

The Engineering and Mining Journal

VOL. LXXXV.

NEW YORK, JANUARY 25, 1908.

NO. 4.

Mining Practice at Kalgoorlie, West Australia

The Telluride Ores, Resembling Those of Cripple Creek, Occur in Lenses and Are Extracted by Methods Insuring Perfect Ventilation

BY GERARD W. WILLIAMS*

The Kalgoorlie or East Coolgardie goldfield is situated about 390 miles by rail northeast of Fremantle, the port of Perth, the capital of West Australia. The field was discovered in 1893 by P. Hannan and party who, starting from Bayley's Find, now Coolgardie, first located the claims that attracted attention to the small area which now produces about 900,000 oz. gold per annum and which

ples proved equally efficacious. Today the idle hoisting frames that dot the horizon for miles around Coolgardie and Kalgoorlie are but memorials of the "roaring days," tombstones of buried English millions.

But of all wildcats none seemed more flagrant than those mines which lay toward the Lake till, almost by accident, it was discovered that these claims con-

The mine is developed hundreds of feet deeper than the other mines, the shaft being down to nearly 2100 ft., and good ore has been opened up on the lowest levels. The Horseshoe, Ivanhoe and Kalgurlie have also received fair treatment as is shown by the position they occupy today.

As the result of experience and experiment the mines evolved economic and



SURFACE PLANT, KALGURLIE GOLD MINES, LTD.

since 1893 has produced a total of 9,000,000 oz. gold. At first the mines which now produce the bulk of the gold were overlooked; for the lode formation was new to the prospectors who were looking only for quartz. This was the maddest of all the years that marked the foundation of West Australian mining. Wildcats sprang into being in all directions; it was scarcely necessary to have a reef; borrowed sam-

plains unsuspected formations containing equally unsuspected ore. The early history of many of the mines is too often merely a repetition of the early days of most of the goldfields of the world, the record of the prostitution of mining engineering to the exigencies of the share market. There were notable exceptions; the Great Boulder was consistently worked in the interests of the mine and the stockholder and in particular the deep-level development on this mine deserves notice.

metallurgically successful methods for the treatment of their refractory ores. Gold mining in Kalgoorlie is no longer a speculation; it is an industry, and an industry carried out on the most open lines. Whatever may have been the methods formerly in vogue at certain mines it is certain that the mines now pursue a most open policy. As far as the present managers of the several mines are concerned, the great reductions in costs which have been effected in the past three years are a sufficient

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tribute to their abilities. The combination of reduced costs and increased extraction has to a large degree counteracted the decrease in grade consequent on deeper mining. I must here express my thanks to the managers of all the mines described in the following pages for the uniform courtesy received at their hands and for the liberal manner in which mining and treatment data and costs were supplied. All data in these articles have been either supplied directly by the officers of the mining companies or have been taken from the official records of the chamber of mines.

GEOGRAPHY AND GEOLOGY

The Kalgoorlie mines are situated upon

of sodium chloride and magnesium and sodium sulphates. Water for domestic and mining purposes is piped about 350 miles. It costs the mines 5s. per 1000 gal.

The whole surface of the country is covered with red loam and other surface deposits of varying thickness. The latter consist chiefly of iron cements passing in places to nearly pure iron ore. The underlying rocks consist of: (1) amphibolite rocks, (2) new intrusive rocks ranging from ultra basic to acid, (3) highly metamorphic sedimentary rocks dipping at a high angle. The whole area has undergone extensive dynamic and thermal metamorphosis. As a result of great pressure

ANALYSIS OF CHARACTERISTIC ORE.

	Per cent.
Silica	60.0
Alumina	11.0
Ferrous oxide.....	5.5
Pyrites	7.0
Calcium carbonate.....	7.5
Magnesium carbonate.....	6.0
Soda and potash.....	1.5
Water, etc.....	1.5

There is a marked resemblance between the Kalgoorlie lodes and some portions of the Mother Lode of California. In both cases amphibolite rocks have been altered into softer, carbonated rocks with sericite and pyrites on the planes of maximum stress. The comparison of the Kalgoorlie mines and the mines of Cripple Creek is even more striking. In both cases the pay lodes are confined to a small area, and



FLAT-BACK STOPE, 400-FT. LEVEL, GOLDEN HORSESHOE MINE

the slopes of a low range of hills that rise from the arid plain extending for hundreds of miles northward and eastward. There is but little timber in the district and such as there was originally has long since gone to feed the furnaces of the Golden Mile plants. Wood is the only fuel and it is now brought in over a distance of from fifty to seventy miles. This wood has an actual working evaporation power of 3.25 to 3.5 lb. of water per pound of wood.

The plains are almost waterless, the "lakes" only contain a few inches of salt water after heavy rains, and the water from the mines is very salt. In fact it consists of an almost saturated solution

of the amphibolites have developed, in the regions of maximum stress, roughly parallel series of foliated, highly altered schists. These lines of weakness served as channels for the ascending mineral and gold-bearing solutions. With the exception of the Iron Duke lode these formations or lodes are nearly vertical and trend from north 30 to 50 deg. west. The natural rock on these lines of foliation has been further altered by the formation of carbonates and the infiltration of quartz. The percentage of free silica tends to increase with depth. The percentage of pyrites is high, averaging fully 8 per cent.

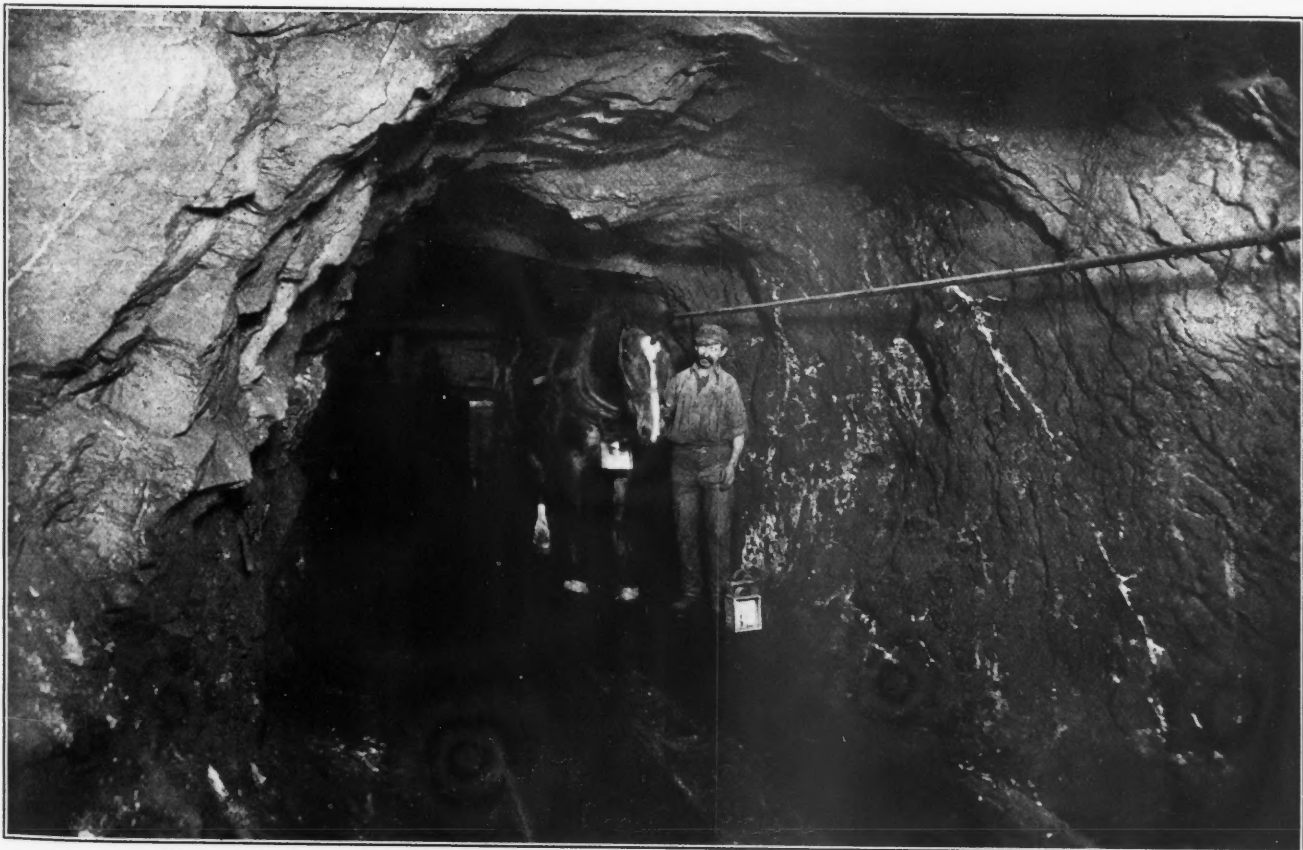
The following analysis is characteristic of the orebody in depth.

are not dissimilar in appearance. Magnetite is not found in Cripple Creek but sericite occurs as in Kalgoorlie. In both cases the gold is largely in the form of telluride, massive in Kalgoorlie and crystalline in Cripple Creek. Both places were discovered at about the same time, Cripple Creek being a few years older than Kalgoorlie, and both have produced about \$145,000,000. Finally both places show a similar decrease in the orebodies in depth, both as regards width of the body and of assay values.

The drop in grade from level to level is well exemplified in the following table showing the ore reserves of the Great Boulder:



STOPE, ASSOCIATED NORTHERN MINE, KALGOORLIE, WEST AUSTRALIA



UNDERGROUND HAULAGE, GOLDEN HORSESHOE MINE, KALGOORLIE

DIMINISHING GRADE OF ORE WITH INCREASE OF DEPTH.

Depth In Feet.	Gold per Ton.
300 to 400	\$29.6
400 to 500	39.9
500 to 600	49.5
600 to 700	18.8
700 to 800	28.7
800 to 900	27.2
900 to 1000	27.3
1000 to 1100	24.6
1100 to 1200	19.7
1200 to 1300	19.8
1300 to 1400	13.4
1400 to 1500	14.6
1600 to 1750	12.6
1750 to 1900	12.8

There is every indication that the drop in grade is not proportional to the depth but that it tends to a comparatively constant figure. Recent development on the 2050-ft. level has exposed ore of somewhat higher grade than that which has been maintained for the past 500 ft. Developments in the Perseverance and other mines support the view that most of the Kalgoorlie mines may reasonably hope to work profitably at depths fully twice as great as those attained at present.

OCCURRENCE OF THE GOLD

The gold occurs in three forms: free, associated intimately with pyrite and other sulphides, and in chemical combination as a telluride. Four tellurides are found, usually in intimate combination: sylvanite, steel gray, carrying 33 per cent. gold, 9 per cent. silver and 58 per cent. tellurium; calaverite, bronze yellow, containing 39 per cent. gold, 2 per cent. silver and 58 per cent. tellurium; petzite, steel gray, with 25 per cent. gold, 40 per cent. silver and 35 per cent. tellurium; and coloradoite, carrying 51 per cent. mercury and 49 per cent. tellurium. Coloradoite is usually associated with coarse free gold.

The width of the auriferous portion of the lode varies within wide limits, the pay shoots occurring in lenses up to a maximum diameter of 120 ft. The average may be taken at 11.5 ft. for the deeper levels as now worked.

MINING METHODS

The mines are worked from vertical shafts, the levels are put in approximately every 100 ft. Three methods of stoping are in vogue as follows:

(1) *Rill System.* The leading stope is carried on both sides of a winze in such manner that the working face is roughly parallel to the curve of the filling which is run in from the winze. The surface of the rill or filling of waste rock is covered with poles and old filter cloths. After the face has been carried up 10 or 14 ft., the stope is shoveled down and the flooring removed. The ore chutes are then built up and more waste run in. The floor is then replaced and stoping proceeded with. The method requires good walls or the stope may be temporarily lost.

(2) *Shrinkage System.* The leading stope is carried horizontally, ore chutes

being placed at frequent intervals in the drives. The stone is all broken to 6-in. cubes and the excess of broken ore drawn off at the chutes so as to leave a floor of broken ore within working distance of the face. When the stope is worked through, about 45 per cent. of the ore is left in the stope. This is then drawn off and the whole stope filled with waste. This method is most economical, but has several disadvantages. All material must be taken; it is not possible to leave pillars of low-grade ore; if the walls do not hang well the value of the ore may be unduly diminished by rock peeling off the walls of the stope.

(3) *Flat Back System.* The leading stope is carried horizontally, waste rock is laid along the floor to within a few feet of the face, and covered with planks and cloths. The ore chutes are carried up as the stope is worked through. The method is the safest, but is somewhat more costly, as so much ore and waste has to be shoveled. With indifferent walls this system is the most economical in the long run. In small lodes where sorting in the stope is possible this system is extremely cheap, for the stope may receive the waste ahead as the following stopes progress. This system is much used in outlying mines where the lode is usually small and readily separated from the country rock.

The question of stope filling is an important one. The method of filling requires many chutes for waste, but it has an indirect advantage in that ventilation is much improved; the air is restricted to the working faces and consequently the air currents do not lose their force in velocity by traveling through large areas of pillared stopes. Moreover the number of air outlets to the surface is materially increased. Speaking generally, the ventilation of the Kalgoorlie mines is extremely good and the marked absence of cases of miner's phthisis contracted locally among the workers is the highest testimony to the truth of this statement.

DRILLING AND BLASTING

The following figures, kindly supplied to me by Mr. Sutherland, manager of the Golden Horseshoe, are instructive. The average width of the lode in this mine is about 12 feet.

WORK OF NEW INGERSOLL, 3%, F. 9., ROCK DRILLS IN STOPES FROM JANUARY 1 TO JULY 31, 1906.

Average number of machines in use	19.2
Number of shifts	541
Number of holes drilled	31,660
Number of feet drilled	217,280
Feet drilled per drill per shift	20.94
Average depth of holes	6.86
Tons of ore broken	149,313
Average tonnage per drill per shift	14.39
Steel sharpened:	
Hand drills	79,151
Machine drills	130,094
Picks pointed	694

HANDLING BROKEN ORE

The visitor to Kalgoorlie, especially if he is accustomed to the large hauling ways of the Rand mines, is apt to be somewhat disappointed with the winding gears of this field. The majority of the mines raise the ore in 15-cwt. trucks in double-deck cages, and mechanical handling of the ore underground is unknown. The Perseverance mine uses a belt conveyer for distributing waste along one of the principal levels and horse traction is utilized at one or two mines, but, generally speaking, all tramming is done with hand labor. This, with truckers paid \$2.40 per 8-hour shift, appears somewhat strange when one reflects that on the Rand with truckers at 50c. per 10 hours it pays to install mechanical haulage on the main levels. Nor can this be explained on the assumption that the white worker is four times as efficient as the colored worker, for in regard to unskilled work of this description the kafirs are nearly, if not indeed quite, as efficient as the average unskilled worker on the Kalgoorlie or any other goldfield.

From the collar of the shaft to the dump, however, all handling of the ore is mechanical.

According to a series of experiments described in *Comptes Rendus* (pp. 720-722, Vol. 145, investigating certain causes of error in the molybdate method of phosphorus determination in steel, not less than 30 c.c. of molybdate reagent (75 grams ammonium molybdate per liter) should be used for each gram of iron. This is needed to counteract the solubility of ammonium phospho-molybdate in ferric salts. Distilled water only should be used for washing as wash water containing ammonium nitrate or nitric acid dissolves sensible quantities of the precipitate.

EXPLOSIVES USED IN THE GOLDEN HORSESHOE FROM JAN. 1 TO JULY 31, 1906.

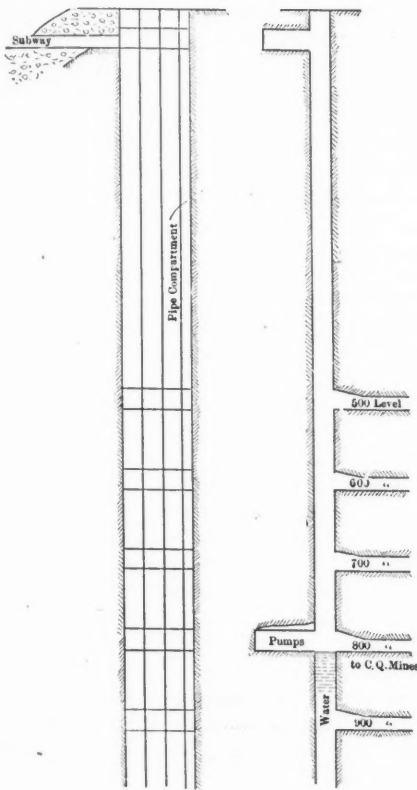
	Stoping.	Driving.	Cross-cutting.	Winzing & Raising.	Shaft Sinking.	Plat Cutting.
Tons of ore broken	149,313					
Footage		2,175	434	1,578½	103½	3,350 c. u.
Pounds of Explosives used:						
Gellignite	89,580	1,210	140	995		
Gelatin dynamite	130	5,885	450	260	50	
Blasting gelatine	890	21,975	5,125	9,195	1,750	350
Detonators	52,525	10,100	2,200	6,875	700	200
Coils of fuse	11,575	2,320	552	1,401	203	33
Average pounds of explosives per ton of ore broken	.61					
Pounds of explosives per foot progressed		13.37	13.17	6.62	17.39	4.375

A Shaft Fire in the Shattuck Mine, Bisbee, Ariz.

BY I. J. STAUBER*

The suddenness of mine fires is often disconcerting; therefore it is well to know the method used elsewhere under similar circumstances. On that account this description of the method of fighting the recent fire in the shaft of the Shattuck-Arizona Copper Company is given.

As the 800-ft. level of the Shattuck is



SHAFT ELEVATION, SHATTUCK MINE,
BISBEE, ARIZ.

connected with the Cuprite workings, belonging to the Copper Queen Company, the Shattuck shaft is strongly upcast, the air velocity being about three miles per hour. Fire was first noticed by the night watchman about midnight Nov. 19, 1907. There was no one in the mine at the time and had not been during the previous nine hours since the mine was only working a day shift. As soon as the fire was discovered three lines 2-in. fire hose were hung in the shaft; this almost immediately diminished the smoke and also, by lowering the temperature, decreased the velocity of the air in the shaft. By this time, perhaps 15 minutes after the fire was discovered, sufficient help was on hand to start building bulkheads; three of these were necessary, one at the surface, one in the sub-drift near the surface and one on

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the 800-ft. level where the Shattuck connects with the Cuprite mine. This last was built about 1000 ft. from the shaft, but even at that distance some difficulty was experienced owing to gas. It seemed to shoot back in blasts even against the strong draft.

Within an hour and a half from the time of discovery every opening was tightly closed. About this time it was found that the 6-in. steam-pipe was broken somewhere below. Advantage was taken of this, and steam from the 250-h.p. boiler was discharged into the shaft for about five hours to assist in smothering the fire.

The next day a small hole was made in the bulkhead at the collar of the shaft and a light cotton rope lowered to the bottom to test for fire, this came up unscorched, but it was decided best to keep things closed for fear of fire smouldering somewhere in the three miles of underground workings.

EFFECT OF PROMPT CONTROL

Everything consequently was kept tight for 4½ days; the shaft was then uncovered and thoroughly wetted. The accumulated gas was very strong, but cleared enough in three hours to permit of a descent. It was found that the fire originated in the 800-ft. pump-station in the upper part of some lockers and had burned out about four feet of solid cribbing on top of the station sets.

The shaft is always wet and did not burn to any extent except in the "dinky" compartment which joins the steam-pipe compartment. The guides on that side and the lining boards between the two compartments burned to the 500-ft. level. None of the posts or plates of the shaft sets were damaged, but about 40 of the center girts were burned enough to need strengthening; this is being done by means of a false girt bolted to the top of the old ones.

Apparently the rapid spread of the flames was due to a large electric lighting cable; the waterproof covering of this was very inflammable. The fire ran along this wire and burned the switch boxes on the stations and, in the case of the 700-ft. level, followed the drift wires for 200 ft. but, as the drift was untimbered, no further damage was done.

The total damage consisted of 2000 ft. of guides destroyed, 40 girts so damaged that they had to be strengthened, slight damage to the pipes, electric cable destroyed and a few chairs so injured that they had to be reset. This is a very small damage for a shaft fire and especially so when one remembers that the fire must have been under very strong headway at one time. Undoubtedly the prompt use of hose and water quickly put out the flames in the shaft while the smothering action of the bulkheads checked the fire in the places where water could not reach.

Tin Mining in the Northern Territory of Australia

According to an Australian paper, quoted by the *Mining Journal*, December 21, 1907, there are about 100 men on the Western Arm tin field at present, where wages for white miners average 11s. 8d. per day, and for Chinese 7s. to 8s. Within a radius of eight miles there are 20 payable claims, and new discoveries are frequently made. The climate is said to be much better than that of Cairns and Townsville, while food is good and the supply of vegetables and game plentiful.

As regards individual properties, little or no development has been done, with the exception of the John Grant, Good Hope, and Rocky Bar claims. In other cases the work done has been conditioned by the discovery of rich patches which have been picked out at the expense of future working. Thus, in one Chinese claim 300 tons of tin have been extracted, valued at £30,000, from a depth of less than 40 ft., without the installation of any machinery whatever. This method of working is caused partly by lack of capital, and partly also, it would seem, by the character of the formation met with. The tin is said to occur, not in lodes, but in "blobs," yielding up to 100 tons of ore, after which the occurrence pinches out until another patch is met with. The patches, however, are so rich and close to the surface as to be decidedly payable.

The Market for Tungsten Ore

The following statements were made recently by the managing director of a Cornish mining company at the annual meeting of the stockholders:

Wolframite is an ore that has been selling for very high prices, but for the moment buyers prefer to look on, as they express it. Their reason is largely this: Most of the ore is bought by Germans, who convert it into tungsten metal and sell it on forward contracts chiefly to America. America for the moment, as a result of the financial position, is almost in a state of chaos as far as commerce and steel manufacture are concerned. They are not drawing tin from here to the extent of their normal consumption, nor can they make use of the tungsten metal they have bought on forward contracts. The result is that they are sending it back to this market at less than the prices of the German makers, and for the time being this has brought the price of tungsten ore down to a comparatively low level as compared with a few months back.

Mining in New Mexico During 1907

BY REINOLD V. SMITH*

Mining in New Mexico during 1907 included the production of coal, iron, copper, lead, gold, silver, zinc, vanadium, uranium and turquoise. Silica, clay, lime, natural cement, and building stone added materially to the monetary value of the mineral industry. Aluminum, meerschau and soda are under serious investigation, and will, beyond doubt, soon be added to the list of products of the State. Silica was made into refractory materials for smelting purposes in the Territory, and was shipped in manufactured forms; other silica, such as gangue material, went regularly to the Arizona smelters as gangster and flux.

The financial depression affected the Territory to some extent, but not to so great a degree as some of the other mining sections. This was due largely to the nature of the mineral products, of which coal, iron, and gold are most important. These were not seriously affected until the close of the year, so that the partial suspension of copper smelting did not result in much contraction in the value of the year's production. The coal production remained normal, but the demand is expected to fall off at the beginning of 1908. The mines are not laying off men, and many of the coal companies are enlarging their plants and preparing to increase production; during the year the value of coal and coke both materially increased. Iron ore did not decrease in production, and several new fields are being developed and filed upon by local capitalists.

GOLD AND COPPER

Cyanide treatment for gold was the metallurgical feature of the year in the Territory, and promises the greatest returns in the immediate future. Several of the copper smelters were enlarged and new ones built. The growth in copper smelting was to an extent induced by the past high price of the metal, but it was aided by the proof of the existence of many valuable deposits of copper in the central and southern camps.

The drop in the price and the consequent curtailment in production has injured copper mining more than any other branch of the mining industry. Development is being limited to those properties which are fortunate enough to have ores which can be profitably treated at the present prices. There is a general belief among mining men that the spring will see a surprising activity in copper, and holders of property are not allowing assessment work to remain unperformed.

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ZINC

The production of zinc was curtailed materially, owing to the action of the larger mines at Magdalena. The shipments from one of the largest producers was continued until within the last few weeks of the year, but the marketing of zinc from the property of the Tribullion company was stopped as soon as the lease expired and the property came back into the hands of the owners. This was on Jan. 1, 1907, and the year was spent in installing machinery and erecting a mill in order to extract more cheaply and prepare the ores for shipment to the new smelter of the company at Cañon City, Colo. Several companies within the Territory are, however, shipping zinc to Eastern points for treatment, and the character and grade of the ore is such that it is not at all likely that the shipments from Cook's Peak, and from Hanover, as well as from Magdalena, will be interfered with. The mines show reserve orebodies larger than in 1906 and development work is being systematically carried on.

METALLURGICAL IMPROVEMENTS

A number of concentrating mills were installed and orders for machinery for many others were placed. About 20 mills have undergone renovation or enlargement. Electric separation of copper from iron was undertaken on a large scale in one mill. Copper-leaching mills were, in three cases, run experimentally on oxidized ores. Placer mining and dredging on a small scale were practised and produced about 10 per cent. of the total gold output. Copper was smelted in several localities and lead smelting in one. About 550 new coke ovens were built and several new coal mines were opened. The new coking-coal mines were, in three cases, opened by the metal-mining company owning the coal, so as to secure fuel for its own use.

Railroad construction did not meet the expectations of the beginning of the year, but definite plans for extensions, especially for the transportation of fuel, appear to have been arranged.

The quantity and value of the mineral products, so far as figures are at present obtainable, are given in the accompanying table.

MINERAL AND METAL PRODUCTION IN 1907.

Coal, tons.....	2,300,000	\$3,225,000
Copper, lb.....	7,250,000	1,655,000
Silver, oz.....	450,000	824,000
Iron, tons.....	182,000	600,000
Gold, oz.....	14,850	307,150
Lead, lb.....	6,650,000	304,000
Zinc, lb.....	3,260,000	163,000

The total mineral production, including non-metals, was about \$6,850,000.

The major portion of the coal came from Colfax county, which furnished about 35 per cent. of the total; San Juan and McKinley counties produced about 50 per cent., and Rio Arriba, Santa Fe, Sandoval, Socorro, and Lincoln counties 15

per cent. Iron ore was mined at Fierro, in Grant county, and was smelted at Pueblo, Colo. Zinc was produced in Socorro and Grant counties principally, although three other counties made shipments during the year. Grant county, in the southwestern part of the Territory, led in the production of copper, although this metal was mined in all of the counties in the central and western part of New Mexico. Lead came mostly from the camps of Grant, Socorro, Sierra, and Dona Ana counties. Silver is found associated with lead, gold, copper and zinc, but the greater part comes from the mixed ores of Socorro and Grant counties. Gold to the amount of \$307,000, a gain over 1906, came from silicious ores and also from the mixed ores of the Grant county camps, from the Mogollon, Burro Mountains, and from the Hillsboro district in Sierra county. The production of placers was mostly from the counties in the northern part of the Territory. Investigations of placers were under way in the southern districts, and in some of these, where conditions are most favorable, active mining is soon to commence. Milling operations for the extraction of gold were mostly cyaniding or aqueous concentration. Pneumatic concentration did not increase, although the mills now operating along this line have been entirely successful.

Turquoise was mined in several localities near the central part of the territory, the production being a little in excess of last year. The Azure company's mines, in the Burro mountains, were reopened and machinery was being installed at the close of the year preparatory to an active campaign in 1908. This section has been idle for a number of years.

Conditions in New Mexico are rapidly improving, and many strong companies are engaging in iron, coal, copper and gold mining.

Irrigation projects are attracting much attention, and the growth in this line cannot fail to re-act on the mining industry.

According to *L'Echo des Mines*, which quotes the French Legation at Copenhagen, the Danish Government, in order to hasten the opening up of Greenland, has renounced the monopoly of mining, reserved to the State, and has given an important mining grant to Mr. Bernbourg, a Copenhagen merchant. Copper mining is the chief object in view. Besides copper, the grant comprises deposits of graphite and mica.

G. Szivessy, in *Annalen der Physik*, finds that the electrical resistance of silver and platinum wires is increased by heating them in a current of oxygen, but no effect is produced on gold and palladium wires. In the case of silver, the increase amounted to 0.3 to 0.6 per cent., and in that of platinum up to 3.8 per cent.

Notes on the Tyee Copper Mine

Lenticular Copper Deposits in Coast Region of Vancouver Island, British Columbia. Peculiar Characteristics of the Tyee Orebodies

BY WALTER HARVEY WEED*

Lenticular masses of pyrite and copper pyrite have for centuries furnished a large part of the world's supply of copper, and careful studies have been made of a number of such deposits. Yet neither the genesis of such orebodies nor any general law of occurrence to aid the prospectors in their discovery and development has as yet been definitely established.

CHARACTERISTICS OF LENTICULAR OREBODIES

Practically all the larger bodies of this character, which are minable, outcrop at the surface and are marked by the "iron hat" or gossan, mentioned in all our text books. The ore masses occur almost

and have been recorded by the men in charge.

COPPER DEPOSITS OF THE COAST DISTRICT.

The coastal region of British Columbia contains numerous copper deposits, in the belts of altered rocks that border the great granite areas forming the mountain ranges. There are, however, only three productive districts, namely, Howe Sound (Britannia mine), Texada Island and Mount Sicker. The last named is at present the only productive area on Vancouver Island and in point of output is the most important copper producer of the coast area. It is situated about 25 miles north of Victoria, high up on the

of the three mines, and under the supervision of its able managing director, Clermont Livingston, has been successfully developed from an unproved prospect in an exceedingly rough, heavily forested, almost inaccessible situation into a mine that has repaid its cost, and now—when remarkably extensive prospecting has failed to discover another orebody—has, it is said, a comfortable balance in the treasury, wherewith to purchase another property.

THE TYEE OREBODIES.

Through the courtesy of Mr. Livingston I was permitted to visit and examine this property, accompanied by the su-

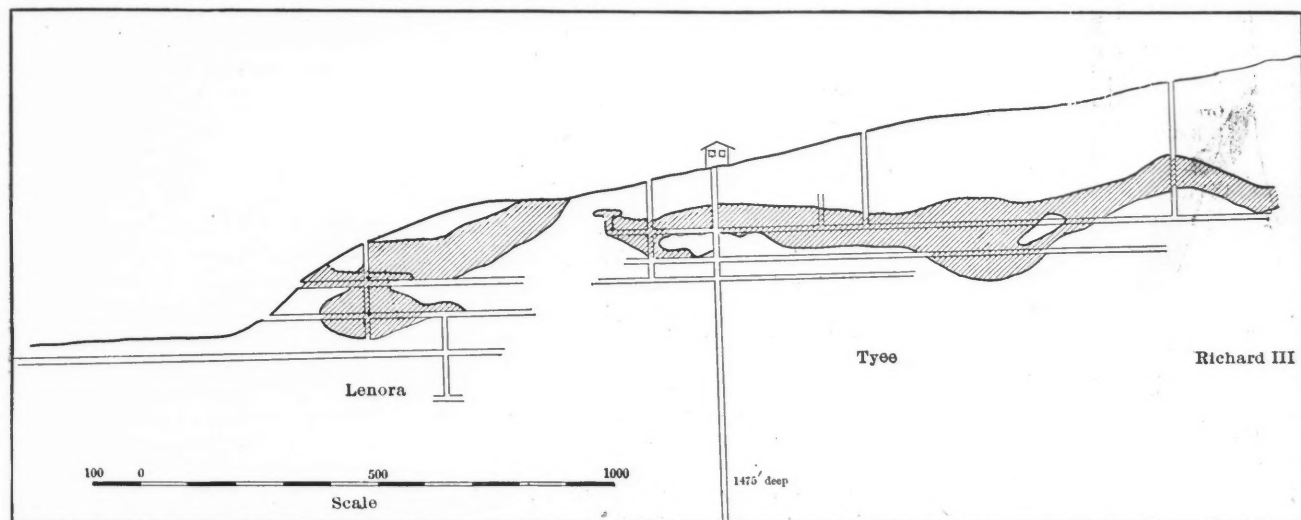


FIG. 1

without exception in schistose rocks, and the layers of schist conform to the walls of the orebody. As, however, the foliation of the schist is a result of pressure and bears no necessary relation to sedimentary bedding, it does not prove a sedimentary origin for the ores, as claimed even nowadays by a few geologists. Others have maintained an origin through igneous waters, as suggested by the frequent association of igneous rocks.

The Tyee deposit on Vancouver Island offers a peculiarly good opportunity for the study of an orebody of this type, for not only is the orebody absolutely delimited by development work, but diamond drilling and many thousands of feet of crosscutting and sinking have made known the detailed structural relation,

eastern slope of the mountainous backbone of the island. Duncan's Station, the nearest railway point, is about six miles from the mine by wagon road, but the ore is handled by wire-rope tram and smelted at Ladysmith, a few miles distant, on the eastern shore of the island.

The entire production of the district has come from a single lens of ore extending through several adjacent claims owned by the Lenora, Tyee and Richard III companies. The first named mined out the southern end of the lens, extracting approximately 60,000 tons of ore. It has been closed down for some years, and the amount of ore left has not, it appears, tempted the owners to rehabilitate the mining plant and railway line. The relative position of the three mines is shown in Fig. 1 herewith.

The Tyee is by far the most important

perintendent, J. W. Bryant, to whom I am indebted for the sections given herewith. Fig. 3 represents a cross section through the orebody showing its relation to the synclinal or canoe-shaped fold of the inclosing rocks, and the post-mineral fault which cuts it. The other drawing, Fig. 2, is a longitudinal section through the orebody along its strike or course.

The deposit presents several features of unusual interest to mining engineers. In the first place the lenses, unlike most deposits of this so-called Rio Tinto or Kieslager type, do not come to the surface, or at any rate outcrop at only one small point, being covered by the encasing rocks. There is nothing to distinguish the ridge, or so-called hog-back, in which this deposit lies, from any other on the slope of Mount Sicker. The small

*Mining geologist, New York.

inconspicuous area exposed was only found after forest fires had swept the ground and burned the dense timber, brush and moss to ashes that were carried away by heavy rains. Elsewhere the ore lens tapers upward as it does downward, and is completely enclosed in the schists. It is certainly not a surface deposit.

The orebody is, moreover, peculiar in its structural relations and mineralogic character. The ore consists of chalcopyrite, with pyrite, in a barite gangue. It occurs in a shear-zone or fault-zone, definitely traceable for a mile or more down the mountain slopes and across the Chemainus river. Throughout its course it contains disseminated particles of copper pyrite, which at some points reaches a copper content of 0.5 to 1 per cent., though no other orebody has as yet been found. This shear-zone, marked by

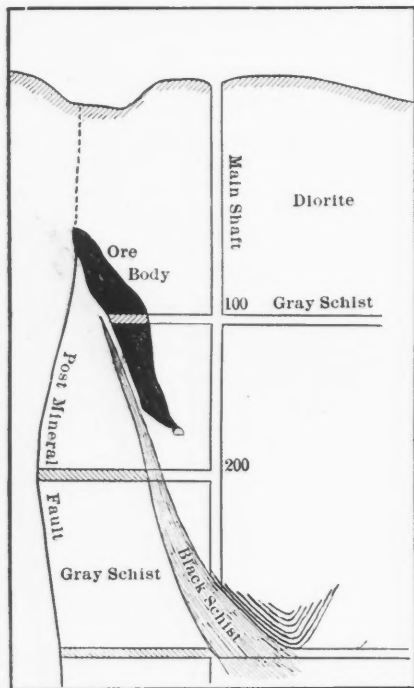


FIG. 2

whitened and by iron-stained rocks, traverses crystalline schists usually considered to be part of the Vancouver Island series of Dawson. The rocks seen about the mine show considerable variation. The lignite-bearing series is exposed near the mine, though tuaceous igneous rocks and granular igneous rocks, probably dioritic, cut through the prevailing green and gray schists. The latter rocks are well exposed but at the surface are altered by weathering. No detailed survey of the district has been made and the exact relations of the shear-zone to the rocks cannot be distinguished without it.

SURROUNDING ROCKS

The rocks near the orebody are mainly green chloritic schists; pieces of this rock from the underground workings have the

greasy look of a crushed and schistose serpentine. The gray schist of the ore zone proper is hard, silicious, thinly foliated and devoid of any mineral recognizable to the eye. The rock immediately adjacent to the ore is mainly a dark gray schist, the color being due to graphitic matter.

According to an examination under the microscope made by E. H. Adye, the result of which has been kindly supplied me by Mine Superintendent J. W. Bryant, "it is quite inconceivable that such a rock can have had an igneous origin. . . . The finely divided opaque black matter is, of course, graphite, attesting an early phase of thermal metamorphism in an originally highly carbonaceous, argillaceous deposit which contained some sand. The last is evidenced by the presence of anthogonous (secondary) quartz. The rock also carries plenty of small scattered crystals of iron pyrite."

