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The Iron-ore Mines of the Mesabi Range

Opened in 1892, the Mines of the Mesabi Now Produce 62 Per Cent. of the Total Ore from the Northern Ranges

BY REGINALD MEEKS

The history of the first discoveries of iron ore on the Mesabi range in Minnesota, was fully given by Dwight E. Woodbridge, of Duluth, Minn., in an interesting series of articles published in the JOURNAL of January to May, 1905.

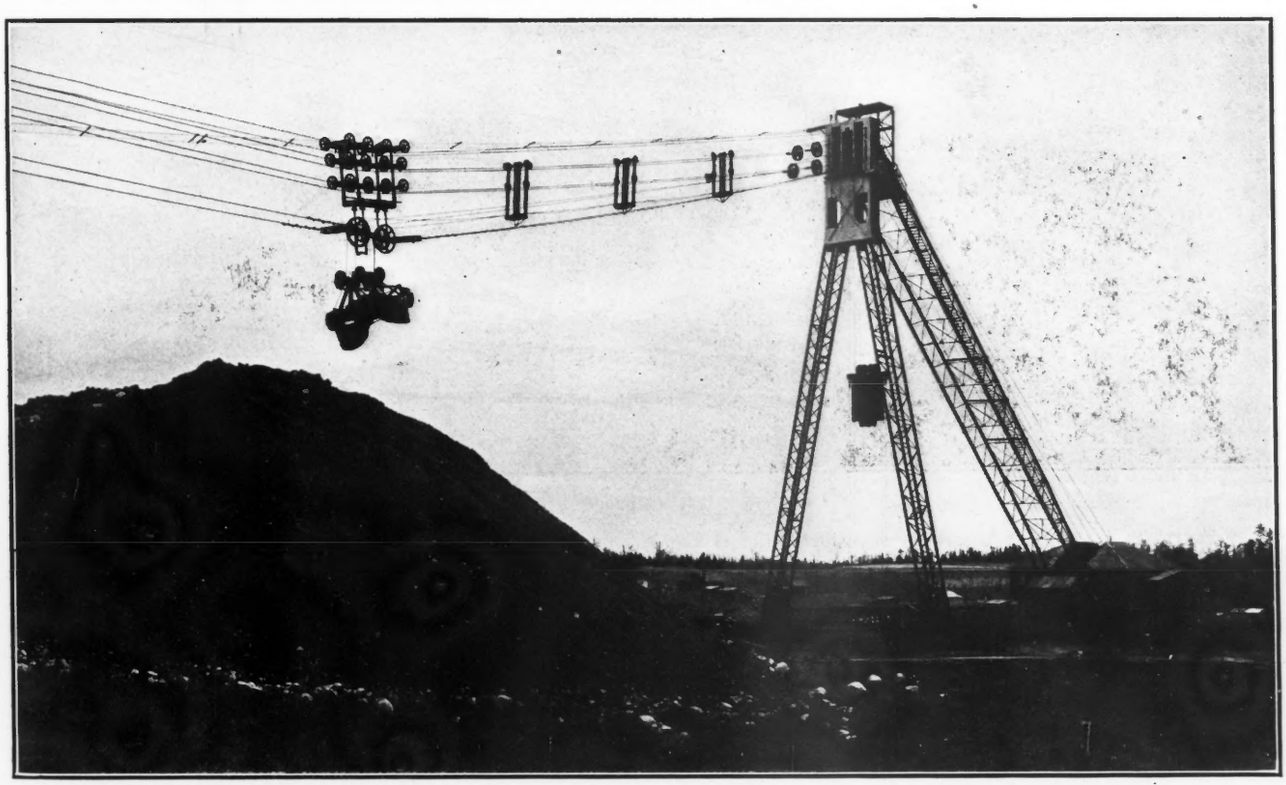
In 1892 the mines of the Mesabi range began shipping and the first feeble effort of the Mountain Iron mine was 4,245 tons which comprised the total for the range that year. Fourteen years later this mine shipped more than 2,500,000 tons in one year. So rapid has been the development of the Mesabi range that it is almost incomprehensible. Where it took the Marquette, the Menominee and the Gogebic ranges 46 years to produce a combined output of 46,000,000 tons of ore, the mines on the Mesabi eclipsed this record in 11 years. Of the total ore produced in the Lake Superior Region, 36 per cent. has been shipped from the great Mesabi range.

These remarkable shipments were made possible by the existence of vast beds of soft ore and the simplicity of extraction.

PROSPECTING FOR ORE

It is rare that ore comes close to the surface and outcrops are unkown. Moreover there are no surface indications to guide the prospector. In some cases the test-pits of moderate depth revealed the deposit. The usual method of prospecting however, is to bore with either a diamond or churn-drill. Diamond drilling costs $6 per foot on the Mesabi while churn drilling costs but half that amount. The former method is however, by far the more prevalent.

Overlying the great shallow beds of ore is an overburden of from 20 to 135 ft. of sand and gravel, interspersed with boulders of varying size. The ore is rarely found at a depth greater than 300 ft. There is practically no dip to the deposits and they extend over great areas. The ore is soft and contains considerable limonite or yellow ocher, and is almost entirely within the bessemer limit for phosphorus. In a number of the mines the ore is highly silicious. On account of its soft character it is necessary to mix Mesabi ore with considerable harder ore from the other ranges in order to prevent clogging the furnaces.



STRIPPING THE SURFACE WITH A "GRAB" AT BUHL, MINN.

FEE OWNERS AND THE MINING COMPANIES

Years ago the land was taken up by settlers who acquired it under the homestead law. These pioneers cut the lumber and never dreamed of the vast mineral wealth under their feet. Some of the original holders sold to lumber companies and the rest held on to their land. When ore was discovered a few acres were sold to mining companies but the great majority of land owners soon learned that

they could realize better profits by leasing the property to the companies for a term of years and receiving a royalty of from 15c. upward to as high as $1 per ton. These two royalties represent the extremes; an average would probably be about 37½c. per ton.

It is customary for a number of fee-owners to employ an agent to represent their interests. This agent must make frequent inspections and see that the operating company is living up to its contract, and is developing and mining the property to the best of its ability. It is probable that more than $8,000,000 per annum is paid to the fee-owners on the Mesabi range. This same system is in vogue on all of the other ranges and the big companies own outright, comparatively little land. As some of the leases are for as long as 50 years and as the mining companies own outright comparatively little to produce a minimum tonnage a lease may virtually amount to ownership in some cases.

Fortunes Made Over Night

Figuratively speaking, fortunes have been made "over-night" by obtaining options from the land-owners, proving mineral and selling these options, for large advances, to mining companies. Duluth has many citizens who have made fortunes in options. The owner of the land acquired it perhaps, for nothing or else paid a few dollars per acre for the timber. These men have later been made wealthy either from royalties or from the sale of the land.

With such possibilities and with the vast tonnage of grain and iron ore being shipped from its docks it is not surprising that Duluth has grown and prospered in the last decade.

Mining on the Range

The great open pits at Hibbing, Virginia, Eveleth, Mountain Iron and elsewhere furnish examples of iron ore extraction which, for speed, volume and economy are not equalled anywhere in the world. To the mining engineer, perhaps, the open pit does not appeal. One mining captain from one of the other ranges remarked that the method of "mining" was only "ore farming," and he was not far wrong. The work comes more within the province of a civil or a railroad engineer than it does within that of a mining engineer. However, the majority of mines are being worked by underground methods, but the greater tonnage comes from the open pits.

When the mines were first opened it was calculated that one foot of overburden could be removed for each two feet of ore underneath. Later this was modified to foot for foot and now even better is done. The enlargement and perfection of the steam-shovel has made this possible, and the cost of stripping, has steadily decreased with the increased efficiency of new methods and equipment.

Open Pits

There are several points to be considered before deciding upon stripping the overburden and extracting by steam-shovel.

To be economical the ratio of overburden to ore must not be too great, and there must be sufficient known ore to warrant the great expense. Again the company must control a suitable approach for railroad tracks to remove both ore and stripping and the topography of the land must be such that the locomotive will not require too great an effort to get out of the pit with a loaded train. Moreover there must be acquired a suitable location, not too far distant, to dump the overburden. Some mines transport dirt and gravel many miles because they cannot find a locality nearer the mine and this is naturally costly. The royalty which the fee-owner receives also enters into the problem and frequently decides the question. But where conditions warrant the open pit is a marvel as a producer.

The workings of the Mahoning Steel and Ore Company at Hibbing and the adjoining Hull-Rust mine of the Oliver Iron Company, the Mountain Iron pit and the Fayal mine at Eveleth, four mines in all, produced nearly 30 per cent. of all the ore produced on the Mesabi range in 1906.

At the Mahoning pit the railroad tracks approach the orebody on the west end and instead of making straight cuts as with all other mines, the tracks are laid so as to form an elongated spiral going down into the deposit in steps.

The shovels scoop up the ore with great rapidity, from three to six cubic yards being the capacity, and a train of 20 to 30 cars is loaded with wonderful dispatch and is hauled out of the pit. All day and all night, during the shipping season, these shovels are busy, and year after year the tonnage increases. At the Mountain Iron mine, the holder of the production record, the cuts are taken in one direction and the cars are hauled out of the pit up two inclines. The overburden at this mine is about 70 ft. thick and was stripped from an area of about 300 acres. This represents the removal of nearly 40,000,000 cu.yd. of gravel and rock before the ore is entirely exposed.

AN OPEN PIT AT HIBBING, MINN.

During the winter stripping operations are continued, but no ore is mined. The shipping season starts about April 1 and ends about Nov. 1, but this is entirely dependant upon the weather and may be longer or shorter. The ore is largely transported over the Duluth, Missabe & Northern or the Duluth & Iron Range railroads. Both of these roads are operated by the United States Steel Corporation. The charge for hauling to the Lake port, which averages about 70 miles, is about 80c. per ton.

A New Departure in Surface Stripping

It is not often that a radical departure from the beaten paths of engineering practice is made, and when such a step is taken it brings forth much adverse

criticism, and many calamities are predicted. The clam-shell grab bucket has been used for years to unload vessels and to load from stock piles. Howe & Mason conceived the idea of applying this principal to strip the surface and later to remove the ore by means of a specially designed clam-shell bucket which is the largest of its kind ever constructed. These engineers succeeded in interesting the Jones & Laughlin Steel Company, and contracted to equip the Grant mine at Buhl, Minn., with the "grab" which has been operating for more than a year. Until some of the many difficulties which have been encountered have been overcome, no

SURFACE AND ORE AT THE LEONARD MINE, CHISHOLM, MINN.

details will be given out by the contractors, but a full description will be published at a future date. Briefly the method is as follows:

Two steel towers 170 ft. high, are placed on tracks 1150 ft. apart. These towers are built with three legs, the back leg of each running on a separate track. Between the towers are stretched eight wire cables on which a carriage runs which also carries the cables operating the grab. The entire mechanism is controlled and operated from a small tower, situated at one end of the property. The moving force is electricity and the man in the tower can, by throwing switches, control every movement of the whole device.

Between the two towers is the railroad track and, when the surface has been stripped, the cars will be loaded directly from the pit. It is natural to expect failures and delays when it is remembered that great forces are involved, and that this is the first attempt to apply the clam-shell on such a large scale. Delays have been caused by breakages and the work has thus far progressed slowly.

Operation of the Bucket

The clam-shell travels over to the excavation on one side of the track, descends to the bottom of the pit, and the powerful jaws start to close when the bucket is lifted. The maximum capacity is said to be 11 cu. yd. but it is rarely that the grab is able to take up more than half of that amount. When the bucket takes its load it travels along the cables to the dirt pile on the opposite side of the track where it drops the dirt. Lying on the pile is a boulder which probably weighs close to 20 tons. This was carried from the pit to the pile by the grab and is a forcible illustration of the power involved.

Men who are used to steam shovels scoff at the clam-shell for this work and predict failure. It must be remembered that hundreds of difficuties have arisen which have been overcome only by the most patient and skilful work by the engineers in charge. It may be that the method will eventually prove more costly than the steam-shovel, but if success is attained, the experience gained from this first attempt will prove beneficial in another trial. It is generally conceded that the bucket will work better in ore than in overburden since much of the trouble has been caused by boulders. It is intended to replace the dirt in the excavation after the ore has been removed instead of transporting it a long distance. Then the other half of the property will be stripped and mined.

Underground Mining

The problem of underground mining on the Mesabi range is comparatively simple, and is the same as is used on the Marquette range and known as the "North of England" method. This method was described in the Journal of June 15 last.

The ore on the Mesabi contains in some mines at least, considerable sand in layers or bands, which frequently prohibits mining in certain portions of the mine on account of the high silica content. Aside from this the ore formations are extremely regular. Under the deposit is a formation of taconite which is similar in some respects to the jasper of the Menominee range. This layer forms what is practically a horizontal footwall and below this no ore exists. Therefore a fairly clear idea of the total production can be obtained, and plans can be made accordingly, from diamond-drill holes.

There is one mine, the Leonard at Chisholm, where underground methods were superseded by an open pit. In this mine no approach is possible, now that the surface has been removed, and so a modification has been adopted. The steam-shovel loads two small cars alternately. These are drawn by a dinky-engine to a shaft, a relic of underground days, and dump into one of two balanced skips which conveys the ore to the surface and into the pockets.

The Leonard ore is a mixture of red and blue hematite and yellow ocher. It is very soft and easily shoveled. Standing in the pit the visitor can see the timber of the old drifts protruding out into the air, since the bottom of the pit is more than 50 ft. below the old level. There is an overburden which averages nearly 70 ft. thick. This is shown quite clearly in the illustration.

L'Industrie Electrique gives a new method of preparing tantalum by the use of cathode rays. The metal is connected to the anode and is placed at the focus of the cathode rays, which are concentrated on it by a mirror. The cathode rays cause rapid fusion of the metal; by means of a magnet their action and direction can be controlled in a simple manner and the adjustment of the rays on any part of the metallic mass obtained. This apparatus will work with alternating currents.

Subsidence in Underground Mines

A Summary of Investigations upon Certain Problems in Mining That Heretofore Have Received Comparatively Little Attention

BY ALEXANDER RICHARDSON*

The subject of mine subsidence is one which hitherto has had little attention paid to it on the Witwatersrand, owing to the comparative immunity from anything serious in the nature of crush or creep; there have been, however, within the last few years several heavy falls of ground, and it is only natural to expect that, as the workings become more extensive, so will these cavings occur more frequently.

Surface Effects of Subsidence

The surface effects of subsidence have been closely studied by many able colliery engineers, and the conclusions they arrived at are briefly as follows:

(1) Beds do not break at right angles to the planes of stratification.

(2) In stratified deposits the zone of subsidence is limited by a sort of dome, which has for its base the area of the excavation.

(3) Where the beds are horizontal, the dome is symmetrically arranged about its axis, but where the beds are inclined, the dome is no longer symmetrical about its axis, and this axis departs further from the normal to the planes of stratification as the inclination increases. Vertical, normal, axis of figure of dome, line of maximum subsidence, all these coincide when beds are horizontal, but are distinct when beds are inclined.

(4) Generally roofs of hard rock fall all at once in large blocks, while soft and laminated rocks sink in slow and regular manner. The fracture of the roof is caused more often by the weight of the first beds than by the pressure of the upper masses, and much before this pressure can have produced its effect.

(5) Faults, dikes and other geological features, the hight of the excavation, the manner in which it is made, and its depth below the surface have an important bearing on the shape and dimensions of the zone of subsidence.

