

Foundry supplies of pig iron are known to be short and it seems only a question of a short time until the market will turn again to heavy buying for the future.

Coke is strong, though some stacks have shut down for repairs, causing the supply to be ample. Connellsville 72-hour brings $6.65 for quick deliveries, and $6.40 on contracts.

Cleveland

March 26—Conditions are pointing to the largest lake shipping business this season in the history of the trade. Shippers are practically all contracted up to the last half and independent vesselmen are only making short-time shipping obligations in anticipation of higher rates later on.

Pig Iron—The iron market is reported quiet, with no change in values. A number of furnaces are out of blast and a lightened production will be the temporary outcome. Spot delivery No. 1 foundry is bringing $26 at furnace. Bessemer is quoted at $21.50.

Philadelphia

March 27—The crude-iron market has not presented any sensational features for a week, or, in fact, any interesting points deserving of special comment. Our local consumers are showing some degree of indifference and the furnace men are equally indifferent as to whether they sell any iron at present. Reports from quite a number of furnace centers throughout middle and eastern Pennsylvania show the usual oversold condition and some difficulty in making shipments on time. Forge iron continues strong and the bar mills are all busy, filling orders with comparative promptness. The concessions reported in Southern iron, from 25 to 50c. per ton, are regarded here as exceptional and temporary, and our best informed dealers and makers consider that the strong quotations prevailing for months past will continue. Small lots of spot iron are bobbing up unexpectedly and are commanding very strong prices. Quotations are rather variable and in a way misleading. Standard forge for early delivery has been selling at $23.50, basic $25 and Middlesboro at $22. For delivery in midsummer iron is offered at $22.50@23, for forge, and basic quotations are held as high as $24.50. For early winter delivery No. 2 foundry has been quoted and

to some extent sold at $23.50. Forge can be had at $22; basic can be bought at $23.50.

Steel—It is impossible to gather any decided news concerning the steel market. Agents have the same stereotyped report to make as to demand and prices. The conditions are practically the same as they have been for months past.

Bars—Premium prices prevail for steel bars for early and late deliveries. Manufacturers are paying no attention to the rumors in the market as to weaker prices. Common iron is moving with a little more freedom and some car-builders have been sneaking around the market trying to obtain better terms than have been offered.

Sheets — The presentations of specifications, for light sheets especially, is a feature of the market just at present. Small lots are selling freely at the usual advance.

Pipes and Tubes—The tube market is exceptionally strong and mills are simply deluged with orders. The damage done by the recent floods in western Pennsylvania has interfered somewhat with the output.

Merchant Steel — Within the past few days the agents of merchant-steel mills report quite an improvement among the small buyers, who appear to be insistent upon early deliveries, regardless of prices.

Plates — The suspension of production in some of the Western plate mills has had its effect upon output and prices, especially where early deliveries are desired. The situation in plates is rather uncertain, as there are large buyers in the market who are insistent that their orders be given preference.

Structural Material—The came conditions exist to a certain extent in regard to structural material. Deliveries are somewhat delayed, but construction has not been interfered with. Premium prices do not appear to help some of our smaller buyers out.

Steel Rails — Some business has been done in steel rails, but they were largely in trolley material and in light rails, which bring $33@34 for weights ranging from 20 to 40 pounds.

Scrap—The scrap market is better supplied with certain lines of scrap than a month ago and the dealers are scouring the country without having to pay higher prices. The special demand at present is for machinery scrap, which is held at $22.50; railroad scrap, which has sold at $21.50, and for No. 1 steel scrap, which is worth about $19. Quotations for steel axles are $22.50, old iron rails $27.50, wrought turnings $17 per ton.

Pittsburg

March 26—The wild break in prices of stocks in Wall street yesterday is not likely to affect the iron and steel trade, but may keep some buyers out of the market for a short time. Business in all finished lines is better than it has been for several months, and the mills are sold up for the first half and, in a number of lines, through the third quarter. Unless there are heavy cancelations of orders, which is not regarded as at all probable, there can be no decline in prices before the fourth quarter. The Carnegie Steel Company during the week booked orders for 25,000 tons of standard steel rails, which brings the total tonnage sold by that company for delivery in 1907 to about 800,000 tons, or considerably more than were sold at this time last year. The tonnage now on the books is divided about as follows: Standard sections for steam roads, 550,000 tons; traction lines, 75,000 tons; for export, 135,000 tons, and light rails, 40,000 tons. The Carnegie company expects to make about 1,100,000 tons of rails this year, or over 100,000 tons more than last year. The books have not yet been opened for deliveries in 1908, but it seems to be pretty well settled that the price will be continued at $28 for bessemer steel rails, and that railroads may make reservations for next year's delivery if they desire.

There was no new buying of finished steel products of any consequence during the week, but specifications continue heavy and the mills are well filled up with business for several months. All the mills in this district have fully recovered from the effects of the flood, and are running again to capacity, but the idleness has thrown them further behind in deliveries. The committee of agricultural implement makers appointed to endeavor to secure concessions from the steel bar mills visited the leading interests in this district during the week, but failed in their mission. The bar mills are booked for months ahead at the established price of 1.60c., and last week a 10,000-ton contract was received for third-quarter delivery at that price.

The American Sheet and Tin Plate Company announces that it will make no change in tin-plate prices for third-quarter delivery, but so far it has not booked any orders for shipment beyond July 1. It will likely begin taking on business before the close of the week. This action on price taken by the leading interest will probably make inoperative the rate of $4 a box made by independent producers on large orders booked for the third quarter. The established price of $3.90 a box will continue, although for prompt delivery premiums are paid.