The diorite, which practically forms one wall of the orebody underground, is not schistose near the ore, but becomes so going northward, as shown by bands of schist varying from a foot to many yards in width that alternate with belts of solid diabase rock. To the unaided eye the schists generally seem to be altered greenstone formed from old tuffs, and sediment carrying lignitic matter, similar to the tertiary breccias of the Yellowstone Park. By shearing and thermal metamorphism they have been altered to the schists of today. These rocks form distinct bands, and have been compressed into a series of narrow folds, alternating saddles and synclines, well exposed in the rounded rocky bosses about the mine.

While the ore appears to occur in a shear-zone traceable for a mile or more, observations underground show that the ore lens lies on the south side of a V-shaped trough and that it lies against graphitic schist and within gray schists. The fault and the adjacent diorite mass show no genetic relation to the ore, the fault being post-mineral.

SIZE OF THE OREBODY

The orebody is a large but irregular lens with a proved length of 2800 ft., a mean width of 20 ft., and a depth of 150 ft. It is 40 to 50 ft. wide in many places. In the Lenora and Tyee mines, where its limits are known, it contains in all over 300,000 tons of ore. Extensive cross-cutting, drifting and diamond drilling from the various levels of a shaft 1250 ft. deep show that the orebody does not go down, but that the shear-zone, with its peculiar barytic impregnation, extends through the folds, showing patches of low-grade copper-bearing rock at one or two points in other and lower saddles. The ore contains an average of nearly 38 per cent. barite, yet the rocks on either side of the ore do not contain even traces of that substance.

The ore is a dense, compact mass of chalcopyrite and barite, carrying a little zinc blende, and aluminous silicates. According to analyses made for the company and furnished me by Mr. Livingston the ore has the composition shown in the accompanying table.

COMPOSITION OF TYEE ORES.			
	I	II	III
	Per Cent.	Per Cent.	Per Cent.
Copper	4.56	4.08	4.50
Iron	11.94	10.49	12.50
Zinc	6.60	7.36	7.00
Silica	13.50	13.48	12.50
Alumina	3.95	7.01	.....
Baryta	37.30	37.63	38.00
Lime	2.20	2.04	.....
Magnesia	Trace	Trace	.....
Sulphur	16.62	15.65	.....
Total	96.67	97.74	.....
Silver, oz. per ton	2.87	2.67	2.80
Gold, oz. per ton	0.14	0.13	.....

I. Average of analyses made by company.
 II. Average composition of ore mined in 1905.
 III. Average of 150,000 tons shipped up to middle of 1905.

FAULTS IN THE OREBODY

Throughout its course the orebody is battered, cracked and full of chips and

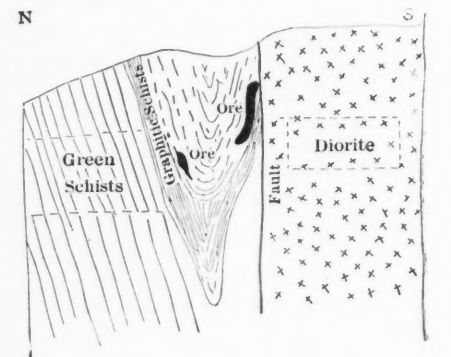


FIG. 3

slickensides. This is due to a strike fault, which cuts through the tip of the orebody, and has shattered the footwall rock along its course. This fault has been found in the workings to the deepest levels attained, and varies from 3 in. to 2 ft. in width. It is filled by stiff bluish mud and clay containing fragments, often well rounded, of the rock through which it cuts. A branch of this fault cuts through the ore but does not appreciably shift or dislocate it, though the fractures are filled with soft gouge matter. Later movement and slipping has made slickensides and grooves, showing that the ore has moved downward a short distance, but as a skin of ore remains on the opposite wall of the fault it is evident that the movement was post-mineral and that the shift was small. Both walls of the orebody show clay selvage throughout the entire mine; pyrite mirrors and slickensides are common.

The new exploration work of 1907 developed a second, but smaller, orebody

of low and very irregular grade in the north leg of the inverted saddle.

PRODUCTION AND COSTS

With wages \$3.50 per day for miners, \$4 a day for shaft work and \$7 per foot for crosscuts, mining costs have averaged \$2.40 per ton. Up to May, 1904, the company had produced 59,338,099 lb. copper. The production since has been approximately 20,000,000 lb. more. The mine water all comes from the surface and only extends downward 200 to 300 ft. The deep workings are dry—even dusty—except where the fault slips are channels for descending surface waters. The country is dry in summer and the mine boilers are supplied by water from the Chemainus river, pumped up against a 1300-ft. head.

ORIGIN OF THE ORES

The Tyee orebody resembles in features and occurrence the lenticular bodies of iron ore of the Lake Superior ranges, the origin of which has been so clearly disclosed by Van Hise, Leith and others. The hypothesis that the copper is a concentration by shallow ground-water circulations of material extracted from sparsely disseminated particles of chalcopyrite and pyrite of the schists, liberated during gradual erosion of the country, gathered in shear-zone cracks or trunk channels and precipitated by graphitic matter with coincident replacement of crushed material, appears at first sight to be an adequate explanation for this and many other deposits. The chief objection to this, and apparently an insuperable one, is the fact that the Tyee deposit consists largely of barium sulphate, while the surrounding rocks are entirely free from it; showing that lateral moving waters have not furnished the ore. It is, therefore, evident that we must look to deep-seated waters as the source of the ore in this deposit.

Metallurgy of Antimony

A. Germot in *Revue des Produits Chimiques*, Dec. 15, 1907, describes the following process: Antimony sulphide is melted in a converter, and air is blown in. The air burns part of the sulphur and produces sulphurous acid and antimony, which remains in the crucible. The operation is made continuous by the addition of more ore. The sulphurous acid escapes through a pipe at the upper part of the converter, and carries off antimony sulphide fumes which are sublimated in special chambers. If a current of air is made to act on these fumes oxysulphides or antimony oxide will be produced, according to the amount of air.

The Rocky Mountain Club of New York

The first annual meeting of the Rocky Mountain Club, of New York, an organization of western men in the East, was held at the new club rooms in the Knickerbocker hotel, New York, Jan. 9, 1908. The report of John Hays Hammond, president, showed that one year ago the club started with a membership of seven, and today has 386 members.

When the club was organized it was thought wise to provide a fund to insure the financial success of the club. An underwriting syndicate was formed which subscribed to a guarantee fund of \$60,000. The president of the club reported that it had not been necessary to call upon the guarantors for any assistance. Instead of having to borrow money during its first year, the club has been able to pay its way and now has a comfortable surplus with which to carry out its work of promoting good fellowship among western men in the East, and of furthering the interests of the western States in the East. It was decided to increase the number of directors from 7 to 15 so as to give each western section a representative on the board.

It was decided to have a weekly gathering at the club on every Tuesday evening from 4 to 6 o'clock, and to hold a club smoker on the last Tuesday of each month during the year. The club is fulfilling its purpose in that it is the headquarters of western men in New York. New directors elected for the years, 1907-8-9, are: John Hays Hammond, William B. Thompson, mine owner and banker of Butte, Mont., now doing business in New York; Albert J. Seligman, John C. Montgomery, of Denver, the American representative of the Venture Corporation Ltd., of London; Benjamin B. Thayer, managing director of the Amalgamated Copper Company; Edward H. Clark, of California, manager of the Hearst estate; General George O. Eaton, U. S. A. retired; John B. Farish, of Colorado and New York; Willis S. McCornick, of the banking firm of McCornick Bros., of Salt Lake and New York; J. G. Hopkins, managing director of the Arizona Copper Company and a director of the Cumberland-Ely Copper Company; Dr. C. K. Cole; A. Chester Beatty, mining engineer with the Guggenheim Exploration Company; S. W. Eccles, of Salt Lake and New York; Thomas H. Leggett, of London and New York, and James J. McEvelly, an attorney of New York, and formerly of Montana.

Immediately after the annual meeting the directors met and elected the following officers: John Hays Hammond, president; Albert J. Seligman, vice-president; William B. Thompson, treasurer; Frank W. Holmes, assistant treasurer; and James J. McEvelly, secretary.

It is a purpose of the club not only to

maintain a social headquarters, but also to co-operate with all commercial organizations in the western States, and to assist them in furthering the interests of the respective western communities. Members of the club say that within another year they will have 700 members and that the club will be one of New York's leading organizations within five years.

Phosphate Mining in Tunis

According to a correspondent of the *Mining Journal*, London, the shipments of phosphate rock in 1907 were as follows: Gafsa company, 750,000 tons; Kala Djerda, 240,000; Kala-Senaam, 100,000; La Floridienne, 30,000; total, 1,120,000.

The railway from Metlaoui to the Gafsa company's Redeyef mines is now completed, and the rich rock of the latter (65 per cent. tribasic phosphate) will commence to be shipped early in 1908. The increase in the Gafsa production over 1906 is 160,000 tons. During 1908 the total will probably reach 1,000,000 tons, the arrangements for the shipment of that quantity being already provided for. It is said on good authority that the sales effected for 1908 ensure a profit of 20 francs a ton.

The line from Sousse to Ain Moularès is being steadily pushed forward and will be carrying the fertilizer from these beds a year hence. According to the terms of this concession the Gafsa company has to bring a minimum of 250,000 tons annually to Sousse. As far as the southern half of Tunisia is concerned, the Gafsa company has practically a monopoly, as it can exercise the option of taking over any ground conceded in that district on equal terms within a specified time of the adjudication. In this way it took over the Ain Moularès concession on the terms of a bid made by another company.

As indicating the extent of the industrial reaction at Pittsburg it is stated that the Pennsylvania Railroad is not able to find room on its sidings for its empty freight cars. Another interesting rumor about the road is that no rails for 1908 will be delivered before June.

A new method to prevent infiltration of water in walls and the soil is described by *Elettricità* (Nov. 1, 1907). Compressed air is conveyed into a vessel furnished with a mixer containing lime or cement well diluted. To inject the cement, a flat-nosed fire-hose nozzle is employed. The nozzle is applied against the wall or the earth, and gradually moved over all parts. The cement, thus injected, gradually sets, forming a single piece with the main work, increasing its strength and preventing infiltration.

The Copper Mines of Katanga

At the annual meeting of the Tanganyika Concessions, Ltd., at London, Dec. 20, 1907, Robert Williams who is in technical control of the mines in Northern Rhodesia and the Congo Free State, made a report upon the developments up to date. The Tanganyika Concessions is the exploring company, which received a great concession from the Congo Free State. It owns 45 per cent. of the capital stock of the operating company that has now been organized, and 90 per cent. of the Benguella railway. The substance of Mr. Williams' report is as follows:

During the year the Union Minière du Haut Katanga was formed in Brussels with a working capital of £400,000 to work the mines we had discovered up to Dec. 9, 1906, including the great copper mines. At the last meeting, I reported that, taking copper at £50 per ton, the Katanga mines had £100,000,000 opened at that date, and I put the cost of production and delivery on the market at £25 per ton. Since then the tonnage of the properties of the Union Minière has greatly increased, and the cost of production will be less than we had estimated. The diamond drill operations have proved the continuity of the Kolwezi copper beds to three times the depth opened up by our shafts and drives, and developments at the Star of the Congo mine have exposed a further 800,000 tons of 12 per cent. ore, which, with sorting and dressing, will be almost self-fluxing. At our Kansanshi mine the reef has been cut at 200-ft. level, the main shaft is already down to the 300-ft. level, and I have little doubt that the reef will be cut at that level in due course. Test smelting operations will have probably commenced by this time at this mine, and they have already started at Kolwezi mine.

In view of the great wealth developed at the Star of the Congo mine, we are now negotiating with the Rhodesia Railway company to construct its line direct to that mine instead of direct to Kansanshi mine, and to serve the Kansanshi mine with a branch line. The Star of the Congo, besides having about 10 times the wealth opened up that Kansanshi has, is about 60 miles nearer the Rhodesian rail head. I offered the Rhodesia Railway company to construct the railway from the Rhodesian frontier to the Star of the Congo mine by the Katanga Railway company, provided the Rhodesia Railway would construct the line in its own country to its own frontier, and to leave its line free to compete with other lines provided it gives fair rates, and I have pointed out to the Rhodesia Railway company that by this connection I will probably join them direct to Lobito Bay at no distant date, as I expect to bring about a

combination of finance and interests to complete that connection. I have had a very favorable reply from the Rhodesia railway company quoting rates for traffic which I think will lead to business. The Chartered company has everything to gain by this extension, as, apart from traffic from Katanga and Kansanshi mines, it owns one-third interest in the latter mine. The Rhodesia Railway could, I am told, be at the Star of the Congo mine in a year, while our own line can tap our mines in three years.

With regard to the Benguella Railway, the first 100 miles constructed over the worst section of the whole route will be opened for traffic this month at a point where it joins the main road to the interior. At this point, according to our reports, the line will take the traffic now being carried by 200,000 native carriers annually to and from the interior, and the traffic will increase with every mile we build, as we are penetrating a country thickly populated by natives, and with a considerable white population. The traffic between Lobito, Catumbella, and Benguella has increased from 759 passengers and 1000 tons of goods in 1905, to 12,000 passengers and 5000 tons for eight months of this year, exclusive of all returns for railway material and staff.

This line is not going to be so costly as some folks say. We, as a company, never intended to construct the whole 1000 miles from Lobito to Katanga. What we expected to do was to find about half the necessary capital. This line will have cost us about £2,500,000 when completed to K.320. Our difficulties are past, as the following cable, which I received yesterday from the railway contractors, will show: "Average rate platelaying last four days, 1½ km. per day, increased to 2½ km. today. All work in full swing and difficult country now overcome. The earthworks are finished well ahead, and will not delay platelaying in the future. Continued rapid progress platelaying can be relied upon." I have our contractors' statement that a temporary line for copper can be completed for £3500 per mile—let us say £4500 per mile for 800 miles—within three years. It will, therefore, take another £3,600,000 to complete the 1000 miles at a total cost of £6,100,000 sterling from Lobito Bay to the Lualaba smelting site in the middle of that group of mines. Of the required £6,100,000 we have already provided nearly half the amount, and I have every reason to believe that the negotiations I am now carrying on will bring those already interested with us in our great copper mines also in with us to find money for this line. We have still some £800,000 in cash in hand and uncalled capital, and we are, therefore, in no hurry for further capital.

We have made solid progress during

the year, and smelting is probably going on now both at Kolwezi and Kansanshi, and from all practical tests made, and from all reports received, our copper will not cost us over Mr. Farrell's original estimate of £12 per ton in Katanga. Our ores can be easily treated in several ways; the natives have been smelting copper from these mines for a hundred years or so. Mr. Farrell in his first report on our properties in 1902 stated our ores were silicious but easily treated by direct smelting. His estimate of the cost of producing copper at Katanga was £12 per ton. On July 4, 1906, after receiving many analyses of our ores, I wrote as follows *re* their treatment—viz.: "I have had a long consultation with Mr. Dewar, who agrees with me that while some of our mines are highly silicious, there are others and portions of others which might almost be termed self-fluxing propositions, and what we are trying to arrive at is whether it is possible by a commonsense method of dressing the same free of quartzites and scientifically mining it, to land ore at the smelter containing a greatly reduced quantity of silica. It is a fact that in almost every one of your mines there are two classes of ore, a quartzite containing almost pure malachite in 'blobs' and seams, which may be separated from the quartz by hand-picking, and what is known as an impregnated sandstone ore. These two occur in various proportions at each mine, and it is almost certain that out of the quartzite reef class of ore almost pure malachite may be extracted, which would go to the enrichment of the impregnated sandstone ore, thereby producing a parcel of enriched ore from each mine with proportionately less silica. This, together with a careful selection of ore from the mines containing a lesser proportion of silica and also containing larger quantities of lime, carrying, in some cases, copper, would enable us to arrive at a mixture which might keep a large smelting plant going for many years. By this method the ore that is best suited for smelting will be sent to the smelter, and the ore that is suited for other purposes will be dealt with accordingly. It does not follow, because there are one or two mines in Katanga tremendously high in silica that we need use these mines at present, or even include them with others which may be almost self-fluxing, unless we do so with the idiotic idea of raising the cost of the production of copper. The object of these investigations is to produce a ton of copper with the least possible quantity of fuel and flux. The average value taken over all the mines of Katanga might show, say, 10 per cent. copper, with 40 per cent. free silica, taking the whole thing *en masse*, while the smelting production of copper would cost anything from £20 to £50 per ton. If, on the other hand, we

take certain mines and scientifically mine the ore on the lines I have indicated in this letter, we should be able to produce ore containing, say, 20 per cent. copper and 20 per cent. silica, with a probable cost of smelting of about £12 to £13 per ton. This is the proposition we have to deal with in Katanga, which seems to me to offer facilities such as do not exist in any other country in the world."

The views expressed in that letter are the lines our engineers are working on. We have made experiments in sorting and dressing our ores, and we find that the most silicious portion of these ores can be dressed down at about 1s. or 2s. per ton to almost pure malachite. Mr. Dewar states in his report: "With proper working conditions I see no reason why a recovery of 75 per cent. to 80 per cent. of the total copper could not be obtained in a product represented by some 5 per cent. actual weight." We are now running out copper at Kansanshi and Kolwezi by test furnaces, and propose to send it to Rhodesian railhead by traction engines which are now at work on the spot. Mr. Watson wrote me on Sept. 30 *re* Kolwezi smelting tests as follows: "Running on very rich ore as we now do, even with this small blast furnace, I think we should be able to turn out 25 tons of copper per month at a cost of £10 per ton." Allan Gibb, the mining engineer and metallurgist who was obtained from America, writing on Oct. 29, states with regard to Kombovo mine: "I have had a good general look at this mine, and feel convinced that I will be able to confirm the splendid reports you have already had about it. It will in itself be an enormous asset to the company, and much care will be required in preparing it for work. I am bringing in men to work on it, and will commence operations on my return from Ruwe." And I received a cable from Mr. Gibb on Dec. 9, as follows—viz.: "I shall be able to treat the ore, cost per ton will not exceed £10 per ton copper, from the average produce of Katanga mines."

The London Spelter Market in 1907

SPECIAL CORRESPONDENCE

The year opened inauspiciously for all metals, chiefly in consequence of financial stringency; and spelter was no exception. Opening at £28 2s. 6d. per ton for ordinary brands ex ship in the Thames, the price quickly fell to £27 15s., a few bear sales helping the depression. Consumption, however, remained on a large scale, with every prospect of continuing so. Moreover it was known that continental producers had already sold at relatively high prices for delivery in the second quarter of the year; but these favorable

indications did not serve to arrest further decline down to £26 12s. 6d. on Jan. 18. At this point a rally ensued, prompted partly by demand for early delivery and partly by threatened difficulty in transport, owing to the frost. The price rapidly rose to £27 7s. 6d. after which demand was satisfied, buyers were unresponsive, and the price fell back to £26 17s. 6d. for ordinary brands, and £27 7s. 6d. for Silesian specials, remaining steady thereafter until the end of the month.

February found the market awakened by reluctance of consumers to operate in face of recent unsteadiness, while speculative realizations gradually forced the price of ordinary brands down to £25 15s. on Feb. 11. Thereat some active business followed and raised the price, but the movement soon spent itself, and price relapsed to the old level. Meanwhile producers, having sold well ahead, and held firmly for higher prices, and consumers having allowed their stocks to run low, gave the market some support toward the end of the month. Closing prices were £26 1s. 3d. for ordinary brands, and £26 2s. 6d. to £26 7s. 6d. for specials.

March opened with moderate but increasing demand, particularly for export, and with prices still ruling higher on the Continent than in London. A gradual advance marked the first fortnight, after which further progress was stayed by the financial panic which originated in American securities and which disturbed business generally. Industrial requirements, however, protected spelter from collapse. About Feb. 26 prices relapsed seriously, on account of forced sales for future delivery just when consumptive demand was in abeyance. Prices fell to £25 17s. 6d.; special brands at the relatively high price of £26 10s.

April opened with a dull market which, however, soon revived on improved demand, particularly from galvanizers, whose trade was very active; sheet zinc being also in good demand and held for full prices. On April 10 ordinary brands commanded from £26 2s. 6d. to £26 5s. By this time demand was partly satisfied, and the market suffered by pressure of speculative holdings, so that ordinary brands relapsed. A gradual improvement set in, however, and closing values were £26 to £26 2s. 6d. for ordinary brands, and £26 10s. for specials.

May opened with active business at foregoing figures. This, however, was of short duration, business generally being adversely influenced by instability and shrinkage of values in American securities. Galvanizers bought largely down to the middle of the month, but were freely met by dealers. When this demand was satisfied, a persistent decline finished at £24 17s. 6d. for ordinary brands, and £25 17s. 6d. for specials.

June showed no improvement; the London market was dull and uninteresting, consumers' orders being eagerly competed

for, and bears ever alert to check any improved tendency. In the latter half of the month the galvanizing industry showed further expansion, and there was a more active business in sheet zinc and chemical products. The close was at £24 5s. @ £24 10s. for ordinary brands, and £25 12s. 6d. @ £25 17s. 6d. for specials.

July opened with a dull market, to which some animation was soon imparted by galvanizers. An advance was of short duration, and the rest of the month witnessed a persistent decline, due to abstention of consumers and eagerness of holders to sell. Closing prices were £23 2s. 6d. for ordinary brands, and £24 5s. for specials.

August was dull as regards volume of business, and the market was demoralized by the apathy of consumers, no less than by pressure of sales on the London Exchange by parties operating for the fall. The middle of the month saw a temporary rally, but this was of short duration, and the decline thereafter continued to the end of the month when ordinary brands were quoted £21 12s. 6d. @ £21 15s., and specials £22 5s. @ £22 12s. 6d.

September opened with general uneasiness and depression. Consumers bought reluctantly and only for early delivery, while producers could not tempt buyers even with substantial concessions. The month closed with ordinary brands at £20 17s. 6d., and specials at £21 10s. @ £22.

October opened with a steadier market, which induced an improved volume of business. Values improved until Oct. 15, when the general depression in commerce prompted some bear selling for forward delivery and reduced values by 5s. It was evident, however, that prompt supplies were scarce, and producers well sold and holding for full prices. Zinc rollers were busy, and an improvement in the galvanized iron trade stimulated an advance to £22 2s. 6d.; special brands, £22 12s. 6d.

November was a time of severe financial strain in the commercial world, but spelter was less affected than other metals. Advancing rate of interest on money in Germany induced sellers there to part with their holdings. The result was a decline in price. Some improved inquiry thereafter raised values, but hopeful factors were powerless to resist the pressure of speculative sales for forward delivery, which brought down prices at the close to £21 5s. for early delivery, and £20 15s. for forward; special brands being quoted at £22 and £21 10s.

December opened with a dull market, the consuming industries being sufficiently supplied with metal, and the prevailing depression in commerce and finance being sufficient to check enterprise. Further depression was caused by the rumor of American spelter on offer in the English market. Prices varied, with fully £1 margin between spot and forward metal. The close was at £19 10s. for good ordinaries, and £19 15s. for special brands.

The Deposition of Flue Dust

By CHARLES F. SHELBY*

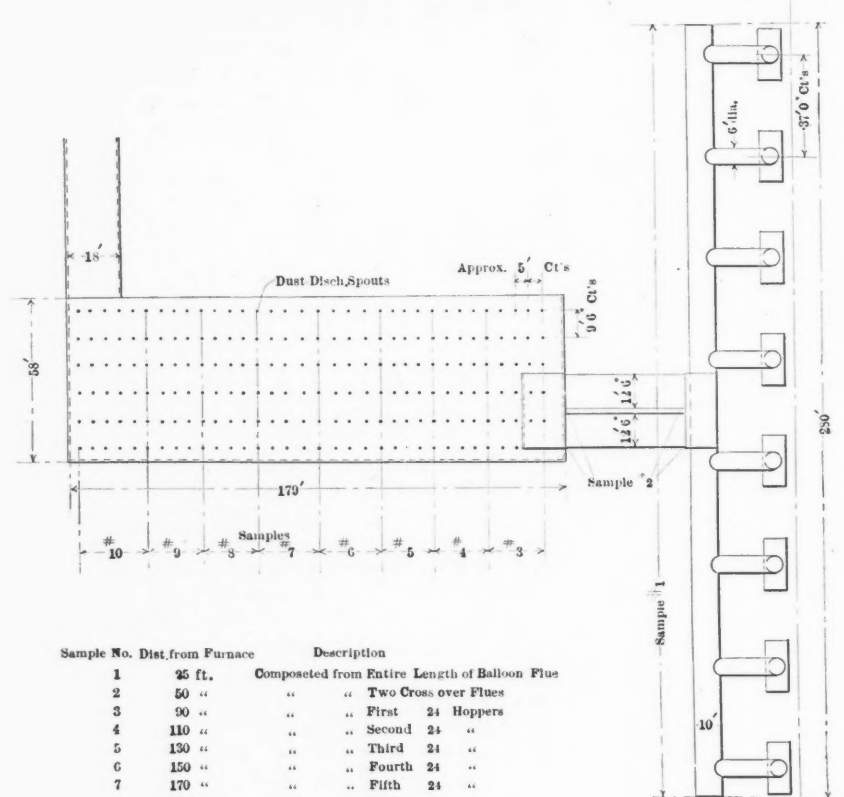
The accompanying engraving and table give some results made in connection with the study of flue dust deposition and its sizes at different distances from the furnaces at Cananea. Some further data that may be interesting in connection therewith are the facts that 55 per cent. of the total flue dust is caught at the place marked "Sample No. 1," about 2 per cent. at "Sample No. 2" and 28 per cent. at samples 3, 4, 5 and 6 (the major portion of this 28 per cent. being caught almost directly beneath the cross-over flue), and the remaining 15 per cent. at the point represented by samples 7, 8, 9 and 10. In the table showing the percentage of flue dust left on the various sizes of screen, attention is at once attracted to the great disagreement of the percentage on 100-mesh as compared with the remainder. This is accounted for in a different manner of weaving the wire screen on which the 80-mesh was supposed to have been taken, and after all these results were tabulated and this discrepancy noticed a microscopic examination was made of the screens, which showed that the 80-mesh was in reality almost equivalent to a 100-mesh screen; and if these two columns are put together and called 100-mesh the table can be considered correct.

At the time the samples were taken, and previously thereto, six of the eight furnaces, each with a hearth area of 48x210 in., were in operation and connected by means of goose necks, as shown, to the balloon flue that runs parallel to these furnaces. These furnaces have a capacity of the Cananea charge of about 450 wet tons of ores, by-products and fluxes per day, of which for the month of November 50.3 per cent. was what we term "fines," or what will pass through a 1/4-in. ring. The figure of 50.3 per cent. is in accordance with the general monthly result. Now, these furnaces will produce under current conditions about 50 tons of flue dust each per day. Figuring the blowers at 90 per cent. volumetric efficiency, there was being delivered to each one of these furnaces approximately 14,000 cu.ft. of free air per minute, or 200 ft. per sq.ft. of hearth area, against which the material in the furnace produces a back pressure of about 18.5 oz. per sq.in. The height of the column in the furnace is from about 9 to 10 ft., and this low pressure with the degree of fineness of the charge is maintained by reason of the maximum number of tuyeres, which are of large diameter, and an eternal vigilance in seeing that they are kept open and free. A stack 19 ft. in diameter and approximately 200 ft.

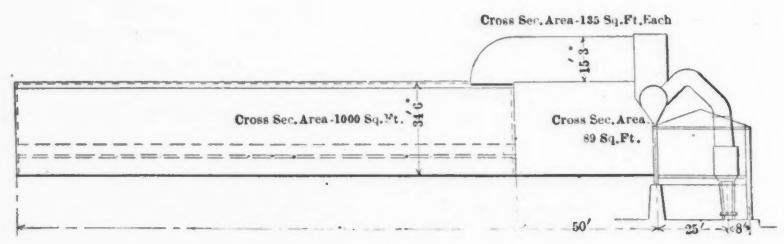
above the feed floor is connected to the flue leading from the main dust chamber, which on the drawing is marked "18 ft. wide." This produces a draft at the base of the stack of an approximate average of 1 in. of water, which at the furthest furnace amounts to only 0.1 in. and at the two central furnaces to about 0.3 in. The furnaces are hand-fed, and by reason of the speed with which they are operated, the feed doors are open all the

chamber, in the space marked "50 ft." on the blue print, are the ore bins for the blast furnaces, on the top of which are railroad tracks on which the ore comes in, and as this entire space is filled up with these bins, it can be seen at a glance what an undertaking it would be to make any changes in this balloon flue during operating times.

It is the intention of the present management, however, to remove these ore



Sample No.	Dist. from Furnace	Description
1	25 ft.	Composited from Entire Length of Balloon Flue
2	50 "	" " Two Cross over Flues
3	90 "	" " First 24 Hoppers
4	110 "	" " Second 24 "
5	130 "	" " Third 24 "
6	150 "	" " Fourth 24 "
7	170 "	" " Fifth 24 "
8	190 "	" " Sixth 24 "
9	210 "	" " Seventh 24 "
10	225 "	" " Last 36 "



STUDY OF FLUE DUST SIZES AT VARYING DISTANCES FROM FURNACES OF CANANEA CONSOLIDATED COPPER COMPANY

time, which doors run the entire length of one side of the furnace, the opening being about 30 inches high.

The various areas through which the gases have to pass are not correct. The balloon flue was first built to serve a few small furnaces, but by reason of other work that was considered of more importance, and other complications, it has never been changed and has simply been added to as the plant has grown. Located between this balloon flue and the main dust

bins and build a brick dust chamber of approximately 500 ft. cross-sectional area paralleling, and the entire length of, the eight furnaces shown. This dust chamber will be connected with the main dust chamber shown by large goose necks coming out of the top, and of ample area, so that the plant will really have a primary and a secondary dust chamber; and by reason of the fact that the primary dust chamber will be of good dimensions itself, the greater portion of the dust will be col-

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lected here, and then the gases in having to rise out of this chamber and descend into the other will not carry with them the amount of dust that they would were these two chambers connected on the same level. Then there will be very little work left for the second chamber to do; and it is hoped that the maximum efficiency in settling dust will be obtained by

stalled a washery, where the coarse ore, carrying a large proportion of free sand closely intermingled and attached, was broken and jarred and washed till the bulk of this sand was carried away in the tailings. This method lost a considerable proportion of the finer ore, which enriched the tailings. The problem was to find some method that, while economical,

THE HILL ORE LANDS.

In connection with this work has been the final leasing of the so-called "Hill lands" on the western Mesabi range, which was concluded late the past summer. These lands are owned in fee by numerous parties, including the State of Minnesota, and others, but were all bunched together in a transaction whereby the Oliver Iron Mining Company secured practically all that was left of the western part of the range. Something under 200,000,000 tons of ore have been shown on these lands, of which about half is owned, either in fee or lease, by the Great Northern road, and the rest by various parties, of whom Pillsbury, Bennett & Longyear are chief holders. Most of the ores on these lands are washable, so their acquirement was directly connected with the concentrating experiments at Coleraine; the failure of one would have meant that this vast tonnage was worthless until such time as 40 per cent. ore could be shipped to furnaces and worked into steel.

TABLE SHOWING PER CENT. OF FLUE DUST LEFT ON THE VARIOUS SIZES OF SCREENS.

Number Sample.	Per Cent. on 10.	Per Cent. on 20.	Per Cent. on 40.	Per Cent. on 60.	Per Cent. on 80.	Per Cent. on 100.	Per Cent. on 150.	Per Cent. on 200.	Through 200.
1	0.8	11.2	16.2	36.6	20.9	0.7	9.0	2.9	1.7
2	0.2	2.2	8.2	37.4	30.6	0.5	13.5	5.0	2.4
3	nothing.	0.7	2.4	38.7	35.5	0.3	11.2	7.3	3.9
4	.....	0.7	3.2	42.7	25.4	0.2	15.9	7.2	4.7
5	.....	0.2	0.6	16.1	38.7	0.3	27.2	9.0	7.9
6	.....	0.1	0.2	15.3	35.0	0.1	29.0	11.7	8.6
7	.....	nothing.	nothing.	4.0	19.4	0.5	38.4	18.5	19.2
8	.....	.....	.....	3.0	18.0	0.4	37.9	19.4	21.3
9	.....	.....	.....	1.6	16.4	0.4	36.0	20.4	25.2
10	.....	.....	.....	0.3	4.6	0.4	29.0	27.6	38.1

Combine 80 and 100 mesh and call both 100 mesh, on account of error in manufacture, or specification.

this method. Other changes, of course, will also be made, but as this article is intended primarily only as an explanation of the results shown on the accompanying drawing, they are not mentioned here.

Operating Changes in the Lake Superior Iron Mines

By DWIGHT E. WOODBRIDGE*

In a previous article I reviewed the production and progress of the iron-ore mines of the Lake Superior region in 1907. This is supplemented herewith by some account of recent and prospective changes in methods of operating the mines and handling the ores.

CONCENTRATION EXPERIMENTS.

An interesting feature of the year was found in the concentrating experiments. The most important of these is that conducted by the Oliver Iron Mining Company on the West Mesabi. While this is by no means new, changes were introduced in the work this year that seem to have solved the question of the concentration of the sandy ores of the western end of that range. When the Oliver company took over the Canisteo district, where perhaps as great ore deposits exist as anywhere in the world—possibly greater than the famous Hibbing region just east—it was upon the belief that these lean ores could be economically treated to remove the excess of silica at a charge that would not bear too heavily on the ore. The company first secured practically the entire region covering these ores, adding an enormous tonnage to its reserves, and knew that what remained in the district would come to it, and no one else, when the proper time came. It then in-

might reduce the losses to the point where further refinements of the savings would become uneconomical. That has been the work of the past year. "Turbo," or supplementary log washers, Hancock jigs, settling tanks, classifiers, etc., have been added from time to time, and the problem seems now solved by the addition of the turbos and the jigs. The losses of fine ore have been reduced to a very small percentage, while the costs of operation have not been increased to the point where the saved ore does not more than pay for itself.

THE CANISTEO DISTRICT.

While a certain share of the ores found in the Canisteo district are suitable for shipment without treatment, the tonnage that must be washed is enormous, and the preparations made for mining and shipment have been on a vast scale. Probably not less than \$6,000,000 have so far been expended on the Canisteo district, in the construction of railway lines, the stripping of mines and building of towns, and in the experiments with concentration. One unit of what will in time be a plant capable of treating upward of 10,000 tons of ore per day has been erected for these experiments. It is not yet determined how soon big mining operations will be conducted on these lands, and it may be another year or two before the tonnage taken from the Canisteo region will be at all commensurate with the magnitude of the enterprise. But by the successful outcome of these experiments a tonnage of hundreds of millions of tons of what, when washed, is desirable iron ore, has been added to the reserves of the Mesabi district. No small degree of credit is due President T. F. Cole and his Duluth and Eastern associates for their courage in acquiring these lands and in their energy and persistence in carrying forward the experiments mentioned.

CONCENTRATION ON THE MENOMINEE

Another interesting experiment in concentration is now in progress on the Menominee range, under the charge of John T. Jones, a mining engineer who has impressed his skill on the Lake Superior region for many years. Great bodies of lean magnetic ores exist in that district, and these are to be crushed and concentrated by magnetic processes, including some new devices, eliminating the jasper and, to some extent, the phosphorus. By subsequent semi-roasting the concentrates are partially oxidized. The projectors of this plan have great hopes of changing the situation on the Old Ranges and bringing into the available reserves immense tonnages of ores now considered worthless. By their nearness to market and the ease of mining the cost of the roasted concentrates will be quite low; indeed they expect to deliver these ores at lower lake ports for less than \$3 a ton. These experiments have not yet progressed beyond preliminary stages, but semi-hematite nodular ores of fine character have been produced.

ELECTRIC PLANTS.

Aside from the Oliver company's various developments to which reference has been made, the installation of a complete underground electrical equipment for the Penn Iron Mining Company, at its Norway and Vulcan properties, is most interesting. This company has a group of mines producing about 500,000 tons a year, whose fuel costs are said to be reduced \$110,000 per annum by this installation. A water power on the Sturgeon river, four or five miles from the mines, was developed for a head of 40 ft., and wheels driving 3700-kw. revolving field generators were placed.

*Mining engineer, Duluth, Minnesota.

Mining and Smelting at Cerro de Pasco, Peru

Modern Methods of Copper Production Are of Recent Introduction in a District Formerly the Field of a Great Silver Industry

BY CLARENCE C. SAMPLE*

The rocks of Cerro de Pasco, the copper district in the Peruvian Andes, include sedimentaries of Jurassic and Cretaceous age. The series is made up of calcareous conglomerates, sandstones, slates, limestones and quartzites. The different strata were laid down upon each other unconformably, and were subsequently disturbed so that at present they dip eastward at a high angle and strike north and south.