Fayol's Rules

M. Fayol, the chief investigator of these phenomena, enunciated the following two rules for his own guidance:

(1) The hight of the zone of subsidence where sandstone predominates in the strata and the beds have a less inclination than 40 deg., and when the area is infinite, does not exceed 200 times the hight of the excavation.

(2) When the area is limited, the hight of dome is about twice the breadth excavated for excavations less than 6 ft. up to four times for excavations more than 6 feet.

Cracks in the ground are generally disposed in multiple lines, discontinuous, meandering, irregular. They are sometimes very wide, but as a rule they are not deep; long rectilinear cracks and those which continue without interruption from the surface to the excavation are exceptional.

With the deeper mines the effect is more in the nature of a pull over in the case of buildings than an actual downward movement.

Careful and efficient stowing is the only remedy. As mentioned in the foregoing summary, beds do not break at right angles to the planes of stratification, and for the due protection of surface objects it is necessary to know what the angle of fracture will be, that is, the angle which the plane of fracture makes with the horizontal plane. The usual rule is that for moderate dips the angle of fracture lies halfway between the vertical and the normal to the planes of stratification; or, expressed in mathematical form: Angle of fracture $= 90$ deg. $- \frac{1}{2} d$ where d is the dip in degrees. For dips greater than 30 deg. the formula, proposed by Hausse, should be used.

Tangent of angle of fracture $=$

$$\frac{1 + \cos.^2 d}{\sin. d \cos. d}.*$$

The following results are calculated by this formula:

Dip.	Angle of Fracture.
0	90°—00′
10	85°—10′
20	80°—30′
30	76°—10′
40	73°—00′
50	70°—50′
60	71°—00′
70	74°—00′
80	80°—50′
90	90°—00′

Proper Location of Pillars

From an inspection of the accompanying diagrams it will be seen that the only instance of complete unconformity to this law was on the Treasury; in the other cases where surface effects were observable the lower angle of fracture was, with the exception of the Windsor, where it was vertical, in approximate agreement with it. The upper angle of fracture in the Windsor, Bonanza and May Consolidated is not in agreement, being below the normal. If there were any uniformity in the dip of faults it might serve as a guide to the probable angle of fracture, but no such uniformity exists.

Having determined the angle of fracture, the locating of a pillar to support a given surface object becomes a simple problem, the solution of which is readily effected graphically. All that is necessary is to construct a cross section of the mine showing the surface object and the reefs underlying it. Then from each end of the object draw lines cutting the reefs toward the rise side and making an angle with a horizontal plane equal to the angle of fracture. The portion inclosed within these lines will then be the pillar required.

The lateral displacement of the pillar in plan to the rise side when the $90 - \frac{1}{2} d$ formula is used will be f tan. $\frac{1}{2} d$ cos. d, where f is the depth in feet to the excavation.

It is obvious that a pillar so located will not be in accordance with the "Mines and Works Regulations," where it is laid down that a pillar must be left not only vertically below the surface object, but for such a distance beyond as may be considered necessary.

It is only possible at present to estimate very roughly the minimum depth from which the effects of caving will not reach surface, and at which therefore pillars for the protection of the surface may be dispensed with.

Colliery Experiences

Among collieries there are numerous instances of the effects of caving reaching the surface from great depths, notably one in Wales, where the surface sank from 6 to 10 ft., although the seams lie under cover of from 1800 to 2400 ft. Newstead Abbey was entirely undermined by longwall, the seam being 3 ft. 8 in., and the depth 1680 ft.; the resulting subsidence of 23 in. occasioned no damage to the building whatever, the lowering of the surface being gradual and uniform. At Sunderland, where the measures contain 50 per cent. of hard-rock beds, seams at a depth of from 1400 to 1800 ft. have been worked for 70 years without reference to the surface. On the other hand, in the Midland and South Yorkshire coalfields, where the cover is composed largely of soft shales, the effect of workings at as much as 2000 ft. is appreciable on the surface.

In cases where a pillar has been left the subsequent pull over or draw on each side has often caused more damage than if no such pillar existed. It was observed that

*Mining engineer with Treasury Gold Mines, Ltd., Cleveland, Transvaal.

†Slightly condensed from a paper in *Journ. Chem., Met.,* and *Min. Soc.* of South Africa, March, 1907.

*A simpler formula is: *tan.* $A = 3$ *cosec.* $2d + cot. 2d$.

a cessation of work for any time frequently caused a serious difference of level due to the arrest of the wave of subsidence following the face. Colliery opinion seems to be that if the seam is swept out in a rapidly moving face, little damage will result when the depth is over 900 ft., and that at 1200 ft. the effect will be negligible.

Experiences on the Rand

Local experience on this head in view of the figures quoted above is reassuring. The maximum depth from which caving produced surface effects was at 710 ft. on the Champ d'Or. Other depths from which there were surface effects are: Bonanza, 566; May Consolidated, 650; Treasury, 480; New Kleinfontein, 340; New Heriot, 490; Windsor, 425. On the Geldenhuis Deep an area of 620 on the dip by 1000 on the strike at depths of from 650 to 924 with a total average stope width of 15 ft. suddenly caved, but of this there resulted no surface indications whatsoever. The caving on the French Rand, which took place between depths of 720 and 1040, also failed to cause any surface disturbance. From these examples one may be justified, then, in concluding that the effects of caving at a depth of 1000 ft. will never reach surface.

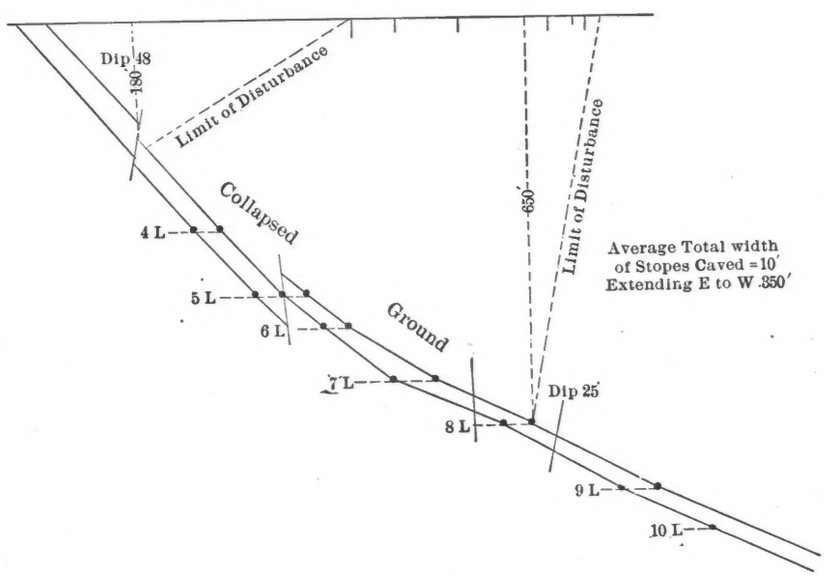
Owing to "draw" the boundary of the area of surface disturbance has sometimes extended considerably beyond the boundary of the area of underground disturbance, not only on the dip side, as would be expected from the angle of fracture, but also on other sides as well. Thus on the New Kleinfontein the surface was affected to a distance of 25 ft. back from the outcrop and to a distance of 60 ft. on each side beyond the underground limit. On the Treasury-Jumpers the surface was affected 140 ft. north of the underground limit, and to a maximum of 100 ft. east and 200 west, but on the dip, contrary to expectation, the underground limit extended to a maximum of 300 ft. beyond the surface limit.

Influence of Faults and Dikes

The direction of surface cracks sometimes bears a close relation to the strikes of faults and dikes and to the boundaries of unworked ground. The width of these cracks rarely exceeds 6 in. or the difference of level of the sides 6 in. Widths of 8 in., with a difference of level of 6 in., were recorded on the New Kleinfontein, a difference of level of 8 in. on the Windsor, and a width of 10 in., with a difference of level of 10 in. on the Treasury for 200 ft. along the outcrop of a small dike. When selecting sites for surface plant, the outcrops of faults and dikes should as far as possible be avoided, as they form lines of weakness which may become lines of maximum subsidence.

One very objectionable feature is the suddenness of these cavings. One day a roof may seem passably sound and the next day it may be all down. Beyond the fact that the hanging wall of certain stopes is shaky, and that some pillars show signs of taking weight, there is little to indicate that an extensive fall of ground is about to take place, nor can any prediction be given of when it will take place. When pillars begin to scale and split, it is well to prepare for trouble, and if much cracking is heard in the hanging, the sooner precautions are taken the better.

Unworked ground is naturally the chief controlling factor, but faults and dikes have often exercised great influence on the extent of the disturbance. The caving on the French Rand was to a great extent controlled by two faults in the central section of the mine; also on the May Consolidated; on the Geldenhuis Deep by a 25-ft. shaft pillar on the east and a 6-ft. dike on the west; on the Treasury-Jumpers by solid dike ground on the east and a 5-ft. dike on the west; on the Windsor by a fault on the east and by faulted ground on the west; and on the New Kleinfontein by unworked ground.



INCLINED SHAFT, MAY CONSOLIDATED

Causes of Collapse of Ground

The predisposing causes of the collapse of ground are various, but the final determining cause is of course insufficient support. On the New Kleinfontein ample pillar support had originally been left, but owing to the presence of a high percentage of iron pyrites in the reef of which these pillars were composed and the length of time (seven to eight years) they had been exposed to atmospheric influences, their strength had become greatly reduced, with the result that the hanging of the Main Reef gradually came in, bringing with it the leader, and a sudden general subsidence eventually took place.

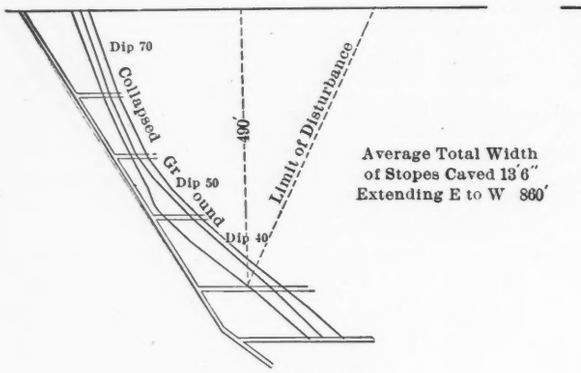
At the French Rand, before the actual caving occurred, the ground in that portion of the mine appeared to be on the move, the pillars commenced to crush, and a great deal of cracking was heard. The caving started first in the hanging wall of the Main Reef, and in some places the whole 36-ft. parting settled down into the Main Reef stopes.

At the Windsor the South reef hanging began to crush a fortnight before the main caving.

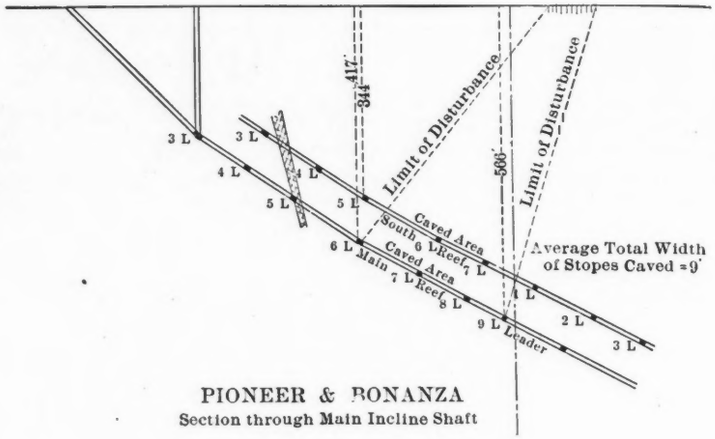
At the Treasury, about two months before the occurrence, the western shaft pillar at the fourth level began to show signs of taking weight. The adjoining stopes had been standing for about seven years and probably the pillars would have sufficed to sustain any ordinary pressure. Just at this point, however, there is a synclinal fold extending right across the mine which pitches sharply up on its southern dip against a strongly developed fault plane with broken ground, consequently the roof required more support than would usually be the case. Eventually the hanging wall of the South Reef fell in large blocks, crushing in the underlying stopes with it; another and severer fall took place a week afterward.

Stresses in Deep Masses of Rock

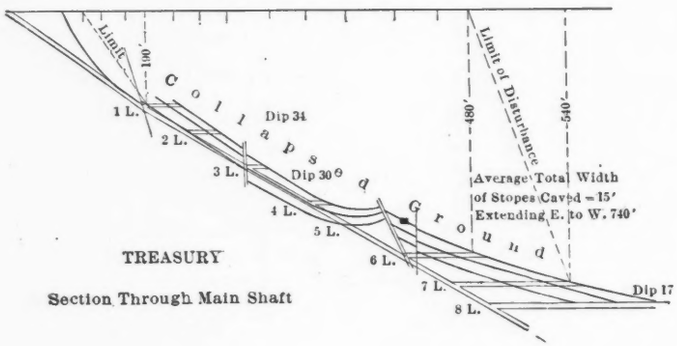
The question of the stresses set up in deep masses of rock unsupported for hundreds of feet horizontally is a very complicated one. In the extreme case of steeply inclined faulting planes or dikes cutting the roof near the supports or abutments and dipping away from each other as they descend, there would be practically nothing to carry the huge wedge above, while, where the strata are unfaulted, one would be justified in considering the mass as a huge slab supported on two or more sides or as a lever hinged at the bottom of the workings.