Pig Iron—The heavy buying last week has greatly strengthened the bessemer pig-iron market, and the expected decline for second-half delivery may not materialize. Sales of bessemer for second quarter, including those mentioned last week, and an option on 14,000 tons for May taken by the United States Steel Corporation, aggregate 61,000 tons. The corporation bought altogether 11,000 tons for April delivery, and the Cambria Steel Company took 36,000 tons for equal monthly deliveries through the second quarter. The price was uniform at $22 f.o.b. Valley furnaces. Unless there is a general buying movement for last half it is believed that $22 will continue as the price for third quarter, which will insure a strong pig-iron market for the rest of the year. The market for foundry iron is a trifle stronger this week, sales for prompt having been made at $24.50, and for second quarter at $23.50. The market for the second half is firm at $21.50@22, Valley furnaces. Gray forge is not in demand and is quoted nominally at $21.85, Pittsburg.

Steel—The Carnegie Steel Company has bought 5000 tons of open-hearth steel billets in addition to the 10,000 tons recently purchased from the New York State Steel Company. This tonnage will be applied to outside steel contracts and enable the company to operate its finishing mills fully. Bessemer billets remain nominally at $29.50, and open-hearth at $32. Plates remain at 1.70c., and steel bars at 1.60c.

Sheets—The miills are still from eight to ten weeks behind in deliveries on black sheets, and fully three months behind on galvanized sheets. The prices remain firm at 2.60c. for black, and 3.75c. for galvanized No. 28 gage.

Ferro-Manganese—There is no change in prices, and for prompt delivery quotations are $75@76 per ton.

London

March 15—Exports of iron and steel, and of machinery, from Great Britain for the two months ended Feb. 28 are valued by the Board of Trade returns as follows:

	1906.	1907.	Changes.
Iron and Steel..	£ 5,979,012	£ 7,345,336	I. £1,366,324
Machinery.....	4,031,869	4,409,746	I. 377,877
New Ships.....	1,018,503	1,409,437	I. 390,934
Total.....	£11,029,384	£13,164,519	I. £2,135,135

The total increase was 19.4 per cent. The leading items of the iron and steel exports were, in long tons:

	1906.	1907.	Changes.
Pig iron.....	171,783	315,655	I. 143,872
Wrought iron.....	29,620	33,460	I. 3,840
Rails	75,593	61,420	D. 14,173
Plates.....	35,025	57,642	I. 22,617
Sheets.....	83,444	81,024	D. 2,420
Steel shapes, etc.....	27,964	39,038	I. 11,074
Tin-plates.....	61,544	68,392	I. 6,848

The total quantities of iron and steel were 651,474 tons in 1906, and 826,854 tons in 1907; an increase of 175,380 tons, or 26.9 per cent. Exports of pig iron to the United States this year were 177,036 tons, an increase of 78,654 tons; of tin-plate, 11,292 tons, an increase of 4032 tons.

Imports of iron and steel, and of machinery into Great Britain for the two months were valued as follows:

	1906.	1907.	Changes.
Iron and steel...	£1,713,915	£1,080,307	D. £633,608
Machinery.....	751,373	758,075	I. 6,702
Total.....	£2,465,288	£1,838,382	D. £ 626,906

The total decrease was 25.4 per cent. The chief items of the imports were, in long tons:

	1906.	1907.	Changes.
Pig iron	14,718	17,764	I. 3,046
Wrought iron	25 882	11,988	D. 13,894
Steel billets, etc.	115,605	47,201	D. 68,404
Bars and shapes	12 964	1,821	D. 12,143
Structural steel	22,007	8,635	D. 13,372

The total quantities of iron and steel were 269,112 tons in 1906 and 141,262 tons in 1907; a decrease of 127,850 tons, or 47.5 per cent.

Imports of iron ores into Great Britain for the two months were as follows, in metric tons:

	1906.	1907.	Changes.
Manganiferous ores.	77 703	67,844	D. 9,859
Iron ores	1,264,826	1,320,331	I. 55,505
Total.	1,342,529	1,388,175	I. 45,646

Of the imports this year 49,544 tons manganiferous ores and 1,055,481 tons iron ores came from Spain.

Dusseldorf, Germany

March 4—Owing to changes in classification in the German tariff, reports of imports and exports of metals for the full year have not been published. For the 10 months, March-December, these imports and exports were as follows, in metric tons:

	Imports.	Exports.	Balance.
Copper	104,710	5,807	Imp. 98,903
Tin	11.523	4,183	Imp. 7,343
Lead	58,395	20,015	Imp. 38,380
Zinc	31,189	53,094	Exp. 21,905
Nickel	2,908	751	Imp. 2,157

The output of the German blast furnaces in January, is reported by the German Iron and Steel Union as follows, in metric tons:

	Tons.	Per Ct.	Tons.	Per Ct.
Foundry iron	165,014	16.2	177,543	16,7
Forge iron	74,196	7.3	69,503	6.6
Steel pig	81,820	8.0	87,493	8.2
Bessemer pig.	41,101	4.0	40,712	3.8
Thomas pig	656,330	64.5	686,901	64.7
Total	1,018,461	100.0	1,062,152	100.0

There were increases of 12,529 tons in foundry iron; 5673 tons in steel pig, and 30,571 tons in Thomas, or basic pig. There were decreases of 389 tons in bessemer and 4693 tons in forge. The total gain was 43,691 tons, or 4.3 per cent.