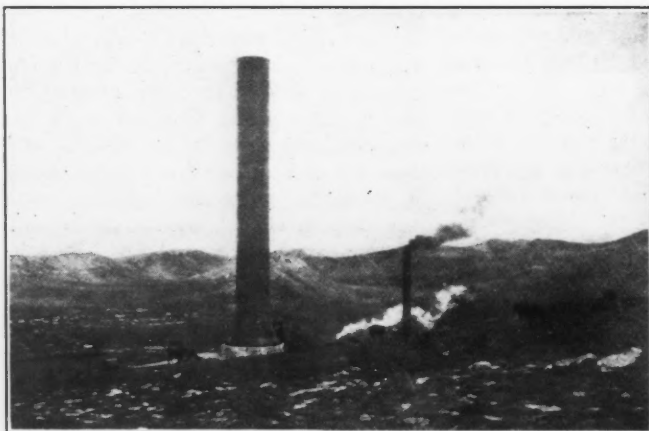
Between the limestones and slates there is a wide belt occupied by an intrusion of dacite. The dacite is composed of small phenocrysts of plagioclase, biotite and quartz in a felsitic ground mass, orthoclase, apatite and magnetite being present as accessory minerals. The eastern side of the dacite intrusion has suffered severe

veins of ore, but considering the deposit as a whole it appears to be a huge stockwork. Taking any mineralized fissure individually it might be considered as a pipe or continuous vein according to the manner and extent of mineralization; so also could the impregnated rock be mistaken for a bedded deposit. The fissures in most cases were not completely filled with metallic minerals, but rather these were concentrated in certain zones so that the ore lies in the veins in lenses or pipes surrounded by a clayey or chalcidonic matrix. It is stated by Raimondi that the entire orebody is underlain by diorite which here, as in other districts in Peru, has mineralized the deposit.

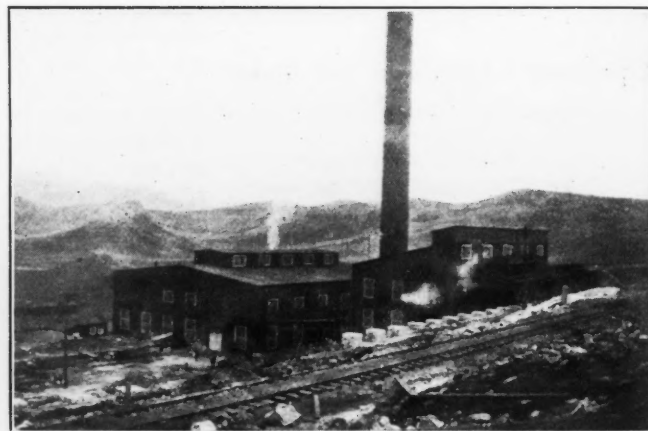
The ore zone seems to have been shattered again after mineralization. The

or copper but occasionally some are found with considerable silver in which case the copper tenor is higher also. Below the *bronces* are the *pavonados*, complex mixtures of sulphide ores with tetrahedrite and rich silver minerals. These often contain as much as 20 per cent. copper and 8 or 9 kg. silver per metric ton.

The primary ores below water level are made up of pyrite, chalcopyrite, blende, tetrahedrite, bornite, and arsenopyrite. They contain small amounts of silver with mere traces of gold. Very commonly there is a zone near the water level where the transition from sulphides into sulphates, carbonates and oxides is seen in all stages and upon an extensive scale. Galena is frequently found in clusters of crystals and is highly argentiferous;



SMELTER STACK, LA FUNDICION



POWER PLANT, CERRO DE PASCO

shattering, alteration and metamorphism, so that the characteristics of the original igneous rock have been completely changed. It is quite possible that at the extreme eastern side of the metamorphosed zone and in contact with and below the limestones, there were, before the intrusion of the dacite, beds of sandstone and slate. The metamorphism has completely altered the original form of such beds, so that now they cannot be distinguished from the altered sides of the igneous intrusion.

The shattering of the rock opened numerous fissures, ramifying in all directions and reaching in some instances far into the limestones. Vein-forming and silicious solutions have impregnated the softer and more porous rock with mineral and filled the fissures. Raimondi notes the existence of beds, pipes and continuous

transition from altered and metamorphosed rock above to sedimentaries below is often very sudden, but no plane of contact can be traced for any considerable distance. The caving of the old workings has added greatly to the difficulty of a study of the orebody.

The orebodies outcrop as great ridges or *crestones*. For the upper 200 or 300 ft. they are brightly colored and much altered by oxidizing waters. The surface ores are called *pacos* or *cascajos*. These are bright red in color and consist of a silicious skeleton material impregnated with oxide of iron, and to a less extent, with copper. They contain usually at least 300 to 500 grams of silver per metric ton. The *pacos* were the ores usually treated in the old patio process. Immediately below the *pacos* and above the water level are found the *bronces*. These are extensive and consist of nearly pure iron pyrites. They rarely contain much silver

native copper is rarely found in small plates; cuprite, malachite and azurite are abundant in amorphous masses; bournonite is frequently found, also copper and iron sulphate, in well-defined crystals, in zones above the water level. The ores vary so much in composition that lists of analyses are likely to be misleading.

COMPOSITION OF ORES

Silica in combination with basic oxides is present only in small amounts; as fine crystals or grains of quartz, it makes up most of the gangue of the ore. It varies from a few per cent. in the purer pieces of pyrite ores up to 70 per cent. and more in the *cascajos*. The ores smelted in the various furnaces contain an excess of silica which requires the addition of limestone as a flux. From 35 to 40 per cent., I believe, is a fair average of the silica in the majority of the ores smelted.

Iron is present in the surface ores as

*Bluefields, Nicaragua.

hydrated ferric and ferrous oxide; in the sulphide ores as pyrite, chalcopyrite and magnetite. The iron content varies from 14 per cent. in the *cascajos* to 27 per cent. or more in the sulphides. Lime and magnesia in the form of carbonates seldom run above 4 per cent. for combined CaO and MgO. Alumina is found in amounts up to 6 or 7 per cent. in combination with silica or as clay. Manganese is reported in amounts seldom exceeding 0.5 per cent. The sulphur varies greatly. It is 2 or 3 per cent. in the oxidized ores, increasing to 35 or 40 per cent. in the purer lumps of pyrite ores which are roasted in kilns. From 26 to 35 per cent. would include the limits of sulphur content of most of the pyrite ores that are smelted.

Zinc as blende is reported, but not in quantities sufficient to cause annoyance to the smelters. To my knowledge 8 per cent. is the highest amount of zinc that has been found. Lead occurs as carbonate and sulphate in the surface ores and as galena in the deeper zones. In certain veins the amount of galena is considerable and is

to 3 per cent. and upwards. Arsenic occurs as arsenopyrite and probably in combination with both silver and copper. The amount varies about the same as antimony. Silver is found in all amounts from zero to 1 per cent. It occurs native and in combination with sulphur, antimony and perhaps arsenic. According to Hodges 85 per cent. of the silver in the surface ores is native. The *cascajos* or surface ores alone were treated by the patio process and ores containing less than 1400 grams per metric ton were considered too poor to treat at a profit by this method. Gold is not found in consequential amounts. Bismuth is reported in all ores up to 0.2 per cent. Thallium has been found in the bullion from several mines, and nickel has been reported in traces.

OLD AND NEW METHODS OF MINING

The mines of Cerro de Pasco are not mentioned by any of the early historians of Peru, although accounts are given of the working of the silver mines of Porco and Potosi in Bolivia, and of the quick-

these *tajos* breaks off and falls to the bottom. The caved ground gave new entrances and exits to the workings, and today the tunnels are seen in the sides of the *tajos* perhaps 100 ft. above the bottom of the pit and equally as far below the edge of the uncaved ground.

More modern methods are now being adopted. The mines are entered through vertical shafts from which the levels branch off at regular intervals. Pillars are left wherever possible in poor ground, and the workings are filled with waste after the ore is taken out. Timber is brought into the country at great expense and is used only in lining the shafts and more important tunnels. Water in great quantities is found 300 to 400 ft. below the surface. The pumps are kept going continuously, and in some mines the pumping capacity is such that an interruption of three hours would drown out the lower levels.

During the past 40 years there have been many schemes for driving an adit to drain all the mines. Henry Meiggs was granted



BACK OF FURNACE BUILDING, LA FUNDICION



SMELTER AND CONVERTER BUILDING, CERRO DE PASCO

very argentiferous. Such ore is usually separated from the regular run of mine. Some lots, containing as much as 8 or 10 per cent. of lead, go to the copper furnaces but this is exceptional. The usual amount is 6 per cent. or less.

The copper content of the ores varies between wider limits than any of the constituents except silica. In the *cascajos* it is often present only in traces and reaches its highest value in the *pavonados*. The accompanying table conveys a very good idea of the average copper content of the ores smelted at different works.

PERCENTAGE OF COPPER IN ORES SMELTED AT PERUVIAN WORKS.

Works.	Year.	Average % Cu.
El Triunfo.....	1898	16-17
San Jacinto.....	1899	8-9
Huaracaca.....	1899	20-25
San Miguel.....	1900	13-16
Tinahuarca.....	1906	12

Antimony occurs in nearly all ores usually as tetrahedrite and in combination with silver. The amounts vary from 0.25

silver mines in Huancavelica, with details of the methods of extracting the metals from their ores. The earliest date of working the Cerro de Pasco mines is 1630. From that time until 1893 they were exploited continuously for silver.

The method of mining first adopted was by quarrying or open cuts which were carried from the surface downward in the *cascajos* in a series of descending terraces. Later tunnels were run, always inclined downward or zig-zagging back and forth and downward, but never on a level. When bonanzas of ore were found great chambers were excavated, leaving pillars in the poorer or barren parts of the vein. In many of the workings these chambers were hollowed out so large and left so entirely without support that the ground caved, opening enormous pits often several hundred feet across. These pits are called *tajos* and some of them have fallen to a depth of 300 ft. below the surface. Now and then a portion of the sides of

a concession for such a project about 1868, for which he was to receive all mining claims not denounced at the time, and a royalty of from 25 to 75 per cent. on all ore taken from existing mines that would be drained by the adit. Several short drainage tunnels have been driven but at present they are caved and useless. A company was formed several years ago which had for its object the construction of a drainage tunnel deeper than the deepest mine workings but as far as I know no work has yet been begun.

ORE TREATMENT BY THE PATIO PROCESS

Although the mines of Cerro de Pasco were not worked until the patio process had been well perfected in other places, a short account of the early methods of the Indians and Spaniards may be of interest.

Garcilasso de la Vega in his Royal Commentaries says, "The Inca kings had a knowledge of quicksilver but were unacquainted with the nature and use of it,

and only admired the lively and quick motions of it. However, having observed some certain noxious qualities and effects which it produced, such as stupefactions, palsies and trembling of the nerves, the kings, whose first care was the safety of the people, did absolutely forbid their subjects to use or meddle with it: and they being so possessed with an apprehension of its noxious qualities abhorred it to a degree, as not to think it worthy of thought or word; so that they had no name for quicksilver."

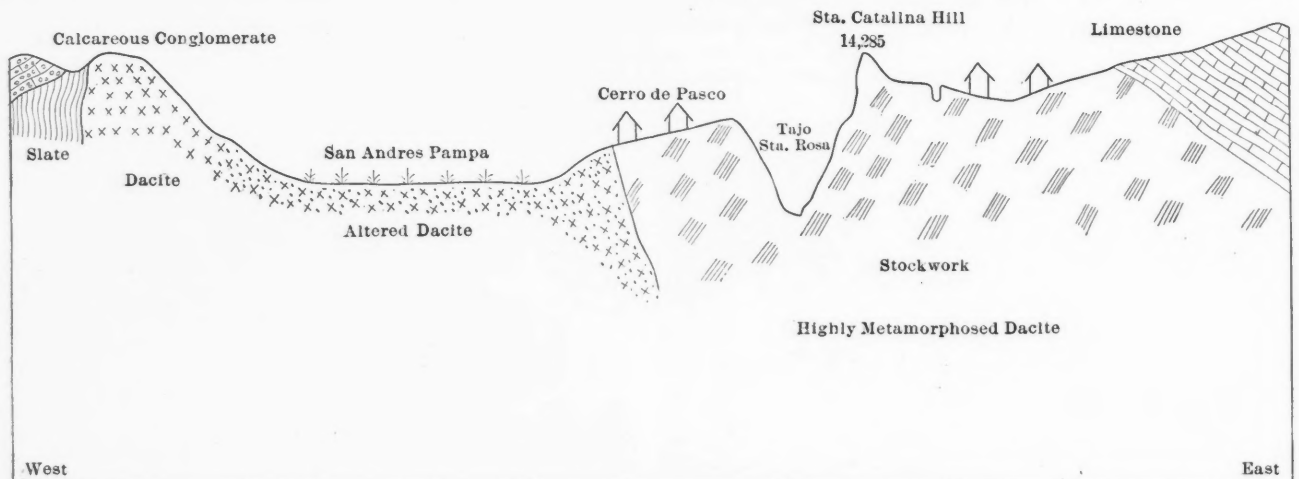
The mines of Potosi were discovered April 21, 1545, a few months before the first Spaniard commenced mining. Before this time mining and the extraction of silver had gone on for a long time at Porco. Here dry silver ores were mixed with argentiferous lead and the mixture placed in crucibles which at night were heated in fires kept hot by natural draft of the moderate gales which blew up the sides of the mountains after the sun had set. "It

axle driven by a horizontal water wheel placed in a vault below the paved ground around which the stone rolls moved. After grinding, the ore was placed in circular, enclosed stone courts, moistened, and mixed with salt; *magistral*, an impure copper sulphate, was then added, and later the requisite amount of mercury. Mules were driven through the pulp to incorporate the mixture thoroughly, and kept there until the extraction of the silver had gone as far as possible. The ore pulp was then washed out of the courts by a stream of water through ditches paved with stone in which were wells for catching the mercury and amalgam. After cleaning, the amalgam was retorted in the usual manner.

The plain of Junin, near the old town of Pasco, about 15 miles south of Cerro, was the site of a surprisingly large number of these old patio *haciendas*. The dates on the buildings run from 1803 to 1893. Some of these works were of enormous extent, inclosed by high stone walls,

and soon there were a dozen or more small plants in the town of Cerro de Pasco.

Ores running above 30 per cent. copper were sent directly to Europe or to the smelters at Yauli or Casapalca. Lower-grade ores were reduced to matte, which was shipped. These small plants consisted of reverberatory roasters for the fine ores, fired by *taquia* or dry llama dung. The coarser sulphide ores were roasted in Guyer kilns with only such fuel as was required to ignite them. The roasted ores whose sulphur content had been reduced to 10 per cent. were melted down to matte in reverberatory furnaces fired with bituminous coal or shale from the mines near the town of Cerro de Pasco. Limestone was added to the charge for a flux. The slags were usually very silicious and contained 1 to 1.5 per cent. copper. The mattes produced contained 50 to 55 per cent. copper with a considerable amount of silver.



GENERAL SECTION THROUGH OREBODY, CERRO DE PASCO MINING COMPANY

was a pleasant sight in those days," says the Inca historian, "to see, eight, ten, twelve, or fifteen thousand of these fires burning all at the same time upon the sides of the mountain, ranged in order one by the other." The bullion obtained from the smelting in the mountains was cupelled in the houses of the Indians; they could not, however, separate the silver from the gold.

The mines of quicksilver in Huancavelica had long been known to the Indians, but it was not until 1567 that the Portuguese assay master, Enrique Garces, recognized the ore as that of mercury. In 1571 Fernandez de Velasco came to Peru from Zacatecas, Mexico, and there introduced the amalgamation process for dry silver ores.

In Peru in preparation for the patio process the ores were pulverized in Chilean mills. The rolls, cut from granite, were often 10 ft. in diameter with a breadth of 18 in. Two such rolls were mounted on a horizontal cross bar fastened to a vertical

with dwelling houses for the workers, plant buildings, assay offices and churches. They appear as veritable villages from a little distance. The frequency with which one comes upon these plants is astonishing. It is not a question of seeing two or three in a short ride, but one goes out of one into another continuously for hours at a time.

EARLY COPPER SMELTERS

After the fall in the price of silver in 1893, Cerro de Pasco continued producing until, in 1897, the Government refused to coin any more of the metal. When silver mining was at its height the copper ores were only valued as a source of *magistral*. Large quantities of high-grade copper ores had been left in the workings, which also contained no small amount of silver. Late in 1897 a new era was begun when Señores Aza and Rivera erected a small reverberatory furnace and commenced smelting the copper ores to matte. Others followed their example

In 1898 an American syndicate became interested in a large number of the Cerro de Pasco mines. The Oroya road was completed, an active campaign of mine development inaugurated, and an extensive reduction works planned to be erected at Tiñahuarca, seven miles from the town of Cerro.

THE HUARACACA SMELTER

The first smelter to have a blast furnace, was that of Eulogio Fernandini, at Huaracaca, on the San Juan river, about nine miles from Cerro de Pasco. The plant consists of one water-jacket furnace, 4x2 ft., with three tuyeres on each side; one Brown roaster, 90x14 ft.; two turret roasters, 24 ft. in diam.; six Guyer kilns for roasting lump ores, and a briquetting mill of 50 tons capacity. Power is supplied by Leffel turbines operating under a 17-ft. head. Blast is supplied by a No. 3 Green blower.

A small concentrating plant is also operated to produce silver concentrates

from ores low in copper. The plant consists of one Dodge crusher, three stamps of 850 lb. weight, one four-compartment Hartz jig, one No. 3 ball mill, two Frue vanners, and four other concentrating tables.

The ores, consisting of sulphides, oxides and ferruginous material, average 20 per cent. copper, 75 oz. silver, and 30 to 35 per cent. sulphur. The fine ores are roasted in Brown and turret furnaces fired with *taquia*. The coarse ores are burned in the Guyer kilns without fuel, their sulphur being reduced to 12 to 15 per cent. The blast furnace melts 30 tons of roasted ore and briqueted silver concentrates per day, with the necessary limestone flux. Coke from Quishuarancha or Gollariquisca, 21 miles away, is used in the furnace. The coke costs \$20 to \$25 at the mines or \$30 delivered at the smelter. The coke is 10 to 15 per cent. of the charge. German coke has been imported, and though costing \$40 per ton, a much smaller amount suffices to do the smelting. From 9 to 10 tons of matte are produced daily, averaging 60 to 65 per cent. copper and 250 oz. of silver. The slag and matte separate in the furnace and are tapped out intermittently. The slag carries about 0.5 per cent. copper.

THE TINAHUARCA SMELTER

The smelter of the Cerro de Pasco Mining Company is situated at La Fundicion, near the old town of Tñahuarca and about seven miles from the mines at Cerro de Pasco. The plant, which was blown in early in 1906, occupies a terraced site on the side of a hill. All the buildings are of steel frame covered with corrugated iron.

The plant consists of 12 ore bins, each of 2000 tons capacity; a sampling mill, power house, boiler house, furnace and converter building, warehouse, foundry, carpenter and machine shop, office building, laboratory and the houses of the employees. The plant treats ores from the company mines at Cerro de Pasco and Morococho, as well as custom ores.

The ore bins run parallel to the furnace building and are about 50 ft. further up the side of the hill. They are flat-bottomed, built of steel and lined with a double thickness of 2-in. plank. The ore trains run in on tracks directly over the bins. The floor of the bins is some 15 ft. higher than the feed floor ground, so that the charge cars may run on a track directly under and alongside and allow the ore to be loaded on the cars by chutes. The tracks on the top of the bins are extended on an elevated structure to the sampling mill, where the ore to be sampled is dropped into a steel hopper just below the track.

The hopper feeds into an 18x24-in. jaw crusher and the ore falls into a steel chain-bucket elevator, which carries it to the top of the building. An automatic

sampling device is mounted directly over a smaller crusher, which sampler may be so adjusted as to send any desired portion of the ore into the waste launder. The ore from the second crusher passes through another similar sampling device, thence into a pair of 18x36-in. rolls. The sample from the rolls is mixed and reduced by hand and is sent to the drying room. The portion of the ore rejected by the samplers falls into chutes which feed to a second elevator that discharges into a bin in the top of the mill, from which ore may be drawn off into a car standing on the elevated track. The mill is provided with an extra set of rolls and a pair of tromeels for grinding quartz for the converters. There is a third bin in the sampling mill for the storage of this quartz.

The charge cars are drawn about by a dinkey locomotive on a standard gage track. They run along each side of the furnaces and dump directly. Two cars on each side at a time constitute a charge.

There are four furnaces 168x54 in. at the tuyeres. These are the Montana type of water-jacket furnace with brick-lined hearth and crucible. Their estimated capacity is 500 tons daily. The furnaces are set end to end in the building and each is provided with a spout at each end so as to be able to discharge into either of the two 16-ft. settlers. These settlers are between the furnaces and there are five of them. Compressed air is used for raising and lowering the furnace doors and for dumping the charge cars.

The downtakes enter a brick flue situated under the yard tracks and between the furnace building and the ore bins. The flue leads off at right angles to the ore bins and passes under them at about their center. The flue continues several hundred feet up the hill to a steel stack, 220 ft. high and 20 ft. in diameter.

The slag overflowing from the settlers is granulated by a stream of water which carries it out of the building and over the dump. The matte is tapped into iron ladles and carried by an electric crane across the building to the converters.

There are four converter stands. The converters are of the upright pattern and are tilted hydraulically. The slag from the converters is poured off into ladles which are taken further up the building, where the slag is poured into cast-iron molds. The slag is broken up and fed to a crusher which discharges into a bucket elevator. This lifts the crushed slag to a storage bin on the feed floor, to be used later as part of the smelting charge.

The blister copper is poured into molds mounted on a low car running under the converter stand. These mold cars are moved back and forth hydraulically. The shipping platform is in the same building back of the converters. There are two pan mills for grinding and mixing the converter lining, with two large bins

above them for storing the clay. The quartz is brought from the bin in the sampling mill by cars running over a wooden trestle.

POWER EQUIPMENT

In the boiler house are eight 250-h.p. Babcock & Wilcox boilers. These at first burned soft coal, but are now arranged to burn gas from the coke ovens. The boiler stack is nearly as high and as large as the smelter stack.

The power house is directly in front of the boiler building. In it are three No. 11 Root blowers driven by cross-compound Nordberg engines. There is a large Nordberg blowing engine for supplying the converter blast and an air compressor for operating the air cylinders which lift and lower the furnace doors, bin gates and dump the charge cars. The works are lighted by electric current and the motors in the sampling mill and cranes in the foundry and furnace buildings are electrically driven. The power is supplied by two small dynamos, and a large Westinghouse 750-kw. alternator. Three-phase alternating current at 220 volts is delivered to all points about the works.

The blast machinery in the power house is equipped with fly wheels grooved for rope drive in case electric power should later be used.

The foundry is furnished with a small cupola for melting pig iron, a drying room, capacious casting floor and overhead electric crane. The machine and carpenter shops are all well equipped and do all the work for the smelter, mines and railroad.

There are 72 beehive coke ovens. The gases are collected in a central flue and delivered to the boiler house to be used as fuel. A moving platform runs along each side of the bank of ovens upon which the coke is drawn. The coal comes from the company mines at Vin-chuscancha, Quishuarancha and Gollariquisca. At these places there are extensive beds of a poor variety of bituminous coal. The ash runs about 13 per cent., volatile matter 20 per cent., and fixed carbon from 40 to 60 per cent. The coal contains a considerable amount of pyrites in balls and disseminated through it. Coal washeries are to be erected to clean the coal before coking. Native labor at this plant is paid 62c. per day and upwards. Wherever possible, mechanical means are used to replace labor. This is not because the labor is expensive, but because it is inefficient.

According to a consular report the Balukissar and Scios antimony mines in Asia Minor are not now worked on account of the low price of the metal. The ores from these mines are sold on analysis and show usually 50 to 55 per cent. antimony.

The London Lead Market in 1907

SPECIAL CORRESPONDENCE

On the resumption of business after the holidays there were early signs of weakness in metals generally, caused mainly by uneasiness in the money market. About the middle of the month prices improved, prompted by fair consumptive demand, particularly in America, whence also the supply for the English market was correspondingly diminished. This improvement was gradually lost as buyers became more reserved; and the month closed with values at £19 15s. for Spanish lead, £20 for English.

February found the market sufficiently supplied and unprepared for some heavy arrivals which, in conjunction with bear selling, brought down the price. Thereafter prices were nearly stationary, closing at £19 10s. @ £19 12s. 6d. per ton for foreign, and 5s. more for English lead.

March opened with a more active market and with depleted supply for early delivery. Prices advanced steadily without bringing any increased offerings, and the building season helped to promote trade and to strengthen values. On March 14 occurred the severe panic on the Stock Exchange whereby all commodities suffered, and prices persistently declined. Scarcity of material, however, sufficed to avert what might otherwise have been a sensational relapse in face of selling pressure. Closing values were £19 5s. @ £19 10s. for foreign brands, and 5s. higher for English.

April found the market steady in spite of persistent efforts to depress it, and a large consumptive demand from all quarters soon raised prices: up to £20 being paid for prompt delivery. Scarcity of supply became gradually more acute; demand for forward delivery being also active. The more pressing requirements being covered, there followed a lull, but the closing days of the month were active in business both for prompt and forward delivery, and particularly for export, while scarcity of supplies helped to restore values which, at the close, stood at £20 @ £20 7s. 6d. for foreign brands, and £20 5s. @ £20 10s. for English.

May opened with arrivals which eased the pressure for prompt delivery and caused some decline in prices. The tendency, however, was firm. Some brisk buying for continental consumption was followed by heavy covering of bear sales and renewed scarcity for early delivery. Fancy prices were paid in some cases for prompt parcels. Closing prices were £19 17s. 6d. @ £20 10s. for foreign brands, according to time of delivery, and £20 5s. @ £20 15s. for English.

June was an active month throughout, notwithstanding wide-spread depression in other markets. The scarcity of the

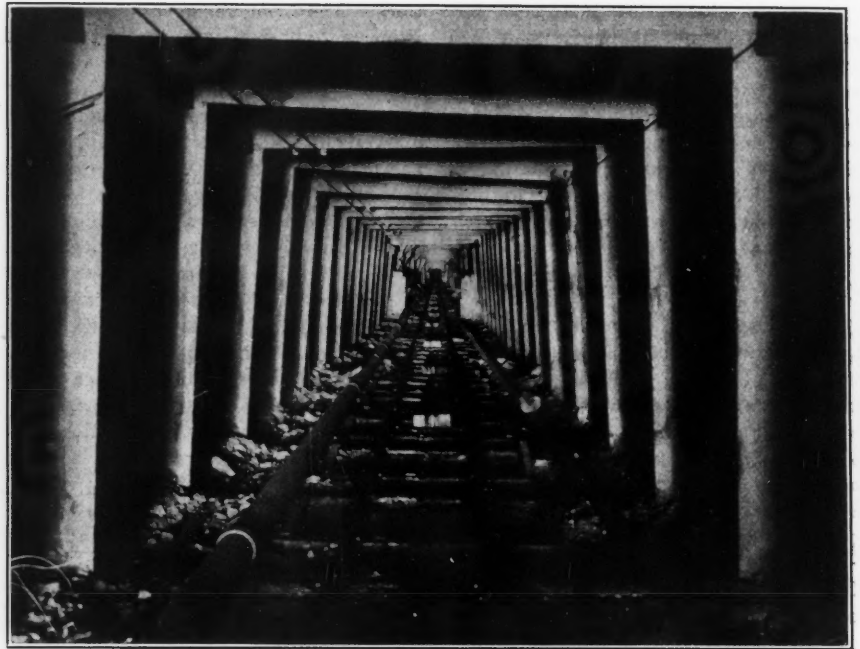
metal for early delivery became gradually more acute until, about the middle of the month, spot lots commanded a premium of £1 15s. per ton. Consumers also bought largely for July and August, and a fair export trade helped to support prices. The tendency at the close was buoyant, with foreign brands at £19 15s. @ £21, according to time of delivery, and English at £20 15s. @ £21 5s. per ton.

July opened with an irregular market, though with considerable business with consumers as well as for export. Scarcity of supply became more acute by reason of arrivals being retarded, with the result that £21 15s. was paid on spot foreign, forward delivery commanding £20 5s. The tension soon relaxed and the easement encouraged sellers to make concessions for forward delivery. Consumers held aloof, occasionally coming

ume of business was restricted, prices drooped and closed at £19 7s. 6d. @ £18 15s. for foreign brands, and £20 @ £19 10s. for English.

September found the metal markets generally depressed, lead being the only exception. Quantities on sale were very limited, and consumers had some difficulty in covering early requirements. The scarcity of spot metal was manifest throughout the month, prices starting at £19 15s. and finishing at £21 10s.: forward delivery being obtainable at prices starting from £18 15s. and finishing at £19 10s.

October opened under the preceding conditions, spot metal commanding £21 15s.; but the premium thus established brought out several sellers, while the relatively low price for distant delivery caused mistrust, and prices moved very irregularly but generally downward. Con-



LOOKING DOWN SHAFT NO. 3, INCLINED 25 DEG. FROM THE HORIZONTAL, OCTAVE MINE, ARIZONA

in to take advantage of further reductions in price, or reluctantly paying full price for spot parcels when obliged to. Toward the end of the month supplies were more plentiful, and enterprise was checked by the weakness in other metals. Prices drooped accordingly, and the month closed with foreign brands held for £19 5s. @ £19 15s., according to time of delivery, and English for £19 10s. to £20 10s.

August opened with the market depressed. Later renewed scarcity of prompt supplies raised the price of spot foreign brands to £20: but prices thereafter suffered in sympathy with those of other metals. Trade requirements, however, were sufficient to bring about a gradual recovery up to Aug. 23, when scarcity of spot lots was again acute, and foreign brands commanded £20 to £19 according to time of delivery. Thereafter the vol-

sumers bought sparingly, and as demand diminished prices fell away. The scarcity was meanwhile relieved by arrivals, though without creating any surplus. Thereafter till the end of the month trade was steadier: there was less pressure to sell for forward delivery, and more inclination to buy: and the difference between the two ranges of price was considerably narrowed. Closing prices were £18 10s. for spot foreign and £17 10s. for distant delivery: English brands £19 and £18 10s. respectively.

November opened with a decline in prices, owing chiefly to financial strain. Producers were not pressing to sell, but speculators were eager to sell for forward delivery: and demand was restricted. The scarcity of prompt supply, however, maintained the cash price much above the forward price. This was not likely to be

permanent, and its gradual adjustment was noticeable during the rest of the month as demand subsided and supplies arrived. Closing prices were £16 for prompt foreign brands, £15 17s. 6d. for forward delivery, and English brands £16 5s. and £16 respectively.

December opened with a fair volume of business induced by the fall in prices and the restoration of something like normal conditions in the relative values of spot and forward supplies. Consumers, however, soon withdrew their support after satisfying their more pressing requirements which—in view of approaching holidays and general stock-taking—were not likely to be heavy. Moreover commerce in general was overshadowed by persistent financial trouble. Early in the month prices were depressed by large quantities said to be offered for American account. A temporary rally was quickly lost, the reac-

The Octave Mine, Arizona

By J. E. RUSSELL*

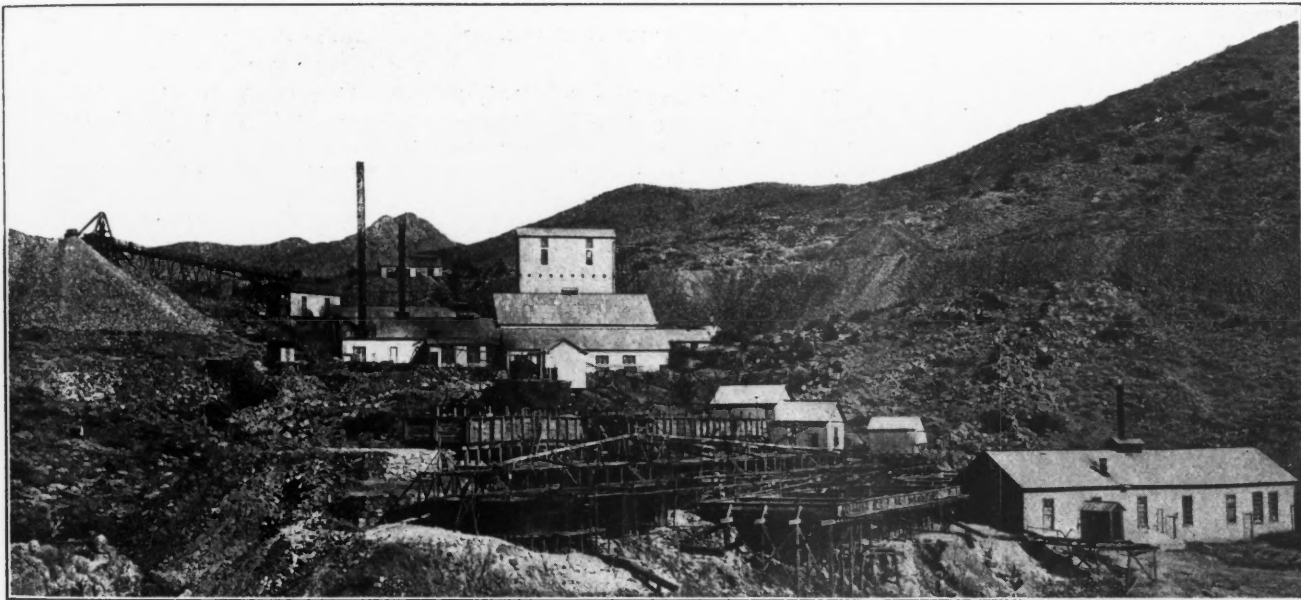
The Octave mine is situated in the Weaver mining district, in southern Yavapai county, Arizona. It is the only mine in the district which has been developed sufficiently to prove whether or not it is a mine. There are many other good prospects but few have been developed to a depth exceeding 30 ft., and many have only the usual 10-ft. hole.

The mine was first brought to public notice in 1899 when a group of Pennsylvania capitalists purchased the property, organized the Octave Gold Mining Company and equipped the mine with a modern stamp mill, containing 40 stamps, 10 concentrators, two hoisting plants capable of sinking to 2000 ft. upon the incline,

ing which time there was an attempt to resume operations, the mine was sold to the Octave Mining Company, a new corporation, which is now bringing the mine back to its old standard and is shipping bullion. Development work has been pushed by the new company and new bodies of ore have been developed. The illustrations accompanying this article show how the mine is equipped and developed.

The Octave mine produces gold alone, about 60 per cent. of which is recovered by amalgamation, and the remainder by concentration and cyaniding the tailings; the tailing from the cyanide plant average about 30c. per ton. The ore is a hard white quartz, and is not easy to crush but yields readily to treatment. The vein averages about 30 in. wide and assays about \$9 per ton.

The mine adjoins the famous Rich Hill,



MILL AND CYANIDE PLANT, OCTAVE MINING COMPANY, ARIZONA

tion coinciding with a bear raid on Broken Hill shares; and prices drifted downward under pressure of a few sales in an unwilling market until on Dec. 16, £13 was accepted for early delivery. This proved attractive to numerous buyers who had long held aloof, and at the close £14 was quoted for Spanish and £14 2s. 6d. for English lead.

The *Engineering Times* (Oct. 31, 1907) describes a coal-loading contrivance consisting of a cylindrical tube in which a specially designed screw is rotated by a 10-h.p. electric motor. An inverted funnel is fitted to one end of the tube into which the coal is emptied. The action of the screw transfers the coal to the upper end; whence it falls through a funnel into the holds or bunkers of vessels or other receptacles. It is claimed that coal can be loaded by the use of this device at the rate of 30 tons per hour.

a modern machine shop, an air compressor capable of furnishing air for 24 machine drills, and one of the most complete cyanide plants in the Territory. The company also proceeded to develop the mine to a depth of 1850 ft. on the incline and to run drifts at 75-ft. intervals. The levels were placed 75 ft. apart, because the lode is very flat, pitching only about 25 deg. from the horizontal. The mill has a capacity of 120 tons per day and the mine kept it supplied continuously from the beginning of operation in July, 1900, until March, 1905. The returns from shipments of bullion to the mint aggregate more than \$1,500,000.

In March, 1905, the mine was closed owing to internal difficulties in the corporation. Up to this time none of the stock had been offered to the public. After a shutdown of about 15 months, dur-

upon the top of which much placer gold was found, and all of the gulches near to the Rich Hill are still good placer ground. There are many other good prospects in this district, but thus far only the Octave has been developed.

According to the *London Engineer* the almost complete cessation of Government orders and the consequent inadequate sales in the inland markets, has caused the Russian copper-finishing works to devote themselves to the cultivation of the export market. They have, therefore, approached the Government, which has undertaken to refund the amount of the duty paid on raw copper when worked up into manufactures for the export market.

Tungsten filament lamps will be manufactured in the United States more extensively this year than formerly.

*Prescott, Arizona.

Coal Mining in Northumberland, England

Methods Are Varied so as to Take Advantage of the Seams' Cleavage and the Work Is Performed by Specialized Labor

BY GEORGE RAYLTON DIXON

Before describing in detail the several methods adopted in working out the coal, I will enter into some preliminary considerations: The direction of the lines of cleavage is most important. In Northumberland they are nearly vertical. The influence of the cleat, when well defined, may be understood by a comparison which must not be taken too literally, but will serve as an illustration.