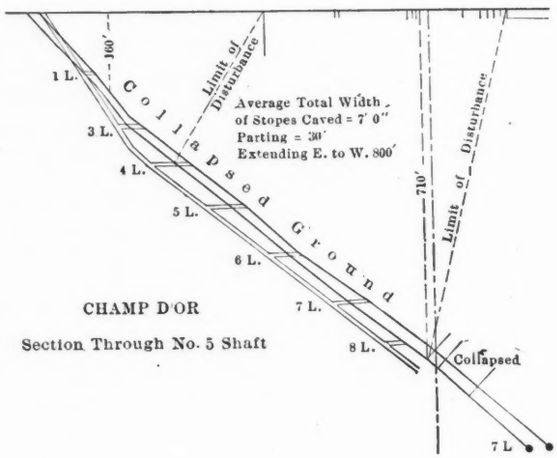
NEW HERIOT
Section through Main Shaft



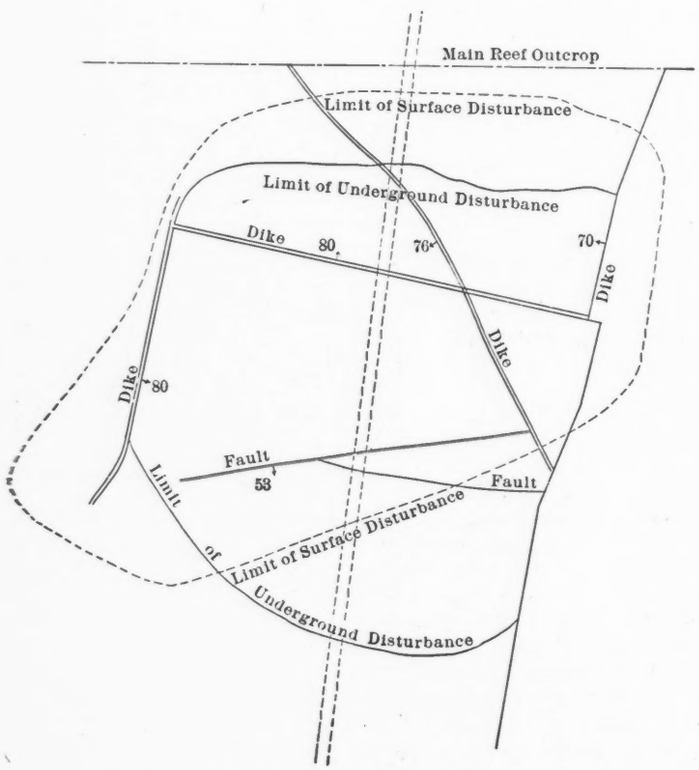
PIONEER & BONANZA
Section through Main Incline Shaft



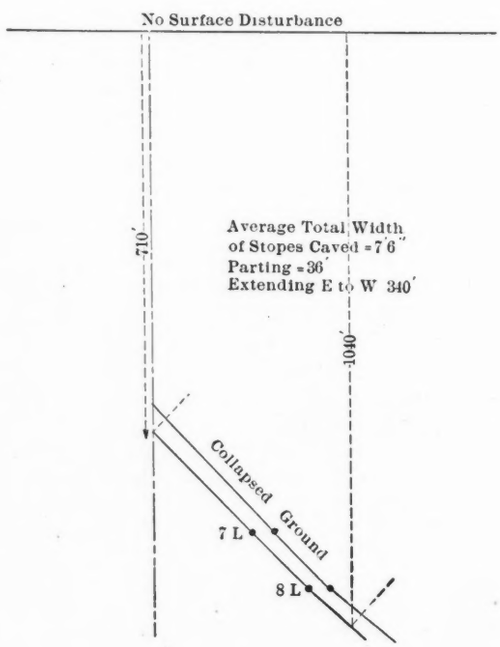
TREASURY
Section Through Main Shaft



CHAMP D'OR
Section Through No. 5 Shaft



TREASURY JUMPERS
Plan



FRENCH RAND
Section 340 ft. West of Champ D'or Section

SECTIONS OF WITWATERSRAND MINES

Isolated pillars stand little permanent chance of supporting deep masses of rock. The latter is never perfectly rigid and must tend to sag in some degree between its final supports, and the pillars must in time scale and crumble. It is true that over very extensive areas the pressure on the roof of an excavation, assuming the beds to be horizontal, will become, in time, equal to the weight of the superincumbent strata; under no circumstances is it immediately so, since the overlying beds must have some carrying strength.

Crushing Strength of Quartzite

There must therefore be a limiting depth dependent upon the crushing strength of the rock which forms the support at which no excavation can be kept open indefinitely. Herewith is a tabulated statement of certain tests undertaken by the Johannesburg municipality to determine the compressive strength of local quartzite. (Table I.)

TABLE I. COMPRESSIVE STRENGTHS OF QUARTZITE CUBES.

Locality.	Level Feet.	Dimensions. Inches.	Preparation of Faces.	Area Square Inches.	Total Pressure. Short Tons.	Total Pressure. Lb. Per Sq.In.	First Fracture. Short Tons.	First Fracture. Lb. Per Sq.In.	Specific Gravity.	How Pressure Was Transmitted.
Robinson G.M. No. 2 Shaft	1,000	4⅛x4⅛x4	Two opposite faces chisel dressed not truly parallel. Other faces undressed.	19.12	77.0	8,054	18.6	1,945	2.84	Steel plates
Salisbury G. M.....	1,000	4 x4 x4⅛		16.00	63.4	7,950	32.0	4,000	2.75	Steel plates
City and Suburban G. M..	1,000	3.33x3.32x3.25		11.11	53.2	9,577	34.9	6,289	2.98	Layer of sand
City and Suburban G. M..	1,000	4x4x4		16.00	46.0	5,750	39.0	4,875	2.69	Steel plates
Village M. R. G. M.....	1,500	4.36x4.22x4.20		18.40	45.8	4,978	29.4	3,196	2.77	Steel plates
Village M. R. G. M.....	1,500	3.69x3.75x3.60		13.84	59.36	8,580	45.81	6,620	2.88	Layer of sand
Village M. R. G. M.....	1,500	4⅛x4⅛x4⅛		18.06	77.5	8,581	36.0	3,987	2.89	Steel plates
Robinson G.M. No. 2 Shaft	2,000	3.66x3.72x3.70		13.66	50.73	7,427	42.17	6,175	2.80	Layer of sand
Robinson G.M. No. 2 Shaft	2,000	3⅝x4x3⅝		15.50	55.6	7,175	18.0	2,322	2.88	Steel plates
City and Suburban G. M..	2,000	4.11x4.19x4.25		17.22	55.6	6,457	38.6	4,483	2.69	Steel plates
Ferreira G. M.....	3,000	3.88x4.04x3.6		15.68	52.5	6,696	16.4	2,092	2.81	Steel plates
Robinson G. M.....	3,500	4.5 x4.51x4.35		20.29	91.6	9,029	69.0	6,804	3.04	Steel plates

From this it will be seen that the mean ultimate strength is 7521 and the mean specific gravity 2.83.

It must be noted in connection with these tests that the specimens were not accurately prepared and that the pressure per square inch which a cube of a few square inches area is capable of resisting becomes very much greater when that area forms a portion of the flat surface of a large block. With these considerations in view 10,000 lb. per sq.in. is here taken as the probable figure, although at great depths even 15,000 might be exceeded. The limiting depth at which excavations can be kept open indefinitely assuming the strata to be horizontal can be arrived at by ascertaining the hight of a column of rock whose weight will equal its compressive strength. The pressure exercised by a column of quartzite 1 ft. high and 1 sq.in. area is 2.83 × 0.036 × 12 = 1.222 lb. This divided into 10,000, and 15,000 gives 8183 and 12,275, respectively, as the limits of depth for the two strengths.

The accompanying table (II) shows the percentage that would under these conditions have to be left as pillars.

Where the strata are not horizontal the pressure per square inch of inclined area and the percentage of pillars can be found by multiplying the above figures by the cosine of the dip.

TABLE II. PROPORTION OF PILLARS.

Depth In Feet.	Pressure per Square Inch.	Percentage of Area as Pillars with Compressive Strengths of 10,000.	Percentage of Area as Pillars with Compressive Strengths of 15,000.
1,000	1,222	12.2	8.1
2,000	2,444	24.4	16.3
3,000	3,676	36.8	24.5
4,000	4,888	48.9	32.6
5,000	6,110	61.1	40.7
6,000	7,332	73.3	48.9
7,000	8,554	85.5	57.0
8,000	9,776	97.8	65.2
9,000	10,998		73.3
10,000	12,220		81.4
11,000	13 442		89.6
12,000	14,664		97.7

Mathematical Determinations

In the actual present-day conditions, where the stope areas are not very extensive, and where, therefore, the weight of the upper masses is supported by their own strength the problem can be approximately solved by calculating the sustaining power of square slabs of rocks, continuous on all sides, supported at regular intervals on pillars, of homogeneous material and uniformly loaded. On account of the different flexures that come in between the pillars definite formulas are very difficult to arrive at, the following are therefore merely suggested as a rough solution of such a case:

Bending.

1. $Fb = 106 \dfrac{K \times t}{l^2 \times w}$.

2. $L = 10.2 \sqrt{\dfrac{K \times t}{w}}$.

3. $W = 106 \times K \times t^2 - l^2 \times t \times w$.

Shearing.

1. $Fs = \dfrac{34.2 \times d \times k}{l^2 \times w}$.

2. $L = 5.85 \sqrt{\dfrac{d \times k}{w}}$.

3. $W = (34.2 \times d \times k - l^2 \times w)t$.

Where

Fb = factor of safety for bending.

Fs = factor of safety for shearing.

l = length of side of slab or distance from center to center of pillars.

L = length of side of a slab which will only support its own weight.

W = total distributed load which the slab will carry in addition to its own weight.

K = compressive strength of quartzite in pounds per square inch (10,000).

t = thickness of slab in feet.

w = weight of a cubic foot in pounds (180).

d = diameter of pillars in feet.

The accompanying table (III) shows a few results obtained by these formulas:

TABLE III. RESULTS.

Distance center to center of Pillars.	Thickness of Slab.	Bending. Fb	Bending. L	Shearing. Fs. Diameter of Pillars. 10	Shearing. Fs. Diameter of Pillars. 15	Shearing. L. Diameter of Pillars. 10	Shearing. L. Diameter of Pillars. 15
40	5	18.4	170	11.9	17.8	138	169
	10	36.8	340				
	20	73.6	680				
	30	110.4	1,020				
50	5	11.8		7.6	11.4		
	10	23.6					
	20	47.1					
	30	70.7					
60	5	8.2		5.3	7.9		
	10	16.4					
	20	32.7					
	30	49.1					
80	5	4.6		3.0	4.5		
	10	9.2					
	20	18.4					
	30	27.6					
100	5	2.9		1.9	2.9		
	10	5.9					
	20	11.8					
	30	17.7					

From the above it appears that slabs usually break by shearing and that the strength to resist this depends on the size and distance apart of the supports.

Advantages of Filling Stopes

The proposal to fill the stopes with surface material is, of course, carried into execution in hundreds of coal and ore mines, and could be largely adopted on outcrop mines with steep dips, and although such a system would probably prove an economic failure on the deeps and deeper deeps, there is much to be done in the way of utilization of waste sorted out underground.

Among the advantages of underground sorting and the subsequent building of the material into packs may be mentioned—increased safety of the mine, reduction in the number of pillars cut, consequently an increase in the percentage of ore-reserves recoverable and a decrease in the cost of breaking ground, increased value of rock hoisted, decreased quantity trammed and hoisted—for the latter alone the cost on the deeper deeps will probably be 2s. a ton—better ventilation, there being fewer openings through which the air can dissipate itself. Its chief disad-

vantages would be—increased labor and timber costs and the danger of losing reef.

The importance of some form of waste-filling system is becoming generally recognized, especially on the older outcrop properties. The Jumpers Mining Company may be quoted as a successful example of its adoption. In this mine 20 per cent. of the rock broken is sorted out in the stopes, and either built inside log pigsties or used as simple filling. In the upper levels large areas of reef are being extracted from subsided ground by a process of back-stoping and resueing. Briefly, the waste is blasted down first and forms the filling, being augmented where necessary with material from the ash dump; on this are laid ⅛-in. iron plates of a suitable size and ordinary coal sacks to form a temporary floor; the clean reef is then blasted down on this. Timber is only used for passes from the level below down which the ore is dumped, and no pillars being required a complete extraction of ore results.

In other parts of the mine where the dip is flatter and this method cannot be applied the sorted waste is used for filling inside log pigsties and for packing in between them, and it is owing to the support these afford that mining in this heavy disturbed ground is rendered possible. The costs for timbering and filling work out at 1s. 3d., and 3d. per ton crushed. No doubt, there are many other mines here where sorted waste is largely used for support, and others where the unfavorable conditions and the cost of its employment would render such a system impracticable.

Though it has been often advocated, no engineer has as yet ventured to introduce on the Rand on any large scale a system of mining analogous to the "longwall" of collieries which aims at the complete extraction of the mineral, leaving no solid pillars to interfere with the regular settlement of the hanging wall on the pack. With the increase of worked areas and depths some modification of this method may eventually have to be adopted.

Some Practical Suggestions

As our present methods are not likely to be departed from for some time it would be well to consider in what way they can be made to afford more protection. In the first place all shafts must be made absolutely secure. Where a vertical shaft intersects the reef series a pillar should be left all round of a minimum size of 100 ft. to the rise by 50 ft. on the other sides. Incline shafts should be sunk so that the roof is not less than 30 ft. below the nearest workable reef, the side pillars of incline shafts in reef to be at least 30 ft. wide. The maximum distance, center to center, of stope pillars to be 50 ft., and these pillars in the different reefs to be superimposed over one another so that their common axis is at right angles to the dip, or, in other words, they are to resist pressure acting at right angles to the roof. Their minimum diameter to be 10 ft. Both sides of faults and dikes, or other well-developed planes of weakness to have a liberal supply of pillars. Special attention to be paid to underground sorting and to the deposition of the resulting waste.

Water should be kept to the levels and other recognized drainage channels, and excluded from access to free stope footwalls; by converting the dry cementing material between the bedding planes into clay, water is a potent factor in bringing down ground. The upper reef to be stoped in advance in order that the other faces may follow on in undisturbed ground, but where an efficient filling system is used the lower reef may be stoped in advance, as a slight settlement will tend to ease the reef above and permit of easier breaking. Should a subsidence unfortunately occur all resulting surface cracks must be well rammed in and the filling kept slightly above the surrounding level.

These suggestions may increase expenses, but low working costs can never be defended if there is any possibility of mining operations becoming in any way hampered or endangered by a too zealous economy. In conclusion, I wish to emphasize the importance of noting and placing on record all the facts relative to a subsidence while the indications are still fresh.

British Columbia Mines in 1906*

The Annual Report of the Minister of Mines for British Columbia for 1906 contains the usual statistical tables showing details of mineral production and values, customary review of the year's operations and progress, reports of gold commissioners and other district officials, and several special reports, chief among these being that of William Fleet Robertson, provincial mineralogist, on a journey he made last summer from Essington to Edmonton, via Skeena river, Babine and Stuart lakes, and Peace river. A new and useful feature is the inclusion for the first time of a list of the metalliferous shipping mines of British Columbia, arranged according to districts and showing name, locality, owner or agent and address of same, and character of ore. This list is largely restricted to mines that shipped ore in 1906.

The report is freely illustrated with well-finished half-tone views, sketch maps, diagrams, etc. Prominent among these are the reproductions of 34 of the photographs taken between Essington and Edmonton, and these are of particular interest now that preparations are being made for the opening up of the extensive area of country known as the Peace river district.

Of the statistical tables, the accompanying will serve to show the mineral production for 1906 in comparison with that of 1905 and 1904, respectively. The value of the total production of British Columbia from 1852 to 1906, inclusive, was $273,643,722 in estimated value.

MINERAL PRODUCTION BY DISTRICTS AND DIVISIONS.

Location.	1905.	1906.
Cariboo Mining Division ..	$300,000	$355,800
Quesnel Mining Division..	96,000	39,600
Omineca Mining Division.	10,000	10,000
Total Cariboo District	$406,000	$405,400
Cassiar District.....	504,372	555,599
East Kootenay District	5,339,154	5,171,024
Ainsworth Mining Division	100,273	268,111
Nelson " "	532,564	515,709
Slocan " "	970,544	532,228
Trail Creek " "	3,672,878	3,223,587
Other Divisions.....	145,650	120,717
Total W. Kootenay Dis.	$5,421,909	$4,660,352
Lillooet District.....	32,584	20,314
Osoyoos, Grand Forks and Greenwood Divisions....	6,356,410	8,698,470
Similkameen "	1,533	2,624
Yale "	125,461	78,617
Total Yale District...	$6,483,404	$8,779,711
Coast District (Nanaimo, Alberni, Clayoquot, Quatsino, Victoria).....	4,273,859	5,382,146
Total by Districts.....	$22,461,375	$24,980,546

MINERAL PRODUCTION OF BRITISH COLUMBIA.