Metal Market

NEW YORK, March 27

Gold and Silver Exports and Imports

At all United States Ports in February and year

Metal.	Exports.	Imports.	Excess.
Gold:			
Feb. 1907	$1,027,058	$ 3,275,933	Imp. $2,248,875
" 1906	8,486,330	2,079,683	Exp. 6,406,647
Year 1907	3,477,130	6,546,438	Imp. 3,069,308
" 1906	14,227,995	4,685,392	Exp. 9,542,603
Silver:			
Feb. 1907	4,223,970	3,693,061	Exp. 530,909
" 1906	6,435,129	4,480,449	" 1,954,680
Year 1907	8,990,935	7,350,102	" 2,640,633
" 1906	13,951,797	9,167,160	" 4,784,637

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 Mar. 23 and years from Jan. 1

Period.	Gold.		Silver.	
	Exports.	Imports.	Exports.	Imports.
Week	$ 200	$1,222,801	$1,081,428	$ 16,024
1907	1,717,426	2,909,617	8,781,916	505,021
1906	3,027,379	1,399,487	17,331,030	446,210
1905	31,207,071	3,194,550	8,807,841	629,336

The gold exported for the week went to Haiti; the silver to London. Gold imports for the week were from Europe; silver from Mexico and the West Indies.

The joint statement of all the banks in the New York Clearing House for the week ending March 23 shows loans $1,049,989,600, a decrease of $3,587,000; deposits, $1,002,044,000, a decrease of $1,829,800, as compared with the preceding week. Reserve accounts show:

	1906.	1907.
Specie	$182,424,500	$184,974,400
Legal tenders	77,207,100	70,271,200
Total	$259,631,600	$255,245,600
Surplus	$6,363,775	$4,709,450

The surplus over legal requirements shows an increase of $1,676,350, as compared with the previous week.

Special holdings of the leading banks of the world, March 23, are reported as below, in dollars:

	Gold.	Silver.	Total.
Ass'd New York			$184,974,400
England	$180,669 280		180,669,280
France	522,088,415	$196,110,895	718,199,310
Germany	169,765,000	56,590,000	226,355,000
Spain	77,150,000	124.185.000	201,335,000
Netherlands	26,320,000	28.562,000	54,882,000
Belgium	16,333,335	8,166,665	24.500.000
Italy	162.305,000	24,928,000	187,233,000
Russia	596 370,000	28,765,000	625,135,000
Aust.-Hungary	231,590,000	61 830,000	293.420,000
Sweden	20,805,000		20,805,000

The banks of England and Sweden report gold only. The New York banks do not separate gold and silver in their reports.

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

	1905.	1906.	Changes.
India	£ 4,514 010	£3,172.210	D. £ 1,341,800
China			
Straits		85,050	I. 85,050
Total	£ 4,514.010	£3,257,260	D. £ 1,256 750

Imports for the week were £8000 from Chile; £317,000 in bars and £45,000 in Mexican dollars from New York; a total of £370,000. Exports were £61,500 in coin to the Straits, and £342,000 in bars to India; £403,500 in all.

Indian exchange has been slightly easier, the Council bills offered in London having been taken at an average of 16.06d. per rupee. Buying of silver for India has been light.

Imports of gold and silver at San Francisco for the two months ending Feb. 28 were as follows:

	Coin.	Bullion.	Total.
Gold	$733,821	$416,559	$1,150,380
Silver	85,876	535,136	621,012

The receipts of gold were largely from Australia; of silver from Mexico. Exports for the two months were as follows:

	Coin.	Bullion.	Total.
Gold	$ 2,000		$ 2,000
Silver	526,245	$27,476	533,721

Exports of silver, chiefly to China and Japan, have been light this year.

The movement of gold and silver in France in January is reported as follows:

Gold:	1906.	1907.
Imports	Fr. 59,174,000	Fr. 13,120,000
Exports	4,388,000	26,636,000
Excess	I. Fr. 54,786,000	E. Fr. 13,516,000
Silver:		
Imports	11,742,000	12,638,000
Exports	7,779,000	6,530,000
Excess, imports	Fr. 3,963,000	Fr. 6,108,000

Imports of copper and nickel coins were 9000 fr. in 1906, and 3000 fr. in 1907; exports were 26,000 fr. in 1906, and 5000 fr. this year.

The movement of gold and silver in Great Britain for the two months ending Feb. 28 is reported as follows:

Gold:	1906.	1907.
Imports	£ 7,977,615	£8,301,912
Exports	4,878,901	6,717,744
Excess, imports	£ 3,098,714	£ 1,584,168
Silver:		
Imports	£ 4,172,862	£3,816 377
Exports	4,087,748	3,388,157
Excess. imports	£ 85,114	£ 428,220

Of the silver imported this year £2,017,623, or 52.8 per cent. of the total, came from the United States.

Prices of Foreign Coins

	Bid.	Asked.
Mexican dollars	$0.51¼	$0.53½
Peruvian soles and Chilean	0.484	0.51
Victoria sovereigns	4.854	4.87
Twenty francs	3.86	3.89
Spanish 25 pesetas	4.78	4.80

SILVER AND STERLING EXCHANGE.

March.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.	March.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.
21	4.8310	66⅜	30 13/16	25	4.8365	65⅛	30 7/16
22	4.8345	66½	30⅞	26	4.8295	65⅞	30 5/16
23	4.8360	66⅝	30 13/16	27	4.8335	66⅜	30 13/16

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

Other Metals

Daily Prices of Metals in New York.

March.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. Cts. per lb.	Spelter. New York, Cts. per lb.	Spelter. St. Louis, Cts. per lb.
21	25¼ @25¾	24¾ @25¼	107 3/16	41	6.00	6.80 @6.85	6.65 @6 70
22	25¼ @25¾	24¾ @25¼	106½	40½	6.00	6.80 @6.85	6.65 @6.70
23	25¼ @25¾	24¾ @25⅛	.....	40½	6.00	6.80 @6.85	6 65 @6.70
25	25 @25½	24⅛ @25	101⅝	39½	6.00	6.75 @6.80	6.60 @6.65
26	25 @25½	24½ @25	97⅛	39¾	6.00	6.75 @6.80	6.60 @6.65
27	25 @25½	24½ @25	98¾	40¼	6.00	6.75 @6.80	6.60 @6.65

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 as made with consumers, basis, New York, cash. The price of cathodes is 0.125c. below that of electrolytic. The lead prices are those quoted by the American Smelting and Refining Company for near-by shipments of desilverized lead in 50-ton lots, or larger. The quotation on spelter are for ordinary western brands; special brands command a premium.