Horizontally the strata are separated by well defined planes of bedding of varying distances apart. In Northumberland the strata are made up of sandstones, shales, fireclays, and coal; and it is seldom that a bed reaches any great thickness. The cleavage planes may be only a fraction of an inch apart, or may be several inches. Shales develop a cleat much better than sandstones, and fine-grained

ported at each end on props. Fig. 1 shows direction of cleat, and joints at right angles to the cleat, also position of timber to prevent falls of rock from between the joints.

I have already referred to the pressure of the overlying rock pointedly, instead of using the term weight, for it is a fact that they are not synonymous terms. To understand this, the reader is asked to think for a moment on the accepted theory of the formation of lines of cleavage.

THE THEORY OF THE FORMATION OF CLEAVAGE LINES

Cleavage lines have been created by the great lateral pressure of forces at right angles to their direction. It may happen that these forces by later earth movement

ward, toward him, and when he sticks in his pick by a lever action he can break them. Fig. 2 shows a place advancing across the lines of cleavage, and the position of supporting timber.

The miner's progress will be slower when advancing his place parallel with the cleat. When working at right angles, however, the "laths" above his head span over the place, which, it will be found, will not need so much supporting timber. In view of the possibility of exposing the joints at right angles to the cleat, timber will be set. There will be a tramway into the place for the cars to run on, and the timber bars or planks must span this way. If the width of the place be increased, it will be found that it will be easier kept good than a place of similar width running in the direction of

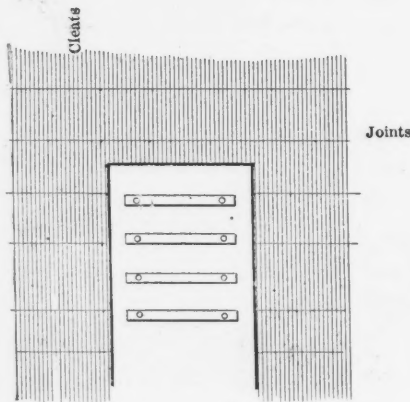


FIG. 1

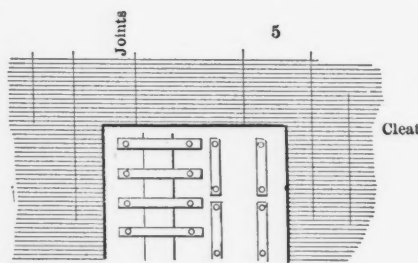


FIG. 2

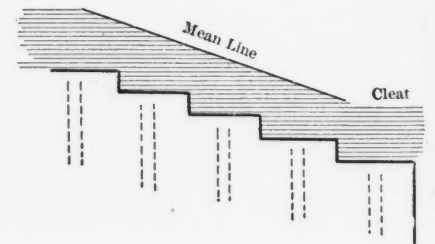


FIG. 3

sandstones better than coarse-grained. In this connection it is proper to mention that the immediate cover of the coal seams is generally a shale in the area under consideration.

Imagine the coal seam and all the containing rocks to be built up of long narrow pieces like slater's laths. In the seam, the miner, when using his pick, is cutting at these strips or "laths." When driving a place parallel with their longitudinal direction, he has to be continually chopping off the projecting ends, and he finds it hard work. The pressure of the overlying rock tends to break the immediate roof, which, however, from its cantilever position, is strong to resist.

Here we must bear in mind the fact that there are joints at right angles to the main cleavage planes, and if the miner undercuts the coal so as to expose those joints, the rock above will fall. Hence he puts in timber bars, or planks, sup-

ported at each end on props. If then an excavation is made in the rocks, the side pressure will be most pronounced when driving in the direction of the cleavage. Moreover the side pressure of the rock above the excavation will tend to make the roof of the excavation burst downward, in the only direction in which it is free to move. The side pressure in the rocks below, will in the same way tend to thrust the bottom up. If the place is driven wide the pressure on the timbering will become considerable so that it will be expensive to keep good.

It is evident that the best position for supporting bars will be at right angles to the cleat. If the place is advancing at right angles to the cleavage the forces above referred to are still in operation, but the miner is in a much better position in regard to them. The pressure in the strata causes the "laths" to bulge out-

ward, toward him, and when he sticks in his pick by a lever action he can break them. In such a wide place, any further planks will be most effective running parallel with its direction. They will serve to make the span less, and will thus keep the immediate cover from being broken.

In this position they serve the further useful purpose of conveniently carrying canvas brattice. A place driven in the same direction as the cleat is called a "headway," and the direction of the cleat is spoken of as a "headway course." A place driven at right angles to the cleat is called a "bord." A place having neither of these definite directions is called a "cross-cut."

METHODS OF WORKING

In Northumberland the method of working usually adopted was the "bord and pillar" system. In the last 15 to 20 years the "longwall" system has come into great vogue. There is still a tendency

to limit the application of longwall to seams in which the thickness of coal is below 3 ft. 6 in. In bord and pillar working, the roads are all through solid coal. In pure longwall the roads are all through areas from which the coal has been extracted, called the "goaf." In longwall, therefore, it is necessary to have stone of sufficient quantity and hardness to pack the sides of the roads with.

In bord and pillar working, the coal is extracted in two operations. The first (that of dividing the coal into rectangular blocks by driving headways and bords), is called "working the whole." The second (that of taking out these rectangular blocks), is called "working the broken."

In broken working, slices or lifts are

settles down, crushing the packs. The function of the packs is to control the weighting of the overburden. It will be seen that this overburden acts as a giant lever. Its action may under certain conditions be too severe, and will crush the coal too much. In other circumstances its action may be too slight. This pressure can be controlled to a great extent by the amount of packing and its distribution. Longwall lets down the overburden more evenly, and is not so likely as bord and pillar working to disturb higher seams. It was formerly believed that when the top stone was bad, longwall was almost impossible. It was thought that with a tender roof it was necessary to have the roads in solid coal.

vent in a horizontal direction, instead of vertically downward. The pressure of water and gas in strata above the seam often causes a bad roof, and a great deal of good may be done by putting boreholes up and thus releasing the pressure. I have known of cases where boreholes have been put up into a weighting roof, and a great deal of good has resulted, and yet there was not any water present, and there was no sign of gas either before or after the holes were bored.

At some collieries where the longwall system has been adopted, the main roley-way is in the solid coal, that is, a strip of coal is left on each side of it for support. When any coal is left in, in the longwall system, there is a departure from

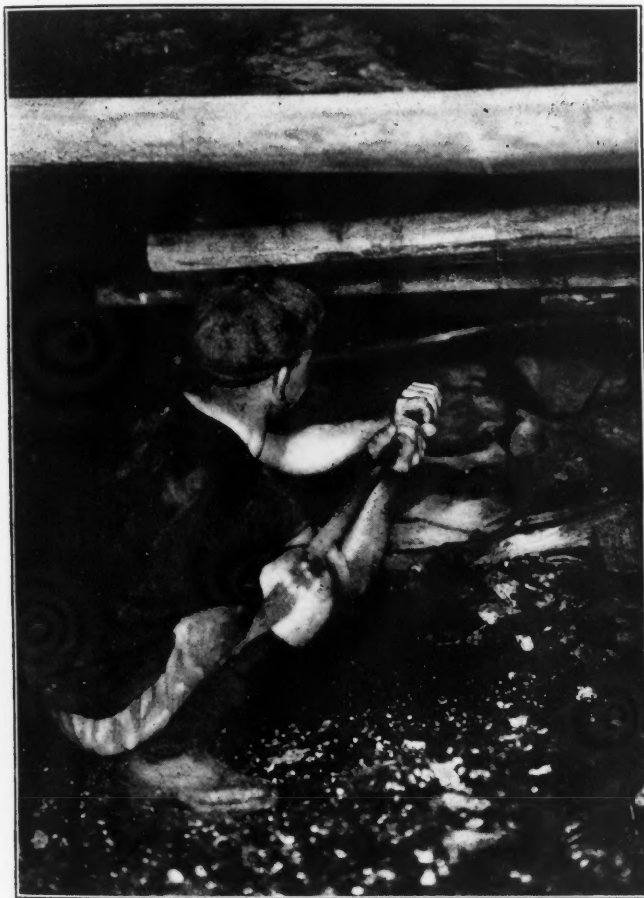


FIG. 4



FIG. 5

taken off the pillars. Usually the cover is kept entire till the lift is up its distance. Obviously, the distance the lift can be driven depends on the extent to which the top can be carried. When the lift is up its distance the timber is drawn out and the stone above falls. Fig. 4 is a photograph of a timber drawer at work.

The next lift is then commenced. The stone above the coal is thus dropped in patches. The height to which the fall goes varies according to the nature of the cover, but usually it is not far.

In advancing longwall all the coal is extracted in one operation. Stone packs are built under the roof, and it gradually

INFLUENCE OF VARIOUS KINDS OF ROOF

This idea is quite exploded. Almost any roof that can be worked under by the bord and pillar method, can be worked under by the longwall system. I have known of several cases where narrow places were most difficult to keep good, and yet when large areas of roof were exposed, in the process of taking out the pillars, all difficulties vanished. This condition may be attributed to the fact that when the first fall of rock took place, there was a free face created for the remainder of the overlying bed, other than the roof of the place. The inherent pressure could therefore find

pure longwall. It is impossible for the surface to settle evenly, hence more surface damage is done then when all the coal is taken away. The coal thus left is severely crushed and when finally secured, is in a poor marketable condition. This is brought about in a great measure by the circumstance that all the main roleyways in the different seams are not in the same position in plan. I am strongly in favor of removing all coal.

INFLUENCE OF CLEAT IN LONGWALL

Let us now consider the influence of cleat in longwall working. When the direction of advance of the face is across

the planes of cleavage we say we are "working on the face." When advancing parallel with the planes of cleavage we say we are "working on the end." When working on the face the coal is easy to get, but the face is bad to keep. The roof pressure springs out our imaginary "laths," whether of coal or stone, and helps in the displacement at the slips. If working to the rise the stone above has a tendency to fall away from the face. If working to the dip the stone above has a tendency to lie against the face.

Therefore, the internal latent pressure in the top stone, acting outward from the coal, is helped, or retarded, according to

the cleat, for while a larger tonnage price will have to be paid to the miner, who will not be able to get in his shift as much coal as when advancing on the face, the extra selling price will more than compensate. There is another consideration whereby even at a coking coal colliery it may be necessary to work on end, and that is when the cleavage lines, in coal and stone, are so pronounced, that as the coal face advances, the stone breaks off over the coal. There is then a want of pressure to help the miner. Our "laths" are not sprung out, and the miner says the seam is winded.

We speak of the width of coal each

good, but on say doubling the rate of advance, there is an immediate improvement. The presence or absence of water is another factor to be reckoned with.

It is supposed that the direction of the lines of cleavage was the same at the time they were formed as the strike of the rocks cleaved. In Northumberland the direction of strike is usually northeast by north, and the cleat runs about northwest by west. The amount of dip is seldom more than 1 in 12, and I know of large areas where it is 1 in 20.

From the preceding remarks it will be seen that there is room for considerable judgment on the part of the mining en-



FIG. 6



FIG. 7

whether the face is advancing to the rise, or to the dip. The result is that more face and face road timber is needed when advancing to the rise.

When advancing on the end, the coal is hard to get, but the immediate top stone can be kept entire better. On the face, the coal is weak to resist the pressure on it, and it is consequently severely crushed. If the coal is to be put on the market as a steam coal, this is a most serious thing, the selling price of large coal being much more than small. In the case of coking coal, the small is as valuable as the large. It will be seen then, that where the object of the management is to get as much large coal as possible, it may be necessary to have the face advancing on the end of

miner attacks as a face. We also speak of the whole line of workings as the face. But while each face may be advancing on the face of the cleat as in Fig. 3 as one face leads another, the mean line of face is making a considerable angle with the cleat. The effect of this is to counteract, to a considerable extent, the consequences one would look for in working on the face. The angle this mean face line makes with the cleat is most important.

EFFECT OF SPEED IN DEVELOPMENT

The speed with which the face advances is another important factor in the successful working of longwall. A face, and the face roads may have been bad to keep

gineer, and it will be readily understood that the considerations mentioned above may cause the direction of the advance of face to be different in mines not widely separated geographically, and yet be the best under the particular conditions of each.

The steam coal seams of Northumberland are hard, and explosives are extensively used. It is generally considered that before a shot is fired, there should be three free faces, in any seam above 3 ft. thick. Below that thickness there must be two free faces. The process of making the vertical cut necessary to make a free face parallel with the direction of the place is called "nicking." Fig. 5 is a photograph of a miner engaged at this work.

UNDERCUTTING AND FIRING

The process of making the free face parallel with the roof and floor is called kirving. Fig. 6 shows a miner kirving in the bottom of the seam. The kirving is made in the most convenient place in the seam, or in the stone immediately above or below. It is obvious that in the process of nicking and kirving a great deal of small coal is made. An average hewer in nicking in a seam, say 4 ft. thick, cuts back 2 ft. 9 in.; the width of the nicking at the front side is 16 in. to 18 in. In kirving the same distance, the depth of the cut at the front is about 18 in. The nicking serves for the full width of the place; hence on that score alone, there is a great advantage in hewing in a wide place as compared to a narrow place.

When a miner by nicking and kirving has prepared enough coal to fire a shot, he says he has prepared a "jud." He next drills a hole for the explosive charge. Fig. 7 shows him in the act, and the style of drill used is plainly seen. When he requires his drills sharpened, he takes them to the surface. It may be mentioned that the mine owner pays the drill sharpener. The pick sharpeners are paid by the men.

The explosive used is generally black powder made up into a loose cartridge by the miner before he goes into the pit. The charge is fired by a squib. The miner finds the powder, and also his candles. Where safety lamps are in use the light is of course in accordance with the coal mines regulation act supplied by the mine owner.

LABOR IS SPECIALIZED

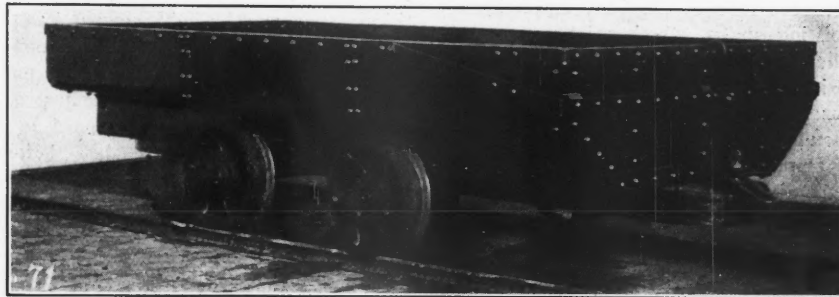
The labor in Northumberland and Durham mines is probably specialized to a greater extent than any other coal field. The main classes of labor are as follows: Hewers, who spend all their time in getting coal, and nothing else. They are paid a price per ton. Putters, who are strong lads from 16 to 21 years of age who convey the cars between the collecting and distributing base and the miners in the face. Generally they have a pony, but sometimes have to push the cars themselves. This collecting and distributing base is called "the flat." They are paid a price per score on the cars "put" by them to the flat. Drivers, who convey the cars in sets between the flats and the main haulage system landings. They drive strong cobs, and are lads of 13 to 16 years of age. Rolleywaymen and lads, who are employed in working the main system of mechanical haulage. In charge of each district of the pit there is a deputy overman. He sees that the air is kept up to the face of each place, that the hewers are protected by a sufficient supply of timber, and generally that the coal mines regulation act, and special rules of the colliery, are complied with by everyone under him.

All the above are employed in the day shift. At night the following classes are employed. Stonemen, who are employed in taking up stone, or taking down stone,

to make hight, setting permanent timber on main roads, etc. Timbermen, riders and shifters, who are less skilled than stonemen, who do repairs on face roads, clear away fallen stone, build packs, etc., with and under the direction of stonemen.

The hewers draw lots every three months for the different places in the pit. This is called "caveling." Previous to the caveling the manager may let winning places, or other special places as bargains. The lowest tender gets the place. In these places the men tender, and are paid, a speeding price per yard, in addition to the prevailing price per ton. The men usually work in sets of four. They put on a common token and share their earnings.

There are two shifts of hewers to one of putters, and others engaged in transporting the coal to the shaft. The first shift of hewers commences at 3:30 a.m. The rolleymen and lads go to work at 6 when the pit starts coal work. The putters go in at 7. The second shift commence at 10 o'clock and relieve their partners or "marrows" in the face. They return to the shaft bottom before 5 p.m. when all



THE KOPPEL STEEL CAR FOR USE IN COAL MINES

classes engaged in getting or conveying coal come to the surface.

The stonemen go to work at 6 p.m., and the shifters an hour or perhaps two hours later. They work an eight hour shift. A bill will be brought before Parliament next year proposing to limit the time of employment below ground to eight hours. Such a scheme would upset the working of Northumberland collieries in a marked degree. There would be an immediate reduction of output, and an increase in the working costs of the collieries. The present system suits the coal-field admirably. It is suggested by many that the solution of the problem lies in the application of machine mining, and it is hoped that such a measure will be followed by one enforcing attendance at evening schools.

Although 15 continuous miles is the maximum day's work for mine mules, but 13 miles is all that should be asked of them. Ten hours out of 24 should constitute a day's work. All pit animals should be given at least one drink of pure water during work hours. The neglect of these humane considerations as to hours and distances results in worn-out stock and increased expenditure.

All-Steel Car for Coal Mines

The mine car shown in the accompanying engraving is one of a lot of 400 to be supplied to the New River Pocahontas Coal Company by the Arthur Koppel Company. The car is of all-steel construction; the hight above the top of the rail is 30 in.; its capacity, 57½ cu. ft., and the gage 44 inches.

A special feature in the design is embodied in the round buffer, which is constructed of channel steel having a small depth and wide flanges. At the ends, this channel is curved and it projects beyond the car, so as to give clearance between the corners of the cars on curves. The bumper channel is continuous through the body of the car, forming a buffing column which takes the end shocks met in service, from car to car, without transmitting the whole strain to any one particular car. This feature is similar to that used in standard railroad practice.

The overhang on the sides gives the car a large capacity, and its rounded cor-

ners facilitate the discharge of the load. The door is of the lift type. The wheels, axles and bearings are of a special self-oiling type, the wheels being 16 in. in diameter. A device attached to the bottom of the car engages the dogs on the chain hoist used in hauling up the tippie incline.

When about to install coal-cutting machines, it is well to remember that while the first cost of a chain machine is three or four times greater than the cost of a pick-machine, it takes the same number of men to run either of them. The pick-machine will under-cut 40 per cent. less coal than the chain-machine and make but little more lump coal than a miner working with a pick, while the chain-machine gives an increase in lump coal of from 10 to 30 per cent. To obtain good results with a pick-machine much depends on the skill of the operator, while the efficiency of the chain-machine is not dependent on the skill of the miner. Also it has been found much easier to instruct miners to run the chain- than the pick-machine.

Imperfect combustion in steam boilers may result from too much as well as too little air.

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

For the economical working of a compressed air plant, the velocity of the air through the mains should not exceed 50 ft. per second. This may be done by employing a sufficiently large sized receiver placed near the charging station.

In mines where the haulage is done by electricity, the provision of separate traveling ways for the workmen is wise in view of the number of accidents that occur from coming in contact with the electric trolley wire. If the trolley can be raised 6 ft. above the rails, this provision is not so necessary.

In timbering a shaft the utmost care should be taken in framing sets so that the measurements are exact and the timbers cut true to the line, especially for hoisting shafts, whether large or small. The center line should be laid off upon the inside faces of the plates and the measurements for tenons, mortises and miters should be taken from this line. The faces of tenons and shoulders should be cut at right angles to, or parallel with the face of the plate.

The number of fatal explosions in Great Britain has decreased more than 100 per cent. during the last decade. This great diminution is chiefly due to the nearly universal use of permitted explosives. In this particular, America is far behind European countries, since we have concerned ourselves only with the quantity of explosive taken into a mine and almost wholly neglected to attach importance to the composition of the powder.

The adaptability of steel for use in mine timbering has been well demonstrated, and its long life under all conditions of temperature, moisture and stress is computed to compensate amply for the increased first cost of installation. In the anthracite region there are in use today steel timbers which for 12 to 15 years have been exposed in the deep parts of mines to constant contact with mine water, without signs of failure or corrosion. It has been suggested that the only method by which to determine the proper sizes for steel timbers is to proportion them in accordance with the relative theoretical values of wood when used for timbering.

When inspecting a boiler, a very important point is to see if there are any signs of grooving or channeling, which is a gradual eating away of the boiler plates in furrows or channels. The grooving is caused by the expansion of

parts of the metal when the fires are lighted, and is assisted greatly by the chemical action of the water. The usual parts which should be examined to see whether or not grooving exists are around the furnace tubes, angle joints, and lap joints which are subjected to severe strain. Grooving generally causes weakening of the plates, and if it is in an advanced stage, it will fracture them at the ends about the rivet holes, which should be thoroughly inspected. When ascertaining the thickness of the plates, the incrustation formed in the boilers should be removed, especially around the furnace plates.

In German coal mines, brattice cloth is extensively used for temporary partitions, supported by light wooden frames, and also as door wards. Good common sail cloth is mostly used for such purposes, but is not impregnated against fire or water. Sometimes it is dipped in a strong solution of water glass before nailing it to the support. In some of the more dangerous mines the sail cloth and wooden supports are given several good coats of asbestos paint, thereby rendering such walls nearly fire- and damp-proof. Another kind of cloth is used for fanning tubes instead of iron air conduits. It is also nearly air and gas-tight. It is strung with rings to a strong line, drawn under the ceiling of each shaft, and may be folded up and moved in any direction, in the shortest time, thereby enabling the miners to bring a great amount of fresh air to any point of accident or danger.

Wherever an underground slope or plane is employed, a means of communicating with the engineer should be provided. This is generally accomplished by the use of a heavy iron wire, the end of which is attached to a hammer in the engine room; the signaling is affected by pulling the wire at the foot. Such practice often results in breaking the wire by the force of a heavy pull or jerk and consequently transportation is sometimes interfered with. To avoid such delays electric signals are installed in some collieries. Usually the current is secured from dry batteries connected in series. The electricity is carried by bare wires fastened upon insulators, which are spiked to props along the road. By bringing these wires into contact with each other, a bell is sounded in the engine room. The signal wires may also be used to carry telephonic messages by connecting them to telephone apparatus.

The following are the explosive ranges of fire damp as fixed by different European commissions on explosives:

	Parts CH ₄ .	Parts Air.	Per Cent. CH ₄ .
France =	1	12-5.9	7.7-14.5
Prussia =	1	19-15.6	5.0-6.0

The results of experiments by one authority are as follows:

Paris CH ₄ .	Parts Air.	Per Cent. CH ₄ .	
1	3-4	25-20	inflammable but not explos.
1	5	16.6	explosive.
1	7	12.5	violently explosive.
1	7.5	11.5	violently explosive.

One expert says that, "when CH₄ in the mixture is 6.6 per cent., it is explosive; less than 6 per cent. is not explosive. Under ordinary conditions (that is mine air without dust) the upper limit of CH₄ is 12.8 per cent., the lower limit 6.1 per cent., so that the explosive range of CH₄ under those conditions is 6.7 per cent. If the percentage limit of CH₄ exceeds the upper limit the mixture will not explode even if a flame is applied to it, but will burn quietly." On the other hand another authority asserts that less than 2 per cent. of CH₄ is explosive when the mixture contains fine dry coal dust.

There are two distinct purposes in building an underground dam; first, to isolate water; second, to localize a mine fire. When a dam is to resist the pressure of water it should be substantially built of sound oak, thoroughly seasoned and dressed to size in wedge-shape pieces, of from 5 to 10 ft. in length, according to the depth of the mine. Each piece of wood should be tapered according to the radius, which varies from 20 to 30 ft. These pieces should be prepared and fitted together outside, so as to secure good tight joints; each piece should be numbered before it is sent into the mine. At the proposed location of the dam in the mine, the space should be enlarged in a wedge shape, the radius of which should be the same as that of the tapered pieces of wood. The ribs, roof and floor should be carefully dressed and leveled. No explosives should be used in dressing the place, as the rock and coal might be cracked. The sides and floor upon which the layers of tapered pieces are built up should be tarred. As each layer is put in, the pieces should be driven forward to tighten the joints, due care being exercised to maintain the proper arc. While building the dam, the water should be temporarily drained off at a point about 50 ft. above the dam construction, and allowed to escape through a pipe provided in the dam. A masonry dam should be used in case of fire.

THE ENGINEERING AND MINING JOURNAL

Issued Weekly by the
Hill Publishing Company
 JOHN A. HILL, Pres. and Treas. ROBERT MCKEAN, Sec'y.
 505 Pearl Street, New York.

London Office: 6 Bonverie Street, London E. C., Eng.
 CABLE ADDRESS "ENGINJOUR, N. Y."

Subscription, payable in advance, \$5.00 a year of 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii or the Philippines, \$6.50 in Canada.

To Foreign Countries, including postage, \$8.00 or its equivalent, 33 shillings; 33 marks; or 40 francs.

Notice to discontinue should be written to the New York office in every instance.

Advertising copy should reach New York office by Thursday, a week before date of issue.

For sale by all newsdealers generally.
 Entered at New York Post Office as mail matter of the second class.

CIRCULATION STATEMENT

During 1907 we printed and circulated 507,500 copies of THE ENGINEERING AND MINING JOURNAL.

Our circulation for December, 1907, was 40,500 copies.

Jan. 4.....	13,500
Jan. 11.....	9,500
Jan. 18.....	9,500
Jan. 25.....	9,500

None sent free regularly, no back numbers.
 Figures are live, net circulation.

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Miners and Smelters

The custom smelters undoubtedly suffered heavy losses in 1907, but the effort to recoup them by a bold increase in smelting charges immediately upon the cessation of competition in Utah and Montana is an impolitic move that is explainable only by the words of William H. Vanderbilt in which he expressed his contempt for the public. The meetings of irate ore-producers at Helena and Salt Lake City show their indignation and also manifest an inclination to do business, which will prove the impolicy of the custom smelting companies if the ore-producers remain steadfast in their intentions. Probably the smelting companies figure that they will not. There have been protests before, but they have ended only with talk. It rests entirely with the miners whether there be a different ending to the present case.

Competition is the life of trade. At present it has been destroyed by the action of the farmers in Utah and by market conditions which have caused certain smelters in Montana to suspend operations. Competition will certainly revive sooner or later by natural developments. It will be hastened if the miners themselves provide it. This is the simplest redress of grievances, as was pointed out by the committee reporting at the last meeting of the American Mining Congress.

There is nothing mysterious about the smelting business. Many excellent metallurgists, thoroughly experienced in the art, are open to engagement and competent managers also can be secured. The essential prerequisite to successful competition is the assurance of an adequate supply of the ores necessary to make an economical smelting mixture. The mine operators are the ones who can provide that assurance, with which there should be no difficulty in raising the capital, a large portion of which the mine operators can also supply. For the treatment of the crude lead there are four competing refiners; for the treatment of the crude copper there is the same number. If satisfactory terms cannot be obtained among these, it is no more difficult to build and operate an independent refinery than it is a smeltery. Indeed, to put a smelting business in an impregnable position it should be self-contained from the

production of the ore to the production of the refined metals.

The only requirements for the successful inauguration of a new and independent competition in the smelting business are consequently (1) assured ore supply, (2) adequate capital and (3) technical knowledge plus experienced business management. The miners can provide the first, can provide or find partners to provide the second, and can buy the third. They can easily develop a coöperative, so to speak, method of treating their ores and eliminate all grievances against existing smelters on the ground of extortionate charges and unfair treatment. The remedy is easy and moreover will be commercially profitable if it be wisely undertaken.

The Monongah Explosion Decision

So far as the general public and those not personally afflicted are concerned, the disastrous mine explosion at Monongah is now only a matter of history. The Fairmont Coal Company has earnestly endeavored to mitigate the sufferings of the bereaved families, and the untiring efforts of its officials and men deserve commendation. From chaos order was quickly restored, and the local community has met the emergency with great generosity and fortitude. Soon the mines will again be opened, and although the miners who will resume, will at first feel some fear and trepidation, this will be only for a short time.

The coroner's jury has met, and after hearing the evidence has decided that the explosion was due to a blow-out shot, or to the ignition of powder. This legally exonerates the Fairmont company. The time is fast approaching, however, when such accidents will not be relegated to history with the decision of a coroner's jury. The members of such a tribunal are usually business men with little knowledge of mining and little ability to weigh correctly the evidence. Many inquests are nothing more than a farce and the evidence submitted seldom comes to the attention of practical mining men who would give it intelligent consideration.

It is impossible at present to secure and discuss in detail all the evidence presented at the investigations of the recent explosions; however, some comments may

properly be made. At the inquests recently held, the coal companies have been represented by their own attorneys, while the State has generally failed to present any case at all. Is there any attorney for any coal company who would not endeavor to relieve his employer of all responsibility? This would imply that often the very points necessary to the enlightenment and betterment of mining conditions are kept entirely in the background if not wholly ignored.

In the case of the Monongah explosion, one of the theories (opposed by the company) was that a runaway trip of cars, in being wrecked at the foot of the slope, raised dust which was ignited by a short-circuited electric wire or by the open lights of miners. When this theory was advanced by one of the mine inspectors before the coroner's jury, his opponents suggested that a trip of 19 cars be permitted to run down the slope and thereby decide whether such an accident could cause an explosion of this kind. Of course this would not be a definite test. Runaways might happen 99 times without leading to an explosion, while upon the hundredth time, when all conditions of danger might chance to be present, an explosion might follow. It is as sensible to say that the explosion was not caused by a blow-out shot and to prove the statement, arrange to have another blow-out shot and see if the same kind of an explosion occur. We doubt if more than one in every 10 blow-out shots causes an explosion. It is certain that many kegs of powder have exploded in mines without killing anyone except those in the immediate vicinity.

Much more remains to be said about the Monongah explosion and other disasters that have lately occurred. When complete evidence has been gathered, we shall take up the subject in detail with the idea of making an analysis that may throw light on some of the mining problems yet unsolved.

A Bureau of Mines

Two bills have been introduced in Congress by Senator Dick and Mr. Englebright, respectively, providing for the creation of a bureau of mines; and a joint resolution, offered by Senator Dick, legalizing what the Geological Survey has been doing under a highly doubtful interpretation of its organic law and greatly increas-

ing its scope in technological investigation. All of these are objectionable and it is to be hoped that none of them will pass.

The Geological Survey has suffered because some of its ambitious directors have diverted its activities from its special field of applied geology, for work in which it was organized. Its organic law provided that it should have "the classification of public lands and examination of the geological structure, mineral resources and products of the national domain." The authorization to examine mineral products has been stretched to cover investigations in the entire subject of applied mining and metallurgy, although the language ought not to be construed as covering more than the determination of the character of mineral products which is necessary in connection with geological investigations. That the simple meaning of this act was misinterpreted by the first director is no excuse for continuing to do so. The Geological Survey has been criticized on this account during practically its whole history.

The scattering of its attention originating in this way has immensely detracted from its usefulness in geological work. This is said in no sense as disparagement of the great results that it has accomplished, but rather as regret at its failure to grasp fully its great opportunities. It has been among the greatest contributors to the development of the science of economic geology and has graduated many of its trained geologists into private practice wherein a demand for their services has grown up. It has provided a great and valuable literature on American ore deposits, but it has failed to give the full aid in the discovery and development of the mineral resources of the nation that it might have done, and this is largely the reason for the present demand that the Government do something more for the mining industry. It is surprising that directors of the Survey have been so blind as to diffuse their time and funds when so much important work in their specialty has been, and is, awaiting them. The scope of the Geological Survey should be narrowed, not enlarged.

The experience of the Geological Survey illustrates precisely why a bureau of mines should be carefully limited in its organic law to what it is intended to do, and it should not be intended to do what the people engaged in the mining industry can and ought to do for themselves. The

bills introduced by Senator Dick and Mr. Englebright are so broad in their provisions that the bureaucracy that would be created by them would be limited in its activity only by the appropriations it could secure and, would have great opportunities for mischief in the mining industry. A bureau of mines could do some useful work, but it must be carefully specified what that work is to be if we are to escape the creation of another unrestrained bureaucracy for the employment of many scientists and the dissemination of a costly literature to prove their activity.

Spelter Production in 1907

By a clerical error, which unfortunately was repeated in several places, the production of spelter in the United States in 1907 was given in our issue of Jan. 4 as 246,668 tons. The figure should have been 251,704 tons. The production by States was given correctly, the error having been merely a clerical one in footing up the total. The statistics were based on reports from the producers of their production during the first 11 months of 1907 with their own estimates of probable production in December. We have reason to believe that several producers did not turn out so much spelter in December as they expected to do, and the revised figures based on the reports for the whole year will show a total a little smaller than 251,704 tons.

Cyaniding in Colorado

While competition in the Utah ore market has been killed by the short-sighted policy of some of the citizens of that State, it has sprung into life again in Colorado in so far as the Cripple Creek ore is concerned, the Golden Cycle mill, near Colorado Springs, having come into operation, an event which has been recognized by the allied trusts in a general reduction of treatment charges. In the interests of the ore producers it is to be hoped that the competition will continue, but that it be not allowed to go so far that profits to the mill-men will disappear, which would eventually put one of the competitors out of business, and leave the victor in a position to tax the ore producers for the expense of the fight.

Besides its commercial interest, the present competition is of great technical

importance, being a renewal of the contest between the cyanide and chlorination processes, but on different lines from that of 10 years ago. At that time the fight was between each process in its simplicity: the barrel-chlorination process on the one hand and straight cyanide lixiviation on the other. Since then the chlorination process has been modified, first by concentrating on Wilfley tables the tailings from the barrels, then fine grinding in tube mills the Wilfley tailings in cyanide solution followed by agitation and decantation. Now the Golden Cycle company comes to the front with a radical modification of the old cyanide process, introduced by Philip Argall, who as metallurgical engineer and manager of the Metallic Extraction Works was the leading exponent of the original process in its application to the Cripple Creek ores. At that time the process consisted in crushing dry to pass 0.02-in. screen aperture, roasting and leaching in tanks; the shot gold formed in roasting telluride ores made fine crushing a condition precedent to satisfactory leaching, and even while crushing to the fineness indicated various appliances were used to recover shot gold and partially roasted ore from the leached sands.

In building the Golden Cycle mill Mr. Argall introduced the following radical modifications: Crushing coarse in ball mills without previous drying, the size of the ore particles being governed, not by their richness in telluride, but by their roasting quality, the object being to crush just as coarse as it was possible to roast satisfactorily. The ball mills were equipped with inner slotted screens with apertures $\frac{1}{2} \times \frac{1}{4}$ in. and outer screens of $\frac{1}{7}$ in. aperture. The machines were operated with and without the outer screens and ore of both sizes passed through the plant. The fine crushing and amalgamation were carried out in Chile mills and Wheeler pans, after which the sands were separated from the slimes, and each class was lixiviated, the sands by percolation, the slimes by agitation and suction filters.

Before the works erected by Mr. Argall had been long enough in operation to show the real results, the whole plant, save the tank house, was destroyed by fire. It is the partially rebuilt works that has just gone into operation. Although Mr. Argall had no connection with the rebuilding, the process laid out by him has

been closely adhered to, the only change of consequence being the substitution of blankets for amalgamating plates and the substitution of an additional Chile mill to replace the Wheeler pans. Considered broadly the process is a radical innovation in the treatment of Cripple Creek ores, and embodying as it does so many important improvements, it will be highly interesting to see if the barrel-chlorination process has kept pace, in so far as the results of the present contest may be unobscured by difference in business management.

Troops to Remain at Goldfield

The outcome of the negotiations between the Federal Government and the State of Nevada will meet with general satisfaction, even if it insures only the temporary preservation of order at Goldfield. It is particularly gratifying that the Nevada legislature asked unanimously for the retention of the troops. The future will depend upon the kind of constabulary that it organizes, but at all events the dread of disorder and reprisals following the withdrawal of the troops will be dispelled inasmuch as when they are ordered away there will be some arm of authority to take their place.

The Virginia Geological Survey

A good deal of feeling is being displayed in Virginia over the proposition to renew the Geological Survey of the State, with headquarters at the University of Virginia at Charlotte, instead of at the Virginia Polytechnic Institute, of Blacksburg. The latest Geological Survey of Virginia was identified with the Institute at Blacksburg from its beginning, its organization (in 1904) being, indeed, the result of an arrangement between the Virginia Board of Agriculture and Immigration and the Board of Visitors of the Virginia Polytechnic Institute. It has published several creditable and valuable reports which emanated from Blacksburg, but about 18 months ago it was temporarily abandoned, owing to the failure of the last legislature to make an appropriation for the work. Professor Watson, the geologist-in-charge, lately accepted a chair at Charlotte, where it is now proposed to remove the Survey.