Mineral.	Customary Measure.	1905. Quantity.	1905. Value.	1906. Quantity.	1906. Value.	Total Production Includ'g 1906.
Gold, placer.....	Ounces.	48,465	$ 969,300	.....	$ 948,400	$68,721,103
Gold, lode.....	Ounces.	238,660	4,933,102	224,027	4,630,639	41,015,697
Total gold.....			$5,902,402		$5,579,039	$109,736,800
Silver.....	Ounces.	3,439,417	1,971,818	2,990,262	1,897,320	25,586,008
Lead.....	Pounds.	56,580,703	2,399,022	52,408,217	2,667,578	17,625,739
Copper.....	Pounds.	37,692,251	5,876,222	42,990,488	8,288,565	35,546,578
Zinc.....	Tons.	9,413	139,200	654	17,100	*a*
Total metalliferous..			$16,288,664		$18,449,602	$179,495,125
Coal.....	T. 2240 lb.	1,384,312	4,152,936	1,517,303	4,551,909	79,334,798
Coke.....	T. 2240 lb.	271,785	1,358,925	199,227	996,135	
Other materials....			660,860		982,900	5,813,799
Total production....			$22,461,325		$24,980,546	$273,643,722

a Not included in report.

The development of electric power in mining in Mexico is shown by the records of shipments of Westinghouse machinery to the three camps, El Oro, Guanajuata and Pachuca. Motors to the number of 600, having an aggregate capacity of 35,000 h.p., have been furnished.

*Report of the Minister of Mines for 1906.

Minnesota Iron-ore Shipments

SPECIAL CORRESPONDENCE

All, and perhaps more, of the increased shipment of iron ore for this year is coming out of the Mesabi range, and the activity there is vast. The tremendous shipments that are planned for this year are tearing things to pieces all along that district, and there was never a year in which so many changes in the surface conditions were made. More mines are changing from milling and underground work to steam shovels, and bigger holes are being torn in the ground than in any previous season. As an instance of the sort of work going on, it may be interesting to note that during June 210,000 cu.yd. of overburden were moved off the Canisteo, the record month by at least 50,000 yd., and 125,000 yd. came out of the adjacent Holman property. At the Canisteo, Superintendent Greenway is working six or seven shovels in stripping. During May the removal at this mine was 150,000 yards.

Season schedules of the three Minnesota railways engaged in the iron-ore traffic have been made up and show some indication of what is looked for from Minnesota. The Duluth, Missabe & Northern road, which last year moved 11,220,000 tons of ore, is scheduled for a total traffic this year of about 14,000,000 tons; and the Duluth & Iron Range will handle, if it comes up to schedules, almost precisely 1,000,000 tons more than the 8,200,000 it moved during 1906. The Great Northern will also increase its record of 6,130,000 tons by nearly a million tons. In other words, the two Minnesota iron ranges, from which the total shipments of 1906 were 25,600,000 gross tons, are scheduled this season for a business approximating 30,000,000 tons. These are the estimates made soon after the beginning of the shipping season, by shippers, of the ore sold by them, or that they expect to forward during the year. They are, to be sure, liable to be changed, and are quite pliable, but the shippers endeavor to reach them, and in some cases exceed the early estimates. Last year several independent shippers were able to increase shipments materially over the estimates made early, and on which the railroads based car allotments and dock space. It may be considered settled that, allowing for unexpected contingencies of strikes, accidents to transportation facilities and the like, nearly 29,000,000 tons of ore may be moved from Minnesota this year. Michigan districts last year shipped 12,800,000 tons, and have averaged for the past three years not far from 11,200,000 tons. They are easily capable of a production in 1907 of 12,500,000, and will doubtless reach that amount, barring accidents and unforeseen contingencies.

ORE SHIPPING PIERS

The various roads that have been erecting new shipping piers have completed them, and all are now in service, resulting in better facilities, and a more easy handling of the traffic. It is probable that during July, the shipments of both the Great Northern and the Duluth & Iron Range roads, will show a marked increase over June, when they moved a combined total of 2,522,000 gross tons. No. 5 dock of the latter and No. 4 of the former, are new. The latter is of 100,000 tons capacity and contains 374 pockets, holding 250 tons each. As the cost of these docks is now well up to $3000 per pocket, the investment in one of them is no small matter. Formerly an ore pier cost on the average about $2000 per pocket, but that was with fir timber at $16 per thousand feet. Now it is $26, and it is a fact that to piece out for construction this season both companies have been compelled to pay as high as $40 for fir sticks. The constantly increasing cost of timber and other material has brought prices nearer the expense of steel for dock purposes, and the Duluth & Iron Range road is now preparing to erect a steel ore pier, the only wood in which will be lining for pockets. It will probably cost as much as to build three wood piers, and must, therefore, last about 40 years to show a profit over wood, if the freedom from danger of fire to docks structure is not considered. This danger is, however, very serious and might easily have a very marked effect upon shipments of ore and calculations of steel-making concerns. Fire that would now destroy one of the larger docks of either of the upper lake roads might curtail shipments to such an amount as to make a scarcity of steel the coming 12 months. The Duluth & Iron Range cannot make its new dock more than 142 pockets long, as the water grows very deep. It will soon begin driving piles for the foundation; these will be cut off 5 ft. below water level, and capped by concrete piers 10 ft. high, on which the steel structure, of channels, I-bars and angles will rest. It is expected to have it ready for next spring. The Great Northern also expects to build a new dock for 1908, and may use steel as its main construction material.

A new variety of mica, called Irvingite, has been discovered in the pegmatite veins in the vicinity of Wausau, Wis., and is described in the *American Journal of Science,* (June, 1907). The crystals vary in size from the fraction of an inch to over an inch in diameter, and have well developed basal cleavage and prominent prismatic partings. The mineral is extremely tough and elastic and fuses easily. Analysis shows the mica to contain a considerable amount of lithia and chlorine, and a relatively large amount of silica and soda.

Improved Transportation for Alaska

According to President Joslin, of the Tanana Mines Railway Company, which operates a narrow-gage railway between Fairbanks, Chena, and the surrounding creeks, about $450,000 will be expended for further construction and equipment this season. One proposed extension leaves Gilmore, taps the Chatanike and will have its terminus somewhere between Cleary and Chitnak creeks, the distance being about 20 miles. Some experiments will be tried with gasolene motors, and if successful it is thought a two-hour service will be maintained between Fairbanks and the creeks.

Transportation of supplies is the great problem of most mining camps, and nowhere has this difficulty been more keenly felt than in the far North. It is therefore with some satisfaction that the miners and operators of the Yukon basin watch the growth of the river steamer service. The value of the Yukon trade is now coming to be more generally recognized. Of two steamship companies recently formed the Yukon Alaska Transportation Company is organized under the laws of Maine with a capitalization of $1,000,000. The company will soon put a fleet of steamers on the Yukon to operate between Dawson, Fairbanks and St. Michael. Andrew F. Burleigh is named as president. The Merchants & Miners Transportation Company, a corporation organized at Seattle, expects to operate a fleet of vessels along the Yukon to St. Michæl and thence to Nome. The company is now purchasing boats in San Francisco and Portland. Of the full fleet of nine which it expects to put on, three will be put into service this summer. Two are Columbia river boats formerly plying between Portland and Astoria.

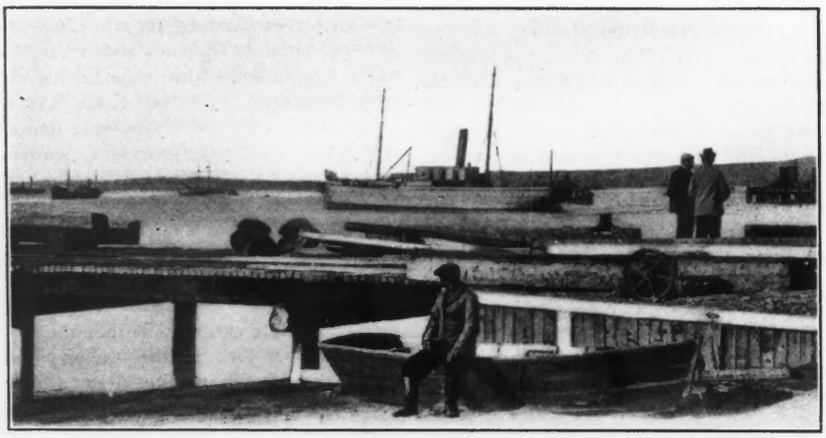
The Guggenheim-Morgan interests have secured control of the Alaska Steamship Company and the Northwestern Steamship Company. The two companies have been merged, but will continue to operate under their former names. The same interests control the Alaska Central Railroad and lately have purchased the title to the Valdez, Cordova & Catella railroad and have also secured a steamship line belonging to the latter. These roads have but little mileage constructed but own rights-of-way and terminals. They seem in no hurry to push construction. It has been further reported that the Guggenheims now hold a controlling interest in the White Pass Railway and the river steamers which operate between White Horse and Dawson; but this has not been confirmed. The White Pass road has been owned chiefly in England.

There are approximately 600 lb. of raw material required to produce one barrel of Portland cement clinker.

Placer Mining in Southern Chile and Tierra del Fuego

Special Correspondence

The gold placer workings in Chile at the southern extremity of the South American continent, and those on the island of Tierra del Fuego, are probably further south than any others in the world. The richest of these discoveries were made at latitude 55 deg. 20 min. south and 67 deg. west of Greenwich on an island known as Lennox island. About 25 years ago gold was discovered on this island, and worked successfully by seafaring men who happened to be in that vicinity, and who made the first discoveries. The placer gold was found upon the beach, and seemed to be the result of concentration caused by the action of the sea.



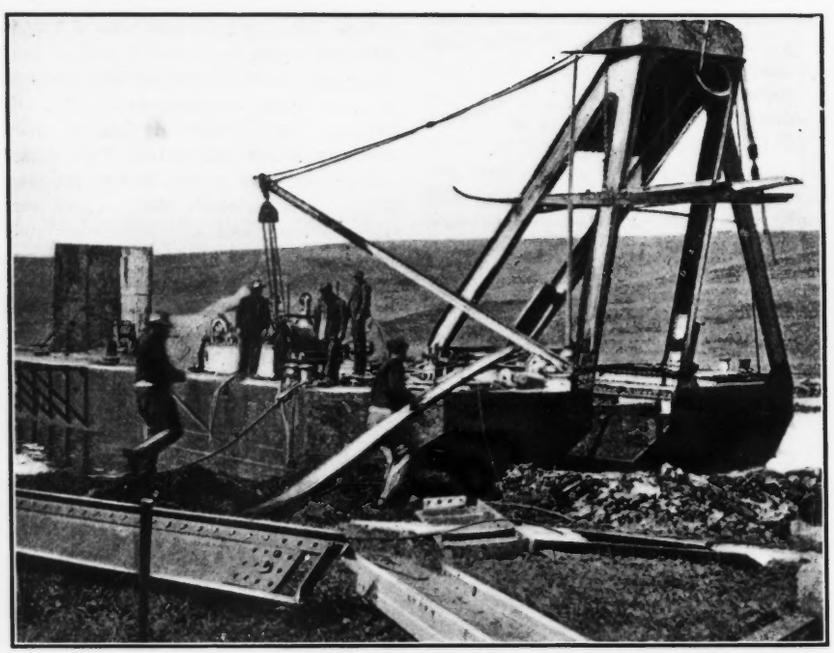
PORT OF PUNTA ARENAS

The diggings were very rich in years past, and many small fortunes were taken out by the miners, but at the present time no work of this kind is being carried on there, all the rich deposits or pockets having been worked out. There are, however, also lower-grade beach sands, and an English company has taken up a tract of ground, and is at present installing a dredge which will be completed, and in running order during the coming season.

The more notable of the placer mines are situated on the island of Tierra del Fuego, and on the Straits of Magellan, in latitude 53 deg. 20 min. south, and longitude 70 deg. 40 min. west. The formation of this gold-bearing district is an auriferous gravel which covers the whole of the region. While all of this is not pay gravel, there are numerous rivers, which seem to have concentrated and deposited gold in different localities in quantities sufficient to pay, where modern machinery can be used. There are localities on the Straits of Magellan where placer mining has been carried on by hand, and it has paid fairly well, but no fortunes have been taken out, as was done on Lennox island.

Operators in the Field

A number of large companies are operating here. One large English company and several other companies have been organized in Buenos Aires and Valparaiso to work with modern machinery. Five dredges and one hydraulic plant have been installed. While not all have been successful, some have shown promising results. One company in particular was recently handling, with one dredge, 1200 cu.yd. per day of gravel, that would average 30c. per yard, at a cost of about 7c. a yard. It is the opinion that there are large tracts of land which can be dredged, and which will run from 20 to 30c. per cubic yard. While these tracts have been taken up by individuals, and are being held for speculative purposes, there is no doubt that some can be had on reasonable terms.



MOUNTING A DREDGE, TIERRA DEL FUEGO

The general impression that this region is cold and eternally frozen up is entirely wrong. The thermometer seldom registers lower than 15 deg. below zero F. in winter, and in the summer season, the thermometer never goes higher than 80 deg. F. The climate is healthful, although disagreeable in the summer on account of heavy and frequent rains.

Punta Arenas

Punta Arenas is the principal port and treaty point, and has a population of about 10,000 inhabitants. It is not like most South American towns, but is laid out with wide streets like any modern North American town. It has a system of water works, sewerage and plenty of hotels. There are two banks; the municipality owns a large theater; and there are a number of large buildings, which would be an ornament to any town of its size. There is also a coal mine about four miles from Punta Arenas. A small railroad line from the mine runs directly to a wharf, where the coal can be delivered into small vessels from cars loaded at the mine.

The cost of living is as low, if not lower, than in the United States. The fact that Punta Arenas is a free port no doubt has something to do with this. Outside of gold mining, the principal industry of the country is sheep farming. The price of meat is very low, because there are no good markets; meat is really the cheapest food to be had. Regular steamers run from Liverpool, stopping at Punta Arenas every fortnight on their way to and from Valparaiso; there is also a line of German steamers running directly between Hamburg and Valparaiso, calling at Punta Arenas.

All business transactions carried on with foreign firms are done in English currency, but the unit of value in Chile is the peso, which fluctuates from 16 to 19

pesos per £1 sterling. Anyone contemplating going there should buy English gold, for merchants and banks pay no more for $5 gold than for an English pound.

Unskilled native labor can be had for from 4 to 8 pesos per day. A great deal of skilled English labor is contracted for at Buenos Aires, there being many skilled mechanics there.

Operations of the Yukon Consolidated

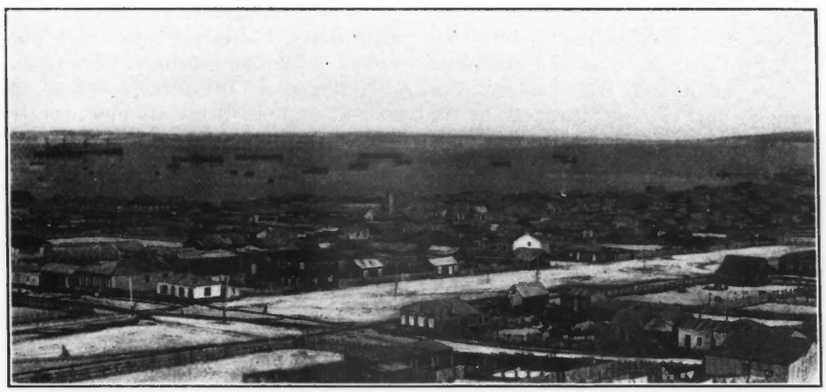
SPECIAL CORRESPONDENCE

The Yukon Consolidated Gold Mining Company, which represents Guggenheim interests, has begun work on all its various projects. The four dredges installed last year are working continuously. Pits for four additional dredges are to be excavated this summer, and if the material arrives dredges will be installed. The new and old dredges are on lower Bonanza and on the lower Klondike creek, in the Yukon.