Copper—The enormous decline in values on the stock exchange has not failed of its effect on all metals. Buyers have become most cautious and prefer to await developments before entering into any new commitments. Quotations at the close are entirely nominal at 25@25½c. for Lake copper; 24½@25c. for electrolytic in cakes, wire bars or ingots; and 24@24¼c. for casting.

Realizations of bull holdings, aided by bear sales, brought about a most substantial decline in the speculative kinds which are dealt in on the London exchange. The low level reached for standard on March 26 was £95 10s. for spot, and £97 10s. for three months. From this there has been a fair recovery, which, however, was not fully maintained. The market closes at £98 15s. for spot, and £100 12s. 6d. for three months'.

Refined and manufactured sorts we quote: English tough, £105@106; best selected, £107@108; strong sheets, £116@117.

The National Copper Bank expects to begin business May 1, with a capital of $2,000,000, in New York.

Exports of copper from New York for the week were 2496 long tons. Our special correspondent reports the exports from Baltimore for the week at 89 long tons copper.

The average price received by the Franklin Mining Company for its output of 4,571,570 lb. of copper, in 1906 was 18.603c. This low average is explained by the fact that the copper was sold largely in September and November for delivery in January and February. The Isle Royale reports an average of 18.81c. on 2,937,098 lb. The Mohawk average for the year 1906 was 19.60c. on sales of 12,723,515 lb. copper.

Copper Sheets—The base price of copper sheets is 32c. per pound.

Copper Wire—The base price of copper wire, No. 0000 to No. 8, is 27¼@27½c. per pound.

Tin—In sympathy with the standard market, tin suffered a severe decline, and a new low level was established, the market in London at one time touching £180 10s. for spot, and £178 10s. for futures. It rallied, however, and the close is cabled as £184 for spot, and £182 for futures.

In this market no business of consequence has been done, values ranging from 39½, the low point reached, to 40¾c., at the close.

Shipments of tin from the Straits for the first half of March were: United States, 695 long tons; Great Britain, 1626; European continent, 215; total, 2536 tons.

Arrivals of Bolivian tin concentrates in Europe for the two months ended Feb. 28, reduced to fine tin, were 2572 tons; a decrease of 125 tons from last year.

Lead—There is no change in the quotation of 6c., New York; 5.92½., St. Louis.

London reports a weaker market, and the quotation there is cabled as £19 5s. for Spanish and £19 7s. 6d. for English lead.

The American Metal Company, of New York, has bought a controlling interest in the Ohio & Colorado Smelting Company, which has its works at Salida, Colorado.

The movement of foreign lead in the United States in January is reported as follows, in short tons:

In bond, Jan. 1	5 691
Imports	4,724
Total supplies	10,415
Re-exports	2.073
In bond, Jan. 31	5,208
Total deductions	7,281
Balance	3,134

The balance has, presumably, entered into consumption in this country.

St. Louis Lead Market—The John Wahl Commission Company reports as follows: Lead is dull and slightly lower. The latest sales are on a basis of 6.02½@6.05c. for Missouri brands.

Spanish Lead Market—Messrs. Barrington & Holt report from Cartagena, Spain, under date of March 9, that the price of lead is 91 reales per quintal; silver, 14 reales per ounce; exchange, 27.56 pesetas to £1. The price of lead, on current exchange, is equal to £18 9s. 8d. per long ton, f.o.b. shipping port. Exports for the week were 1583 tons argentiferous and 320 tons desilverized lead to Great Britain; 501 tons argentiferous and 66 tons desilverized to Marseilles; a total of 2470 tons.

Spelter—Entire absence of demand has had a weakening effect on prices and quotations are entirely nominal at 6.75@6.80, New York and 6.60@6.65c., St. Louis.

The London market has had a serious decline, and is reported as weak, at £25 5s. for good ordinaries, and £25 10s. for specials.

It is stated that E. V. Lanyon has bought the old W. & J. Lanyon smelter, at Pittsburg, Kan., including 13 acres of land and old buildings. He proposes to tear down the old buildings, put up a substantial new structure, and install new machinery throughout. The old smelter was a two-block plant, but the new one will be larger. Gas furnaces will be used, run with producer gas.

Zinc Sheets—The base price is now $8.60 per 100 lb. (less discount of 8 per cent.) f.o.b. cars at Lasalle and Peru, in 600-lb. case for gages No. 9 to 22, both inclusive; widths from 32 to 60 in., both inclusive; the lengths from 84 to 96 in., both inclusive. The freight rate to New York is 27.5c. per 100 pounds. The base price was advanced 10c. on March 27.

Spanish Zinc Ore Market—Messrs. Barrington & Holt report from Cartagena, Spain, under date of March 9, that the market is quiet. Exports for the week were 1800 tons blende to Stettin.

Antimony—The market is lifeless. Quotations are unchanged, but are merely nominal, as follows: Ordinaries, 22¾@23½c.; Hallett's, 23½@24c.; Cookson's, 24½@25½c.

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

Platinum—Demand continues strong and prices high. Unmanufactured platinum is quoted at $38 per oz. for ordinary and $41 per oz. for hard. For good scrap $31.50@32 is paid.

Quicksilver—Current prices in New York are $41 per flask of 75 lb. for large quantities, and $42 for smaller orders. San Francisco prices are $38@39 per flask, according to quantities, for domestic orders, and $37@37.50 for export. The London price is £7 per flask, but £6 16s. 3d. is quoted by jobbers.