Naturally, this excites the opposition of the friends of the Polytechnic Institute, and we think they have sound grounds for

their feeling in the matter. It would be, of course, a blow to the prestige of their school to lose the charge of the Survey to another school, and we do not think that the State should thus cause one of its cherished institutions to suffer in favor of another, which would be especially unfair in view of the instrumentality of the Blacksburg institute in creating the geological survey. Such an act would be so manifestly unjust that we do not believe it will be done.

Underfinanced Enterprises

It is not creditable to the engineers and managers that so many of the recent great copper mining enterprises have turned out to have been grossly underfinanced, although the difficulties under which the constructors of works labored in 1907 were exceptionally severe and highly vexatious, illuminating examples being mentioned in the last report of the Boston Consolidated. However, it is hardly to be denied that in the cases of some of these companies the disagreeable necessity of providing more money has been due largely to extravagance in the plans and considerable misconception as to the magnitude of the work undertaken.

The Balaklala was the first to appeal for more funds; then came the Boston Consolidated and Utah Copper companies. Now the Nevada Consolidated is obliged to make a new issue of bonds in order to pay for its share in the Steptoe works and provide working capital. Thus the four great prospective producers of copper have experienced the same obligation to increase their bonded indebtedness as a preliminary to beginning business.

Bogus Gems in California

The gem mining industry in California, especially in the southern counties, has increased in importance of late and many beautiful specimens of kunzite, tourmaline, etc., are being taken out. This has led to a somewhat extensive business in bogus gems, which has been established in the tourist towns of southern California. State Mineralogist Aubury has taken up this matter and says that the annual fraudulent sales, especially in Los Angeles, run into high figures. The action of dishonest dealers hurts the legitimate ones. Mr. Aubury proposes to take steps to stop this illicit trade.

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

The Yampa Coal Field

In your issue of Jan. 4, 1908, under the head of "Coal Mining in the United States in 1907," and the sub-head of "New Operations," occurs the following: "The year 1907 brought few new coalfields to our attention," and further on, "What we desire most is a new supply of anthracite, but little hope seems to exist that we shall find a field to succeed the present district in Pennsylvania. With the completion of the Denver, Northwestern & Pacific Railroad through the Rockies, it is possible some fairly good anthracite will be marketed."

Permit me to say that to us in Colorado, who are, for caloric as well as numismatic reasons, deeply interested in its being speedily opened, it appears that in the article referred to the Yampa Coal Field, which contains 1200 square miles of fine bituminous and anthracite coal, and about 800 square miles of lignite and sub-bituminous coal, has been touched with an unduly light hand.

In a measure, too, the article is contradictory, as in your issue of Aug. 17, last, under the heading of "The Fuel Famine in the Western States," you published an article by one of your special correspondents, accompanied by a map, showing an available tonnage of ten billion tons of coal, the extent of area of bituminous and anthracite coal, as above mentioned, being corroborated by the United States Geological Survey report in Bulletin 207. The gist of the article is to the effect that the opening of this undeveloped coalfield can alone relieve the fuel shortage which exists in the districts and States surrounding it, and also that for the reason of there being no steam coals on the Pacific Slope suitable for the battleships and liners coaling at those ports, the speedy opening of this field is a matter of national importance.

In this connection, let me mention that among various comments by the European press on the present Pacific cruise, I read that an eminent German naval authority, Count von Roentlow, in answer to the question of a representative of the Hamburger Nachrichten, thinks it a reflection on America that the fleet is not to be re-victualled and supplied with coal from ships flying the American flag. This author observes:

"The most interesting question, from a technical point of view, with regard to the American fleet is the method of supplying coal during its long voyage. The fact that nine-tenths of the colliers employed are

English, and not American ships, throws an unfavorable light on the strength of the American mercantile marine. Perhaps in view of possible complications the Americans will hasten to remedy this deficiency, for in case of war between them and Japan, they could not, of course, rely upon the support of England in this particular."

This, to my mind, still further accentuates the importance of the opening of the Yampa coalfield, whose coals are eminently adapted for the use of steamships, as the analyses and opinions of authorities will show.

Now with regard to the Yampa anthracite, while many mining engineers other than myself who have reported on this field, place the area at forty square miles, the report of the United States Geological Survey in Bulletin 207, which, of course, is strictly disinterested and impartial, gives the area in these words: "The actual area in which anthracite coal is now known to outcrop, or within which it is thought likely to be found, does not exceed ten square miles." But I have examined and studied that same field for the past five years, and have, in my reports (which have been corroborated by other engineers) given the anthracite area at forty square miles. My opinion therefore should be entitled to some consideration as well as that of the gentlemen of the United States Geological Survey, and mine is that, allowing for barren places caused by displacements, replacements, and intrusions of igneous rocks, etc., the area underlaid with anthracite is at least twenty square miles. However, taking the Government engineers' very noncommittal estimate of ten square miles, I will divide that in two, and call it five square miles. Now, the thickness of the workable seams, as shown by the outcrops and bore-holes, is twenty-seven feet, but I will call it twenty-five feet. This then represents about 80,000,000 tons of coal, and at an output of 2000 tons per diem there is enough to last one hundred years.

Surely this Yampa Field then, in view of the evidence adduced, is entitled to a little more extended notice in your review of 1907 than "it is possible some fairly good anthracite will be marketed," especially as the writer of that article has never seen the region referred to, and must therefore have obtained his information from sources which may, or may not, have been disinterested.

It can no longer be claimed that this field is not entitled to consideration on account of its distance from a railway, for

the grade of the Denver, Northwestern and Pacific Railway has been advanced into the Oak Creek section, where one 11 ft. seam has already been sufficiently opened to enable it to supply coal for the locomotives when the rail-head reaches that point, and the present temporary terminus of the operated line, at Yarmony, is only 40 miles from Oak Creek, with contracts let for construction to Steamboat Springs, over two hundred miles from Denver.

Your article on "Fuel Conditions in the Northwest" in your issue of Nov. 2, 1907, likewise contained no mention of this unquestionably important Colorado coalfield, and in justice to the same, and those who are interested in it, I ask space in your always fair and impartial columns for the publication of this letter.

W. WESTON.

Denver, Colo., Jan. 10, 1908.

Negative Results in Pyritic Smelting

In reading the communication from Hiram W. Hixon, together with a letter from Dr. H. O. Hofman, in the JOURNAL of Dec. 7, it occurs to me that there is not so much difference between the results obtained at Ducktown and at Sudbury as would appear at first sight. I have already expressed my belief that the presence of nickel has nothing whatever to do with the results, as I have had all these troubles with pyrrhotite containing no nickel.

The point which I wish to make is that concentration is not governed by the number of tons in one, but by the richness of the resulting matte. Both at Ducktown and Sudbury a 12 per cent. matte is obtained. In one place it is five into one; at the other it is two into one. Now, the affinity of copper for sulphur is much greater than that of iron, and it may be that 12 per cent. matte has too firm a hold upon sulphur to permit further oxidation, with the peculiar slags made at each place.

There are two other points in pyritic smelting which I do not remember to have seen brought out by anyone since the question attained its present importance: (1) The size of the ore going into the furnace; (2) the use of the reverberatory furnace in pyritic smelting.

SIZE OF ORE

Concerning the first point, the surface

exposed to oxidation varies with the size. A cube of pyrite of 4-in. face would expose six faces of 16 sq.in. each, equal to 96 sq.in. to the oxidizing influence of the furnace. Now, if this cube should be broken into 8 cubes of 2 in. each, it would expose 48 faces of 4 sq.in. each, equal to 192 sq.in., or twice the surface of the first cube, and so on. Of course, this may be expressed by a mathematical formula, but the above will do for my purpose. If the original 4-in. cube should be crushed to stamp-mill size the gain in surface exposed to the flames would be many hundred times greater, hence the oxidizing action would be many hundred times quicker, so that if the ore is very fine, it will wholly oxidize, and nothing be left for matte making.

Now, this is exactly what happened to me at Deadwood. With the peculiar charge employed there I found it absolutely impossible to make iron matte with Homestake concentrates alone, so that I always had to add coarse pyrite or copper, which would last through the furnace, to bind the sulphur.

PYRITIC SMELTING IN REVERBERATORIES

Concerning the reverberatory furnace, it may not be generally known that when pyritic, or raw, smelting was employed years ago at Freiberg, the reverberatory furnace was preferred* to the eupola furnace. The quantity smelted was three times larger, and a saving of labor and fuel was effected. More blende could be given, and the most refractory ores could be used. Of course, I am aware of the fact that raw smelting, as we formerly used the term, is not exactly the same as pyritic smelting as we now use the term, but formerly they were the same.

At Deadwood I added the stamp mill concentrate directly to the ore charge, but, owing to the fineness, very much of it blew out into the flue chamber, without any change, except that it lost the first atom of sulphur; that which went through the furnace was wholly oxidized and made no matte, as above explained. The pyrite caught in the flue chamber, together with the other flue dust, we smelted in what were then very large reverberatories, and enough iron was always oxidized to make a fair reverberatory slag; and the resulting matte was returned to the blast furnace, where it seemed to oxidize and give no trouble whatever. But little, if any, oxidized iron went into the reverberatory charge, the reverberatory doing its own oxidation.

Ever since this discussion began it has seemed to me that the conditions at Sudbury call for one of two things. I would crush much of the ore fairly fine for the blast furnace, so as to expose the greatest surface to oxidation, and the resulting flue dust I would treat in reverberatories,

returning the low-grade matte thus formed to the original blast furnace; or, I would crush all of the ore fine and smelt it in the reverberatory direct, re-concentrating the resulting matte in a blast furnace.

I do not remember to have seen any of these views advanced except as I have referred to them in my own papers, and one reference made in "Pyrite Smelting," by R. L. Lloyd, who was at that time our superintendent at the Deadwood & Delaware Smelting Works. I do not know that these views will aid in the solution of the Sudbury problem, but it would seem to me that the Nickel company could well afford to experiment. Professor Hofman's experiments show that the slag formed from the silicates practically is an infusible one, but that it does soften and, perhaps, while "gummy," it gets below the tuyeres and makes trouble.

FRANKLIN R. CARPENTER.

Denver, Colo., Dec. 11, 1907.

Copper Belt of California

In the JOURNAL of Nov. 16, 23 and 30, articles by Herbert Lang on "The Copper Belt of California," contain a number of errors that should not be allowed to pass uncorrected. Though I am interested in this copper belt, I have no present desire to engage in any controversy regarding its history, development, geology, or the metallurgy that has been practiced in the reduction of its ores. I simply wish to have the truth stated regarding my work on this belt.

In the issue of Nov. 23, p. 966, Mr. Lang says, "It has been generally held that the mines of Copperopolis, as well as the Newton and some others, contained no gold or silver; but more careful work seems to disprove that idea." This is a vague statement, but so far as the Union and Keystone mines are concerned they contain practically no gold or silver, and these two mines have yielded more than 95 per cent. of the Copperopolis ores. The ores smelted and matte shipped from these mines were regularly and carefully assayed for gold and silver. The ore contained but a few cents of gold and silver per ton, and the matte never enough of gold and silver to pay for extraction.

Of the smelting at Copperopolis Mr. Lang, on page 1008, Nov. 30, says, "The Copperopolis mines have undergone two later periods of activity in recent years, the first some 20 years ago, the other within a year past, contingent upon the erection of smelting works. A large Orford furnace set up in the former period was run for some months, smelting, I believe, about 25,000 tons of ore. At the later date, under the management of G. McM. Ross, another attempt, not long-lived, was made, a modern reverberatory furnace being erected. This is now quiescent, for reasons unknown to me, but sup-

posedly connected with some difficulty of ore reduction."

The facts are that 40,000 tons of ore were treated in the Orford furnace that ran for more than two years. In December, 1906, after smelting more than 11,000 tons, I turned over to my successor at Copperopolis the modern reverberatory furnace in regular operation with about 10,000 tons of ore on the roasting yards, the bulk of it ready for smelting, and this furnace was in operation and not "quiescent" in November, 1907, when Mr. Lang wrote his article.

In Mr. Lang's "General Conclusions" in speaking of the depth of the ore deposits he says, "I have some evidence, though scarcely enough to warrant a sweeping generalization, to the effect that the few lodes that have reached considerable depths, show signs of impoverishment if not of actual exhaustion. Information of this kind is hard to get, and I speak more from hearsay than from actual knowledge in most of these cases."

Having followed some of these ore-bodies from the surface to, a vertical depth of 700 ft. (the greatest depth referred to by Mr. Lang), I am in a position to know that Mr. Lang's hearsay evidence of impoverishment and exhaustion of the orebodies on the copper belt that I have developed is both misleading and untrue.

Mr. Lang's article would lead one to believe that all of the copper belt had been fully covered by the United States Geological Survey, but the work of the survey has not been extended on the copper belt farther south than that covered by the Jackson folio. Those who are interested in the belt regret very much that this work has not been done, and the statement that "the Copper Belt of California which is frequently spoken of locally as the Foothills Copper Belt is one of the most remarkable and extensive ore-bearing formations in the world" cannot be questioned.

G. McM. Ross.

Stockton, Cal., Jan. 3, 1908.

The Recent Colliery Explosion at Inkerman, Penn.

In the JOURNAL of Dec. 7 it was stated that six men were injured by an explosion in the No. 5 mine of the Pennsylvania Coal Company at Inkerman, Penn. The fact is that only three men were injured, one of them but slightly. These men were notified by the foreman in charge that gas was in their chamber, and they were given orders not to go into it until the gas was removed and the place made safe. The accident occurred in violation of this order.

J. PALMER,

General Mine Foreman,
No. 6 Colliery, Penn-
sylvania Coal Company.

Pittston, Penn., Dec. 13, 1907.

*Crookes & Rohrig's Treatise on Metallurgy, Vol. 1, 1868, pp. 226, 227.

The Proposed Bureau of Mines The Relations Between Miners and Smelters*

The editorial in the JOURNAL of Jan. 18, on the proposed establishment of a bureau of mines, is one which all those connected, either professionally or industrially, with mining should read with care. There is no question that the general trend of events under the present administration points toward an increase of "paternalism" in every branch of the Federal Government. The establishment of a bureau of mines, provided it had the same powers of the policing and general supervision of all mining enterprises as is the case under most of the European Governments, might effect some good. But how would this be possible under our Constitution? In Germany, where the idea of paternalism in all matters is carried to the extreme limit, the Government supervision of the operation of mines is absolute, but there a special corps of experts are educated and trained for the purpose and remain in the service for life similarly to officers in the army.

It does not seem as though any half-way measures are either possible or advisable. If the bureau is to have any power beyond that of a statistical office how would such power be given it without interference with the State right of supervision? For statistical purposes only it seems to me the present *expanded* Geological Survey suffices, or at least could be made to.

As a means of providing lucrative positions to a host of office seekers in every mining district a bureau of mines would certainly fill a "long-felt want," but beyond that, its value to the mine wage earner or to the mine operator appears problematical.

From a professional point of view I should say that it would increase rather than eliminate the abuses which have gradually crept into, the usages of the Geological Survey, some of which have been pointed out clearly in the editorial.

By all means let us have a department of mines if it can be made effective, and constituted on a scientific and not on a political basis, and then while we are at it why not continue our imitation of other countries and establish a department of "bridges and highways" (*Ponts et Chaussées*) as in France, or a Federal department of buildings similar to the "Bau Amt" of Germany?

Mines and mining so far have escaped the sphere of politics, and have notwithstanding, or consequently, been fairly successful. The advisability of changing this independent condition would appear questionable.

E. GYBON SPILSBURY.

New York, Jan. 21, 1908.

The deepest mine on the Rand is the Simmer West, where a depth of 4500 ft. has been reached.

The complaints have come in the main from the Western ore producers who are obliged to sell their products in markets where there is little or no competition. These complaints have been directed, most of them, against the American Smelting and Refining Company and its allies, popularly known as "the Smelting Trust," by whom nearly all of the important custom smelting plants in the United States are controlled. The mine owner who wishes to sell his product must accept the best offer he can get, and in order to insure a market for his ores he must enter into a contract under which his output for a long period in advance goes to the purchasing smelter and is paid for in accordance with terms specified in the contract. Under such conditions there is nothing to prevent the ore buyer from exacting as much tribute as the traffic will bear.

In considering the complaints that have been filed with the committee, we have tried to bear in mind that custom smelting is a legitimate industry and is entitled to recognition as such. We must remember that the owner of a smelting plant cannot afford to buy ores unless they are of such nature that he can utilize them and get the metals from them within a reasonable length of time. He is entitled to a fair return for the money invested in the business, including, of course, the money represented by ores awaiting treatment, product tied up in process of reduction, and metals awaiting sale. Perhaps he is entitled to an allowance for possible fall in metal prices while he is getting the product in shape for the market, although in the long run prices are as apt to rise as to fall. His problem is to roast off the volatile elements, to flux off the worthless earthy dross, to save the metals as a base bullion which can then be put through a refining process for the purpose of separating the valuable metals from one another, and finally to sell the refined product to consumers.

It should be noted that in lead smelting, as practiced in the West, the lead, silver and gold are saved as bullion and that a by-product is made from which the copper can be recovered. In copper smelting, the copper, silver and gold are saved, but no recovery is made of any lead that may be present. In neither of these processes is there any attempt to save other elements in the ore such as zinc, antimony, arsenic, etc.; on the contrary, these elements are looked upon as objectionable, either because extra expense is entailed in getting rid of them, or because in disappearing they carry off precious metals to an alarm-

ing extent. In practice, complete recovery of the valuable metals is not made. Therefore, in buying ores, the smelter does not expect to pay the ore producer for greater percentages of the metals than he can recover; he cannot pay the full market price for the metals without first deducting sums sufficient to transport his product to the refinery, to pay the cost of refining, the cost of transporting refined metal to the market, and the additional costs of brokerage, interest, insurance, etc. He is entitled to charge for roasting off the volatile elements in the ore and for slagging off the earthy dross. If, in order to make the slag, he is compelled to buy barren limestone, iron, etc., he is entitled to charge for the cost of these materials and for the cost of handling of the additional stuff in the furnace. If, after all of this, he exacts a fair profit and does it without subterfuge, the ore producer should not complain.

But the objection is made that the methods of ore buyers are not always fair. Summarizing the complaints that have been made to the committee, we find them to embrace: (1) Excessive deductions for smelting losses and for refining and selling costs. (2) Unsatisfactory settlements on account of arbitrary valuations placed by the smelters upon different metals. (3) Exorbitant smelting charges. (4) Arbitrary and unfair rules governing the sampling and assaying of ores. (5) Questionable tactics to stifle and forestall competition.

RELIEF THROUGH COMPETITION

If any or all of these things are true, what can the ore producers do about it? Turning to the Salt Lake Valley of Utah, where there seems to be least cause for complaint, we find a number of independent smelting plants which were built by private concerns for the purpose of treating the ores from their own mines and which were afterward enlarged in order to handle custom business. These plants are now formidable rivals of "the trust." Under the stimulus of competition the smelting industry in the Salt Lake valley has advanced commercially and technically to such an extent that this is now the most important smelting center in the West. Moreover, this competition has brought substantial relief to the ore producer who has no smelting plant of his own.

Ore producers in other parts of the west will therefore be glad to learn on what basis ores are bought and sold in the Salt Lake Valley. By permission of certain producers, we recite below the terms of existing contracts for the sale of their output of ores. In individual instances, and for exceptional ores, even better terms than these have been obtained.

Gold contained in the ores in question is paid for at the rate of \$19.50 per Troy ounce. No gold is paid for when the assay shows less than 0.03 oz. per ton.

*Extracts from the majority report of the Committee on the Mutual Relations and Grievances of the Ore Producers and Custom Smelters, presented by H. S. Joseph, at the meeting of the American Mining Congress at Joplin, Mo., Nov. 14, 1907.

Silver. 95 per cent. of the silver contained in the ore, as shown by fire assay, is paid for at the New York "official" price on the date of the first assay.

Copper. All copper contained in the ore, in excess of 0.5 unit (10 lb. per ton of ore) is paid for at the ruling wholesale price of electrolytic copper in the New York market for the previous week, deducting therefrom 2½c. per lb. If, however, the ore happens to contain lead in excess of three units, such ores are treated in a lead furnace, making a more roundabout process for the recovery of the copper contents and the sum of 4.5c. per lb. is deducted from the New York price of electrolytic copper.

Lead. 90 per cent. of the lead contained in the ore, as shown by wet assay on fire button, is paid for at the ruling wholesale price of common desilverized lead in the New York market, deducting therefrom the sum of one cent per pound. No lead is paid for when the assay shows less than three units.

SMELTING CHARGES AND DEDUCTIONS FOR METAL LOSSES

While all metallurgical losses, and all expenses attaching to bullion after it leaves the smelting works, are amply covered by the foregoing deductions, the schedules in use in other localities call for deductions far in excess of these. No two smelting companies have exactly the same schedule of deductions, neither does any concern apply the same schedule in dealing with all patrons. When brought to the point, the ore buyer does not maintain that his schedule of deductions represents actual metallurgical losses and the costs of freighting, refining and selling bullion. The average ore producer, if paid for 100 per cent. of the metals in his ore, at full market prices, would object most strenuously to a treatment charge which would cover metallurgical losses, freight on bullion, refining costs, selling costs, interest, depreciation, profit, etc. It is plain that this entire outlay must be borne by the ore in some way, but by the subterfuge of deductions, a little on one metal here, and a little there, and a little somewhere else, the ore buyer is able to bring the treatment charge, which first attracts the attention of the producer, to a low point. Although not in fact singled out as victims, the producers of gold ores have been the most bitter in their complaints against the ore buyers; one reason being that with no valuable metals in the ore, except gold, there is little chance for roundabout figuring, and the treatment charge stands out in its cold reality.

REASONS FOR VARYING TREATMENT RATES

Rates of treatment vary within wide limits, according to the locality, the nature of the ore, and the needs of the smelter. The ore buyer aims to assemble at his plant, ores containing silica, ores containing iron, and ores containing lime, so that from these a mixture can be made

which will yield a fluid slag in the smelting furnace. Under such ideal conditions the smelter does not have to buy barren rock for flux, and his furnaces are burdened with nothing except pay ore. Too much of one kind of ore is a bugbear in the absence of enough of the other kinds. In the smelting centers nearest the Pacific coast there is frequently such a shortage of silicious ores that the smelters handle them for almost nothing; from such regions no complaints of exorbitant treatment charges have come to your committee. But in most smelting centers, as in the Salt Lake Valley, there is a large surplus of silicious ores, and in order to flux them the smelter is compelled to buy more or less barren iron ore and barren limestone, which not only cost money to get but also cost money to smelt, to say nothing about metallurgical losses through increased volume of slag.

In the Salt Lake Valley one producer of silicious ores is paid for the metals in his ores on the terms already quoted, and pays treatment charges as follows: on ores going to the lead furnaces, a base or initial charge of \$1 per ton; on ores going to the copper furnaces, no base or initial charge. To the base or initial charge is added: 10c. for each unit of insoluble matter; 30c. for each unit of zinc in excess of 10 per cent.; 25c. for each unit of sulphur in excess of 2 per cent.; the maximum penalty for sulphur being \$1 per ton of ore; 25c. for each unit of speiss in excess of 5 per cent. On iron, a credit of 10c. per unit is allowed. All of this means that on highly silicious ore carrying 20 to 25 per cent. of lead, this mine owner pays a treatment charge of some \$5.50 per ton, and up to this time the buyer has made no complaint.

A private smelting plant, handling sulphide copper ores and having no flux to buy, reports a working cost for roasting, smelting and converting, of less than \$3 per ton. But as to sulphide ores in general and ores containing other objectionable elements, it is impossible to lay down any hard and fast rules, because the ore from any mine is peculiar to itself.

COMPETITION AS THE REMEDY

No ore producer can build his own smelting works and operate it to advantage without making provision for such ores as will combine with his own to make a good smelting mixture. The producer who attempts to set such an enterprise on foot usually finds that other producers, whose ores he needs, and who would ordinarily be willing to cooperate in the enterprise, are not free to do so because they have been allured into long term contracts with "the trust." Because of these long term contracts, the producer who finds himself free can seldom get any cooperation; and as all such contracts have been timed so carefully that not many important ones terminate during the same year, the producers, however much they may sigh

for relief, seldom succeed in getting together. In this respect "the trust" must be given credit for its shrewd and adroit efforts to forestall further competition.

The three most prominent remedies suggested are: (1) Intervention on the part of the United States Government. (2) Intervention by way of State legislation. (3) Intervention by organization of mine owners and operators throughout the country for the purpose of building, operating and maintaining their own mills and smelters.

The third remedy suggested, viz.: "Intervention by organization of mine owners and operators," seems to us to be entirely practicable and if wisely organized and judiciously managed will be eminently satisfactory. About the desirability of this remedy, it seems to us, there can be no question, for the reputed dividends earned by the great smelting companies place their enterprises beyond the question of doubt as successful business and financial propositions. And with this idea in mind your committee is disposed to discourage mine owners from contracting their output to any concern for such long periods in advance that they will be unable to join with their friends in enterprises of this kind whenever the time seems ripe.

The Hepburn Law and the Coal Roads

According to press dispatches from Washington under date of Jan. 17, the Federal administration intends to be lenient in the enforcement of the section of the Hepburn railway rate law which prohibits railroads from transporting from State to State products other than lumber produced by them. This section of the law will become effective on May 1 next and applies particularly to the anthracite coal roads of Pennsylvania. The coal roads have represented that in order to comply with the law they would be obliged to sell a part of their property at a sacrifice. They have been advised by their counsel that this section of the law is unexceptional.

Attorney-General Bonaparte announced that there would be no prosecutions until the matter is determined by the Supreme Court of the United States in a friendly suit. His statement is as follows:

"What is generally known as the 'commodities clause' of the Hepburn bill, approved June 29, 1906, reads as follows:

"From and after May 1, 1908, it shall be unlawful for any railroad to transport from any State, Territory or the District of Columbia to any other State, Territory or the District of Columbia, or to any foreign country, any article or commodity, other than timber and the manufactured products thereof, manufactured, mined or produced by it, or under its

authority, or which it may own in whole or in part, or in which it may have any interest, direct or indirect, except such articles or commodities as may be necessary or intended for its use in the conduct of its business as a common carrier.

"It is clear that this clause if valid will make it impossible for many railroads which own coal mines to transport the coal to market after the date named, and it is understood that some of these railroads have been advised by their respective counsel that the above quoted provision of law is unexceptional. The Department of Justice contemplates the institution of proceedings, as soon as possible after the date named, whereby a prompt determination of this question by the Supreme Court of the United States may be obtained. It is expected that the railroads concerned will cooperate with the Government to this end and if they do so in good faith and if they in good faith and immediately obey the decision of the Supreme Court when rendered it is not the purpose of the Department of Justice to prosecute them for a failure to comply with the terms of the act pending the decision of the Supreme Court."

Nevada Consolidated Copper Company

Notice has been given that a special meeting of the stockholders of the Nevada Consolidated Copper Company will be held at Portland, Me., Feb. 5, 1908, to consider and act upon a resolution authorizing the increase of its capital stock from 1,300,000 shares of the par value of \$5 each, to 1,600,000 shares of the par value of \$5 each, and to take any other action that may be requisite or advisable in connection with this matter. Accompanying this notice is the following letter from James Phillips, Jr., the president of the company:

The company has been engaged for some years past in the development of its extensive properties, and has succeeded in blocking out great bodies of valuable ore. In order to bring about the best and most speedy results from its operations, it was deemed advisable to cooperate with the Cumberland-Ely Copper Company in the construction of a concentration and smelting plant which would be adequate for the requirements of both companies, and which would be capable of treating the daily output of ore which the development of its properties enables this company to produce, for a long term of years.

It was also found, that in order to carry on the extensive operations which this plan involved, it would be necessary for this company to have on hand as working capital the sum of at least \$1,000,000, and that the early payment of dividends on the stock issued by the company, would

depend upon the speedy consummation of the plans of operation thus outlined. It has, therefore, been deemed advisable to make immediate arrangements for increased capital to insure immediately increased concentration and smelting facilities rather than to suffer the consequences of a dilatory policy.

It has, therefore, been determined that if the stockholders will, at the meeting of which notice has been given, vote in favor of the increase of the capital stock of the company, bonds to the amount of \$3,000,000, bearing interest at the rate of 6 per cent. per annum, and convertible at the option of the holder into the stock of this company on a basis hereafter to be determined, which bonds are to be secured by a mortgage on the real estate of the company, will be issued when and as required for the purposes of the company. It is the intention of the management to offer the bonds so to be issued *pro rata* to the stockholders. Arrangements have been made for the underwriting of the bonds so to be offered. The increased stock will be held for purposes of conversion of the bonds when issued, and so much thereof as shall not be required for conversion purposes will remain unissued, to meet the future requirements of the company.

American Smelting and Refining Company

The stock of the American Smelting and Refining Company closed on Jan. 20 at 65¼ after 128,000 shares had changed hands. The decline was accompanied by rumors of a probable decrease in dividend, inside liquidation, and forced loss of control by the Guggenheims. The reports were denied categorically by one of the most prominent officers and directors of the company.

"None of the insiders," he said, "has been selling Smelters today. On the other hand insiders have been buyers and have picked up a good deal of very cheap stock. There is no liquidation on the part of any of the Messrs. Guggenheim and not the slightest prospect that they will lose control of the company. They have in fact recently increased their stock holdings.

"None of us pretends that the company is doing the business of the boom times of a year ago. Yet the business is satisfactory, general conditions considered, and the outlook appears to be very good. The rate of the next dividend has not even been considered and will not be for six weeks at least. No dividend meeting is scheduled until almost two months from today."

In spite of the above denial, the belief in well-informed quarters is strong that the Guggenheims no longer control the stock of Smelters, but it is not believed that control has passed to Standard Oil interests, as frequently has been rumored.

Troops to Remain at Goldfield

Both houses of the Nevada Legislature, Jan. 16, passed unanimously resolutions asking President Roosevelt to keep United States troops in Goldfield until proper police arrangements can be made for preserving order.

A communication to the President from Governor Sparks, Jan. 17, quotes the resolution adopted by the Nevada State Legislature on the previous day without a dissenting vote, and earnestly urges the President to carefully consider the same. "We are working on a constabulary law, and will keep you advised of progress," the Governor concludes.

Upon receipt of this communication, the President telegraphed to Governor Sparks as follows:

"In response to your telegram transmitting the resolution of the Legislature of Nevada, I authorize you to inform the Legislature that, in accordance with its request, I will permit the troops to remain in Nevada for such reasonable length of time as will give opportunity to the Legislature to organize such police force as will enable the State authorities to perform the police functions of the State. I assume, of course, that there will be all possible expedition in providing this police force."

Applications for a congressional investigation of the Goldfield mining trouble are being received by the House Committee on Labor, according to the chairman, John J. Gardner, who conferred with President Roosevelt, Jan. 17. Mr. Gardner said that the most urgent demand seemed to be for the retention of the troops at Goldfield until all possibility of trouble between the miners and mine operators should be obviated. The committee later voted to report favorably the resolution calling on the President for the full data of the report of Goldfield labor trouble, made to him by the special commission of investigation.

An Independent Miners' Union

Thomas O'Brien, an old Comstock miner, and afterward labor commissioner of the State of California, who has been in Goldfield trying to start an independent miners' union, which he calls the Nevada Miners' Union, is reported to be making some progress. He has opened headquarters and has a large American flag flying from the window. Americanism is the keynote of his organization; respect for the American government, its flag and constitution, is the fundamental tenet. The union declares against strikes, boycotts and lockouts and eliminates all the vicious features in the fundamental law of the Western Federation of Miners. This will be a commendable union if the plans above outlined are carried out.

Patents Relating To Mining and Metallurgy

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

UNITED STATES AND BRITISH PATENTS

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

COAL AND COKE

COAL-MINING MACHINE. Harry Specht, Frostburg, Penn. (U. S. No. 875,296; Dec. 31, 1907.)

COAL-MINING MACHINE. Thomas J. Newcome, Jamisonville, Penn., assignor of one-half to John C. Hirst, Reynoldsville, Penn. (U. S. No. 874,028; Dec. 17, 1907.)

COKE-OVEN. Arthur O. Jones, New Brancepeth, England. (U. S. No. 875,436; Dec. 31, 1907.)

COKE-OVEN DOOR—Closure for Coke-Ovens and Similar Devices. Heinrich Koppers, Essen-on-the-Ruhr, Germany. (U. S. No. 875,356; Dec. 31, 1907.)

COPPER

EXTRACTION OF COPPER and Other Metals from Roasted Pyrites. Auguste Tixer and Casimer Tortal, Paris, France, assignors to Les Produits Chimiques de Croissy (J. Basler & Co.) Paris, France. (U. S. No. 875,012; Dec. 31, 1907.)

REFINING—Apparatus for Refining Copper. Frank L. Antisell, New York, N. Y. (U. S. No. 875,641; Dec. 31, 1907.)

IRON AND STEEL

CUPOLA-FURNACE. Michael Zipplier, Allegheny, Penn. (U. S. No. 874,476; Dec. 24, 1907.)

KNOBBLING-FURNACE. William Sharp, McKeesport, Penn. (U. S. No. 874,038; Dec. 17, 1907.)

MANUFACTURE — Process of Making Steel. Harry O. Chute, Cleveland, Ohio. (U. S. No. 874,391; Dec. 24, 1907.)

MANUFACTURE—Process of Producing Steel. George O. Seward, East Orange, N. J., and Franz von Kugelgen, Holcombs Rock, Va., assignors to Virginia Laboratory Co., New York, N. Y., a Corporation of New York. (U. S. No. 874,628; Dec. 24, 1907.)

WROUGHT IRON—Apparatus for Producing Wrought Iron or Steel Direct from Ore. John A. Potter, Los Angeles, Cal. (U. S. No. 874,537; Dec. 24, 1907.)

WROUGHT IRON—Process of Manufacturing Wrought Iron or Steel. John A. Potter, Los Angeles, Cal. (U. S. No. 874,536; Dec. 24, 1907.)

NICKEL

METAL EXTRACTION—Method of Extracting Metallic Ores and Matte. Emil Günther and Rudolf Franke, Elselben, Germany. (U. S. No. 875,259; Dec. 31, 1907.)

REFINING PROCESS—Electrolytic Process for Refining Nickel. John N. Pring, New York, N. Y., assignor to Elmer A. Sperry, Brooklyn, N. Y. (U. S. No. 874,864; Dec. 24, 1907.)

SALT

MINING METHOD—Mining Salt. Herman Frasch, Cleveland, Ohio, assignor to United Salt Company, Cleveland, Ohio, a Corporation of Ohio. (U. S. Nos. 874,906 and 874,907; Dec. 24, 1907.)

SULPHUR

SUBLIMED SULPHUR—Apparatus for Producing Sublimed Sulphur. Arthur Walter, Naples, Italy. (U. S. No. 873,812; Dec. 17, 1907.)

ZINC

ORE TREATMENT—Metallurgical Method of Treating Oxidized Zinc Ores (Calamines, Oxides, Silicates) By the Precipitation Process. Antoine H. Imbert, Grand Montrouge, France, assignor to Imbert Process Company, New York, N. Y., a Corporation of New York. (U. S. No. 875,580; Dec. 31, 1907.)

ORE TREATMENT—Process for the Treatment of Zinkiferous Ores and Metallurgical

Products. James H. Gillies, Auburn, Victoria, Australia. (U. S. No. 875,424; Dec. 31, 1907.)

ORE TREATMENT—Process of Treating Complex Ores Containing Zinc and Other Volatilizable Metals. George M. Rice, Worcester, Mass. (U. S. No. 875,381; Dec. 31, 1907.)

PIGMENT—J. C. A. Meyer, Lyons, France. Method of producing a white sulphide of zinc suitable for use as a paint. (Brit. No. 5032 of 1907; Nov. 30, 1907.)

SULPHIDE ORE TREATMENT—Process of Treating Zinc and Lead Sulphide Ores. Antoine H. Imbert, Grand-Montrouge, France. (U. S. No. 875,578; Dec. 31, 1907.)

MINING—GENERAL

MINE-ROOF SUPPORT. Frederick C. Keighley, Uniontown, Penn. (U. S. No. 875,182; Dec. 31, 1907.)

ORE DRESSING

ORE-CONCENTRATOR. Ulysses S. James, Newark, N. J., assignor to James Ore Concentrator Co., Newark, N. J., a Corporation of New Jersey. (U. S. No. 874,364; Dec. 17, 1907.)

ORE-FEEDING MECHANISM. Marshal Henderson, Doe Run, Mo., assignor of one-third to Ulysses Hawk, Doe Run, Mo. (U. S. No. 873,748; Dec. 17, 1907.)

SCREENING PULP—Apparatus for Screening Pulp. William A. Stevenson, Northampton, Mass., and Ambrose H. White, Brooklyn, N. Y. (U. S. No. 873,390; Dec. 10, 1907.)

SEPARATION—Device for Separating Materials Held in Suspension by Liquids. Charles N. Waite, Wilmington, Del. (U. S. No. 872,033; Nov. 26, 1907.)