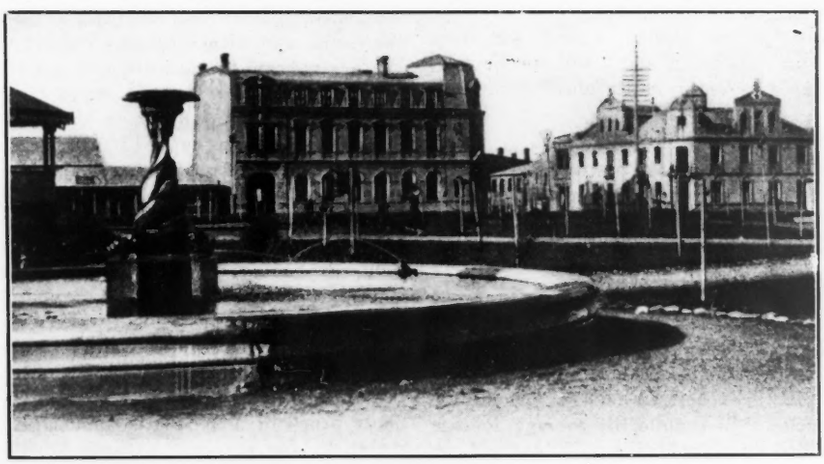
To work the narrower beds of gravel encountered farther up the creek a new scheme is being applied. If this proves successful no dredges will be installed along the upper narrower courses of the gold-bearing creeks. It consists of two steps: first, ground sluicing away the top soil, muck, etc., which is valueless so far as gold is concerned; and, second, hydraulicking the gravel down to bed-rock. After the top soil is removed, a trench or drain is cut, extending down into bed-rock several feet. Into the bottom of this drain, and below the bottom of the gravel bed, sluice boxes are placed. At the lower end of the drain a sump is dug in which a pump is installed sufficient to lift out all the water coming through the drain, and also an elevator to remove the gravels washed in by the hydraulicking process. By this means bed-rock is washed off clean. All pumps and elevators are to be operated by electric power transmitted from the company's power plant, on Twelve Mile creek.

It is claimed that this method has two important advantages over the dredge. Everything is removed from the bed-rock; the dredges, it is said, do not remove the rather large boulders sometimes encountered upon the bed-rock surface. An opportunity is also given to secure all the gold held in the surface of the bed-rock. This process has been used in the gravel beds at Oroville, Cal., and, it is believed, it will prove highly successful in the gravel beds of the north.

The Consolidated company has again commenced work on its big ditch line. Two dipper steam-shovels are now working and a third will be installed as soon as it arrives. The steel pipe for the inverted siphon across the Klondike river valley is arriving, and is promptly transferred to wagons and sent out to its place. Several million feet of lumber for flume purposes will be cut this year at the company's mill on Twelve Mile creek. A large proportion of this will be held till winter and then freighted to the ditch by means of sleds.



PUNTA ARENAS, TIERRA DEL FUEGO



BANKS AT PUNTA ARENAS

The new buildings of the Clausthal Bergakademie were opened on May 14 to 16 in the presence of numerous distinguished guests and old students of the school.

International Petroleum Congress

Horace G. Knowles, American minister to Roumania, states that the third International Petroleum Congress and exposition will be held in Bucharest in the early part of September, and that the Roumanian government extends an invitation to the United States to send delegates to the congress and for American manufacturers to participate in the exposition. It is expected that the oil producers and refiners, the manufacturers and dealers in machinery, appliances, and devices for producing, refining, and using petroleum from every country in Europe and Asia will attend or be represented at this congress. The minister adds:

"In view of the very short time intervening and in order to accommodate any American manufacturers who may desire to exhibit their products, I will have reserved in the exposition hall sufficient space for such exhibits. I will also arrange with some competent person to take charge of the American section, and exhibits can be forwarded to 'American Representative, International Petroleum Congress and Exposition, in care of American legation, Bucharest, Roumania.' Shipments can be made from New York by White Star line to Liverpool and Johnston line to Bucharest, or the Mediterranean Steamship Company, from New York direct to Bucharest. Machinery, appliances, devices, motors, engines, lamps, stoves, photographs, pamphlets, etc., will be received and every effort made to give them the best showing possible in the exposition at a nominal expense to the exhibitor.

Johnson, Matthey & Co., Ltd., of 48-81 Hatton Garden, London, have succeeded in producing iridium and rhodium of such extreme purity as to render these hitherto practically unworkable metals so malleable as to enable their being used for the manufacture of such apparatus as basins, tubes and flasks. These metals, having a very high melting point, and being almost unattacked by acids, should prove of great value in chemical research.

Method of Excavating Rock in Large Masses

In Removing Red Granite from a Railroad Cut, 25-foot Holes Were Loaded with 325 Pounds Black Powder or 150 Pounds Dynamite

BY GEORGE C. McFARLANE*

The following notes are taken from experience in heavy rock excavation on the line of the Grand Trunk Pacific Railroad in the region north of the Lake of the Woods. The rocks of this locality consist of hard granites, traps and diabase of the Laurentian and Huronian systems. Owing to the extreme hardness of the rocks the expense of drilling is very high, consequently deep holes and heavy blasts are used wherever permissible.

Hand and Machine Drilling

In the smaller cuts hand steel is used for putting down the blast holes, which are often drilled to a depth of 30 ft.; 1-in. steel is used, and the same gage, 1⅜ in., is carried throughout. The holes are started with two hammers on a drilll, and when down 5 or 6 ft. the drill turner also swings in with a hammer; the rapid blows jump the steel enough to bore a fairly round hole. The average depth drilled per day by three men is 16 to 29 ft., and 45c. is the average price paid to foot drillers.

Steam drills are generally used in the big cuts, a 3-in. machine drilling to 25 ft. and a 3¼- to 3½-in. machine drilling the depths of 30 and 35 ft. In using steam the only change required for an air drill is a steam front head and thin paper gaskets in the outer joints. Flexible metal steam hose is used exclusively, the oiler being placed at the end of the steam pipe to lubricate the hose as well as the machine. When several drills are run from the same boiler, a sight-feed lubricator can be placed on the main steam pipe. This saves the runner the bother of oiling and insures a regular and continuous lubrication of the hose and machines.

The life of the metal hose is about six months, as against two months for the best grades of rubber steam hose. When drilling over 20 ft. the steam pressure is run up to 115 lb. or more. During the past winter drills were operated when the temperature was 45 deg. below zero, some of the machines being 500 to 600 ft. from the boiler.

Drill Steel

For deep holes the drill steels are made up for 24-in. runs, the starters being gaged 3½ in. and the gage being dropped ⅛ to 3/16 in. for each succeeding steel, so as to finish the hole about 1¼ in. The bits are forged with long, heavy shoulders and very little clearance to reinforce the corners of the cutting edge and prevent excessive wear in the gage. The last two or three drills of the set are usually fitted with blunt chisel bits.

The cheaper grades of drill steel are used almost exclusively; the high-grade brands of bar and cruciform steels require to be forged and dressed at low heat, and even when properly dressed and tempered wear as fast the the low-priced drills. The latter, while they can be forged at a much softer heat, will not stand excessive upsetting, and it is often good practice to weld on short lengths of heavy steel to form the bit.

In tempering, the bit should be toughened by heating to a bright red heat, then plunged into the water ⅝ to ¾ in. and held there 15 to 20 sec., soused a few times until the part out of the water is cooled sufficiently to show no color, and finally immersed in the tub until cold. If tempered in this manner a drill will show ½ in. of cutting edge, with a fine gray temper backed by softer tough metal.

Method of Drilling

The usual practice is to drill the blast hole on the center line of the cut. A 15-ft. hole is set back 15 ft. and a 3-ft. hole 25 ft. from the face of the cut. I prefer to drill two holes 10 ft. on each side of the center line and burdened not to exceed 15 ft. In this case very little drilling is necessary to square up the bottom of the cut. Where the cut is much more than 30 ft., it is best to take it out in two benches. In granite the average footage drilled by a machine is 30 ft. per 10-hour shift, while in trap and diabase 20 to 25 ft. is considered a good shift's work.

After drilling, the bottom of the hole is chambered to the required size by springing with dynamite. In the bottom bench, where a heavy lift is required, no more than a foot of the hole is chambered; in the upper benches it is permissible to chamber 2 or 3 ft. of the bottom. In the first case each spring would be loaded until the dynamite raised 8 or 10 in.; in the second, a 12- or 15-in. raise would be permissible. The first springs are held down by 5 or 6 ft. of water tamping and detonated by a cap-and-drop fuse. The fuse, usually 12 in. long, after being split is held under water for 5 or 6 sec. to kill any fire hanging in the taping, and then dropped into the hole. Unless the drop fuse were dipped in water, it might ignite dynamite adhering to the sides of the hole, causing a premature explosion. After each water spring, the hole is blown out with steam or pumped out with a sludge pump. Usually two or three water springs will be used; the succeeding springs are tamped up with sand and detonated with a battery.

Two exploders are always placed in a hole, as it would be exceedingly hazardous to draw the tamping in case of a misfire. Misfires with a battery are, however, extremely rare. Usually the spring will not throw the tamping if more than 6 or 7 ft. are used.

Blasting

Springing is continued until it is estimated that the pocket is large enough to hold the blasting charge. The charge is computed from the number of cubic yards the blaster estimates will be thrown out. The springing opens up the rock jointing and indicates very closely where the burden of the shot will cleave from the solid and the successive springing charges indicate the ratio of enlargement of the pocket. At least 60 lb. of black powder or 40 lb. of dynamite should be loaded for each 100 cu.yd. of the shot.

The following are typical springing and blasting charges: (1) A 25-ft. hole, burdened 18 ft., in the bottom bench of a 45-ft. cut—first spring, two sticks (60 per cent. dynamite); second spring, four sticks; third spring, 10 sticks; fourth spring, 25 sticks; fifth spring, 60 sticks; sixth spring, 100 sticks; seventh, 180 sticks; blast charge, 325 lb. black powder. (2) A 25-ft. hole, burdened 12 ft., in the upper bench of a 45-ft. cut—first spring, six sticks (60 per cent. dynamite); second spring, 20 sticks; third spring, 60 sticks; fourth spring, 125 sticks; blast charge, 325 sticks (150 lb.) of 40 per cent. dynamite.

The effective force of the blast is a short powerful blow equivalent in length to about one-half the diameter of the powder charge. This blow is transmitted in all directions. In the immediate vicinity of the powder charge the compression is so great as to crush and pulverize the rock. As it expands toward the free faces its energy becomes absorbed by the elasticity of the rock, and the recoil from the compression throws the rock out, the propulsion being assisted by the backlash of the wave of compression from the solid behind the shot. The rock is heaved out not so much by direct propulsion from the seat of the explosion as by the momentum of the transmitted shock which is greatest near the free faces. The natural rock jointing materially influences the results of a heavy blast. Large irregular

*Mining and civil engineer, Kenora, Ont.

jointing such as is found in the granite where quartz and feldspar predominate cause the most trouble.

Conditions Affecting the Blast

The heavy springing opens up the jointing and the blocks shift irregularly on the bed planes, often completely closing off the drill hole. Here is one great advantage of machine-drilled holes, for owing to their greater diameter they permit of considerable shifting before the hole is cut off. The effect of floors and slips between the explosive and the free faces is to cause the rock to cut off at one of these floors while the rock around the explosive is merely crushed and shattered. These slips and floors deaden and deflect, or at least imperfectly transmit, the shock of the explosion. On the other hand if the slips and floors are behind and under the blast charge, the momentum of the rock ahead of the shot would tear back to these slips and floors, giving a great deal more muck than would be expected.

The slips and floors put a practical limit to the size of the blast. I find that this limit is reached with 30-ft. holes, burdened 15 ft., and throwing out from 400 to 800 tons of muck.

The remark is often made that water is the best tamping for dynamite. As a matter of fact I note that, in springing, water tamping is always blown even if the hole is full of water, whereas 7 or 8 ft. of sand tamping is seldom blown out unless the rock is very tough and the bottom of the hole dead on the solid.

Loading

The following precautions should be observed in loading blast holes. The loading stick should be a single straight-grained stick 1¼ in. in diameter at the middle, tapering to 1 in. at the ends. It is made by dressing down a long tamarack sapling. Before loading a hole, put in the loading stick for ten minutes and see that it is cold for its entire length as it is withdrawn, because a hole may be cold on the bottom and hot a few feet above. After a heavy spring the holes should be allowed to cool for hours; sometimes the gases catch fire after an explosion and burn quietly for an hour or more in the hole. Never load partially thawed dynamite, and in loading a ragged hole do not skin the cartridges. Simply slit the paper in two or three places. If loose dynamite is put in, it lodges in crevices along the sides of the hole and is liable to be exploded by the blow pipe or churn drill used to draw the tamping after firing the springs. Use exploders with lead wires as long as the hole.

Ragged holes are more easily loaded with black powder than with dynamite. I have loaded holes in which the springing had shifted the rock so that a loading stick could not be shoved down, by simply pouring in the powder, lowering the primer and lead wire and then pouring down dry sand. Of course this is taking big chances, for the hole is liable to plug up with the first keg. Black powder can be used only when the hole is dry. A wet hole can often be dried by firing a few sticks of dynamite in the pocket. Black powder requires more tamping than dynamite. Not only the hole itself but all crevices showing in the rock above the blast should be tamped with dry sand.

I find that three kegs of black powder are equal to 50 lb. of 40 per cent. dynamite. Neither dynamite nor black powder will throw a good shot if the rock has been shaken up too much by previous springing. With large burdens the heavy springing opens up the seams so much that excessive powder charges are required to make a shot; and the explosive is liable to kick back through a seam and leave a standing shot. The muck from a very heavy blast is usually coarse and requires much block holing or bulldozing before it can be handled. The most economical shots are from holes 16 to 24 ft. deep and burdened from 12 to 15 feet. It is very seldom that a heavy blast throws the rock far, the bulk of the muck being heaved out 20 to 50 ft., and very rarely are any fragments thrown more than 150 feet.

Results of the Blast

About 20 per cent. of the muck from a heavy shot is shovel dirt; about 30 per cent. can be lifted or rolled on the boats or cars by the muckers; the remaining 50 per cent. consists of large blocks from 1 to 50 yd. in volume. A derrick or team of horses will handle blocks up to 1½ yd., and occasionally blocks of 2½ to 3 yards. All larger than these must be broken up either by block holing or bulldozing. Block holes are drilled from 6 to 48 in. deep, a 6-in. hole for a 1½-yd. rock and a 48-in. hole for a 30-yd. rock. Some contractors use baby drills for block holing, but I believe hand steel to be preferable. Long flat rocks are broken by bulldozing, about 1 lb. of dynamite being required per cubic yard. If the stones are round or rhomboid it is not good practice to bulldoze them.

Handling Loose Material

Three methods are in general use for handling the broken rock: for short hauls, pole tracks and stone boats are used; on long hauls and light cuts, hand loading on low cars; and on heavy cuts the cars are loaded with derricks operated by hand, horse or steam power. Since the rock has to be raised only the hight of a car, a hand or horse derrick loads almost as fast as a steam derrick. The derricks are set up on the edge of the cut and require to be shifted for each 40-ft. advance of the cut. It requires six men one day to take down, set up, and ballast a 35-ft. derrick.