Aluminum—Prices are steady and demand good. Prices for ton lots, or over, are: No. 1, over 99 per cent. pure metal, 40c. per lb.; No. 2, over 90 per cent., 38c. Small lots are 1 to 3c. higher, according to size. The Pittsburg Reduction Company—now the Aluminum Company of America—no longer gives out monthly price lists.

Missouri Ore Market

Joplin, Mo., March 23—The highest price for zinc ore was $53.50 per ton for one lot of three tons, the general high price being $52.50; the assay basis price $48@51, and the average price $48.02, over a dollar decline in prices.

The highest price paid for lead was $85 per ton, medium grades, $80@83; the average price, $82.60 per ton.

Zinc purchasing has lightened the past two weeks, while the output has increased. Instead of continuing to advance on the ore as produced the smelters seem determined to ship the ore they own, and buy as little as necessary in the meantime, until the reserve stock is changed from their ownership to that of the producers. The output is now averaging around 6000 tons per week, climbing as high as 6800 tons last week.

The lead buyers have been enabled the past two weeks to ship a large part of their previously purchased stock, and this

is believed to be the cause of a more spirited market today.

Following are the shipments of the district for the week ending March 23:

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville.	2,905,260	1,569,240	$137,969
Joplin	2,612,180	397,700	82,915
Alba-Neck City	1,298,870	.....	33,770
Duenweg	1,049,860	170,410	33,232
Galena-Empire	897,980	250,320	32,712
Badger	789,020	.....	20,514
Prosperity	310,950	192,740	15,674
Spurgeon	452,950	94,790	12,006
Oronogo	430,710	18,460	10,865
Granby	384,150	95,000	10,070
Aurora	661,580	6,820	8,679
Springfield	62,460	114,280	6,250
Baxter Springs	.....	70,400	2,921
Stott City	96,040	.....	2,352
Cave Springs	70,730	.....	1,768
Reeds	70,000	.....	1,710
Carthage	63,990	.....	1,663
Wentworth	59,440	.....	1,466
Sherwood	39,240	3,490	1,045
Zincite	34,300	.....	789
Totals	12,289,710	2,983,750	$418,370
Twelve weeks	143,267,140	21,584,600	$4,288,370

Zinc value, the week, $295,112; 12 weeks, $3,385,922
Lead value, the week, 123,258; 12 weeks, 902,448

Average prices for ores 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	.....	March	73.73	.....
April	44.63	.....	April	75.13	.....
May	40.51	.....	May	78.40	.....
June	43.83	.....	June	80.96	.....
July	43.25	.....	July	74.31	.....
August	43.56	.....	August	75.36	.....
September.	42.58	.....	September.	79.64	.....
October	41.55	.....	October	79.84	.....
November.	44.13	.....	November.	81.98	.....
December.	43.68	.....	December.	81.89	.....
Year	43.24	.....	Year	77.40	.....

Wisconsin Ore Market

Platteville, Wis., March 23—The demand for all grades of zinc ore continued strong, nearly all the ore was sold on a $51 basis for 60 per cent. ore. There were no unusual circumstances affecting the selling market and owing to the early spring and quick drying up of the roads, the output should increase materially within the next 45 days, as a number of new mills will be put in operation and the ore that has been piling up at a few of the large producers can now be hauled. Dry bone, lead and sulphur suffered no material change. Owing to the continued shortage of cars the buyers were unable to get all ores loaded. This accounts for an apparent shortage.

The camps of the district loaded ore for the week ending March 23, as follows:

Camps.	Zinc, Lb.	Lead, Lb.	Sulphur, Lb.
Platteville	284,980	.....	.....
Highland	177,000	51,500	.....
Linden	159,640	41,160	.....
Mineral Point	123,560	.....	46,680
Galena	79,000	.....	.....
Benton	76,300	.....	.....
Livingston	52,000	.....	.....
Total for week	952,480	92,760	46,680
Year to Mar. 23	19,078,294	893,180	143,160

Owing to the condition of the wires it was impossible to get the ore report from Hazel Green and Buncombe.

Chemicals

New York, March 27—The chemical markets are generally strong, with good demand for nearly all sorts of material.

Copper Sulphate—The demand continues strong, and supplies are readily taken by consumers. Prices remain unchanged. For carload lots and over, we quote $7.50 per 100 lb., while smaller parcels bring $7.75 per 100 lb. in the local market. Supplies are quite large, but hardly equal to current demand.

Nitrate of Soda—Spot supplies are still scarce and the market is strong. Quotations are unchanged, 95 per cent. for 1907 delivery, all positions, commanding $2.45 @2.47½ per 100 lb., and 96 per cent. $2.50 @2.52½. For 1908 delivery quotations are $2.42½ and $2.47½, respectively.

British Chemical Trade—Exports of chemicals from Great Britain for the two months ended Feb. 28 were as follows, in cwt. of 112 lb. each:

	1906.	1907.	Changes.
Bleaching powder	175,167	191 247	I. 16,080
Muriate of ammonia,	18,687	27,386	I. 8,699
Soda ash	214,770	330,886	I. 116,116
Bicarbonate of soda.	45,353	66,496	I. 21,143
Caustic soda	230,676	253 260	I. 22,584
Soda crystals	26,067	18,885	D. 7,182
Soda sulphate	119,818	133,834	I. 14 016
Sulphuric acid	15,939	11,310	D. 4,629

Exports of copper sulphate for the two months were 7213 tons in 1906, and 8902 tons in 1907; an increase of 1689 tons.