SLIME-CONCENTRATOR. Edward C. Porter, Telluride, Colo. (U. S. No. 874,433; Dec. 24, 1907.)

PULVERIZING-MILL. George E. Rudnick, Iola, Kan. (U. S. No. 872,201; Nov. 26, 1907.)

METALLURGY—GENERAL

ELECTRIC SMELTING—Art of Electric Smelting. Frank Creelman, New York, N. Y., assignor to Willson Carbide Works Co., of St. Catharines, Limited, St. Catharines, Canada, a Corporation. (U. S. No. 874,944; Dec. 31, 1907.)

LEACHING PROCESS—Apparatus for Leaching Ores and the Subsequent Separation of the Liquids From the Solids. James H. Gillies, Auburn, Victoria, Australia. (U. S. No. 875,425; Dec. 31, 1907.)

SLAG BREAKING—Machine for Slag-Breaking. Carl G. Lindstrand, Bisbee, Ariz. (U. S. No. 874,692; Dec. 24, 1907.)

SMELTER SMOKE—Process for Treating Smelter Smoke and Extracting Values From Ores or Metallurgical Waste Products. Stanley S. Sørensen and George C. Westby, Murray, Utah. (U. S. No. 875,222; Dec. 31, 1907.)

SMELTING—Method of Smelting Ores. John C. Harde, Helena, Mont. (U. S. No. 874,336; Dec. 17, 1907.)

SULPHIDE ORE TREATMENT—Metallurgical Treatment of Sulphurous Ores by the Precipitation Process. Antoine H. Imbert, Grand-Montrouge, France, assignor to Imbert Process Company, New York, N. Y., a Corporation of New York. (U. S. No. 875,579; Dec. 31, 1907.)

SULPHIDE ORE TREATMENT—Process of Rendering Soluble in Water the Nickel and Copper Contained in Sulphide Ores and Mattes. Walter S. Gates and Herbert H. Dow, Midland, Mich., assignors, by mesne assignments, to Ontario Nickel Co., Limited, Worthington, Canada, a Corporation of Canada. (U. S. No. 874,496; Dec. 24, 1907.)

MINING MACHINERY AND APPARATUS

DRILL—Pneumatic and Other Drill. Martin Hardsocg, Ottumwa, Iowa. (U. S. No. 868,661; Oct. 22, 1907.)

DRILL—Sink-Shaft Drill. John P. Karns, Boulder, Colo., assignor to J. P. Karns Tunneling Machine Co., Boulder, Colo. (U. S. No. 874,848; Dec. 24, 1907.)

MINE CAR DOOR-LATCH—Latch for Mine-Car Doors. Christian H. Smith, Tranger, Penn. (U. S. No. 874,872; Dec. 24, 1907.)

ORE CAR—Metal Ore-Car. Ethan I. Dodds, Pullman, Ill., assignor to Pullman Company, Chicago, Ill., a Corporation of Illinois. (U. S. Nos. 874,576 and 874,577; Dec. 24, 1907.)

PROSPECTING TOOL—Miner's Prospecting-Tool. Dominik Böderl, Oakland, Cal. (U. S. No. 874,730; Dec. 24, 1907.)

ROCK-DRILL and Other Percussion-Tool. Thomas Warsop, Conlston, England. (U. S. No. 873,813; Dec. 17, 1907.)

ROCK-DRILL. Edward N. Jones, Victor, Colo. (U. S. No. 871,594; Nov. 19, 1907.)

ROCK-DRILL. Frederick V. Swanton and Burt Price, Braamfontain, Johannesburg, Transvaal. (U. S. No. 874,455; Dec. 24, 1907.)

ROCK DRILL—Hand Rock-Drill. Charles H. Gunn, Oroville, Cal. (U. S. No. 874,499; Dec. 24, 1907.)

ROCK DRILL CHUCK—Self-Tightening Rock-Drill Chuck. James A. Thompson, Edwin M. Mackie, and Percival F. Doyle, Chicago, Ill., assignors to Chicago Pneumatic Tool Co., a Corporation of New Jersey. (U. S. No. 871,972; Nov. 26, 1907.)

ROCK-DRILLING MACHINE. Alva D. Lee, Brookline, and Francis J. E. Nelson, Jr., East Boston, Mass. (U. S. No. 874,603; Dec. 24, 1907.)

ROCK-DRILLING MACHINE or Engine. Henry Hellman and Lewis C. Bayles, Johannesburg, Transvaal. (U. S. Nos. 872,417 and 872,418; Dec. 3, 1907.)

ROCK DRILLS—Swivel for Rock-Drills. Samuel A. Sizemore, Leadwood, Mo. (U. S. No. 873,801; Dec. 17, 1907.)

STEAM-SHOVEL. George W. King, Harry J. Barnhart, and Charles B. King, Marion, Ohio, assignors to Marion Steam Shovel Co., Marion, Ohio, a Corporation of Ohio. (U. S. No. 873,756; Dec. 17, 1907.)

TUNNELING-MACHINE. John P. Karns, Boulder, Colo., assignor to J. P. Karns Tunneling Machine Co., Boulder, Colo., a Corporation. (U. S. No. 875,664; Dec. 31, 1907.)

METALLURGICAL MACHINERY AND APPARATUS

CASTING—Apparatus for Holding and Pouring Metal into Molds for Casting-Machines. Edgar A. Custer, Philadelphia, Penn. (U. S. No. 870,869; Nov. 12, 1907.)

DESULPHURIZING FURNACE—Furnace for Desulphurizing and Agglomerating Ores. Andrew J. Dull, Harrisburg, and Joseph Weatherby, Jr., New Cumberland, Penn., said Weatherby assignor to said Dull. (U. S. Nos. 875,331 and 875,332; Dec. 31, 1907.)

ELECTRIC FURNACE. Edward R. Taylor, Penn Yan, N. Y. (U. S. No. 871,971; Nov. 26, 1907.)

ELECTRIC FURNACE Jesse C. King, St. Catharines, Ontario, Canada, assignor to Willson Carbide Works Co., of St. Catharines, Limited, St. Catharines, Canada, a Corporation of Ontario. (U. S. No. 872,352; Dec. 3, 1907.)

ELECTRIC SMELTING-FURNACE. William R. Parks, Chicago, Ill., assignor to Samuel Shaw Parks, Chicago, Ill. (U. S. No. 873,890; Dec. 17, 1907.)

FURNACE-STOKER. Edwin E. Slick, Pittsburg, Penn. (U. S. No. 872,382; Dec. 3, 1907.)

MUFFLE-FURNACE. Edward L. Stine, Buffalo, N. Y., assignor to Republic Metalware Co., Buffalo, N. Y., a Corporation of New York. (U. S. No. 874,452; Dec. 24, 1907.)

ORE-REDUCING FURNACE. James McLoughlin, Rye, N. Y. (U. S. No. 874,527; Dec. 24, 1907.)

ORE-ROASTER. Allen J. Garver, Clarkston, Wash., assignor to himself and Jonathan McAssey Clarkston, Wash. (U. S. No. 869,360; Oct. 29, 1907.)

ROASTING-FURNACE SHAFT. Grant B. Shipley, Milwaukee, Wis., assignor to Allis-Chalmers Co., Milwaukee, Wis., a Corporation of New Jersey. (U. S. No. 873,687; Dec. 10, 1907.)

Personal

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

H. M. Swayne, of Butte, Mont., is in Mexico.

H. C. Holthoff, of Taxca, Mexico, is in the United States on a short trip.

J. P. Smith, of Denver, Colo., is in Mexico City on professional business.

Zach. Samuels, of Mexico City, has returned from a business trip to London.

James Douglas went last week to Arizona whence he expects to return in about a month.

S. V. Kemper, of Butte, Mont., is in Mexico on a general inspection trip to various mining camps.

J. J. Yeckel, of Oaxaca, Mexico, has gone to San Antonio, Texas, and to St. Louis, Mo., on business.

Prof. Robert H. Richards, of Boston, is paying a professional visit to Great Falls and Anaconda, Montana.

John Wessell has been appointed manager of the Lee S. property at Sunset, Boulder county, Colorado.

Neil J. Sorenson, president of the San Lucas Mining Company, Mexico, is in Atlanta, Ga., on a vacation.

W. S. Leebrick, of Montezuma, Colo., president of the Montezuma Mines Company, has gone East on business.

George A. Sanborn, manager of the Fraction mine, near Idaho Springs, Colo., is making a business visit to Detroit.

Charles Hocking has been appointed superintendent of the mill of the Democrat Mining Company, at Georgetown, Colorado.

J. R. Finlay, consulting mining engineer, of New York, went to Missouri, Jan. 21, for a 10-day trip of inspection of his mining interests.

Joseph F. Bridge, of Dumont, Colo., has been appointed superintendent of the Marshall-Russell tunnel in Clear Creek county, Colorado.

George A. Schroeter has returned to Denver after two months spent in installing the Butters filters at the Dolores mines in Mexico.

Owen Rice, general manager of the Dives-Pelican mines at Silver Plume, Colo., has returned from a business visit to Eastern points.

Harry A. Lee, of Denver, Colo., has been spending a week in New York, and has gone to Cobalt, Ont., where he will examine several mines.

O. B. Thompson, manager of the Fifty Gold Mines Corporation, operating at Black Hawk, Colo., has returned from a business visit to New York.

Henry P. Lowe, managing director of the Frontenac Syndicate, Ltd., operating in Gilpin county, Colo., is making a business visit to London, England.

Harry L. Charles, general manager of the Bingham Consolidated Mining and Smelting Company, at Salt Lake City, Utah., resigned his position on Jan. 1.

W. Rowland Cox has resigned as assistant general superintendent of the American Smelters Securities Company, in charge of mines in Mexico, in order to engage in private work.

W. F. Brunne, of New York, was in Port Arthur, Ont., recently, arranging for the transfer of several gold locations in the Sturgeon Lake district to a syndicate of New York capitalists.

Major Harley, mining engineer, of London, England, is examining iron-ore properties in McTavish and McGregor townships, near Port Arthur, Ont., in the interests of a British syndicate.

Samuel Newhouse and Lafayette Hanchett, general manager of the Newhouse mines, have left Salt Lake City to attend the annual meeting of the Boston Consolidated Mining Company in London.

J. S. Kent has resigned his position as superintendent of the rail mill of the Dominion Iron and Steel Company, Sydney, N. S. After taking a trip to England, he will return to the United States.

William Mackenzie, president of the Canadian Northern Railway, and heavily interested in mining and industrial enterprises, returned to Toronto on Jan. 11 from a three months' trip to England on financial business.

John H. Brickenstein, long examiner in metallurgy in the United States Patent Office, has resigned his position and will enter into the practice of patent law as a member of the firm of Byrnes, Townsend & Brickenstein, of Washington.

Arthur L. Walker has severed his connection with the American Smelting and Refining Company, and will shortly go to Bermuda for a vacation. Upon his return from Bermuda he will open an office in New York as consulting metallurgical engineer.

Francis L. Robbins, formerly president of the Pittsburg Coal Company, and for two years past president of the Monongahela River Coal and Coke Company, has retired from that position, and is no longer connected with the company. It is said that he will take charge of another large coal interest.

J. B. Risque, manager of the Utah Consolidated Mining Company, has gone to New York to confer with the executive heads of the company. It is expected that, by the time he is ready to return to Salt Lake, the plans of the company as regards the building of a new smelter in Utah will have been formulated.

Obituary

The many friends of Henry Burrow Vercoe will regret to hear of his death, which took place Dec. 17, 1907, at St. Leonards-on-Sea, Sussex, England, after a long and serious illness. He was the eldest son of the late Captain John Vercoe, of Bodmin, Cornwall, a well-known mining engineer in the early days. For many years Mr. Vercoe was actively engaged in mining in various parts of the United Kingdom and for 12 years prior to his retirement he had been heavily interested in gold and copper properties in California.

James B. Gallagher died in Butte, Mont., Jan. 5, of pneumonia; he was 54 years old. He was born in Ely, Nev., and removed to Butte in 1882. He was engaged in mining all of his active life. He was at one time assayer and chemist of the Parrot Mining Company and later was the manager of the Copperopolis mine near Sulphur Springs. He was also at one time in charge of the properties owned by the Trenton Mining Company, and at the time of his death was manager of the Washoe sampling works. He was prominent in social life and politics in Montana and had many friends. He left a widow and one son.

Industrial

The latest catalog of the A. S. Cameron Steam Pump Works, New York, not only gives full descriptions of pumps of all classes, but also includes a number of useful tables giving pump capacities, friction of water in pipes, pressure of water at different heights, capacity of pipes and other information, making it a handy book of reference as well as a catalog.

The use of lifting magnets in connection with cranes, etc., in handling iron and steel of all kinds, is a recent development which dispenses with the services of many laborers in iron yards, foundries and mills. The construction and use of such magnets is fully described and illustrated in a pamphlet recently issued by the Electric Controller and Supply Company, of Cleveland, Ohio.

Wm. Waldie, of Nelson, B. C., owner of the Queen gold-quartz mine, near Salmo, B. C., is adding 10 stamps to his mill, making 20 in all. Other new equipment ordered includes a Canadian Rand Company's cross-compound, belt-driven air compressor, capacity 1015 cu. ft. of free air per min. compressed to 100 lb.; a 42-in. by 10 ft. air receiver; complement of 3 1/4-in. new type Little Giant machine drills; and a 12x15-in. single-drum hoist, to be operated by compressed air.

The committee of creditors of the Westinghouse Electric and Manufacturing Company has prepared a plan for the adjustment of the company's finances. It provides for an issue of \$35,000,000 in 5

per cent. bonds to take up the outstanding bonds, \$20,469,000, and the floating debt, which amounts to \$14,531,000. The plan further provides for the payment of \$7,000,000 new capital into the company's treasury for new stock, which is to be taken by President Westinghouse and his friends.

The Consolidated Mining and Smelting Company of Canada, Ltd., recently made a shipment of 250,000 oz. silver to the new Canadian mint at Ottawa. The silver was in bars and 0.999 fine. It was smelted from British Columbia ores in the works of the Consolidated Company at Trail, and refined at the same works. The mint will require about 1,000,000 oz. this year, and its specifications call for bars 0.998 fine. The production of the Trail smelter, chiefly from lead bullion, is at present about 150,000 oz. silver and 2000 oz. gold monthly. Heretofore the Trail silver has gone partly to the United States, partly to China and Japan.

Bulletin No. 1604 of the Allis-Chalmers Company describes a pump designed to meet the requirements of plants where steam economy is an important factor in the cost of production. The Allis-Chalmers hydraulic transmission pump is built for any capacity desired up to 400 gal. per minute, and pressures as high as 6000 lb. per square inch. Pumps of this type are particularly adapted for operating under conditions that entail hard and continuous service, as in mines; for forcing fluids through pipe lines, or for the operation of hydraulic presses, and apparatus of all kinds which depends for its successful operation upon the delivery of water or other liquids under heavy pressure.

The United States District Court in St. Louis has reduced the award of the special master in the patent-infringement suit of the Westinghouse Electric and Manufacturing Company against the Wagner Electric Manufacturing Company, from \$132,433 to \$1 and costs. The suit was filed in 1902, and charged an infringement of patent. The Wagner company admitted there had been a slight infringement of the patent, but asserted that it was only a small part of the entire apparatus. The award made by the special master represented all the profits made by the Wagner company in infringing on the transformers, the patented article. On the contention that the infringements did not affect the sale of the article because of the particularly slight portion of the patented part, Judge Dyer holds that the Westinghouse Company failed to show that the infringement produced the profit.

Societies and Technical Schools

Tri-State Mining Association—This association held its fourth successful meeting at Galena, Ill., Friday, Jan. 17. An informal session was held in the morning, in which general conditions were freely

discussed. The afternoon program proved highly interesting and instructive. Among the prominent speakers present and the subjects of their remarks were the following:

"Need of a Federal Bureau of Mines." Prof. H. Foster Bain, director of the Illinois Geological Survey.

"Coöperation in Mining and Geology." Prof. U. S. Grant, Northwestern University, Evanston, Ill.

"Present and Future of Mining in Tri-State Field." Mayor Shunk, of Dubuque, Iowa.

"Electric Smelting." F. D. Snyder, of Chicago, Ill.

"Mining Trade Education and Purposes of the New Mining School at Platteville." Prof. R. B. Brinsmade, director of Mining School at Platteville.

"Collection of Statistics Relating to the Mining Industry." C. E. Siebenthal, U. S. Geological Survey, Washington.

A banquet was tendered to visiting members in the evening by the Business Men's Association of Galena.

Trade Catalogs

Receipt is acknowledged of the following trade catalogs and circulars:

Ohio Brass Company, Mansfield, Ohio. Monthly Bulletin. Pp. 20, illustrated, paper, 6x8½ in.; January, 1908.

Arlington Manufacturing Company, Canton, Ohio. Arlington Technical Paints for All Purposes. Pp. 20, paper, 4x9 in.

Wood Drill Works, Paterson, N. J. Testimonials as to the Working of the Wood Rock Drills. Pp. 24, paper, 3½x6 in.

J. H. Hillman & Son, Frick Building, Pittsburg, Penn. How Connellsville Coke is Made. Pp. 28, illustrated, paper, 7¼x10¼ in.

Wagner Electric Manufacturing Company, St. Louis, Mo. Bulletin 78. Wagner Transformers. Pp. 12, illustrated, paper, 6x9 in.; 1907.

Murray Iron Works Company, Burlington, Iowa. Series D, No. 7. Nomenclature of Murray Corliss Engines. Pp. 24, illustrated, paper, 7x10 in.

H. W. Johns-Manville Company, 100 William Street, New York City. Linolite; The Modern System of Lighting. Leaflet, illustrated, paper, 3½x6 in.; 1907.

A. S. Cameron Steam Pump Works, foot of East 23rd Street, New York City. Number 35. Steam Pumps. Pp. 158, indexed, illustrated, paper, 6x9 in.; 1908.

George F. Blake Manufacturing Company, 114-118 Liberty Street, New York. Bulletin B-808. List of Parts of Blake Pumps. Pp. 12, illustrated, paper, 6x9 in.

American Well Works, Aurora, Ill. Bulletin 104. Modern Practice in "American" Centrifugal Pump Construction.

Pp. 64, indexed, illustrated, paper, 7½x10½ in.

Denver Engineering Works Company, Denver, Colo. Bulletin No. 1032. Electric Hoists. Pp. 48. Bulletin No. 1033. Gears. Pp. 20. Bulletin No. 1034. Rigid Rolls for Ore Crushing. Pp. 16. Illustrated, paper, 8¼x10½ in.; August 1, 1907.

Fort Wayne Electric Works, Fort Wayne, Ind. Bulletin No. 1102. List of Plants Operating Direct-Current Direct-Connected Generators, Types MP and MPL. Pp. 10, November 15, 1907. Bulletin No. 1103. Series A. C. Arc Lighting System. Pp. 20, January 1, 1908. Bulletin Index. Index to Bulletins Nos. 1001 to 1103. Pp. 4, January 1, 1908. All illustrated, paper, 8x10½ in.

Crocker-Wheeler Company, Ampere, N. J. Bulletin No. 91. Induction Motor Panels. Pp. 8. Bulletin No. 92. Combined Generator and Feeder Panels Direct Current, 125-250 Volts. Pp. 8. Bulletin No. 93. Small Engine Type Direct Current Generators. Pp. 8. Bulletin No. 94. Alternating Current Switchboard Panels Type 10 Three-Phase. Pp. 16. All illustrated, paper, 7½x10 in.; October, 1907.

Construction News

Salina, Colorado—The Pollock Mining Company is arranging to put in a 20-stamp mill on its property. Address at Salina.

Central City, Colorado—The Pearl Tatum Mining Company will put in an air compressor and a 100-h.p. boiler. R. Wilkinson, Central City, Colo., is manager.

The Great Overland property has been sold, and the new owners propose to put in new machinery. A. J. Smith, Central City, Colo., is in charge.

Miami, Oklahoma—A concentrating mill of 200 tons daily capacity, for zinc ores, is to be put in at the Old Chief mine. A. L. Maness, Webb City, Mo., is lessee.

Hessie, Colorado—The Highland Mary Mining Company proposes to install a hydro-electric power plant next spring on its property in Boulder county. Address at Hessie.

Idaho Springs, Colorado—The Old Town Consolidated Mining Company is arranging to build a concentrating mill at the mouth of the Newhouse tunnel. G. K. Kimball, Idaho Springs, Colo., is manager.

Black Hawk, Colorado—The Fifty Gold Mines Corporation is figuring on the erection of a roasting plant to treat its ores, which carry copper, gold and silver. O. B. Thompson, Black Hawk, Colo., is manager.

Special Correspondence from Mining Centers

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

REVIEWS OF IMPORTANT EVENTS

San Francisco

Jan. 12—The supervisors of San Mateo county have passed an ordinance placing smelting works erected in that county (adjoining San Francisco) under the supervision of the county health officer, and providing stringent conditions under which they may be allowed to operate. The ordinance was presented by the Home Protection Association, composed of wealthy residents of the bay counties near the site of the proposed Guggenheim smelter at Point San Bruno. The ordinance was passed without giving the smelter people any hearing on the subject to contradict the *ex parte* statements submitted to the supervisors. It is believed that the ordinance as it stands at present will virtually prevent the erection or operation of the smelter where several thousand men would be employed. Citizens of South San Francisco have, since the passage of the ordinance, held a meeting to protest against it and have appointed a committee to take the matter up. The supervisors doubtless did not know of the adoption of the recent invention for preventing damage by smelter fumes by the Selby Smelting and Lead Company, but as representatives of the company were not present at the meeting, nor even invited to be there, they could not well officially give this information. If the Selby people are prevented from building the smelter at Baden on the shores of San Francisco bay, they will not build elsewhere within the State of California.

The Palm Borate Company, of Los Angeles, owning borax lands near Daggett, San Bernardino county, has sold out to English people, who expect to put up a concentrating and refining plant near the mine. Finch & Campbell, of Spokane, Wash., are largely interested in the deal.

The 21-mile pipe-line from Telescope peak to the gold camp of Skidoo, Inyo county, costing upward of \$200,000, has been completed. The camp is at 6000 ft. altitude in the Panamint range, and has always been without a satisfactory water supply. Water has heretofore been sold for 10c. a gallon, but the completion of the pipe line now brings a suitable supply.

Forty-four miners who attached the Bonanza King mine in Trinity county over two weeks ago for \$6000 due for wages have paid themselves \$2600 by working ore they had themselves mined while on wages. They ran a batch of ore through the mill, and cleaned up enough to pay each one a little more than \$50.

This gave them money enough to travel on. Before making the clean-up they were broke. All have left the camp, and mine and mill have shut down. The property is still in the hands of the sheriff's keeper. There is nothing irregular in the transaction. By agreement between the company and the creditors the miners were permitted to help themselves. They rendered a strict account of everything and the \$2600 that they paid themselves reduces the amount of their attachment by that sum. The Bonanza-King is the Treadwell mine involved in the failure of the California Safe Deposit and Trust Company.

The great Table mountain at Oroville, Butte county, the end of a lava-capped divide, is underlaid with auriferous gravel. At one end is the famous old Cherokee mine, which yielded by hydraulic process ten to twelve millions, and at the other end is Morris Ravine, six miles from Oroville, where there are several drift mines. A preliminary survey has been made for a great mining tunnel under this mountain, to be some five miles long, to prospect and work the gravel channel which lies under it. A number of small tunnels have been run at different periods but there was an excess of water. The proposed tunnel would drain the property, so the water could run out by gravity. The tunnel would, in fact, make virtually a great drift mine by which the buried gravel of the old river channel could be exploited.

In Del Norte county, on the northwestern coast, the early-day miners in a few years cleaned out the creek beds with pan, rocker and sluice. Few operations in hydraulic quartz mines have been started until lately, but now several are in operation. At Haines Flat, there is deep gravel worth an average of 8c. per cubic yard. Big Flat, Coon mountain, French hill, Myrtle creek and the beds of Smith and Klamath rivers are rich in gold carrying a little platinum. At Monumental the company of that name has spent large sums in prospecting and developing quartz claims. Within the past two years a number of copper prospects of value have been found, but there are no smelters in the county and no railroads or navigable streams. The prospects are now such, however, that facilities for transportation and reduction of ores will soon be furnished.

The starting up again of both the Utica and Lightner mines, as well as the Angels, at Angels, Calaveras county, after labor troubles extending over several

months, is a cause of congratulation. During the long idleness a larger portion of the miners left the camp, but there are plenty of men to do all the necessary work. The three mines named are all large gold producers. The Utica was for many years the leading quartz gold producer in California, this place now, however, having been taken by the Kennedy, of Amador county, which also has the deepest shaft in the State, and one of the best equipped.

Salt Lake City

Jan. 16—The organization of the Utah Mine Owners' Association Jan. 15 is looked upon as being one of the most important events affecting the mining interests of this State which has occurred for a long time. By many the arbitrary action of the American Smelting and Refining and United States companies in advancing smelting rates on ores is regarded as being an unwise policy, which has resulted in arraying the mine owners to combat them, if necessary, to obtain fair treatment. The officers of the new organization are: John Dern, president; Thomas Kearns, vice-president; Willard F. Snyder, second vice-president; H. S. Joseph, secretary; C. E. Loose, treasurer; who, with L. Hanchett, Ernest Bamberger, George W. Riter and W. C. Alexander, comprise the board of directors. The articles of the association adopted and to which every member subscribes set forth that the object of the association is to guard the interests of those engaged in the mining industry in the State of Utah; to promote State and National legislation affecting the mining and smelting industries and metal trade; to encourage amicable relations between employees; to obtain equitable adjustment of railroad, freight and smelting rates; to promote friendly relations between ore producers, custom smelters and mills; to cooperate with similar organizations in other States and to better all conditions under which mines are operated. The revenues of the organization are derived from an annual membership fee of 50c. on each \$1000 of pay roll, but the minimum charge will be \$25.

The annual meeting of shareholders of the Jennie Gold Mining Company, operating at Gold Springs, Utah, resulted in the election of Charles A. Short, president; H. R. Elliott, vice-president; and W. W. Barton, secretary and treasurer. The Jennie mine is now second among the mines of Utah exclusively producing gold.

The Utah Fuel Company has closed several of its mines in Carbon county and Mr. Williams, the manager, says that in all probability others will be shut down. This is much in contrast to the conditions which existed a year ago at this time when coal-mining companies found it almost impossible to supply the demand. The closing of so many metal mines and smelters throughout the West has caused a great falling off in the demand for fuel and the Utah Fuel Company has reduced its working days to four instead of six. Altogether, about 2000 men are employed, and the present output is about 7000 tons a day. In order to meet the cut made by Wyoming operators, the price of coal at the mines has been reduced 25c. per ton.

About 30 mining companies of Utah have brought suit against the Secretary of State to test the validity of the corporation tax law enacted at the last session of the Utah legislature. One of the reasons set forth is that of double taxation. The amount of the tax is \$50 on each \$1,000,000 capitalization. Failure to pay the tax by Jan. 15 of each year imposes a penalty of \$100. It is believed that the contestants of the law will win.

A deal is pending for the consolidation of the Nevada-Utah and Ohio-Kentucky properties at Pioche. They own several valuable claims in the district jointly, each corporation owning an undivided one-half interest.

Denver

Jan. 18—In the issue of August 17, 1907, the JOURNAL published a brief description and map of the Yampa coalfield of Colorado, now to be opened by the Denver, Northwestern & Pacific Railway, the Moffat road; and in the issue of November 2, an announcement of the organization of the Continental Railway Tunnel Company by Denver capitalists, to build a six-mile tunnel through the Front range of the Rocky mountains, thus giving an 1.8 per cent. maximum grade over which to haul the anthracite and bituminous coal of the Yampa field into Denver, and eastward.

Denver, the eastern terminus of the road, is 5200 ft. above sea level, and the road operates its trains over the summit of the main Continental divide, 70 miles distant, at 11,660 ft. elevation. The temporary western terminus is at Yarmony, 146 miles from Denver, and within 67 miles of Steamboat Springs; and the grade has been advanced into the Oak Creek section of the coalfield, 50 miles west of the rail-head.

D. H. Moffat, has since 1902 been fighting his way with funds from his own private fortune, against practically the combined efforts of the heads of those great railway systems and coal companies with which his line and the Yampa coalfield will come in competition. Not only this, but in Denver, where it seems that he should have received solid support, he found almost without exception antagonism.

The capitalists of this city held themselves severely aloof, or covertly fought the enterprise. Happily this war is at an end, for it is now announced that practically the same group of capitalists who compose the Transcontinental Railway Tunnel Company, have formed the Denver-Steamboat Springs Construction Company, to take up the work of the contractors, who, owing to the money stringency, were unable to complete it. The new contracts have been signed, and the line will be completed at once through the southeastern portion of the coalfield, to Steamboat Springs, a distance of 67 miles. Construction of the six-mile tunnel will commence as soon as the road is being operated into the coalfield.

According to some previous remarks and predictions on the subject in these columns, Judge Lewis, of the Federal Court, on Dec. 30, quashed all but two of the indictments for coal-land frauds in this State, ruling that department regulations are not laws, and that under them criminal charges cannot be made. The Government attorneys, it is said, will take the cases to the United States Supreme Court on a writ of error, and have 30 days to perfect their bill. It was held by the court that there is nothing in the statutes that prohibits the making of contracts for transfer of coal lands at any time before or after entry. The persons filing on the lands in these cases before the court had paid the full price demanded by the Government, kept within the acreage limit of the statute, and are not denounced as criminals by the law on any action performed by them under the coal-entry act. If the ruling of Judge Lewis is sustained by the Supreme Court, the only recourse of the Government will be by civil suits in equity, asking the courts to vacate the titles. In these cases the defendants will be the present owners, and presumably innocent purchasers—not those individuals who were indicted by the grand jury.

A decision by Judge Lewis involving a sum of \$40,000, in favor of the Stratton estate, has been sustained by the Court of Appeals at St. Louis. There are four more suits to be settled before building can be commenced on the Myron Stratton home for the poor, as provided in the will of the late mining millionaire of Cripple Creek. The home will cost about \$1,000,000, and will have an endowment fund of nearly \$5,000,000.

Scranton

Jan. 20—Nearly one half of the persons killed in the anthracite mines of Pennsylvania during the year 1906 were the victims of their own carelessness, according to the report of the chief mine inspector which has just been published. One-eighth lost their lives through the carelessness of others, while the rest of the casualties are classed as "accidental" and where responsibility could not be fixed.

The Young Men's Christian Association in the anthracite region has taken up the question of minimizing the dangers in coal mining and will organize mining institutes in the different cities. The object of the institute is to give the mine workers a technical knowledge of their work. The institutes will also prepare candidates for the examination for foremen and assistant foremen. Meetings will be held at regular intervals, when lectures will be given and practical demonstrations of the higher and more scientific features of mining will be given.

An original plan has been adopted by the Kingston Coal Company for extinguishing fires in culm banks. A big blaze in the bank at No. 2 colliery called for extra efforts to save the culm and Superintendent Zerby is building a flush line from the bank to the mine and intends to flush the burning material into the mine in just the same manner as the culm is flushed, the heated coal, slate and other materials coming in contact with the mine water. This plan will fill up the abandoned workings as with ordinary culm, while it extinguishes the culm fires.

The laws of Pennsylvania provide that no boy under the age of 14 years shall be employed in or around a breaker. This week, a boy, named Thomas Long, was fatally injured at the breaker of No. 18 colliery, of the Lehigh & Wilkes-Barre Coal Company, at Wanamie, who, it is claimed, was but 10 years of age. An inquest has been demanded to ascertain if this charge is correctly made.

Toronto

Jan. 17—Judge Burbidge, of the Exchequer Court of Canada, rendered a decision on Jan. 9 in four actions taken by the Government for the cancellation of the cases of Yukon hydraulic concessions. The judgment, which was in favor of the Government, and confirmed the cancellation in each case, was merely a formal one in order to enable the cases to be carried to the Supreme Court as quickly as possible. The concessions involved are those of A. B. Palmer, P. H. Palmer and D. Doig; the Klondike Government Concessions Company; the Bonanza Creek Hydraulic Concession Company, and T. D. Brooks and E. W. Smith. The Guggenheims are heavily interested having bought a mammoth dredge in connection with one of the properties.

At the opening of the Alberta legislature on Jan. 16, the Lieutenant-Governor's address announced that bills would be introduced regarding compensation to workmen in case of accidents, and limiting the hours of labors for those engaged in mining.

An official announcement is made that the King Edward medal, recently adopted in England as a recognition of bravery in saving or attempting to save life in mines or quarries, will be conferred on Canadians who have earned it.

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

Alaska

KOYUKUK DISTRICT

Reports come from Valdez of a rich strike made by some miners, who found an old channel on Nolan's creek. At a depth of 125 ft. gravel carrying high values was struck. Many prospectors have started for the district.

Arizona

COCHISE COUNTY

Empire Copper and Gold Mining Company—Sinking in the two-compartment shaft on the property at Johnson has been resumed. The shaft is down about 300 feet.

GRAHAM COUNTY

Arizona Copper Company, Ltd.—The production of copper for the month of December was 1412 short tons.

SANTA CRUZ COUNTY

Mejia—H. J. Karns and associates have secured a working bond on this old mine in the Planchas de Plata district, west of Nogales. A plant to treat the dumps is to be installed.

GILA COUNTY

Arizona Commercial—President N. L. Amster has announced that the company intends to resume shipping ore from the Black Hawk mine in a few days. A new three-compartment shaft will be sunk on the Eureka claim.

California

CALAVERAS COUNTY

A gravel mine near the old Boston claim on the Mokelumne river, owned by S. L. Davidson, of Mokelumne hill, is yielding handsomely just now in coarse gold. The claim is under lease to T. & H. McSorley, who are "drifting" it. There are some 30 acres of gravel in the deposit.

INYO COUNTY

Estella—This company has taken over the properties of Troeger Brothers and of Clinton & Sweetzer, at Cerro Gordo, and has commenced work on a tunnel to tap the properties at great depth and to finally be about 7000 ft. long. An air-compressor will be installed and power drills used.

Lee District—In this district, near the Nevada boundary line, the Hayseed is now sacking shipping ore from four places

in the mine. The Burro mine has ore averaging \$60 per ton. On the Lee-Jumbo mine, three shafts have been sunk in good milling ore. Other mines now sacking ore are the Grotto, Skidoo, Gilt Edge, Lee Bonanza and Echo Lee.

MADERA COUNTY

Hildreth—At this old camp C. R. Hotchkiss is operating several claims he recently purchased, and in one drift, at a depth of 300 ft., is in a good body of ore. There are a number of abandoned mines at the place, including the McNally, which was worked to 900 ft. depth.

MONO COUNTY

Oil—At Mono Lake preparations for boring for oil are in progress. The island in the lake is the center of interest, and several sets of locators are wrangling over the titles to the land.

NEVADA COUNTY

Norumbagua—The crushing last made from this mine averaged \$29.75 per ton. Machinery for sinking will shortly be put in. A drift is now being run north into virgin ground.

Normandie—This mine, owned by Frank Dulmaine, has been bonded to R. Findleyson and associates, all young men, who have commenced work on the property themselves. The old machinery is being repaired and some new has been ordered.

South Yuba—This property has been under prospecting for months and only recently a rich strike of native copper was made, said to be the first ever encountered in the county. The property is principally owned by Grass valley men.

Yuba—This old property at Maybert is being worked under superintendent C. A. Marriner, and 10 stamps are crushing ore from the Mayflower claim, while the other 10 are crushing that from the Yuba.

PLACER COUNTY

Asbestos—W. S. Haworth and T. E. Morgan are opening several asbestos deposits near Green valley, not far from Alta. Eastern capital has now become interested and larger workings will be opened.

Barton—At this mine, near Westville, the ledge is 5 to 7 ft. wide, carrying low-grade ore running from 50 cents to \$2.50 per ton, with additional values in the sulphurets.

SHASTA COUNTY

Mammoth—The new mine-to-smelter railroad, to take the place of the aerial

tramway is virtually completed. The tramway has been unable to deliver the usual quantity of ore, so only two furnaces at the smelter are in operation. When the railroad is in operation five furnaces will be in use.

Northern Light—This mine at De Lamar has been sold by Geo. Van Staden to the Bully Hill Copper Mining and Smelting Company, which has held the option for a year past.

SIERRA COUNTY

Crocus—This company is expected to have its mill make a long crushing of the quartz from the new shoot discovered a few months since.

Sierra Buttes—Only 20 stamps out of the 60 at this mine are running, but the grade of ore being crushed is much higher than usual.

SISKIYOU COUNTY

Scott Bar—On the Rock Point mine at this place, Nesbit & Simon have their large giant ready for work as soon as a plentiful water supply comes. While this mine was worked by the drift process two years ago, it yielded coarse gold and nuggets, one of which was worth \$500.

TRINITY COUNTY

La Grange Hydraulic Mining Company—This extensive property is being worked with a full crew and a number of giants. Some of the gravel banks are 500 ft. high.