Stone boats running on pole tracks furnish the cheapest means of taking out rock where the haul is less than 600 ft. In winter the haul may be extended indefinitely. The track is made by laying two lines of tamarack poles 5 ft. 6 in. apart, for a two-horse team; or 3 ft. apart for a three-horse team. In the former cases both horses walk inside the pole track; in the latter only the middle horse. The poles should be fairly straight, 20 to 30 ft. long and 4 to 8 in. in diameter. The butt end of one pole is hollowed out for a foot or so to receive the top of the next pole, and the joint fastened with a 2-in. hardwood pin. The upper part of the poles are peeled, and even joints are kept so that the track can be shifted from side to side of the fill.

A tongue switch is put in a couple of hundred feet from the face of the cut and a double track run to the muck pile. The stone boats are made of 10 or 12 tamarack logs about 7 in. in diameter and 8 ft. long, held together by two 1¼-in. hinged rods. The logs run crosswise on the pole track; on the under side of the boat the ends of the logs are slabbed down 1½ in. to keep the boat from running off the track. Eye-bolts are put in at the ends for hauling. In winter the pole track is iced and in warm weather greased with black oil, about 1 gal. per 100 ft. being required each day. In winter a team will haul a 3-yd. rock and in summer a 1½-yd. rock. The average load on a 6x8-ft. boat is about ⅞ cu.yd., weighing 4000 lb. On a 500-ft. haul or less a good team and six men will take out from 40 to 60 boats per shift.

Cost of Excavating

In the accompanying table the cost of excavating and moving a cubic yard (4400 lb.) of red granite, steam drills being used for drilling and stone boats and pole tracks for hauling out the rock, the average hight of the cut being 46 ft. and the average haul 500 ft. The item of general expense covers the cost of hauling in the outfit and of building log camps for men, etc. Aside from this item the actual cost of breaking and hauling the rock is 87c. per cu.yd., or a little less than 40c. per ton.

Cost of Excavating Red Granite

	Per Cu.Yd.
Breaking.	
Drilling blast holes	$0.048
Labor, springing and loading holes	0.030
Dynamite	0.084
Black powder	0.024
Wire exploders	0.008
	$0.194
Handling the Broken Rock.	
Block holing and bulldozing	$0.104
Loading	0.308
Haulage	0.165
	$0.577
General expenses	0.250
Total	$1.021

The Chemistry of the Iron Blast Furnace

The Successive Chemical Reactions Which Occur as Iron Ore Is Reduced to Pig Iron in the Blast Furnace

BY BRADLEY STOUGHTON*

In the first article of this series[1], the construction of the blast furnace and its appurtenances were outlined; in the present one the chemical reactions which take place when the furnace is in operation are traced and explained.

The large engraving herewith illustrates one of the first steps in supplying the furnace with the raw material on which it works. It shows a steam shovel at work on one of the great deposits of iron ore on the Mesabi iron range in Minnesota.

Chemical Reactions in the Upper Levels

As soon as the iron ore enters the top of the furnace, two reactions begin to take place between it and the ascending gases:

(1) $2Fe_2O_3 + 8CO = 7CO_2 + 4Fe + C.$

(2) $2Fe_2O_3 + CO = 2FeO + Fe_2O_3 + CO_2.$

These reactions continue with increasing rapidity as the material becomes hotter. The carbon formed by reaction (1) deposits in a form similar to lamp-black on the outside and in the interstices of the ore. This reaction is, however, opposed by two reactions with carbon dioxide gas:

(3) $Fe + CO_2 = FeO + CO;$

(4) $C + CO_2 = 2CO.$

Reaction (3) begins at a temperature of about 575 deg. F. which is met with about 3 or 4 ft. below the top level of the stock, and (4) begins at about 1000 deg. F., or 20 ft. below the stock line. Reaction (4) is so rapid that the deposition of carbon ceases at a temperature of 1100 deg.

All the way down the ore is constantly losing a proportion of its oxygen to the gases. At higher temperatures than 1100 deg. F., FeO is stable and practically all of the Fe_2O_3, (or Fe_3O_4 if magnetite is being smelted), has been reduced. At 1300 deg. F. solid carbon begins to reduce FeO. Practically all the iron is reduced to a spongy metallic form by the time the temperature of 1475 deg. is reached. This is about 45 ft. from the stock line and less than 30 ft. above the tuyeres. At 1475 deg. F. the limestone begins to be decomposed by the heat, and only CaO comes to the smelting zone. The foregoing facts are summarized in Fig. 1. It is not supposed that these figures are exactly correct for the different levels, and it is probable that they change from day to day and from furnace to furnace. It will be seen that the upper 15 or 20 ft. of the stock is a region of Fe_2O_3 and Fe_3O_4, gradually being converted to FeO by CO gas, and forming quantities of CO_2 gas. If these reactions are the only ones, the top gases would contain no CO, and have no calorific power, but reaction (1) produces both metallic iron and carbon, both of which reduce CO_2 and waste much energy as far as the blast furnace is concerned. Thus (3) $Fe + CO_2 = FeO + CO$, absorbs 2340 calories, but wastes

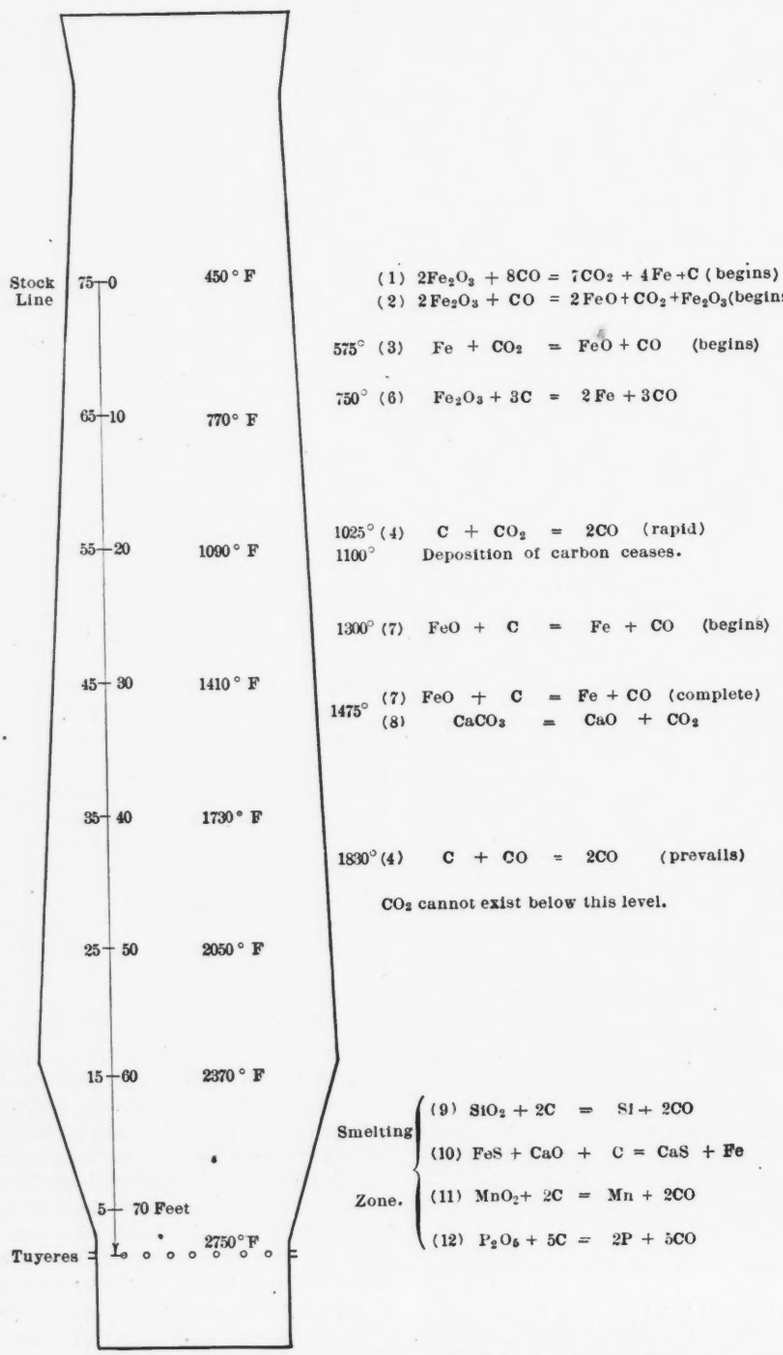


FIG. 1. DIAGRAM SHOWING CHEMICAL ACTION IN BLAST FURNACE

*Adjunct professor of metallurgy, School of Mines, Columbia University, New York.

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STEAM SHOVEL AT WORK AT STEVENSON MINE, MINNESOTA

68,040 calories, while (4) $C + CO_2 = 2CO$, absorbs 38,880 calories.

From 20 to 35 ft. below the stock line is the region of FeO, gradually being converted to metallic iron sponge by carbon. On the lower level of this zone the limestone loses its CO_2 which joins the other furnace gases. From 35 ft. down to the smelting zone is the region of metallic iron. This spongy iron is impregnated with deposited carbon which probably to some extent soaks into it and dissolves, in a manner like in nature, but not in degree, to the way ink soaks into blotting paper. This carburization of the iron reduces its melting point and causes it to become liquid at a higher point above the tuyeres than it otherwise would.

On reaching the smelting zone the iron melts and trickles quickly down over the column of coke, from which it completes its saturation with carbon. At a corresponding point the lime unites with the coke ash and impurities in the iron ore, forming a fusible slag which also trickles down and collects in the hearth. It is during this transit that the different impurities are reduced by the carbon, and the extent of this reduction determines the characteristics of the pig iron, for in this operation, as in all smelting, reduced elements are dissolved by the metal while those in the oxidized form are dissolved by the slag. Only one exception occurs; namely, that iron will dissolve its own sulphide, FeS, and, to a less extent, that of manganese, MnS, but not that of other metals as, for instance, CaS.

CHEMICAL REACTIONS IN THE SMELTING ZONE.

There is always a large amount of silica present in the coke ash and some of this is reduced according to the reaction:

$$SiO_2 + 2C = Si + 2CO.$$

The extent of this reaction will depend on the length of time the iron takes to drop through the smelting zone, the relative intensity of the reducing influence and the avidity with which the slag takes up silica. A slag with a high melting point, will trickle sluggishly through the smelting zone, and cause the iron to do the same to some extent, thus giving it more chance to take up silicon. A higher temperature in the smelting zone, which increases disproportionately the avidity of carbon for oxygen, will promote the reduction of silica. We can produce this higher temperature *by supplying hotter blast. A larger proportion of coke to burden*[2], will further promote this reaction, because this not only increases the amount of the reducing agent, but also raises the temperature, and therefore the chemical activity of this agent. Thus the coke has both a physical and a chemical influence in increasing the intensity of the reduction in the smelting zone. A basic slag, because of its avidity for silica, will oppose the reduction of silica, and is one of the principal means of making low silicon pig iron. This is in spite of the fact that the basic slags are sluggish, and therefore trickle slowly through the smelting zone, thus exposing the silica longer to reducing influence, and also increasing the temperature of the materials in this zone (1) by causing them to pass through it more slowly and absorb more heat, and (2) by reducing the level of the smelting zone nearly to the tuyeres, which confines the intense temperature to the smaller area, or, in other words, diminishes the passage of heat upward.

Sulphur comes into the furnace chiefly in the coke. It is partly in the form of iron mono-sulphide, FeS, and partly in the form of iron pyrites, FeS_2, which loses one atom of sulphur near the top of the stock and becomes FeS, which will dissolve in the iron unless converted to sulphide of calcium, CaS. This is brought about according to the explanation of Prof. Howe, by the following reaction:

$$FeS + CaO + C = CaS + Fe + CO.$$

The CaS passes into the slag, and the odor of sulphur is very strong when the slag is running from the furnace. It is evident from this reaction that intense reduction, which increases the silicon in the iron, has the contrary effect on the sulphur, and this explains the common observation that iron high in silicon is liable to be low in sulphur. Indeed this relation is so constant as almost to be a rule. There are two exceptions, however: (1) Increasing the proportion of coke has a doubly strong influence in putting silicon in the iron; as regards sulphur, on the other hand, it has a self-contradictory effect; by increasing the amount of sulphur in the charge it tends to increase it in the iron, which is partly or wholly counteracted by its effect in the above reaction. (2) A basic slag may hold silicon from the iron, and it also holds sulphur from the iron by dissolving CaS more readily. In other respects the conditions which make for high silicon make also for low sulphur. Particularly is this true of a high temperature in the smelting zone, and the term "hot iron" has come to be synonymous in the minds of blast-furnace foremen with iron high in silicon and low in sulphur.

Manganese is reduced by the following reaction:

$$MnO_2 + 2C = Mn + 2CO.$$

The amount of manganese in the iron is dependent, to a certain extent, upon the character of the ores charged, but it may be controlled somewhat by the character of slag made, because an acid slag will carry a large amount of manganese away in the form of silicate of manganese, $Mn\,SiO_3$.

With a certain unimportant qualification, the amount of phosphorus in the iron is controlled by the character of the ores charged, and districts or countries having high-phosphorus ores must make high-phosphorus irons. This is not an insuperable objection, because the presence of phosphorus, even up to 1.5 per cent., is desired in certain irons for foundry use, and the basic processes for making steel can remove this element.

CHEMICAL INFLUENCE OF THE BLAST FURNACE

The chemical influence of the blast furnace is a strongly reducing one and this is produced in order, first, to reduce the iron from the ore, second, to get rid of the sulphur, and third, to saturate the iron with carbon. Many attempts have been made to provide a process wherein the reducing influence was not so strong, and thus to produce a purer material than pig iron, because it is the intensity of the reduction which vitiates the iron with carbon and silicon. The great weakness of all such processes, however, is that they do not get rid of the sulphur, which is the most objectionable impurity that iron is liable to contain, and which is not satisfactorily removed by any process after once it makes its way into the iron. Finally, to saturate the iron with carbon renders the blast-furnace operation very much cheaper, because pure iron melts at a temperature much higher than can readily be obtained in the furnace and melted iron is handled much more cheaply than it could be if allowed to solidify. Even the presence of silicon is an advantage.

[2]The burden is the amount of material that the coke has to melt. We lighten the burden by increasing the amount of coke and *vice versa*.

A School of Mines for South Wales

A scheme is on foot for the establishment of a mining school in connection with the University College of South Wales and Monmouthshire. It is proposed to raise an initial fund of £30,000. Dr. Griffiths, principal of University College, has the matter in hand and is making urgent appeals to the owners of mine lands, owners of collieries and to the mining population. The Miners' Federation has already passed a resolution in favor of a levy on the members for this purpose. Considering the importance of the mining industries of the district, it is a wonder that such a school has not been established before now. The constantly increasing application of modern machinery, the introduction of electrical plant, mining at greater depths and under more dangerous conditions, are all going ahead in South Wales at present; and it is appropriate that the special conditions under which these improvements are carried out should be studied and taught.

American Institute of Mining Engineers

The American Institute of Mining Engineers held its annual summer meting at the King Edward Hotel, Toronto, Ontario, on July 23 and 24. About 200 members and their friends, including many ladies, were present. President John Hays Hammond occupied the chair. An official welcome on behalf of the city of Toronto was tendered by J. J. Graham, chairman of the Civic Reception Committee, which was fittingly replied to by President Hammond.

Dr. Rossiter W. Raymond, the secretary, was presented by Dr. James Douglas, of New York, on behalf of the institute, with a fine oil painting of himself, as a tribute of appreciation for his long and assiduous service. In acknowledging the gift Dr. Raymond made a feeling and witty reply in the course of which he pointed out that the word "American" in the institute's title was continental in its scope and not limited to the United States.

The announcement was made that Dr. Charles D. Walcott, late of the United States Geological Survey, had been made an honorary member.