Imports of chemicals and raw materials into Great Britain for the two months ended Feb. 28 were, in long tons:

	1906.	1907.	Changes.
Nitrate of potash	1,709	1.997	I. 288
Nitrate of soda	17,570	15,957	D. 1,613
Phosphates	79,463	92,547	I. 13,084
Sulphur	3.597	2,759	D. 838
Pyrites	129,445	135,179	I. 5,734

Estimating sulphur contents of pyrites at the usual figure, the total sulphur imported was 55,375 tons in 1906, and 56,831 tons in 1907; an increase of 1456 tons.

Mining Stocks

New York, March 26—The market has been raided the last three days and prices have declined rapidly. Stocks that have been hitherto strong and steady have depreciated from 10 to 30 per cent.

Amalgamated touched a new low point for the year when it fell off to $78½ today. It closed at $84¾. American Smelting common sold down to $105, but recovered and closed at $114⅛. U. S. Steel, Anaconda, Utah Copper, and all other mining stocks on the Exchange were very weak, and the general tone of the market continued panicky. All efforts to strengthen the situation have so far failed.

The curb has followed the lead of the Exchange and the outside securities have suffered losses all through the list. The coppers have lost heavily, some of the closing prices being as follows: British Columbia, $6¾; Cumberland Ely, $9; Davis-Daly, $12⅝; Greene Copper, $22; Newhouse, $18¾. The silver stocks held firmer, but losses were recorded. Nipissing closed at $11¼ after selling down to $10½.

Boston

March 26—Mining shares have continued on the toboggan slide the past week, and are selling at a level which certainly looks inwiting to the man with means. Prices have been slaughtered and they are without rhyme or reason to the layman. Many stocks sold at panic prices today. Recoveries were sharp although stocks are from $3 to $65 below prices of a week back, the latter being in the case of Calumet & Hecla. The whole financial structure has been weakened by the events of the past few weeks, but who dare say that things may not be worse?

Amalgamated Copper from a closing at $92 a week ago touched $79.50 in this market today, recovering to $85.50 at the close. For a day or two last week the market mended, but it was only temporary and stocks have been dumped over regardless. The sharp break in the New York list has caused the break in metal shares, yet without hurting anyone seriously to date, so far as known. New York and the West are the largest owners of copper shares dealt in on this market and this is really the main trouble, as these people have been extended in the railroad and industrial shares and have had to sacrifice copper shares in their effort to save themselves. North Butte, which closed at $91.50 a week ago, rallied to $92.50, but broke wide open with sales $2 apart in cases, until it touched $72 today, recovering to $84.50 in a short time.

Butte Coalition also went by the board, breaking $10 to $20.50, with recovery to $23.87½. Bingham sought a low level at $14.50, rallying to $17.25, which is $3.75 net lower than a week ago. Boston Consolidated broke $5.50 to $20.50, recovering to $22; Copper Range $11.50, to $72, recovering to $76.25; Isle Royale $8.25 to $13.75, recovering to $17.50; Mohawk $15 to $68, recovering to $75; Old Dominion $11.25 to $38, recovering to $46.50; Osceola $25 to $115, recovering to $124.50; Parrot $3.75 to $19.75; Quincy $10 to $108, recovering to $113; Shannon $4.25 to $14.75, recovering to $17; Tamarack $15 to $100, recovering $10 of it, Trinity $9.12½ to $14.87½, recovering to $18; United Copper $13.75 to $53, Utah $7.50 to $53, recovering to $57.50; United States Smelting $5.50 to $50, recovering to $51.50; Wolverine $6 to $155; Calumet & Hecla $65 to $8.20; and Calumet & Arizona $14 to $149, recovering to $156.

Allouez Mining fell $10 to $50; Centennial $7.25 to $29.25; Arcadian $2 to $6; Atlantic $3.25 to $13; Franklin $3.75 to $16.25; Greene $3.75 to $20.62½; Michigan $3 to $13; Rhode Island $1.50 to $6; Victoria $1 to $7.50; Winona $1 to $8.50;

and La Salle $3, to $15.75. Recoveries followed these extreme prices. Annual reports of mining companies tell the same favorable story for 1906 operations. The curb also suffered declines but not to the same extent as on the board.

Colorado Springs

March 22—The local stock market has been dull and inactive this entire week. Gold Sovereign, Isabella and Work are about the only stocks that have received any attention. Good reports are coming from the mines in the Cripple Creek district, but the brokers and investing public seem to be turning their attention to the Nevada stocks. It is thought, however, that this will be of short duration.

STOCK QUOTATIONS

NEW YORK Mar. 26	
Name of Comp.	Clg.
Alaska Mine	1⅜
Am.Nev.M.&P.Co.	3⅛
Amalgamated	84¾
Anaconda	58½
Balaklala	9
British Col. Cop.	6¾
Buffalo Cobalt	2
Butte & London	2¼
Butte Coalition*	23⅝
Butte Cop. & Zinc	5¾
Cobalt Contact	½
Colonial Silver	2⅞
Cum. Ely Mining	9
Davis Daly	12½
Dominion Cop	5⅛
El Rayo	5
Foster Cobalt	1¾
Furnace Creek	1⅛
Giroux Mine	8½
Gold Hill	2½
Greene Gold	1¾
Greene G. & S	1¾
Greenw'r & D.Val.	1
Guanajuato	4
Guggen. Exp.	265
Hanapah	¾
McKinley Dar.	1½
Micmac	4½
Mines Co. of Am.	1¾
Mitchell Mining	4
Mont.Sho.C.(New)	10½
Nev. Utah M. & S.	4
Newhouse M. & S.	18⅞
Nipissing Mines	11⅛
Old Hundred	3½
Silver Queen	1⅞
Stewart	2¾
Tennessee Copper	39
Union Copper	⅝
Utah Apex	5¾
West Columbus	11