Klondike—This claim is being fitted up by S. Ledgerwood ready for hydraulic mining. A number of good-sized nuggets have been found.

Colorado

BOULDER COUNTY

Ballarat-Smuggler—D. S. Vaughan, of Denver, and Eastern associates are reported to have paid \$100,000 for this property near Jamestown; a 20-ton cyanide mill is to be erected this spring.

Pembroke Mining Company—An air-compressor plant and power drills will be installed at this property near Nederland.

New York Mining and Tunneling Company—Theodore Craig, manager for the company, is having the machinery overhauled for a resumption of operations at the property near Jamestown.

Lincoln Mining, Milling and Development Company—This company, operating in Bummer gulch is installing an air-compressor plant and boiler; Sullivan air drills will be used. N. M. Nelson is manager.

Myrtle—It is reported that this mill at Ward, which was destroyed by fire two years ago, is to be rebuilt this spring.

Tungsten Shipments—Six carlots of tungsten concentrates were recently shipped from the Boulder County tungsten mill at Cardinal.

CLEAR CREEK COUNTY

Brighton—Eastern people have become interested in this property on Seaton mountain; an electric hoist will be installed at the main shaft. E. D. Quigley, of Idaho Springs, is manager.

Bertha—Eastern people have secured a lease and bond on this group of claims, and will work them through the New-house tunnel. Joseph Bellis, of Idaho Springs, is manager.

Great Center—This group of two claims has been sold for \$10,000 to Iowa capitalists, who will install electric machinery. Daniel E. Gabriel, of Idaho Springs, is manager.

DOLORES COUNTY

United Rico—Since this company began to publish its weekly and monthly reports in the *Rico News*, the number of stockholders has doubled. If this plan of publicity were adopted generally by mining companies, it would do a good deal to put an end to mining fakes and wildcat schemes and insure legitimate companies the serious consideration and interest of the investing public. The United Rico is now shipping crude ore and concentrate.

JEFFERSON COUNTY

F. M. & D.—This copper mine situated near Evergreen has been sold by McCaffey Bros. to Eastern people, who intend to install new machinery at an early date.

LAKE COUNTY—LEADVILLE

Downtown Section—The pulling of the pumps from the Penrose shaft may not have such a depressing feature as was at first supposed. It is true that it will flood the lower workings of the Coronado, Northern, Sixth Street, Grey Eagle, Penrose and a large number of smaller shafts in the down-town section when the water reaches its highest level; but it may never rise high enough to affect the smaller shafts, and there is a large territory above the water-level which can be mined successfully for an indefinite period. A large number of men have been thrown out of employment by the shutting down of these pumps, but leases are still being granted and men are steadily being put to work.

Western Mining Company—At the present time the various lessees are working about 50 men, and this number will be increased as soon as the lessees can get in shape to mine intelligently. The work thus far has been very encouraging,

and it will not be long before the lessees will be mining nearly as much ore as was shipped by the company. In the Coronado, Mr. Bennett and his associates are working on the 600-ft. level. They have just put on three shifts of men, and are hoisting ore. In the Grey Eagle, B. I. Graves is employing about 10 men. The ore carries considerable iron and is being sold to the Arkansas Valley plant; about 50 tons per day are shipped. The ore is hoisted through the Penrose shaft. Joseph Jensen has a lease on a portion of the Penrose property. At present he is working a small force of men. Regular shipments of ore from this property will commence in a few days.

Midas—Frank H. Trego, cashier of the Western Mining Company, and associates have taken a lease on the old Midas property, adjoining the Penrose. They are prospecting virgin ground on the 500-ft. level. A large body of iron ore has been struck; possibly this is a continuation of the body of iron ore which was discovered in the Penrose shaft when the Home Mining Company had a lease on that part of the mine. The ore is trammed from the Midas shaft to the Penrose, a distance of about 900 ft., and hoisted through the latter. This will continue for the present, or until the water rises to this level. After that the lessees will equip the Midas shaft with a hoist. There is no danger that the water will ever rise as high as the ore in the Midas property.

Ballard—It seems probable that a new company will be organized to work the Ballard, President and other adjoining claims on Breese hill. These properties have only been worked spasmodically, and then merely at shallow depths. There is no reason why some of the rich bodies of ore found in the Little Jonny should not extend to the west and enter this ground. Some very rich gold ore has been shipped from the Ballard, and the bismuth ore, that has been shipped to Wales from this property, has netted the owners considerable money, but the mine has been closed for years owing to litigation. It is the intention of this new company to form a holding company, leave the royalties from the ores in the hands of the court and, when the case is finally disposed of, to turn the money over to the parties entitled to receive it.

Illinois

MARSHALL COUNTY

Wenona Smelter—The zinc smelter at Wenona, consisting of two blocks of 512 retorts, has been purchased by Keel & Anderson, of Chicago, who also have extensive mining interests in the Wisconsin zinc district. They expect to add a sulphuric acid department, to utilize the sulphur as a by-product.

SALINE COUNTY

O'Gara Coal Company—This company's statement for the year ended Oct. 31 shows 781,547 tons coal mined in 1906, and 1,718,126 in 1907; an increase of 936,579 tons. The president's report says: "We have at the present time 13 mines in operation. When we took these mines over a couple of years ago, they were not, with a few exceptions, fitted for a big output. Since then the plants have all been modernized, new machinery has been installed, 300 miners' houses have been built, and satisfactory contracts have been secured for the sale of the product. The treasurer's report showed that we had on Nov. 1, 1907, available for dividend approximately \$30,000. This overcomes a deficit of about \$70,000 of a year ago, and shows a net gain for the year of substantially \$100,000, after payment of all expenses and bond interest."

Indiana

The scarcity of gas for fuel purposes in the Indiana oilfields is proving a detriment to the average oil operator, as coal and gasolene are expensive for fuel; in consequence the pumping of a number of wells has ceased until spring. "It is evident," the operators say, "that to handle the big salt-water wells successfully electricity will be the proper power. From the electric trolley lines power can be furnished for the pumping of the wells. This kind of power can be used to good advantage and will come much cheaper than any other power. If this can be obtained the oil industry will take on new life." Eighteen wells were brought in or completed in the State in one week recently, and two dry holes. The wells are average producers, running from 25 to 50 barrels per day.

CLAY COUNTY

Vandalia Coal Company—Mine No. 65 of this company, near Cleveland, has been closed by a fire. It started when only a few men were at work, and they all escaped. Attempts are being made to extinguish the fire.

GIBSON COUNTY

Harry Whitman and Vincent Adams, two coal miners, upon a plea of guilty, were fined by a local court for having drilled unlawful holes for purposes of firing shots in a local coal mine. Two charges have been filed against George Burton, superintendent of the mine, for failing to provide fire-clay and other non-inflammable material necessary for the men in tamping the shots, and also for failure to keep the mine properly sprinkled. His case will be tried in a few days. The disposition of the case against Superintendent Burton will have much to do with the two big damage suits which are about to be filed against the Princeton Coal Mining Company by the widows of

the two men who were killed in a recent accident in the mine.

GREENE COUNTY

United Mining Association—This is the name of a new corporation recently organized with headquarters in Midland. The company proposes to sink shafts and construct tipples and other necessary buildings and equipment for the development of coal lands near Midland. The directors are Leonard Lutes, L. E. Culbertson, F. L. McElroy and W. F. Brown.

VIGO COUNTY

Sugar Grove Coal Mining Company—This company, with chief offices in Terre Haute, has filed articles of incorporation. The object of the company is to sink shafts, open and operate coal mines, construct and operate coke ovens, clay and brick kilns and to develop coal lands and produce clay products. James A. Richart is president; Frank L. Richart, secretary.

Kansas

CHEROKEE COUNTY

Mission Mining Company—The property of this company consists of a lease of 40 acres of ground at Baxter Springs and a mill of 100 tons capacity. The ground has been thoroughly drilled and ore has been found in a good proportion of the area. The capital stock of the company is \$2,000,000. The company is controlled by the same men who control the Sunburst Mining Company and the Baxter Royalty Company.

Michigan

COPPER

Atlantic—The new shaft on section 16 is bottomed in vein matter, at a depth of 1000 ft. The direction of crosscutting has been changed from west to east and the formation seems to be more settled.

Calumet & Hecla—An order, issued by Judge Knappen, of the Federal Court at Grand Rapids, Mich., requires Superintendents Cooper and Patch and Vice-President Livermore to testify regarding the cost of smelting and refining the mineral and electrolytically refining copper at both Hubbell and Buffalo; and also the cost of freight, insurance, commission and all other expenses, excepting the general expenses of the Boston, New York and other branch offices, must be supplied. In other words, the total expenses incurred by the Calumet & Hecla company in marketing its copper must be shown and also the cost per lb., at both Hubbell and Buffalo during 1906.

Isle Royale—Diamond drilling on the Hussey-Howe tract has disclosed the Baltic Lode. Work at the new shafts Nos. 4, 5 and 6 is going forward satisfactorily, and copper continues to be found with depth.

Ojibway—Sinking is going forward in the two shafts. No. 1 shaft, the newest of the openings is down about 75 ft. where a fissure was encountered which carries considerable copper. Both shafts are being sunk in the foot wall and it is the intention of the management to start drifting at a depth of about 350 ft. Two hoisting plants each with a capacity of 1500 ft. in depth are being installed and an order has been placed for one alternating-current generator with the necessary switchboards and transformers for light and power purposes.

Missouri

ZINC-LEAD DISTRICT

Columbia Zinc Company—This company made an extensive test of its ore recently, 200 tons being run through the Cambria mill on the tract adjoining. Careful sampling was done at different places and the company has obtained a more accurate knowledge of what the values are, where the losses occur and what can be recovered, than is generally had by the local mining companies. The dirt, which is from sheet ground, showed up well.

High Grade Mining Company—This company's mill has been destroyed by fire, causing a loss of \$5000 in all.

Newtonia—Two drills are at work East of Newtonia and several strikes are reported.

Trinity Mining Company—This company, at Porto Rico, having three of the largest mines of the district in its land—the Whitsett, Cathedral and Trinity—has gone into the hands of a receiver, on account of financial troubles.

Montana

At a meeting held on Jan. 17, at Helena, the Montana Mine Owners' Association effected a temporary organization. Alleged exorbitant smelter rates and the classification of mineral lands were the principal subjects of discussion. Adjournment was taken until Feb. 17, when the different committees will report.

BUTTE DISTRICT

All of the Amalgamated Copper Company's mines in the district are shut down, with the exception of those of the Boston & Montana Company, which are being run at full capacity; 2100 men constitute the full crew in these mines, and in order to give employment to the greatest number of men two crews are worked alternately for two weeks each. The several subsidiary companies of the Amalgamated have been instructed to supply fuel and food to such of the company's former employees as are idle and who may be in actual need. At present the output of the company amounts to about 7,300,000 lb. per month. Unless there is a decided change in the condition of the copper market this figure will not be increased to any great extent.

Pilot-Butte—This company holds the record for rapidity in shaft sinking, the total depth attained in its shaft during November and December being 250 ft. The shaft is now 515 ft. deep and a station is being cut on the 500-ft. level.

East Butte—The leasers who are operating the big precipitating works on this company's ground are engaged in enlarging the plant, and will about double its capacity. The precipitates, together with a limited amount of ore from the upper levels of the property, are being shipped to the Clark reduction works.

Butte Central & Boston—It is reported that efforts are being made to straighten out the affairs of this company so that work may be resumed on the Ophir. It is the desire of the company to sink this shaft to a depth of 1200 feet.

BEAVERHEAD COUNTY

Farlin—This camp, situated 12 miles north of Dillon, has been deserted for the past two years. Recent developments, however, promise renewed activity. The old smelter has been leased and blown in by the operators of the Indian Queen mine.

PARK COUNTY

Articles of incorporation of the Virginia Bell Milling and Development Company, of Seattle, have been filed with Secretary of State Yoder. This company purposes to develop certain properties in the Cooke City district which, in the early days, produced silver. In recent years copper has been found.

Nevada

ESMERALDA COUNTY—GOLDFIELD

The output of the Goldfield district still comes almost entirely from the dumps except for the tonnage treated at the Combination mill. Since the strike began the output of the district up to Jan. 9 has been 1035 tons, shipped to the smelters from the Little Florence ore dump, and 160 tons, shipped by smaller leases to the Western Ore Purchasing Company. The Combination mill has treated 2400 tons of ore since it resumed Dec. 12. The plant at Columbia belonging to the Western Ore Purchasing Company is still closed but the company is shipping all the ore, that is offered, to its sampling mill at Millers. The Nevada-Goldfield Reduction company is running on ore purchased before the strike. The Kinkead mill has not been running since the labor trouble. The American Smelting and Refining Company has offered to make cash settlements on all Goldfield ore assaying 5 oz. gold or under. Some miners have been shipped in from Utah. These came partly from Park City, a Federation camp. Thomas O'Brien, an old Comstock miner and formerly labor commissioner of the State of California is trying to organize an independent union to be called the Nevada Miners' Union.

EUREKA COUNTY

Richmond-Eureka—This company has lately shipped from 200 to 225 tons of ore per day, but owing to the smelter difficulties at Salt Lake, it is probable that the shipments from Eureka will have to be materially reduced. Our attention has been called to the statement in a recent article in the JOURNAL that the shipments were only 130 tons per day. The article in question was a report of a visit to the mines at the end of last July, which was evident from the dates in connection with other articles of the same series. The report of ore shipments was correct for that time.

NYE COUNTY—BULLFROG

Mayflower—Grading for the mill has begun. The contract for the machinery has already been let. This will be a 20-stamp mill; the tailing from the plates will be agitated in cyanide solution. The mill will be constructed so that additions can easily be made to it.

Gibraltar—The ore in the Moesser & Phillips lease is said by Fred Moesser to have improved much recently. Another shipment will be made soon. No returns have been received as yet from the first shipment, which arrived at the smelter Dec. 29.

NYE COUNTY—TONOPAH

Ore shipments from Tonopah mines for the week ending Jan 9 amounted to 366 tons. The Jim Butler shipped 175 tons; Tonopah Extension, 88; Midway, 103 tons. The Tonopah Company sent 2850 tons, the Belmont Company 300 and the Montana-Tonopah 1100 tons to the mills, making the total shipment for the week 4616 tons.

Tonopah Midway—At the annual meeting held in Tonopah, Jan. 6, the old board of directors, H. C. Brougher, J. L. Butler, Henry Anderson, R. P. Stenson, T. L. Oddie, J. J. McQuillan and Wm. J. Douglass, were re-elected. The directors then elected H. C. Brougher, president; Wm. J. Douglass, secretary, and N. Nelson, superintendent, for the ensuing year. According to the secretary's report, money on hand amounts to \$79,880.06; tonnage shipped and settled for during the year, 2343 tons, assaying \$68.51 per ton; total gross value, \$160,520.85; tonnage shipped but not settled for as yet, 665 tons. Cost of treatment and transportation was \$20.825 per ton; net profit per ton shipped was \$47.687. The report states that the greater part of the development work was done on the lower levels during the year, with the exception of the 435-ft. level, where considerable development work was done east and south of the shaft. On the Brougher vein, north of the shaft, there is considerable ore in sight. Very little stoping was done above the 435-ft. level during the past year. Since the last report, it is

stated, a new body of ore was cut on the intermediate level, between the 435-ft. and 535-ft. levels, in the Brougher vein near the east end-line. Most of the ore was taken from this body during the year. Considerable development work was also done on the 850-ft. level. A winze has been sunk from this level to a depth of 60 feet.

McNamara Mining Company—Work has gone on continuously during the past year, but owing to litigation with the West End Consolidated Mining Company no ore can be shipped until this case is decided. The mine is in good condition; high-grade ore has been found in two places west of the orebodies previously found.

Tonopah Extension—Ore is being mined from all the levels above the 600. The west drift on the 600-ft. level is being driven ahead rapidly. The north cross-cut on the 1050-ft. level has not reached the vein as yet.

Montana Tonopah—At the annual meeting of this company, held in Tonopah, Jan. 7, the old board of directors and officers for the ensuing year were re-elected. Chas. E. Knox is president; Chas. E. Morris, vice-president; R. P. Dunlap, second vice-president; W. B. Alexander, secretary and treasurer; Henry D. Moore, S. Herbert Mullin, F. M. Kirk, Geo. S. Nixon, J. J. McQuillan and Thos. J. Lynch are directors. The annual report shows the affairs of the company to be in a satisfactory condition.

West End Consolidated—The usual tonnage of high-grade ore is being mined from the 400-ft. level. Exploratory work is being done on the west end of this level.

Jim Butler—Mining is progressing on all the levels. About 50 tons of high-grade ore are mined per week. Considerable milling ore is also being mined.

STOREY COUNTY

The following is condensed from the mine superintendents' reports for the week ending Jan. 11.

Ophir—This company jointly with the Consolidated Virginia has been repairing the northeast drift on the 1950-ft. level, which is used for an air way. On the 2100-ft. level 208 cars of ore and on the 2200-ft. level 165 cars of ore were mined. Sill floors are being cut in the vein on both of these levels.

Consolidated Virginia—The main shaft was repaired and a small amount of drifting was done on the 2250-ft. level.

Mexican—A small amount of driving was done on the 2000-ft. level.

WHITE PINE COUNTY

Giroux Consolidated—The three miners who were entombed in the pump station on the 1000-ft. level of the Alpha Dec. 4 were rescued at 9 o'clock Jan. 18. The

men taken out are A. D. Bailey, P. J. Brown and Fred McDonald. They had been entombed 45 days but, owing to the fact that the 6-in. water pipe remained intact, food and liquids, as well as even some luxuries, could be sent down to relieve the monotony of their experience.

Oklahoma

OTTAWA COUNTY

Emma Gordon Mining Company—The 400-ton mill of this company at Miami is nearly completed. In all 78 drill-holes have been put down on the property, with very few blanks.

Old Chief—This mine at Miami has been sub-leased to A. L. Maness and associates of Webb City, Mo., at a royalty of 25 per cent. on zinc and 30 per cent. on lead. The lease includes 5 acres. A mill of 200-ton capacity is to be erected at once.

New Mexico

GRANT COUNTY

Copper Gulf Development Company—This company has purchased nearly 1000 acres of mining lands in Burro Mountain district. The purchase includes about 50 tracts of ground owned by as many different persons.

Oregon

BAKER COUNTY

Sumpter Smelter—This smelter shut down temporarily Jan. 9 owing to disagreement between the management and some of the mining companies about ore settlements.

Imperial—This mine has shut down until the Sumpter smelter resumes work.

Pennsylvania

ANTHRACITE COAL

Reliance—This colliery, at Upper Pittston, has been started up again, arrangements having been made to pay off the miners employed. The company has been reorganized, with M. J. Healey, of Pittston, as president and manager.

BITUMINOUS COAL

Monongahela River Consolidated Coal and Coke Company—At the annual meeting last week there was an important change in the management of this company. Francis L. Robbins, who was formerly president of the Pittsburg Coal Company, and who has been president and manager of this company for two years past, was dropped from the board. Alexander Dempster, of Pittsburg, will succeed him as president. Mr. Robbins has been a prominent figure among operators in the Pittsburg district, and to him was largely

due the breaking up of the Interstate Agreement with the miners last year.

South Dakota

CUSTER COUNTY

Saginaw—Operation has started in the new 70-ton mill and development work in the mine has been resumed. The mill treats by amalgamation and concentration, the ore being free-milling and of fair grade.

LAWRENCE COUNTY

Dakota—The special meeting of the stockholders, held in Deadwood, voted to accept the stock trade proposition of the Imperial Mining and Milling company and the consolidation has now been completely effected.

Imperial—With the change from dry to wet process, the mill output has been increased and nearly 160 tons daily are now being handled. The Dakota mill is being utilized and it is expected to shortly handle over 175 tons daily.

Minnesota—This 200-ton cyanide mill in the Maitland district will be crushing ore by Feb. 1, the electric equipment in both hoist and mill having been installed and the mill nearly completed.

Ohio-Beaver Creek—Dr. T. C. Lentz, of Columbus, O., is president. Placer dredging with the new steam dredge will be resumed in the spring.

PENNINGTON COUNTY

Hayward—Development work is in progress on this property, owned by Mahlon Williams. The ledge is said to carry cobalt and nickel ore.

Omega—The New York owners have decided to erect a 500-ton treatment plant on the ground, all of which is patented. The mill will treat by amalgamation and cyanide process and will be electrically driven. The property is located near Pactola.

Tennessee

POLK COUNTY

Tennessee Copper Company—The sulphuric acid plant of this company is now in full operation.

Utah

Utah Copper Company—At the annual meeting, to be held on Jan. 24, the shareholders will be asked to act upon an amendment to the charter of the company increasing its capital from \$6,600,000 to \$7,500,000, all common stock, and to consider authorizing an issue of \$1,500,000 convertible bonds to be secured by a second mortgage on all the company's property. If these propositions are approved, the management intends to offer pro rata to shareholders the bonds, which will bear 6 per cent. interest and be convertible at the option of the holders into

stock at \$20 a share. The company's management says that responsible parties have agreed to underwrite the whole amount of the proposed issue. The balance of the increased stock not required by the conversion of the new bonds will remain unissued to meet future requirements or extensions.

SALT LAKE COUNTY

Yampa—Two stands of converters are to be installed at this smeltery. They are expected to be in operation in about six months. In the meanwhile the United States company will take care of the matte as heretofore.

Bingham-New Haven—This company is at present devoting its entire energy toward development of its Bingham mine.

Boston Consolidated—Owing to the distressing accident resulting in the death of Superintendent of Construction L. H. Wheeler, the Garfield mill of this company is not yet in operation; it has been necessary to order new parts to repair the damage done to the pumping plant.

SUMMIT COUNTY

Wabash—A strike of rich silver-lead ore is reported from this property. The stock rose from 7c. to over \$1 per share within a few days' time.

TOOELE COUNTY

Ophir Hill—This property at Ophir is working the usual force in its mine and mill, but is shipping only 50 per cent. of its output; the balance being retained until higher metal prices prevail.

Virginia

Pocahontas Consolidated Collieries Company—Suit has been begun in the United States district court at Lynchburg, Va., to set aside the consolidation by which this company became owner of the property of the Pocahontas Collieries Company. The suit is brought by certain minority stockholders of the old company, who refused to deposit their stock or to assent to the consolidation. The property owned is in the Pocahontas field in Virginia, extending through into the adjoining section of West Virginia.

Washington

FERRY COUNTY

Insurgent—This gold mine at Republic has been leased for six months to W. M. Crummer, of Republic, by G. B. Dennis, the owner. One shipment of 35 tons has already been made from the lease. Hereafter the ore will be shipped part to the Sullivan smelter and part to the Granby. This mine adjoins the Lone Pine.

PIERCE COUNTY

Wilkeson Coal and Coke Company—The mines of this company at Wilkeson,

which were closed about two months ago by a strike, have started up. About 300 men are at work, two-thirds of them being the old miners who went out. It is said that more of the old men will return.

Wyoming

CARBON COUNTY

Penn-Wyoming Copper Company—E. M. Cobb, president of the company, states that the production of this company for 1907 was 2,600,000 lb. copper. The company's smelting and milling plant was burned down in March, 1906; this has been rebuilt since and about 50 miles of railroad constructed.

Canada

BRITISH COLUMBIA—SALMO-ERIE

Gold-quartz Mines—The lode gold mines of this part of Nelson mining division in 1907 mined some 16,000 tons of ore of a total value of between \$160,000 and \$170,000, chiefly in gold. This includes production of the Queen, Second Relief, Kootenay Belle and Arlington mines.

BRITISH COLUMBIA—SLOCAN

Ruth Mines, Ltd.—The total tonnage for 1907 of the Ruth mine, near Sandon, is about 450 tons of silver-lead ore containing on an average 95 oz. silver per ton and 65 per cent. lead. From 1200 to 1500 tons of zinc concentrate have been produced at the Ruth mill. This concentrate is being shipped to Kaslo for magnetic separation at the Kootenay Ore Company's sampling works.

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore for the week ending Jan. 11 were as follows: Coniagas, 67,020 lb.; La Rose, 85,400; Nipissing, 121,750; Nova Scotia, 40,790; total, 314,960 pounds.

City of Cobalt—The water encountered in the main shaft is interfering with operations, but big pumps have been installed. The main shaft is down 138 ft. on a stringer of the main vein which has widened, at this depth, to more than 4 in. of ore stated to run fully 4000 oz. silver per ton.

Cobalt Central—The concentrator is treating 50 tons of ore daily and will shortly be running to its full capacity. The compressor plant is in operation with 8 drills working night and day shifts. The main shaft is down 170 ft., and the station has been cut for the third level at 160 ft. Fully 900 ft. of drifting and crosscutting have been done on the first and second levels. On the Gamey property, recently acquired by this company, a small force is employed sinking the main shaft, which is now down 78 feet.

Columbus—Recently an important

strike was made on the crosscut at the 160-ft. level, 178 ft. from the main shaft, where a vein of calcite, quartz and galena 10 ft. wide was encountered. Calcite stringers run through it and solid galena is found in places. The silver content is sufficient to make a good concentrating ore.

Foster—Supt. John McDonald reports that vein No. 8, which gave good results at the 70-ft. level, has been struck at the 140-ft. level, giving indications that silver will be found at considerable depth.

Nipissing—The report of T. R. Drummond, late general manager, states that during December the company shipped 183 tons of ore of an estimated value of \$150,578. The total shipments for 1907 were 2400 tons containing silver of a gross estimated value of \$1,375,000, and on Dec. 3 the company had on hand ore of a gross value of \$165,000. At the beginning of 1908 it had ore in the mine available for treatment of a gross estimated value of \$1,057,000. The west drift on the Kendall vein had shown a diminution in ore values. It is now about 100 ft. from the McKinley-Darragh property and the vein has a width of 6 in.; but the ore assays only 150 oz. silver per ton. Superintendent Parks has been appointed general manager on the resignation of Mr. Drummond.

Rochester-Cobalt—Operations have been suspended for some weeks on account of a lack of funds. The directors recently decided to raise money to resume development. The shaft is down 90 ft. and about 100 ft. of drifting has been done.

Mexico

CHIHUAHUA

Chihuahua sees the new year started with a number of enterprises placed on foot, perhaps the most important of which, at least to the district of Santa Eulalia and the city of Chihuahua, is the consolidation just effected between the Mineral railroad, running from Santa Eulalia to the city of Chihuahua, the Chihuahua Electric Light Company, and the Chihuahua Street Railway Company, which will mean the early change of the latter to electric power, and rapid transit between the town and the smelter.

In Parral Grant G. Gillette has obtained an option on the Parral & Durango railroad and the holdings of the Hidalgo Mining Company, and is endeavoring to float the enterprise among foreign capitalists. These properties were under option to French capitalists about two years ago. The holdings are most extensive, and it is said that the proper development would be of material benefit to Parral, Minas Nuevas, and the district west.

The continued low price of metals has forced many prospectors out into the Western Chihuahua, Sonora and Sinaloa

gold belt, particularly around Batopilas, Calabacillos, and the Lluvia de Oro districts.

Lluvia de Oro—This company is busy taking in machinery from the west coast, by way of El Fuerte, on the Mexico, Kansas City & Orient's Pacific branch, for the construction of its new mill, and it is expected that soon after the middle of the year the company may become a large and steady producer of gold bullion and concentrates.

Mexican Mines Corporation—This company, of which C. L. Graves, of New York, is general manager, has opened into a fine body of shipping copper ore on its properties at Almoleya, near Jimenez, Chihuahua.

Descubridora—Thomas Madden, of Torreon, lessee of this mine in Durango, has applied for a renewal of his lease. The company expected to operate the property on company account when the lease expires, but the financial stringency has led to a reconsideration of the matter.

Encinillas Mines, Ltd.—This company has been reorganized and is now controlled by French capitalists led by Clarac Duvivier. R. J. Morambert succeeds Paul Ginther as manager of the mines and smelter at Santa Rosalia. The plant will be operated as an independent customs smelter.

GUANAJUATO

On the authority of Dwight Furness, former United States Consul at Guanajuato, it is stated that the gross output of the mines in that camp amounts to \$1,000,000 per month.

Ciutla—A discovery of copper and fluxing ore is reported to have been made by Americans on this property, and plans are said to be under consideration for the erection of a smelter at Guanajuato.

HIDALGO

Hidalgo Copper Mining and Smelting Company—This company recently organized in Zinapan includes the properties of the Ludlow-Armstrong Company, which comprise 32 properties, about half of which are silver-copper and the other silver-lead. The best known mines are those of the Concordia and Purisima groups.

Amalgamated Mining and Milling Company of Hidalgo—This new company has taken over the properties formerly belonging to the Mutual Mining Association, the Mexican Mining Syndicate and others at El Chico, together with the San Diego mill. The company owns about 20 mines, the most important of which are the Atarjea, San Nicolas and San Isidro.

JALISCO

Agua Blanca—At this property in the Ayutla district, owned by the Dwight Furness Company, a 100-ton mill has been erected which will give 300 tons of con-

centrates per month. The mine is shipping regularly.

MEXICO

El Oro—A fire which broke out on Jan. 18 threatened to destroy the entire town which is built in a ravine, and many of the buildings of which are of wood. The flames were confined to small buildings about the station of El Oro Mining and Railway Company, and the damage will be comparatively slight.

OAXACA

Zavaleta—The 25-ton mill of this company began operations in December and is producing bullion. A mile of tram track connects the workings with the ore bins. The property is owned by the Pittsburg-Oaxaca Company.

ZACATECAS

Santa Rita y Anexas—The property of this company now consists of 34 claims near Pinos. The main shaft is down 40 metres. It will be continued another 20 metres when crosscuts will be run. The ore carries silver and gold. A 50-ton mill including a cyanide plant is planned.

Africa

RHODESIA

Gold production in December is reported at 53,113 oz. bullion, an increase of 2222 oz. over November, and of 4784 oz. over December 1906. For the year ended Dec. 31 the total was 551,895 oz. bullion in 1906, and 612,452 oz. in 1907; an increase of 60,557 oz. The bullion reported in 1907 was equal to \$11,266,845, or 545,082 oz. fine gold.

Australia

WESTERN AUSTRALIA

Gold production in December is reported at 154,455 oz. fine, or 8630 oz. more than in November. For the full year the total was 1,794,546 oz. in 1906, and 1,697,552 oz., or \$35,088,400 in 1907; a decrease of 96,994 oz., or 5.4 per cent.

South Africa

According to press despatches, Jan. 14, the Government being determined to make the Transvaal so uncomfortable for Asiatics that those now in the country will be driven out and further immigration come to an end, 50 prominent Asiatics were arrested at Johannesburg on that date. Among the prisoners are the chairmen of both the British-Indian and the Chinese Associations and several officers and committeemen of these organizations.

South America

CHILE

The labor troubles in the nitrate region have been settled. Recent despatches announce that work has been resumed throughout the region.

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, Jan. 22—The coal trade in the West is quieter, and curtailment of production is being enforced upon the operators. Steam coal is only in moderate demand, and the mild winter is affecting the call for domestic fuel. At some of the large consuming centers a surplus is pressing on the markets.

The seaboard bituminous trade is also very quiet, and some of the railroads are refusing to take coal until the surplus at tidewater delivery points is worked off. Some of the larger producers are said to have agreed upon a curtailment of production.

Anthracite is suffering from the mild winter and trade is dull. Most of the companies, it is reported, have heavy stocks in their storage yards.

COAL TRAFFIC NOTES

Tonnage originating on Pennsylvania Railroad lines east of Pittsburg and Erie, year to Jan. 11, in short tons:

	1907.	1908.	Changes.
Anthracite.....	163,302	123,320	D. 39,982
Bituminous.....	1,302,127	985,266	D. 316,861
Coke.....	478,526	193,973	D. 284,553
Total.....	1,943,955	1,302,559	D. 641,396

Period was 12 days in 1907, and 11 days this year. Daily average, 161,996 tons in 1907, and 118,414 this year.

The anthracite coal shipments by companies were as follows for the full year, in long tons:

	1906.		1907.	
	Tons.	Per Ct.	Tons.	Per Ct.
Reading.....	11,258,295	20.2	14,018,795	20.9
Lehigh Valley....	9,971,699	17.9	11,532,255	17.2
N. J. Central.....	6,983,217	12.6	8,714,113	13.0
Lackawanna.....	9,201,875	16.5	10,237,419	15.2
Del. & Hudson....	5,346,695	9.6	6,562,768	9.8
Pennsylvania....	4,856,004	8.7	6,203,271	9.2
Erie.....	5,636,537	10.1	7,151,683	10.7
N. Y., Ont. & W....	2,444,273	4.4	2,689,089	4.0
Total.....	55,698,595	100.0	67,109,393	100.0

The total increase was 11,410,798 tons, or 20.5 per cent. All the companies showed increases.

Bituminous coal and coke shipments, Pennsylvania and West Virginia, 11 months ended Nov. 30, short tons:

	Coal.	Coke.	Total.
Balt. & Ohio.....	24,616,217	5,122,305	29,738,522
Buff., Roch. & Pitts.	6,704,543	555,112	7,259,655
Penn. Lines, N. Y. C.	7,697,567	70,812	7,768,379
Pitts. & L. Erie....	10,317,398	4,744,496	15,061,894
Norfolk & Western.	11,450,900	2,352,232	13,803,132
Total.....	60,786,625	12,844,957	73,631,582
Total, 1906.....	54,560,097	12,207,962	66,768,059

Baltimore & Ohio carried in addition 864,759 tons anthracite in 1906, and 941,612 in 1907; increase, 76,853 tons.

Coal tonnage, Ohio Coal Traffic Association, 10 months ended Oct. 31, short tons:

	1906.	1907.	Changes.
Hocking Valley.....	3,545,906	3,826,978	I. 281,072
Toledo & Ohio Cent..	1,657,005	1,688,748	I. 31,743
Baltimore & Ohio....	1,764,905	2,100,377	I. 335,472
Wheeling & L. Erie..	2,110,446	3,213,825	I. 1,103,379
Cleve., Lorain & Wh.	1,935,708	2,736,985	I. 801,277
Zanesville & Western	1,063,591	1,455,471	I. 391,880
Toledo Div., Pen. Co.	2,044,072	2,081,111	I. 37,039
L. Erie, Alliance & Wh.	733,398	1,149,587	I. 416,189
Marietta, Col. & Clev.	13,460	34,752	I. 21,292
Total.....	14,868,491	18,287,834	I. 3,419,343

November total was 1,632,086 tons in 1906, and 1,863,930 in 1907; increase, 231,844 tons.

New York

ANTHRACITE

Jan. 22—The demand for all sizes of hard coal has fallen off and the market is inclined to be dull. Stove, chestnut and pea coal, which have been short during the past few weeks, are now in abundant supply and the demand for these sizes has decreased. Current quotations are as follows: Broken, \$4.50@4.75; egg, stove and chestnut, \$5; pea, \$3.25@3.50; buckwheat, \$2.75@3; rice, \$2.15@2.25; barley, \$1.75 per ton f.o.b. New York harbor.

BITUMINOUS

Trade in nearly all territories is flat. Producers have shipped coal to fill orders only to find these orders cancelled when the coal reached the receiving port. This has caused stocks to accumulate and embargoes have been declared generally. It is reported that from 75,000 to 90,000 tons of coal are lying at Hampton Roads ports which are without shipping orders.

New York harbor trade is quiet and prices are low. Good grades of Pennsylvania steam coal are quoted at \$2.30@2.60 as extreme limits. Quotations are mostly for coal on demurrage.

Trade in the far East is quiet and it is difficult to dispose of individual cargoes except at big reductions. There seems to be a little coal coming on contract but delivery is not urged to any extent. Consumers at New England points are well stocked, and take coal only as a matter of accommodation to the dealers. Along the Sound there are a few orders and some inquiries; trade seems to be waking up slightly. All-rail trade is desultory. Car supply is governed largely by the embargoes at the shipping ports. Transportation is slow.

In the Coastwise trade vessels are in good supply but orders are scarce. Large boats can be chartered from Philadelphia

to points around the Cape at 65@70c. In New York harbor the rate has fallen to 16@10c. per ton.

Birmingham

Jan. 20—The coal production in Alabama has been cut down considerably. Several mines have been shut down or are running on slack time because of a falling off in the demand. The union miners of the Alabama Consolidated Coal and Iron Company have remained idle since the company announced that the mines would be operated on the open-shop plans. A card from officials of the coal miners' organization states that the miners declined to accept a readjustment in wages, a cut of 10 per cent., and hence the change of plan. The miners claim that the wages would be 57½c. per ton, in accordance with the contract, with the average selling price of pig iron at \$11.50 per ton, whereas at present the average selling price is \$13 or \$13.50.

Chicago

Jan. 20—Business has shown improvement in the last week, but is not generally satisfactory to dealers. Weather conditions have been more favorable, particularly in the Northwest.

The lower-priced Western coals have the best of the situation. Larger shipments to the country have resulted in lessening demurrage evils in Chicago.