A paper on the destruction of the salt industry at Salton, San Diego, Cal., by the floods, resulting from the overflow of the Colorado river, was read by Prof. W. P. Blake.

The Policy of Secrecy

Dr. James Douglas, New York, read a paper entitled, "Some Reflections on Secrecy in the Arts," in which he contended strongly that the limitations by which technical workers were in many cases prevented from communicating their experiences and receiving helpful suggestions from each other, were prejudicial to progress. It was a mistake for large manufacturing and mining concerns to impose such restrictions, and to enforce a rigid rule of secrecy. There was no diversity of opinion among technical workers as to the need of open-mindedness and the free interchange of opinions. Every limitation meant the concealment of some fact or principle, which could not attain its full development without the co-operation of many minds and suggestions from different sources. Faraday, Röntgen, and other leading scientists, communicated their discoveries freely. The mistake of a policy of secrecy and suspicion was illustrated by the decay of the copper smelting industry of England. Financial success and public approval could be better attained by mutual help and unreserved publicity, and works ought to be open to every respectable technical worker with as few restrictions as possible.

Coal Briquetting

Edward W. Parker, of Washington, read a paper on "Coal Briquetting in the United States." He accounted for the slow progress of this industry in the United States, as compared with the high state of development attained in Europe, by the abundant supply here of cheap raw fuel. Attempts to exploit patent or secret processes for which extravagant claims had been made, but which turned out to be unprofitable, had also discouraged investment. In the anthracite region of Pennsylvania opposition was offered by operators to the introduction of a manufactured domestic fuel which would compete with the prepared sizes of anthracite. The lack of assurance of a regular supply of coal-tar pitch at reasonably low prices had been assigned as another cause holding back the briquetting industry. There was, however, a "getting together" of the coal-tar producing and the briquetting interests, and the period of failure and discouragement had passed. The manufacture of briquetted fuel was being placed on a substantial footing. The paper gave detailed descriptions of several briquetting plants erected within the last two years.

In the evening a reception was given to the members of the Institute at the Legislative Buildings by the Provincial Government. Speeches of welcome were made by Chief Justice Moss, acting governor; Hon. Frank Cochrane, minister of mines, and Hon. J. J. Foy, which were appropriately responded to by John Hays Hammond, who spoke of the Canadian mining engineers as the peers of any in the world and congratulated Canada on the wonderful development. now in progress. Dr Raymond, Dr. James Douglas, Captain Hunt and Professor Blake also made addresses.

On Wednesday, July 24, at the opening of the meeting Dr. Raymond called the attention of the members to an invitation received from the Nevada Mining and Scientific Society of Goldfield, Nev., to hold a meeting at Goldfield. The matter was left for future consideration.

Corrosion of Steel Jackets

Letters were read from G. B. Lee, superintendent of the Copper Queen Consolidated Mining Company, of Douglas, Ariz., in which he directed the attention of Dr. Douglas to a remarkable instance of the corrosion of the steel water-jacket of a furnace, which after five months' use was found to be badly pitted. Rotary pumps of cast iron circulating water for the condensers in the power plant were also badly pitted at certain points, the metal being eaten away at those points ¼ in. for a space of an inch or two, while the adjacent parts were not affected. No action at all was detected in the boilers, which on inspection were found to be in thoroughly sound condition, after being in use for 2½ years. The singular feature of the case was the absence of corrosion in portions of the metal exposed quite as much as the parts affected. The water, obtained from wells 500 ft. in depth, had been repeatedly analyzed, but nothing to explain its action had been detected. The company is having water-jackets made of charcoal iron in the hope that it will not be so readily affected. Samples of the corroded metal were produced, and the attention of members directed to the case in the hope that some explanation might be found.

The Electric Air Drill

"The Electric Air Drill" was the subject of a paper by William L. Saunders, of New York, illustrated by calcium light views showing the drill in operation. Mr. Saunders gave a brief account of the repeated experiments and researches of Edison, Elihu Thompson and others with the object of applying electric power to rock-drilling—a problem that had been before mining engineers for 20 years, in the solution of which fully $800,000 had been expended. Edison thought he had solved it 16 years ago, but the solenoid drill had not sufficient power of pull. He claimed that the electric air drill based on the principle of air pulsation was the only drill that accomplished the drilling of rock by electricity with commercial success. The Ingersoll-Rand Company had installed in mines about 100 electric air drill plants which had given satisfactory service. The principle of pulsation of air by electricity had been applied to other machines, and had been introduced for the process of cutting grooves in marble in the Vermont marble quarries in place of compressed air. The speaker explained the difference between the mechanism of the electric air drill and the compressed air drill. The cylinder in the former was built without valves, and the chuck was of more simple character, dispensing with bolts and more easily adjusted.

An animated discussion followed the reading. In reply to questions, Mr. Saunders explained that the electric air drill gave a peculiar blow combining a push and a pull, the compressed air acting like a spring and forcing the drill back. This rendered its extraction, when caught in the rock easier than in the case of other drills. He estimated the saving of fuel at 50 per cent. The cost of the drill was about 20 per cent. over that of an air-drill equipment, and though the latter might do as much work the saving in fuel would make it the more economical.

Tar Sands of Athabasca

Dr. Robert Bell, of Ottawa, Ont., read a paper on the "Tar Sands of the Athabaska District," which he stated exceeded in extent any similar deposit elsewhere, covering an area of 1350 square miles, with an average depth of 150 ft. and representing about 11,000,000 tons of tar substance apart from the sand. It would be good material for the manufacture of oil and could also be used for fuel, paving and roofing.

A short discussion ensued, during which Eugene Coste, Toronto, Ont., advanced the theory of the volcanic origin of oil and gas, urging that geologists had failed to take into account the extent to which gaseous emanations from the center of the earth had affected the geological formations. Dr. Bell contended that petroleum had a vegetable origin.

Minerals of Cobalt

The afternoon session was opened by a paper by Prof. Willet G. Miller, of Toronto, provincial geologist of Ontario, on the "Cobalt Mineral Area," illustrated with calcium light views. The Cobalt region was unique in its association of ores which was altogether unlike anything found on this continent elsewhere, though similar conditions existed in Saxony and Bohemia. This uniqueness was characteristic of other mineral deposits of Ontario, such as corundum, amber, mica and nickel. He accounted for this on the ground that the rocks of Ontario belonged to an older formation than those in other parts of Canada, and most of the American continent, while the newer rocks were presented showing the geological formations of Cobalt, Professor Miller explaining that the silver-bearing veins were mostly in the Huronian, though some were in the Keewatin and some in the later diabase. Sometimes, however, when a vein passed from Huronian into the underlying Keewatin, the silver content disappeared while the cobalt and nickel continued. An old French map, published in 1744, was exhibited, showing that at that early date some of the mineral resources of the northern country, were known, a spot on the east side of Lake Timiskaming, where a galena deposit existed being marked as "Baie de la Mine." He remarked that had the early explorers discovered the riches of Cobalt, the French would doubtless have flocked to the country in such numbers that it might have changed the history of the continent. The silver area of Cobalt was embraced within a tract of 6 or 7 square miles though cobalt and nickel had been found elsewhere in the district. He regarded it as premature to pronounce definitely as to the value of the newer discoveries on the Montreal river as they had not been worked out in detail.

Geology of the Sudbury District

Alfred E. Barlow, of Ottawa, presented a paper on the "Sudbury Mineral Area," illustrated with calcium light views. He described the peculiar geological formation showing how all the orebodies were situated at the margin of a laccolithic mass, their origin being due to magmatic differentiation, though secondary action had no doubt had an important influence. These orebodies showed much uniformity, varying but little in their constituents. Though nickel had been discovered as early as 1856, it was not until 1882 that mining really began, since which time ore of the value of $50,000,000 had been taken out.

Visit to Cobalt and Sudbury

This concluded the business of the meeting. A number of the members left the same evening on the excursion arranged by the Ontario government to Cobalt, Temagami, Sudbury and the Moose Mountain iron district.

Land and Mining Laws in Korea

Special Correspondence

The Marquis Ito, Japanese Resident-General in Korea, has for some time past had a large staff of Japanese lawyers employed in drafting laws for Korea, and one of the principal causes of the strong feeling against the Japanese among American merchants resident in, or doing business with, the Orient, is the evident desire of these law-makers to favor the Japanese in every way. Prior to the Japanese occupation of the country, the Koreans were an agricultural people, who were little given to litigation, and consequently possessed few laws. Personal and real property were transferred by simple written notes, or contracts, termed "Bunki." The principal laws in the empire related to crimes. During the Japanese occupation it is charged that the soldiers and camp followers manufactured and circulated a large number of false "Bunki" and defrauded the natives of extensive tracts of land. This led to strong protests being made by the Korean Government to the Japanese resident general. The latter on learning of the seriousness of the situation ordered the Law Commission to draft a temporary land-transfer instrument. This was done and resulted in the Land and Buildings Certification Regulations Ordinance (Imperial) of Oct. 31, 1906, and the Land and Buildings Detailed Rules of Operations Ordinance (Department of Justice) of Nov. 7, 1906. In accordance with these, land, buildings, personal property and mortgages may be transferred by formal contracts certified by a "Kun" magistrate or a "Pu" prefect. Such a legal instrument constitutes a sound title. Should, however, a contract be made between a native and a foreigner, in addition to the above certification the document is required to be examined and certified to by the foreigner's consul, or resident government official. A contract between two foreigners requires certification by their consul only.

Formerly foreigners could only own realty in the foreign settlements in the principal towns and within the boundaries of the "Ri" zone around them. In accordance with the new ordinances the whole empire has been thrown open to occupation by foreigners.

The Real Property Commission is still at work on the drafting of real-property laws. These are being based on those in operation in Japan.

The principal mineral products in Korea at present comprise placer gold, and silver, copper, coal and graphite. Formerly minerals were worked by natives on mere occupation licenses, and by a few European companies on government concessions. The Japanese have introduced a new mining law, and numerous mining regulations the principal clauses of which are as follows:

1. Mines already in operation, abandoned mines and mine ditches of which the ownership cannot be definitely ascertained, become State property.

2. To anticipate evils of monopoly, mining districts are to be of fixed extent, and mining is prohibited in prescribed localities to protect public interests; but in case of necessitous mining operations private lands may be compulsorily expropriated.

3. Full protection will be extended to certain mining concessions hitherto held insecurely and their cancellation will be disallowed except in cases where the law provides otherwise. The concession rights may be made the object of transfer by sale, gift or succession, and of mortgage.

4. Taxes will hereafter be levied on mining products and mining districts, in place of the hitherto diversified claims fees, which were charged by the Government for concessions.

5. In the event of rival claims for a concession, grant will be made according to the priority of application.

5. The boundaries of mines belonging to the Imperial household will be re-defined and publicly announced.

The mining laws took effect on Sept. 1, 1906, and are administered by the mining bureau, which is composed of Japanese officials under the charge of the minister of agriculture, commerce and industry, who is also a Japanese official.

It is claimed by foreigners resident in Korea that mining will henceforth be practically a monopoly of the Japanese Government, excepting in the cases of concessions obtained by Japanese capitalists, unless pressure is exerted by the various governments whose citizens may be concerned.

The cost of breaking ore by hand, down to 2 in. size, with labor at 37½c. per hour, for 25 tons per day, will be 66 2/3c. per ton. Rock breaking can be done at that figure, however, only when the men stand up to the work, and use the right kind of hammer, which should have a head 6 in. long, weighing about 2.75 lb. (being forged from a 1½ octagonal bar of the best steel) and a long, springy handle of oak, ash, hickory, or hornbeam.

A Hook for Removing Converter Crowns

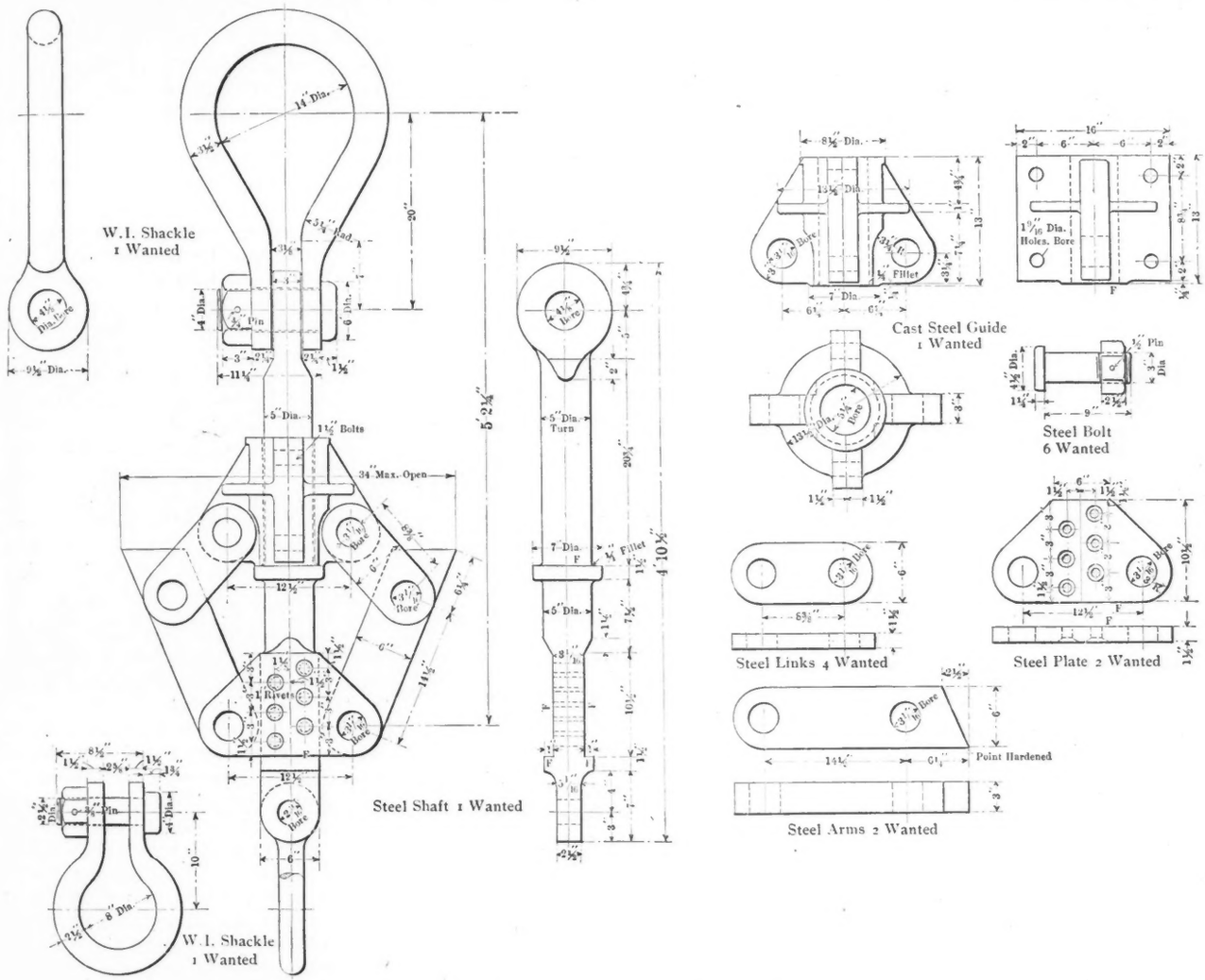
By Charles F. Shelby*

I take pleasure in sending you a blueprint copy of a drawing of a machine that I have used for several years past for the purpose of removing the "collars" or "crowns," that persist in forming on the top of the converters used in bessemerizing copper matte.