N. Y. INDUSTRIAL	
Am. Agri. Chem.	19
Am. Smelt. & Ref.	114¾
Am.Sm. & Ref., pf.	102⅛
Bethlehem Steel	11¾
Colo. Fuel & Iron	32½
Federal M. & S.,pf.	....
Inter. Salt	....
National Lead	53⅞
National Lead, pf.	98
Pittsburg Coal	12⅝
Republic I. & S.	24
Republic I. & S.,pf.	81
Sloss-Sheffield	52⅛
Standard Oil	507
Tenn. C. & I.	137½
U. S. Red. & Ref.	15
U. S. Steel	34¼
U. S. Steel, pf.	96¼
Va. Car. Chem.	27
Va. I. Coal & Coke	61

ST. LOUIS Mar. 23		
N. of Com.	High.	Low.
Adams	.40	.25
Am. Nettie	.08	.06
Center Cr'k	2.40	2.25
Cent. C. & C.	65.00	64.50
C.C. & C. pd.	80.00	78.25
Cent. Oil	70.00	60.00
Columbia	5.00	4.50
Con. Coal	29.00	27.00
Doe Run	170.00	160.00
Gra. Bimet.	.35	.25
St. Joe	18.00	16.00

BOSTON Mar. 26	
Name of Comp.	Clg.
Adventure	4
Allouez	50
Am. Zinc	38
Arcadian	6½
Atlantic	14
Bingham	18
Boston Con.	22
Calumet & Ariz.*	156
Calumet & Hecla*	820
Centennial	31
Con. Mercur	.38
Copper Range	76½
Daly-West	15½
Franklin	17
Granby, New	125
Greene Con*	22½
Isle Royal	17½
La Salle	16½
Mass.	5½
Michigan	14
Mohawk	74½
Mont. C. & C.(new)	1⅞
Nevada	13
North Butte	83½
Old Colony	1¼
Old Dominion	46
Osceola	121½
Parrot	20½
Phoenix	1⅞
Quincy*	111½
Rhode Island	6¾
Santa Fe	3½
Shannon	16½
Tamarack*	110
Trinity	18
United Cop., com.	53½
U. S. Oil	9¾
U. S. Smg. & Ref.	51⅛
U.S.Sm.& Re.,pd.*	43
Utah Copper	57⅛
Victoria	7½
Washington	2
Winona	8¼
Wolverine	155
Wyandotte	1½

*Ex. Div. †Ex. Rights.

BOSTON CURB	
Ahmeek	....
Ariz. Com	23⅜
Black Mt.	6
Cananea Cent.	26
East Butte	11¼
Hancock Con.	....
Keweenaw	9
Majestic	3⅛
Raven	2
Shawmut	.97
Superior	16
Superior & Pitts.	....
Troy Man	2¼

LONDON Mar. 27			
Name of Com.	Clg.		
Dolores	£1	12s	6d
Stratton'sInd.	0	4	0
Camp Bird	1	4	6
Esperanza	2	1	3
Tomboy	1	6	3
El Oro	1	6	10½
Oroville	0	17	6
Somera	1	6	10½
Utah Apex	1	3	9
Ariz.Cop.,pfd.	3	15	0
Ariz.Cop.,def.	3	12	6

Cabled through Hayden, Stone & Co., N. Y.

S. FRANCISCO Mar. 19	
Name of Comp.	Clg.
COMSTOCK STOCKS	
Belcher	.55
Best & Belcher	1.40
Caledonia	.41
Challar	.11
Con. Cal. & Va.	1.00
Crown Point	.27
Exchequer	.80
Gould & Curry	.27
Hale & Norcross	.68
Mexican	.73
Ophir	2.30
Overman	.15
Potosi	.11
Savage	.76
Sierra Nevada	.71
Union	.65
Utah	.05
Yellow Jacket	.90
TONOPAH STOCKS	
Golden Anchor	.25
McNamara	.47
Montana-Pitts.ex.	.21
North Star	.27
Rescue	.14
GOLDFI'D STOCKS	
Black Ants	.08
Blue Bull	.37
Columbia Mt.	.76
Comb. Frac.	3.77
Conquerer	.19
Daisy	2.00
Florence	3.15
Frances-Mohawk.	1.10
Goldfield Con.	7.50
Grandma	.22
Great Bend	.85
Red Hills	.20
St. Ives	1.42
BULLFROG STOCKS	
Amethyst	.38
Bonnie Claire	.38
Mayflower Con.	.38
Montgomery Mt.	.21
Original	.17
MANHAT'N STOCKS	
Gold Wedge	.12
Manhattan Mg.	.12
Pine Nut	.18
Ruby Wonder	.25
Stray Dog	..
Yellow Horse	.07

NEVADA Mar. 27 (Weir Bros. & Co., New York)	
TONOPAH STOCKS	Clg.
Tono'h Mine of N.	16.00
Tonopah Exten.	3.62½
Montana Tonop'h	3.50
Belmont	4.25
Tonopah Midway	1.85
West End Con.	1.37
Jim Butler	1.19
GOLDFI'D STOCKS	
Sandstorm	.57
Kendall	.40
Red Top	4.00
Jumbo	4.00
Goldfield Mining.	1.40
Dia'dfield B. B. C.	.39
Atlanta	.72
Mohawk	16.50
Silver Pick	1.24
Laguna	1.50
BULLFROG STOCKS	
Mont. Shoshone C.	10.50
Tramps Con.	1.23
Gold Bar	1.15
Bullfrog Mining.	.29
Bullfrog Nat. B.	.42
Homestake Con.	1.20
MANHAT'N STOCKS	
Manhattan Con.	.72
Manhat'n Dexter.	.26
Jumping Jack	.16
Stray Dog	.33
Indian Camp	.17