Illinois and Indiana lump and egg bring \$2@2.75; run-of-mine, \$1.50@1.90, and screenings, \$1.30@1.60, Chicago. Brazil block sells well at about \$3.

Of coals from east of Indiana, Hocking is strongest, though selling below the circular price of \$3.15, by 15c. to 25c. Smokeless has been over-plentiful at \$3.05@3.50 for run-of-mine, and \$3.85@4.05 for lump. Youghiogeny is firm, though sales are not heavy, at \$3.15@3.25 for ¾-in. gas coal.

Indianapolis

Jan. 20—Tomorrow morning the United Mine Workers of America will begin their nineteenth annual convention. It will consist of 1000 delegates, and President John Mitchell will be chairman.

The convention will be important from the fact that no interstate convention for fixing a wage scale has yet been agreed on. A conference will be held Jan. 30 when it will be decided as to what shall be done about calling a wage conference of miners and operators from the Central

Competitive field. The miners will be in convention about 10 days. If the conference on Jan. 30 results in an agreement to call an interstate conference, it is likely that one will be called at once.

It is the understanding that the miners will ask for an increase in wages. Leading operators say that such a proposition cannot be considered under present conditions.

Pittsburg

Jan. 21—Not more than 50 per cent. of the railroad coal mines are in operation this week. Prices remain on the basis of \$1.15 a ton for mine-run coal at mine, with slack strong at 80c. All the loaded coal in the pools and harbor has been shipped and all the river mines continue busy. No important action was taken at the annual convention of the Pittsburg district, United Mine Workers, which closed on Saturday.

Connellsville Coke—A large number of idle ovens have been started by the H. C. Frick Coke Company, but this does not affect the general market as the product goes exclusively to Steel Corporation furnaces. There is little new business, and prices continue weak. For spot delivery furnace coke has been quoted \$1.75, but on contract the price remains at \$2@2.25. Foundry coke on contract is \$2.50@2.65, but for prompt shipment these quotations could be considerably shaded. The *Courier* in its weekly summary gives the production in both fields at 142,346 tons. The shipments amounted to 5171 cars, distributed as follows: To Pittsburg, 2754 cars; to points west of Connellsville, 1926 cars; to points east of Connellsville, 491 cars.

Iron Trade Review

New York, Jan. 22—The markets are generally quiet. A slight revival in demand for pig iron seems to have spent itself in small orders. A little is doing in structural steel, but new projects generally are held back until they can be financed. The railroads are ordering lightly, and do not seem disposed to take new material unless they are obliged to do so. In fact everyone seems to be waiting to see what is coming.

Meetings were held in New York this week of the so-called advisory committee. It is understood that it was decided that no price reductions of any importance should be made at present. The plan of maintaining prices and curtailing production will be tried still further.

Iron and Steel Exports—Exports of iron and steel, including machinery, from the United States were valued at \$17,051,755 for November; for the 11 months ended Nov. 30 they were \$182,068,912, an increase of \$24,253,832 over 1906. Chief items of iron and steel exports for the 11 months were, in long tons:

	1906.	1907.	Changes.
Pig iron.....	75,052	70,740	D. 4,312
Billets, ingots & blooms	186,479	74,851	D.111,628
Bars.....	80,110	93,084	I. 12,974
Rails.....	296,873	318,143	I. 21,270
Sheets and plates.....	102,794	113,544	I. 10,750
Structural steel.....	101,275	129,041	I. 27,766
Wire.....	160,844	147,653	D. 13,191
Nails and spikes.....	56,062	53,837	D. 2,225

The only considerable decrease was in billets, ingots and blooms.

Iron and Steel Imports—Imports for November were valued at \$2,623,551; for 11 months ended Nov. 30 at \$36,740,432, an increase of \$5,899,959 over 1906. Chief items of imports were, in long tons:

	1906.	1907.	Changes.
Pig iron.....	305,416	476,448	I. 171,032
Scrap.....	18,379	26,516	I. 8,137
Ingots, blooms etc.....	19,139	18,441	D. 698
Bars.....	31,458	35,854	I. 4,396
Wire-rods.....	16,269	15,817	D. 452
Tin-plates.....	48,969	56,231	I. 7,262

Principal increases were in pig iron and tin-plates.

Baltimore

Jan. 21—Included in imports for the week were 120 tons manganese ore from Liverpool, 800 tons from Rotterdam and 6000 tons from India; 6920 tons in all Iron-ore receipts were 5800 tons from Cuba.

Birmingham

Jan. 20—Pig-iron sales in the Birmingham district, in small lots, have been so strong recently that one of the smaller companies has withdrawn from the market for delivery during the first quarter of the year. There has been another strengthening of the quotations and \$13.50 for No. 2 foundry is the price. That considerable iron was sold under that price is not denied. Much buying was done lately by cast-iron pipe concerns, Nos. 3 and 4 foundry iron mostly. One order of 15,000 tons was placed. President J. Hoadley, of the Alabama Consolidated Coal and Iron Company, during the past week announced the acceptance of one order for 18,000 tons of iron at \$13.50, No. 2 foundry.

The conditions at the steel plant at Ensley remain unchanged. The rail mill will lose the better part of the coming month, during which necessary repairing will be done. The profit-sharing plan of the United States Steel Corporation is to be put into effect at the plants of the Tennessee Company, 25,000 shares of preferred stock to be offered to the employees.

Chicago

Jan. 20—The market for pig iron is improving slowly. Orders have been placed in the last week for iron to be delivered in the second as well as the first quarter of the year, and melters show a tendency to lengthen out their time requirements. Most orders, however, are for delivery in the first quarter and are for small lots. Southern iron sells for \$13@13.50 Birmingham (\$17.35@17.85 Chicago) and

Northern for \$18@18.50, No. 2 foundry. Northern charcoal iron sells for \$23@ \$23.50, with demand light but steady.

Coke is plentiful and inactive, Connellsville being \$5.40, Chicago.

Philadelphia

Jan. 22—There are so many disturbing conditions in the pig-iron trade that it is impossible to present an intelligent account of it. The Southern makers have the whip hand for the present. Producers in this territory think the best policy is to stick to current quotations and await the pleasure of buyers.

Steel Billets—Moderate purchases continue to be made, in which forging billets participate.

Bars—Bars are not holding their own. Concessions are at present the order of the day.

Sheets—This branch of the industry shows an improvement. Mill owners speak of large requirements, but buyers are cautious.

Pipes and Tubes—Quotations are strong on small orders, but manufacturers are ready to make concessions for large business.

Plates—The outlook is not encouraging. The car builders are likely to curtail work, while other consuming interests are indifferent.

Structural Material—The brightest spot in the situation is the number of projected enterprises in sight.

Old Material—Nothing has developed. The yards are doing but little business this week. Holders of scrap are asking more money than it is worth.

Pittsburg

Jan. 21—While the iron and steel situation shows some improvement, the outlook is not as encouraging as was expected a few weeks ago. The Ohio works at Youngstown of the Carnegie Steel Company resumed yesterday. The two blast furnaces are running again. The Ohio works are making billets and tin-bars. The Pittsburg Steel Company resumed operations at its Monessen wire plant, receiving billets from the Clairton works. The Clairton, Homestead, Duquesne and Edgar Thomson plants of the Carnegie company are running about half-time this week.

The different steel committees at meetings in New York yesterday decided to make no changes in prices of finished steel. Iron bars have gone off, and makers are quoting 1.40@1.45c., Pittsburg, for any delivery. Recently the price was established at 1.55c., and for Western shipments the rate fixed was 1.40c., Pittsburg, with freight at 18c. to Chicago added for delivery in Western territory. Steel bars remain at 1.60c., with no sales.

The only large contract likely to be

placed soon will be for steel for the new bridge of the Pittsburg & Lake Erie Railroad across the Ohio river at Beaver. It will require about 15,000 tons of structural material. The American Bridge Company will get the contract and the steel will be furnished by the Carnegie company.

Pig Iron—Production has increased, but prices continue to drop. The Carnegie Steel Company is operating 40 per cent. of its blast-furnace capacity. In the Valleys nine of the 19 merchant blast furnaces are running and it is said that there is an accumulation of about 75,000 tons in the yards, 60 per cent. of which is bessemer and 40 per cent. foundry iron. Several small lots of bessemer sold today at \$17.25, Valley, and it is believed that as low as \$17 can be done. This is a straight cut of 50c. during the week. No. 2 foundry is still quoted at \$16, Valley, or \$16.90, Pittsburg. Basic iron has declined to \$16 and gray forge is held at \$15.25, Valley.

Steel—There is no change in crude steel prices, bessemer and open-hearth billets still being held at \$28 and sheet-bars at \$29. Tank plate remains at 1.70c., and steel bars at 1.60c.

Sheets—The sheet market is dull, but the new prices are being maintained. Black sheets are quoted at 2.50c. and galvanized at 3.55c. for No. 28 gage.

Ferro-Manganese—There is some inquiry this week, but prices are lower, \$48.50@49 per ton.

Metal Market

Gold and Silver Exports and Imports
NEW YORK, Jan. 22.
At all United States Ports in Dec. and year.

Metal.	Exports.	Imports.	Excess.
Gold:			
Dec. 1907..	\$ 1,004,441	\$44,448,509	Imp. \$43,444,068
" 1906..	1,880,895	7,617,237	" 5,736,342
Year 1907..	55,215,681	143,398,066	" 88,182,385
" 1906..	46,709,158	155,579,380	" 108,870,222
Silver:			
Dec. 1907..	4,407,485	4,315,452	Exp. \$92,033
" 1906..	7,404,905	3,999,269	" 3,405,636
Year 1907..	61,619,653	46,005,776	" 15,613,877
" 1906..	60,957,091	44,227,841	" 16,729,250

Imports of gold at the port of New York for the week ended Jan. 18 were \$559,938; of silver, \$54,449. Exports of gold for the week were \$12,000; of silver, \$557,054.

Specie holdings of the leading banks of the world, Jan. 18 are reported as below, in dollars:

	Gold.	Silver.	Total.
Ass'd New York			\$229,027,200
England.....	\$178,957,130		178,957,130
France.....	534,832,355	\$183,254,375	718,086,730
Germany.....	164,010,000	45,660,000	209,670,000
Spain.....	78,335,000	128,565,000	206,900,000
Netherlands.....	38,261,000	21,942,500	60,203,500
Belgium.....	17,900,000	8,950,000	26,850,000
Italy.....	183,300,000	23,000,000	206,300,000
Russia.....	586,175,000	27,215,000	613,390,000
Aust.-Hungary.	229,425,000	58,730,000	288,155,000
Sweden.....	19,525,000		19,525,000
Norway.....	8,260,000		8,260,000
Switzerland....	15,375,000		15,375,000

The New York banks do not separate gold and silver. The foreign statements are from the *Commercial and Financial Chronicle* of New York.

Foreign trade of the United States for full year; reported by Bureau of Statistics, Department of Commerce and Labor:

	1906.	1907.
Exports.....	\$1,798,243,434	\$1,923,498,434
Imports.....	1,320,501,572	1,423,326,680
Excess, exports.....	\$ 477,741,862	\$ 500,171,754
Add excess of exports, silver.....		15,613,877
Total.....		\$ 515,785,631
Deduct excess of imports, gold.....		88,182,385
Net export balance.....		\$ 427,603,246

The gold and silver movement is given in the table in the preceding column.

Silver Market

SILVER AND STERLING EXCHANGE.

Jan.	Sterling Exchange.	Silver.		Jan.	Sterling Exchange.	Silver.	
		New York, Cents.	London, Pence.			New York, Cents.	London, Pence.
16	4.8565	56	25 7/8	20	4.8680	55 3/4	25 1/4
17	4.8620	55 3/8	25 3/8	21	4.8690	55 1/2	25 3/8
18	4.8700	55 1/2	25 1/4	22	4.8675	55 1/2	25 3/8

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

Messrs. Pixley & Abell report silver shipments from London to the East for the year to Jan. 9:

	1907.	1908.	Changes.
India.....	£ 33,480	£ 207,500	I. £ 174,020
China.....	.....	61,000	I. 61,000
Straits.....	.....	.....	.....
Total.....	£ 33,480	£ 268,500	I. £ 235,020

Imports for the week were £52,000 from New York. Exports shown above.

Mint purchases of silver reported are: Jan. 15, 200,000 oz. at 56.747c., deliveries at San Francisco and New Orleans. Jan. 17, 200,000 oz. at 55.877c., deliveries at Philadelphia and San Francisco. Jan. 20, 200,000 oz. at 56.083c., New Orleans and San Francisco.

Other Metals

Jan.	Copper.			Tin.	Lead.	Spelter.	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	London, £ per ton.			New York, Cts. per lb.	St. Louis, Cts. per lb.
16	13 3/4 @14 1/2	13 3/4 @13 3/4	63 3/4	27 1/2 @3.75	3.70 @4.60	4.55 @4.45	4.40 @4.45
17	13 3/4 @14 1/2	13 3/4 @13 3/4	62 3/4	27 1/2 @3.75	3.70 @4.60	4.55 @4.45	4.40 @4.45
18	13 3/4 @14 1/2	13 3/4 @13 3/4	.....	27 1/2 @3.75	3.70 @4.60	4.55 @4.45	4.40 @4.45
20	13 3/4 @14 1/2	13 3/4 @13 3/4	63 3/4	27 1/2 @3.80	3.75 @4.60	4.55 @4.45	4.40 @4.45
21	13 3/4 @14 1/2	13 3/4 @13 3/4	62 3/4	28 @3.77 1/2	3.72 @4.60	4.55 @4.45	4.40 @4.45
22	13 3/4 @14 1/2	13 3/4 @13 3/4	62 3/4	27 1/2 @3.75	3.70 @4.60	4.55 @4.45	4.40 @4.45

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

Copper—Some little business is reported as having been done in Europe the early part of the week, but since then the inquiry from that quarter has almost ceased. On the other hand, fair-sized orders have been placed in the domestic market from day to day, but they have not been of sufficient volume to make an impression on prices. On the contrary, there was keen competition for the business, particularly when near-by shipment was required. The market closes steady at 13 7/8@14c. for lake; 13 5/8@13 7/8c. for electrolytic. Casting copper is altogether nominal, and the average of the week is quoted at 13 3/4 @13 1/2c.

An increase of 1200 tons in the statistics and the slightly lower prices for refined sorts quoted in the domestic market, which were reported on the London Metal Exchange, brought about a decline in the standard market, which closed at £62 12s. 6d. for spot and £63 2s. 6d. for three months. Refined and manufactured sorts, we quote: English tough, £58@59; best selected, £66@67; strong sheets, £69@70.

Exports from New York and Philadelphia for the week were 8103 tons. Exports from Baltimore from Jan. 1 to date are given by our special correspondent at 1560 long tons.

Copper Sheets and Wire—Base price of sheets 20c.; wire, 16 1/4@16 1/2c. per pound.

Tin—The London market showed rather a firm tone throughout the week, at one time reaching as high as £125 5s. for spot and £126 5s. for three months. The close is somewhat lower, and quotations are cabled at £124 for spot and £125 for three months.

Spot material in this market has again become very scarce, on account of small importations during January, and is at present commanding a premium of from 1/2 to 3/4c. over the import price. Quotations at the close are made at 27 7/8c. per pound.

Lead—The market is somewhat irregular. While last week the price was unchanged, an increased speculative inquiry the early part of this week caused a flurry, which, however, quickly subsided, and at the close, quotations are unchanged at 3.70@3.75c. New York.

The London market held steady throughout the week and closes at £14 10s. for Spanish and £14 12s. 6d. for English lead.

Spelter—In spite of the reports from Joplin that the ore price there has advanced to \$40 per ton, the spelter market quieted down perceptibly. Consumers did practically nothing and speculators show an inclination to realize on their holdings, since they are somewhat disappointed in the developments. The close is barely steady at 4.55@4.60c. New York, and 4.40 @4.45c. St. Louis.

Heavy speculative buying on orders from the Continent caused an advance in the London market to over £21, but this

movement has subsided somewhat, and the close is lower at £20 17s. 6d. for good ordinaries and £21 2s. 6d. for specials.

Zinc Sheets—The base price is \$7 per 100 lb.—less discount of 8 per cent.—f.o.b. cars at Lasalle and Peru. The freight rate to New York is 27.50c. per 100 lb.

Antimony—The market is strong and dealers are optimistic. There have been considerable transactions in the local market and abroad the market is active. Quotations are: 9½@10c. for Cookson's; 9@9½c. for Hallett's; 8¾@8¾c. for ordinary brands.

Platinum—The market for platinum is quiet and uneventful. Prices are as follows: hard platinum, \$28; ordinary, \$25.50; scrap, \$17@18 troy ounce.

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

Cadmium—The price is \$1.25 f.o.b. Cleveland in 100-lb. lots. A higher price is asked for smaller lots.

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

Minor Metals—For minor metals and their alloys, wholesale prices are, f.o.b. works:

	Per Lb.
Cadmium, 99.5% f. o. b. Hamburg	\$1.27@1.35
Chromium, pure (N. Y.)	80c.
Copper, red oxide	50c.
Ferro-Chrome (60% Cr., 5% C.)	8c.
Ferro-Chrome (60% Cr., 2% C.)	22c.
Ferro-Chrome (60% Cr., 1% C. or less)	42c.
Ferro-Molybdenum (50%)	90c.
Ferro-Titanium (20%)	80c.
Ferro-Tungsten (37%)	25c.
Ferro-Vanadium (25-50%, per lb. vanadium contents)	\$5.00
Magnesium, pure (N. Y.)	1.50
Manganese, pure 98@99% N. Y.	75c.
Manganese-Copper (30@70%) N. Y.	45c.
Molybdenum (98@99% N. Y.)	\$1.45
Phosphorus, foreign red (f. o. b. N. Y.)	90c.
Phosphorus, American yellow (f. o. b. Niagara Falls)	42c.
Tungsten (best) pound lots	80c.
Ferrosilicon (50%) spot. Ex. ship Atlantic ports	\$89 ton.

Variations in price depend chiefly on size and condition of orders.

Missouri Ore Market

Joplin, Mo., Jan. 18—The zinc and lead ores of the Joplin district are advancing in prices fast. Zinc ore has advanced \$14 per ton already this year, and lead ore \$10 per ton. Producers who thought a month ago that they would resume operations when zinc ore reached a base price of \$40, are now waiting for the base price to reach \$45 or \$50 per ton, and the output continues 25 per cent. under normal conditions. The highest price paid for zinc ore during the week was \$42.50, an advance of \$3.50 per ton, advances ranging on the various grades from \$3 to \$5 over the previous week. There was only one base price, \$40 per ton of 60 per

cent. zinc. The high price paid for lead was \$50 per ton, an advance of \$3 over the previous week.

Following are the shipments of zinc and lead ore for the week ended Jan. 18:

	Zinc, lb.	Lead, lb.	Value.
Joplin	2,185,460	362,140	\$52,491
Webb City-Carterville	1,338,270	257,780	32,282
Duenweg	619,720	55,630	13,419
Galena	591,240	95,800	12,941
Alba-Neck	379,070	.....	7,960
Badger	296,040	.....	6,212
Aurora	262,350	13,500	4,521
Granby	375,000	12,500	3,800
Prosperity	85,220	36,730	2,542
Carthage	59,620	.....	1,252
Sarcoxic	61,530	.....	1,169
Carl Junction	46,300	11,040	1,166
Stott City	49,210	.....	925
Spurgeon	41,810	14,700	895
Reeds	40,340	.....	766
Totals	6,432,180	859,820	\$142,345

3 weeks	19,752,510	2,984,240	\$ 413,036
Zinc value, the week	\$121,650;	3 weeks, \$	344,187
Lead value, the week	20,695;	3 weeks,	66,849

Average ore prices in the Joplin market were, by months:

ZINC ORE AT JOPLIN.			LEAD ORE AT JOPLIN.		
Month.	1906.	1907.	Month.	1906.	1907.
January	47.38	45.84	January	75.20	83.58
February	47.37	47.11	February	72.83	84.58
March	42.68	48.66	March	73.73	82.75
April	44.63	48.24	April	75.13	79.76
May	40.51	45.08	May	78.40	79.56
June	43.83	44.82	June	80.96	73.66
July	43.25	45.79	July	74.31	58.18
August	43.56	43.22	August	75.36	59.54
September	42.58	40.11	September	79.64	58.52
October	41.55	39.83	October	79.84	51.40
November	44.13	35.19	November	81.98	43.40
December	43.68	30.87	December	81.89	37.71
Year	43.24	43.68	Year	77.40	68.90

Wisconsin Ore Market

Platteville, Wis., Jan. 18—The base price for zinc ore during the week was \$36 per ton of 60 per cent. zinc. The highest price paid was \$37. One car of lead ore was reported sold on a basis of \$22 per 1000 lb. for 80 per cent. lead; but no shipments of lead ore were made.

Shipments for the week ended Jan. 18 were as follows:

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point	529,100	.....	.....
Hazel Green	150,000	.....	.....
Livingston	130,000	.....	.....
Rewey	86,000	.....	.....
Platteville	61,620	.....	.....
Total	956,720	.....	.....
Year to Jan. 18	3,226,280	.....	.....

A shipment of 100,000 lb. zinc ore was made from Livingston in the week ended Jan. 11, and not then reported.

Chemicals

New York, Jan. 22—The general chemical market has improved to some extent and the volume of business appears to be larger. Several spring inquiries have come in and local dealers feel more encouraged on this account.

Copper Sulphate—The market is dull and dealers do not expect business to pick up for at least another month, when the

agricultural business usually starts in. Prices remain unchanged at \$5.50 per 100 lb. for carloads and \$5.75 for smaller quantities.

Sulphur—According to Emil Fog & Sons, Messina, Sicily, an understanding has at last been reached between the *Consorzio* and American interests with regard to the competition between the two countries, but details are lacking. It is probable that the Italians will not see the necessity of reducing outputs for some time. It is believed in Sicily that, by this agreement, the *Consorzio* will be able to export about 80,000 tons of sulphur to the United States.

Exports of sulphur from Sicily from January to November inclusive, were 304,426 tons in 1907 against 369,898 tons in 1906. Visible stocks in Sicily at the end of November, 1907, were 570,321 tons, compared with 520,257 in 1906 and 451,355 in 1905.

Mining Stocks

New York, Jan. 22—The advance in the general stock market for the past two weeks was broken this week by a sharp reaction, which carried down many stocks below last week's figures. A special drive was made at American Smelting and Refining. This was largely professional and had the appearance of the covering of a large short interest, or possibly of a party desirous of forcing out stock by scaring holders.

The curb market also showed a reaction. Trading was active in the copper shares and in the Cobalt stocks; but less so in the Nevada stocks.

The Amalgamated Copper dividend, as declared Jan. 16, was ½ per cent. for the quarter. This compares with 1 per cent. for the November dividend, and 2 per cent. for each of the other three quarters of 1907. The Boston & Montana dividend was \$3, which compares with \$6 in November and \$12 in August.

Boston

Jan. 21—Easier money has proven a fillip to stock-market prices. Copper shares have been characterized by strength, although mainly in the so-called Cole-Ryan group. Amalgamated, on the other hand, is off over \$4 to \$49.62½ from a week ago. Butte Coalition and North Butte recorded pretty spurts, although general reactions followed. The buying was largely for Western account. Copper Range rose \$2 to \$65, but is back to \$62 tonight.

The first effect on Amalgamated after the announcement of the cut in the dividend to 50c. quarterly was weakness, but it was temporary only. Balaklala rose \$1.50 to \$4 on the carrying out of the original plan whereby the stock is practi-

cally assessed \$2.50. Boston has three representatives on the board, which is a minority.

Arizona Commercial sold up \$3.50 to \$20.25, but is back to \$16.50, and Bingham spurred \$2.75 to \$6.75. Calumet & Arizona was well bought up to \$116, against \$109.50 a week ago. Old Dominion spurred \$3.75 to \$37.75, but has lost most of it. Utah Consolidated has also been active and rose \$2.25 to \$37, although it has lost net more than it gained. There is talk of consolidation of the Utah mines.

The curb took on a boom, Nevada-Utah being the conspicuous feature. After touching \$6.50 it is back to \$4.75 again. Utah Apex rose to \$5.12½ yesterday.

STOCK QUOTATIONS

NEW YORK Jan. 21		BOSTON Jan. 21	
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Mine.....	½	Adventure.....	2½
Am. Nev. M. & P. Co.	.....	Allouez.....	30
Amalgamated.....	49½	Am. Zinc.....	24½
Anaconda.....	31½	Arcadian.....	5
Balaklala.....	3½	Atlantic.....	13
British Col. Cop.	5	Bingham.....	6
Buffalo Cobalt.....	.....	Boston Con.....	14½
Butte & London.....	.....	Calumet & Ariz.....	113
Butte Coalition.....	18½	Calumet & Hecla.	670
Butte Cop. & Zinc.....	.....	Centennial.....	27
Cobalt Contact.....	.....	Con. Mercur.....	39
Colonial Silver.....	½	Copper Range.....	62
Cum. Ely Mining.....	7½	Daly West.....	9
Davis Daly.....	4¾	Franklin.....	9½
Dominion Cop.....	2½	Greene-Can.....	8¾
El Rayo.....	1½	Isle Royal.....	21½
Foster Cobalt.....	.65	La Salle.....	15½
Furnace Creek.....	.36	Mass.....	4
Giroux Mine.....	4¾	Michigan.....	12½
Gold Hill.....	1	Mohawk.....	55½
Granby, Nev.....	.....	Mont. C. & C. (new)	.....
Greene Gold.....	1	Nevada.....	11
Greene G. & S.....	7	North Butte.....	49½
Greenw'r & D. Val.	.....	Old Colony.....	49½
Guanajuato.....	2¾	Old Dominion.....	35½
Guggen. Exp.....	155	Oscocla.....	87
Hanapah.....	.....	Parrot.....	13¾
McKinley Dar.....	1½	Phoenix.....	1½
Micmac.....	4	Quincy.....	90
Mines Co. of Am.....	1¾	Rhode Island.....	4
Mitchell Mining.....	¾	Santa Fe.....	2½
Mont. Sho. C. (New)	4¾	Shannon.....	12¼
Nev. Utah M. & S.....	4¾	Tamarack.....	71
Newhouse M. & S.....	8¾	Trinity.....	16
Nipissing Mines.....	7½	United Cop. com.	7¾
Old Hundred.....	1½	U. S. Oil.....	10
Silver Queen.....	¾	U. S. Smg. & Ref.	34¾
Stewart.....	¾	U. S. Sm. & Re. pd.	40
Tennessee Cop'r.....	.....	Utah Copper.....	34¾
Union Copper.....	1¾	Victoria.....	5
Utah Apex.....	2½	Washington.....	5
West Columbus.....	.....	Winona.....	5½
		Wolverine.....	129
		Wyandotte.....	.....

N. Y. INDUSTRIAL

Am. Agri. Chem.....	.....
Am. Smelt. & Ref.....	65½
Am. Sm. & Ref. pf.....	90
Bethlehem Steel.....	.....
Colo. Fuel & Iron.....	20½
Federal M. & S. pf.....	.....
Inter. Salt.....	.....
National Lead.....	39
National Lead, pf.....	90¾
Pittsburg Coal.....	9½
Republic I. & S.....	17½
Republic I. & S. pf.....	70
Sloss-Sheffield.....	41¾
Standard Oil.....	490
U. S. Red. & Ref.....	.....
Tenn. C. & I.....	.....
U. S. Steel.....	29¾
U. S. Steel, pf.....	93
Va. Car. Chem.....	17¾
Va. I. Coal & Coke.....	50

ST. LOUIS Jan. 18

N. of Com.	High.	Low.
Adams.....	.25	.20
Am. Nettie.....	.03	.02
Center Cr'k.....	2.00	1.50
Cent. C. & C.....	65.00	63.00
C. C. & C. pd.....	75.00	70.00
Cent. Oil.....	100.00	90.00
Columbia.....	4.00	2.00
Con. Coal.....	25.00	23.00
Doe Run.....	120.00	110.00
Gra. Bimet.....	.25	.20
St. Joe.....	12.00	11.00

NEVADA STOCKS. Jan. 22. Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
TONOPAH STOCKS			
Belmont.....	.77	Golden Sceptre.....	100
Extension.....	1.37½	Homestake King.....	.58
Golden Anchor.....	.03½	Montgomery Mt.....	15½
Jim Butler.....	.40	Mont. Shoshone C.....	4.12½
MacNamara.....	.33	Original Bullfrog.....	.04
Midway.....	.72	Tramp Cons.....	.17
Montana.....	1.90	MANHAT'N STOCKS	
North Star.....	.11	Manhattan Cons.....	.24
Tonopah & Cal.....	.11	Manhat'n Dexter.....	.07
Tono'h Mine of N.....	4.62½	Jumping Jack.....	.07
West End Con.....	.30	Stray Dog.....	.09
		Indian Camp.....	.05
GOLD FID STOCKS			
Adams.....	.08	GREENW'R STOCKS	
Atlanta.....	.35	Furnace Creek.....	.....
Blue Bell.....	.09	Greenwater & D.V.....	.....
Blue Bull.....	.19	Green' Cop. M. & S.....	.....
Booth.....	.21	United Greenw'r.....	.....
Columbia Mt.....	.20	MISCELLANEOUS	
Comb. Frac.....	.74	Golden Boulder.....	.10
Cracker Jack.....	.08	Hayseed.....	.30
Dia'dfield B. B. C.....	.21	Lee Gold Grotto.....	.10
Goldfield Belmont.....	.14	Nevada Hills.....	3.00
Goldfield Con.....	5.56½	Nevada Smelting.....	1.62½
Goldfield Daisy.....	1.10	Pittsburgh S. Pk.....	1.45
Goldfield Mining.....	.....	Round Mt. Sphinx.....	.30
Great Bend.....	.23	COLO. SPRINGS Jan. 18	
Jumbo Extension.....	.60		
Jumbo Mining.....	.....	Name of Comp.	Clg.
Katherine.....	.06	Acacia.....	7¾
Kendall.....	.12	Black Bell.....	.....
Laguna.....	.....	C. C. Con.....	4¾
Lone Star.....	.10	Dante.....	9
Lou Dillon.....	.....	Doctor Jack Pot.....	7¾
May Queen.....	.07	Elkton.....	51
Mohawk.....	.11	El Paso.....	29
Oro.....	.39	Findlay.....	39
Red Hill.....	.07	Gold Dollar.....	6¾
Red Top.....	.79	Gold Sovereign.....	4¾
Roanoke.....	.07	Isabella.....	40
Sandstorm.....	.23	Index.....	.....
Silver Pick.....	.33	Jennie Sample.....	3
St. Ives.....	.50	Jerry Johnson.....	7
Triangle.....	.08	Mary McKinney.....	38
		Pharmacist.....	5
BULLFROG STOCKS			
Amethyst.....	.....	Portland.....	.98
Bullfrog Daisy.....	.....	Un. Gold Mines.....	6¾
Bullfrog Mining.....	.08	Vindicator.....	.....
Bullfrog Nat. B.....	.11	Work.....	18
Gibraltar.....	.10		
Gold Bar.....	.36		

Assessments

Company.	Delinq.	Sale.	Amt.
Banner Hill, Cal.....	Jan. 6	Jan. 27	\$0.10
Belcher, Nev.....	Jan. 3	Jan. 31	0.10
Bullion, Nev.....	Jan. 3	Jan. 27	0.05
Champion, Cal.....	Jan. 2	Jan. 23	0.50
Chollar, Nev.....	Dec. 27	Jan. 20	0.10
Confidence, Nev.....	Jan. 3	Jan. 24	0.20
East Tintic, Utah.....	Jan. 14	Feb. 9	0.01
Imlay, Nev.....	Jan. 24	Feb. 10	0.01
Lady Washington, Nev.....	Jan. 9	Jan. 30	0.05
Lucky Dutchman, Nev.....	Jan. 16	Feb. 8	0.01
Moduff, Utah.....	Jan. 3	Feb. 4	0.01
Nevada Superior, Nev.....	Jan. 24	Feb. 21	0.05
New Stockton, Utah.....	Dec. 23	Jan. 20	0.02½
N. Y. Bonanza, Utah.....	Jan. 4	Jan. 25	0.03
Penn. Con., Cal.....	Jan. 13	Jan. 29	0.10
Posey Canyon, Utah.....	Jan. 7	Jan. 25	0.01
Spanish Ridge, Cal.....	Jan. 15	Feb. 5	0.02
Sunflower, Cal.....	Jan. 30	Mar. 30	0.05
Wabash, Utah.....	Jan. 17	Feb. 8	0.12
Zeibright, Cal.....	Jan. 6	Feb. 1	0.05

New Dividends

Company.	Payable.	Rate.	Amt.
Amalgamated.....	Feb. 24	\$0.50	\$765,440
Am. Cement.....	Jan. 23	0.30	60,000
Anaconda.....	Jan. 15	0.50	600,000
Boston & Montana.....	Feb. 3	3.00	450,000
Bunker Hill & Sullivan.....	Jan. 4	0.20	60,000
Cambria Steel.....	Feb. 15	0.75	450,000
Camp Bird, Ltd.....	Feb. 3	0.24	246,800
Consolidation Coal.....	Jan. 31	3.50	358,750
Doe Run.....	Jan. 15	0.50	29,531
El Oro.....	Jan. 15	0.36	388,800
Esperanza.....	Jan. 2	1.12½	511,875
Fairmont Coal.....	Jan. 31	2.00	240,000
Florence.....	Jan. 0	1.10	105,000
Francis-Mohawk.....	Jan. 0	0.05	45,500
Gen. Chemical, pfd.....	Jan. 2	1.50	150,000
Georges Creek C. & I.....	Jan. 22	2.50	55,000
Homestake.....	Jan. 25	0.50	109,200
Jamison.....	Jan. 18	0.02	7,800
Jerry Johnson.....	Jan. 15	0.01	25,000
Montezuma M. & S.....	Jan. 10	0.04	40,000
N. Y. Hond. Rosario.....	Jan. 25	0.10	15,000
Oroville Dredging.....	Jan. 5	0.12½	87,500
Portland.....	Jan. 15	0.04	120,000
Tenn. Copper Co.....	Feb. 15	1.25	218,750
Vindicator Con.....	Jan. 25	0.04	60,000

LONDON Jan. 22

Name of Com.	Clg.
Dolores.....	£1 7s 6d
Stratton's Ind.....	0 4 0
Camp Bird.....	0 14 9
Esperanza.....	1 7 6
El Oro.....	1 7 6
Oroville.....	0 12 3
Somera.....	.....
Utah Apex.....	.....
Ariz. Cop. pfd.....	.....
Ariz. Cop. def.....	.....

Cabled through Wm. P. Bonbright & Co., N.Y.

Monthly Average Prices of Metals
AVERAGE PRICE OF SILVER

Month.	New York.		London.	
	1906.	1907.	1906.	1907.
January.....	65.288	68.673	90.113	91.769
February.....	66.108	68.835	90.464	91.852
March.....	64.597	67.519	89.854	91.326
April.....	64.765	65.462	89.984	90.533
May.....	66.976	65.981	90.968	90.571
June.....	65.394	67.090	90.185	90.838
July.....	65.105	68.144	90.113	91.906
August.....	65.949	68.745	90.529	91.637
September.....	67.927	67.792	91.483	91.513
October.....	69.523	62.435	92.148	98.963
November.....	70.813	58.677	92.671	97.154
December.....	69.050	64.565	92.003	95.362
Year.....	66.791	65.327	90.868	90.188

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

AVERAGE PRICES OF COPPER

Month.	NEW YORK.		LONDON.	
	Electrolytic	Lake.	1906.	1907.
January.....	18.310	24.404	18.419	24.825
February.....	17.869	24.869	18.116	25.236
March.....	18.361	25.065	18.641	25.560
April.....	18.375	24.224	18.688	25.260
May.....	18.475	24.048	18.724	25.072
June.....	18.442	22.665	18.719	24.140
July.....	18.190	21.130	18.585	21.923
August.....	18.380	18.356	18.706	19.255
September.....	19.033	15.665	19.328	16.047
October.....	21.203	13.169	21.722	13.551
November.....	21.833	13.931	22.398	13.870
December.....	22.885	13.163	23.350	13.393
Year.....	19.278	20.004	19.616	20.661

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

AVERAGE PRICE OF TIN AT NEW YORK

Month.	1906.	1907.	Month.	1906.	1907.
January.....	36.390	41.548	July.....	37.275	41.021
February.....	36.403	42.102	August.....	40.606	37.667
March.....	36.622	41.313	September.....	40.516	36.689
April.....	38.900	40.938	October.....	42.852	32.639
May.....	43.313	43.149	November.....	42.906	30.833
June.....	39.260	42.120	December.....	42.760	27.926
			Av. year.....	39.819	38.166

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	19.898
February.....	5.464	6.000	16.031	19.531
March.....	5.350	6.000	15.922	19.703
April.....	5.404	6.000	15.969	19.975
May.....	5.685	6.000	16.725	19.668
June.....	5.750	5.760	16.813	20.18