COLO. SPRINGS Mar. 23	
Name of Comp.	Clg.
Acacia	....
Black Bell	....
C. C. Con.	5½
Dante	5¼
Doctor Jack Pot.	...
Elkton	57
El Paso	41¼
Findley	68½
Gold Dollar	6⅞
Gold Sovereign	6¾
Isabella	23½
Index	....
Jennie Sample	7
Jerry Johnson	....
Mary McKinney	60
Pharmacist	6½
Portland	1.15½
Un. Gold Mines	....
Vindicator	....
Work	17¼

New Dividends

Company.	Payable.	Rate.	Amt.
Am. Agri. Chemical, pfd.	Apr. 1	$3.00	$544,590
Am. Smg. & Ref., com.	Apr. 15	1.75	875,000
Am. Smg. & Ref., pfd.	Apr. 1	1.75	875,000
Buffalo, Ont.	Apr. 1	0.03	27,000
Central Coal & Coke	Apr. 15	1.50	76,875
Central Coal & Coke, pfd.	Apr. 15	1.25	23,438
Columbus Con., Utah	Apr. 6	0.20	60,000
Daly Judge, Utah	Apr. 12	0.37½	112,500
Esperanza, Mex	Apr. 22	1.32	600,600
General Chemical, pfd.	Apr. 1	1.50	165,000
Gugg. Exp. Co	Apr. 1	2.50	262,500
Inter. Nickel, pfd	May 1	1.50	131,123
Iron Silver, Colo	Apr. 1	0.20	100,000
New Idria, Cal.	Apr. 1	0.20	20,000
Nova Scotia Steel & Coal	Apr. 15	1.50	74,555
Philadelphia Co	May 1	0.75	434,296
Quartette Mg.	Mar. 30	0.01½	15,000
Tenn. Coal, Iron & R.R.	May 1	1.00	225,536
Tenn. C. I. & R.R., pfd.	May 1	2.00	4,960
Teziutlan	Apr. 1	2.00	20,000
Tonopah Belmont	Apr. 1	0.10	125,901
U. S. Red. & Ref., com.	Apr. 15	0.87½	656,250
U. S. Red. & Ref., pfd.	Apr. 15	0.87½	656,250
Utah Con.	Apr. 15	1.50	450,000
Va.-Carolina Chem., pf.	Apr. 15	2.00	360,000
Work	Apr. 1	0.01	15,000

Assessments

Company.	Delinq.	Sale.	Amt.
Alpha, Nev.	Apr. 3	Apr. 24	$0.05
Arizona Prince, Cal.	Mar. 25	Apr. 20	0.04
California, Cal.	Apr. 3	Apr. 20	0.05
Con. Cal. & Va., Nev.	Mar. 21	Apr. 11	0.25
Etna-King, Cal.	Mar. 10	Apr. 3	0.01½
Hale & Norcross, N.	Apr. 3	Apr. 30	0.15
Herkimer Gravel, C.	Mar. 29	Apr. 15	0.04
Ingot, Utah	Mar. 15	Apr. 1	0.02
Julia, Nev.	....	Apr. 4	0.03
Lloyd-Searchlig't, N.	Mar. 29	Apr. 18	0.01
Mexican, Nev.	Apr. 3	Apr. 25	0.15
Oro Blanco, Cal.	Feb. 25	Apr. 22	0.03
Posey Canon, Cal.	Apr. 1	Apr. 15	0.01
Quincy, Jr., Idaho	....	....	0.10
Savage, Nev.	Mar. 13	Apr. 3	0.10
St. Joe, Utah	Mar. 28	Apr. 16	0.02
Wabash, Utah	Mar. 12	Apr. 3	0.05

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		29.854	
April	64.765		29.984	
May	66.976		30.968	
June	65.394		30.185	
July	65.105		30.113	
August	65.949		30.529	
September	67.927		31.483	
October	69.523		32.148	
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

	NEW YORK. Electrolytic		NEW YORK. Lake.		LONDON.	
	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		18.641		81.111	
April	18.375		18.688		84.793	
May	18.475		18.724		84.867	
June	18.442		18.719		83.994	
July	18.190		18.585		81.167	
August	18.380		18.706		83.864	
September	19.033		19.328		87.831	
October	21.203		21.722		97.269	
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	
February	36.403	42.102	August	40.606	
March	36.662		September	40.516	
April	38.900		October	42.852	
May	43.313		November	42.906	
June	39.260		December	42.750	
			Av. year	39.819	

Prices are in cents per pound.

AVERAGE PRICE OF LEAD

Month.	New York.		London.	
	1906.	1907.	1906.	1907.
January	5.600	6.000	16.850	19.828
February	5.464	6.000	16.031	19.531
March	5.350		15.922	
April	5.404		15.959	
May	5.685		16.725	
June	5.750		16.813	
July	5.750		16.525	
August	5.750		17.109	
September	5.750		18.266	
October	5.750		19.350	
November	5.750		19.281	
December	5.900		19.609	
Year	5.657		17.370	

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

AVERAGE PRICE OF SPELTER

Month.	New York.		St. Louis.		London.	
	1906.	1907.	1906.	1907.	1906.	1907.
January	6.487	6.732	6.337	6.582	28.225	27.125
February	6.075	6.814	5.924	6.664	25.844	25.938
March	6.209		6.056		24.563	
April	6.078		5.931		25.781	
May	5.997		5.846		27.000	
June	6.096		5.948		27.728	
July	6.006		5.856		26.800	
August	6.027		5.878		26.938	
September	6.216		6.056		27.563	
October	6.222		6.070		28.075	
November	6.375		6.225		27.781	
December	6.593		6.443		27.938	
Year	6.198		6.048		27.020	

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