The method of procedure in removing a collar is to pick the instrument up with the crane and lower it into the throat of the converter; then the collapsible arms will fold together into a space practically half that they occupied when open, and on entering the larger part of the converter will open up again, so that by raising the entire instrument again the projecting arms should engage with the collar and either break or remove it entirely.

As will be noticed, the machine is of extra strong design which is made necessary by reason of the fact that a large number of these "collars" contain sufficient metallic copper to give them a strong and tenacious hold; so much so that at times they are equal to the effort of lifting the entire converter. This, of course, is a rare instance; but nevertheless it is encountered in daily work and necessitates the building of the collar-removing machine of sufficient strength to withstand the work thrown upon it.

No further explanation of the operations of the instrument is necessary excepting possibly the cause of the clevis or shackle at the extreme lower end. This is made necessary in order to free the machine from heavy collars that are removed intact. As they rest on the arms it is obviously impossible to remove them in any other way excepting over the top shackle of the machine. On account of the weight it is necessary to let the crane perform the operation by suspending it from the lower shackle.



HOOK FOR LIFTING CONVERTER "CROWNS"

*Superintendent Reduction Division, Cananea Consolidated Copper Company, Cananea, Mexico.

Important deposits of manganese ore are reported to have been discovered in Tunisia.

The Mexican Burro

Vice-Consul-General Albert de Baer, of Mexico City, reporting on the commercial posibilities of the Mexican burro, says: The Mexican burro, or donkey, is an animal which, in spite of its lowly condition and almost poetical patience, has played an important rôle in the commercial life of Mexico. The traffic between the railroad stations and interior points must still be handled by burro transportation. While the ox cart is in use in many parts of the country, the burro is much the swifter carrier. The burro is also an important factor in the mining industry, chiefly as an ore carrier.

An animal of average weight, 500 lb., will carry in the neighborhood of 200 lb. Very few burros are sold in the City of Mexico, the principal market being in the States of Guerrero, Hidalgo, Puebla and Oaxaca. Prices vary from $12.50 to $17.50, United States currency, and in the City of Mexico a burro trained to certain work will bring an average price of about $20.

Rack-rail Haulage in Coal Mines

How the Rack-rail and Cog-wheel Are Used to Supplement Ordinary Traction Where Steep Grades Occur in Mines

BY GEORGE E. LYNCH*

The use of rack-rail haulage in mines dates back to early times as regarded from an engineering standpoint. The first installation of which we have authentic record was in 1811 at the Middleton collieries in England, where Blenkinsop perfected a steam locomotive provided with a sprocket or cog-wheel outside the driving wheels, which engaged a rack-rail laid outside of, the parallel to the track rails. This locomotive worked successfully hauling coal.

Early History of Rack-rail Haulage

The engineers of that time did not appreciate the adhesive power of the driving wheels on the rail and, at first, endeavored to avoid the danger of slipping by making a positive drive. Working on this line Vignoles and Ericcson, in England, in 1830, and Sellers, in this country, in 1835, patented center rail devices to increase the effective friction and drawbar pull of locomotives. It was soon found in practice, however, that the friction of the driving wheels upon the rail was sufficient for all ordinary work, and the rack-rail fell into disuse except upon very steep grades.

One of the earliest rack-rail installations of any importance in this country was the scenic road up Mt. Washington, in New Hampshire. This road was opened in 1869, and has continued since then hauling thousands of passengers every summer without serious accident. The maximum grade is about 33⅓ per cent., and the average about 25 per cent. The railway at the Rigi, in Switzerland, was copied after this installation.

Another notable rack-railroad in the United States is that up Pike's Peak, in Colorado, which was opened in 1891. The maximum grades are about 25 per cent. It is usual to specify grades as the size of the angle with the horizontal, regarding 100 linear ft. of track as the unit.

During the last 20 years there have been numerous installations of combined friction, traction and rack-rail locomotives both in this country and in Europe, the rack-rail being used only on the grades. In these locomotives the rack sprocket is mounted on a separate shaft and is driven by a pair of cylinders placed between, and independent of the cylinders actuating the driving wheels. Steam is supplied to these cylinders only when the locomotive is running on rack-rail.

*Mechanical engineer of mines, Hyde Park, Massachusetts.

With the introduction of electric locomotives, the motor was applied also to rack-rail haulage, in Europe perhaps to a greater extent than in the United States. Within recent years there have been a number of electric rack-rail installations, using either direct or alternating current, in Germany, Italy, and elsewhere.

The system which is commonly employed abroad utilizes a rack-rail made from a rolled steel section similar in shape to the ordinary T-rail with teeth cut in the head.

In most cases the sprocket is mounted on a shaft separate from the axles, and is either driven by a separate motor or clutches are provided so that the track wheels may be thrown out of gear when the sprocket is engaging the rack-rail.

It is, of course, not feasible to gear the sprocket and track wheels rigidly together since the correct relation of forward travel would exist only when the track wheel tires were new and unworn. Any diminution of diameter due to wear would necessitate a slipping of the track wheels, each revolution equal to the loss in diameter multiplied by 3.1416, in order that they might keep up with the sprocket which would necessarily advance the same number of teeth, and thus the same linear distance per revolution until worn out.

The Maximum Grade

In practice the maximum grade upon which it is safe to take a friction traction locomotive is not greater than 12 per cent. In mine haulage when the locomotive forms only a small part of the weight of train it is rarely economical to run on long grades which exceed 5 per cent. Short grades of much steeper slope may be run over successfully when other conditions are favorable, such as dry rail and level space at bottom of grade for getting up speed when ascending, or for stopping the trip when descending.

The limits of efficient mining on rack-rail may be taken roughly as from 5 per cent. to 20 per cent. Above 20 per cent. some form of rope haulage must be used to get the coal or ore out of the mine.

A Rack-rail Locomotive Recently Designed

It is only within recent years that practical electrical rack-rail locomotives for mines have been placed on the market. One such locomotive was invented and perfected by E. C. Morgan. It was at first intended for use with rack-rail only, the track wheels being mounted on four stationary studs without springs, and being free to turn independently like the wheels of a car. A 75-h.p. motor was bolted to the top of the frame and geared directly to the sprockets which were two in number, they being mounted so that their centers were in line with the wheel centers. The wheel base was very short, 24½ in., which allowed the machine to run on very sharp curves and offered the additional advantage that the sprockets could be connected by a master gear mounted midway between them and maintaining the teeth always in the same relation. The rack-rail was composed of a flat strip of soft steel with rectangular perforations spaced 3.14 in. centers, the bridges of metal left between forming the rack teeth. The latest form of rack is 4 or 4½ in. wide, and ⅝ in. thick, the perforations being 1⅝ in. long by ½ or 2 in. wide, the 2 in. size being used at switches and curves. This rail was supported on a foundation of painted wood and carefully insulated from the ground, serving the double purpose of a rack haulage rail and a third or conductor rail for supplying current to the motors. The electric return is through the track rails as in friction traction locomotives.

Details of Construction

The sprocket shaft was at first insulated from the locomotive frame, the power being supplied by a pinion of wood or other insulating material. In a later type of locomotive the axles were made continuous from wheel to wheel, the bearings being solid sleeves in the lower part of the frame. The wheels were keyed and clamped to the axles so as to be removed readily when necessary for repairs. In this type the sprocket was mounted on a sleeve or quill running freely on the axle and driven by steel gearing from the motor.

The sprocket proper was a ring of steel with teeth extending inwardly and outwardly, the inner teeth or projections being few in number and adapted to be bolted into an insulating hub composed of wood and fiber, so that only the outer ring was charged by contact with the third or rack-rail. The current was collected by springs or brushes, which also served to hold the sprocket in a central position when crossing breaks in the rack rail at switches, etc. To allow for variations in gage, each sprocket was free to move 1¼ in. on each side of the center line of rack-rail.

Method of Laying the Rack-rail

The rack-rail was laid at a uniform

FIG. 1. MORGAN RACK LOCOMOTIVE, 80 H.P.

FIG. 2. RACK-RAIL ON EMPTY CAR TRACK. SHORT GRADE OF 14 PER CENT., SWITCH AT BOTTOM

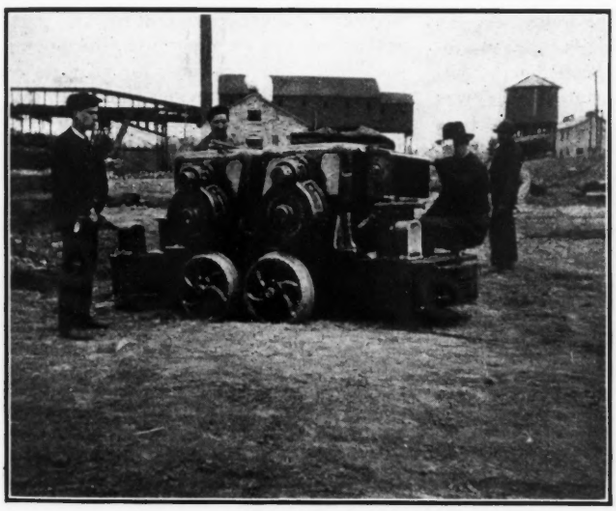


FIG. 3. INSTALLING A 160-H.P. LOCOMOTIVE, JUST TAKEN OFF THE CAR

FIG. 4. LOADING LOCOMOTIVE ON WAGON READY TO HAUL TO MINE

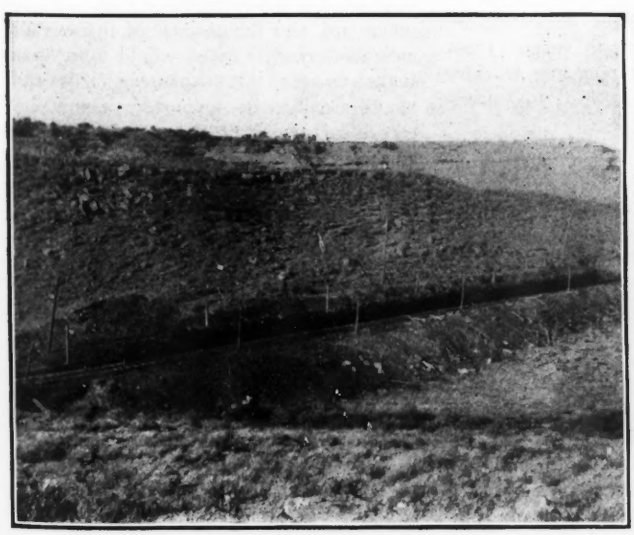


FIG. 5. JEFFREY, D. M. 160, LOCOMOTIVE DESCENDING 15.3 PER CENT. GRADE

FIG. 6. CLOSE VIEW OF FIG. 5. POST IN CENTER OF PICTURE IS VERTICAL

hight of 2½ in. from top of track rail to top of steel strip. The wooden covering or insulation extended above this so that the top of the completed rail was from 3¾ to 4 in. above the track rail, necessitating a clearance of at least 4½ in. for all rolling stock. The usual practice was to lay the rail 5 in. off the center of the track, but it could be laid central when desired.

In crossing switches of short radius, it was necessary to cut out the rack-rail for a distance equal to some multiple of the pitch plus 1⅝ in., or the length of one perforation. The sprockets being held rigidly in relation to each other by the master gear, the forward sprocket was sure to register properly after crossing the gap so long as this occurred before the rear sprocket left the end of the rail on the other side. The maximum gap possible with a 24½-in. wheel base was 29⅞ in., although a gap of 26¾ in. was preferred as safer.

On switches of long radius it was necessary to use throw rails or insulated pieces of rack-rail hinged at one end and adapted to be thrown across the gap to make a continuous rail for the locomotive to follow. The rack-rail was, of course, connected electrically at each gap by a heavy insulated cable passing under the track rail of the switch or crossover. When this rack-rail was carefully laid and properly kept up, the electrical leakage was very small. Of course, if water was allowed to flood the tracks, or coal and slate to accumulate about the rail, the leakage became enormous.

The Single Motor Type Most Successful

A later type of locomotive was equipped with two 80-h.p. motors, the other details remaining the same, except that the frame was made somewhat longer and heavier. This locomotive was not so successful as the single motor type, as the greater drawbar pull and heavier pressure of loads when descending grades combined with the long overhang at the ends, tended to raise one of the sprockets out of the rack rail and cause accidents. The manufacturers of this locomotive have therefore gone back to the single-motor type of unit, preferring to string together two or more units to get greater power. They thus retain the short wheel-base, and the ability to cross gaps in the rail by having the sprockets geared together on each unit.

It is usual to equip these locomotives with air brakes and to supply a tender or braking unit for carrying the elctrical air compressor, reservoirs, etc.

The charged third rail proved in practice to be very costly to keep up, and was regarded as a source of danger to the men. In practically all later installations, therefore, its use has been discontinued, the current being supplied by a trolley wire, and the rack-rail used for haulage only.

There are very few mines in which the grades are such that rack-rail is required throughout. In most cases there are stretches of level track in the headings, and the yard and switches at the tipple are made level wherever possible. The installation of rack-rail in the yard also introduces complications in the switches. For this reason the combined rack-rail and friction traction locomotive has been introduced. In these installations the rack-rail is laid only on steep grades and their approaches, the locomotive working on friction traction at other times. This removes the complication at the tipple and makes it possible to attain a high speed on friction traction on the level places. A simple form of sprocket starter, consisting of a steel casting with teeth of graduated hight, may be used at the ends of the rack-rail for guiding the sprockets into mesh, but it has been found that simply bending down the end of the rack and spiking it to the ties answers the purpose in most cases.

The first combined rack and friction traction locomotives were built with the sprockets and track wheels geared together to run at the same peripheral speed. As previously stated, this was found impracticable except when the tires were new, on account of the changed relation of advance per revolution as the diameter of wheels diminished with wear. It was necessary, therefore, to supply a clutch, thrown either by hand or by compressed air, for cutting the track wheels out of gear when entering upon the rack-rail. If the motorman forgot to throw this clutch at the top of a grade, the results were usually rather picturesque.

The systems of rack-rail used in this country in mines, while manufactured by different companies are mainly alike except in small details. Certain disadvantages which might easily be remedied by a change of design without losing any of the present advantages, are apparent to every practical man who is obliged to work with or install rack-rail. A statement of the disadvantages, and a suggestion of an ideal system to correct them, may be of interest to mining men working with rack-rail, and may lead to suggestions of value from others.

Locomotive Should Be at Head of Trip in Descending Grades

The rack-rail elevated above the track rails, requires a small diameter sprocket which clears the cross rails at switches, etc., thus making it necessary to cut notches for clearance. It is, however, difficult to anchor properly to the ties, and is nearly always knocked out of place whenever a car or locomotive is derailed. The necessity for throw rails on all switches, except those of very short radius, is a source of danger in the chance of a man forgetting the throw rail when throwing a switch in the darkness of the mine, and allowing a train to run upon it and be derailed.

It is usually considered good practice in laying out a mine to have the grades in favor of the loaded trip. Such a disposition of grades gives the advantage of economy in power, since the locomotive has to haul only the empty cars, the loaded trip descending by gravity; it also greatly simplifies the drainage of the mine. The main work of the rack-rail locomotive in more than half of the installations, therefore, is in holding back the loaded trip.

In many cases, also, the car couplings are not sufficiently strong to stand the strain of holding more than 10 or 12 loaded cars, on a 10 per cent. grade. It becomes necessary to put the locomotive at the head of the trip when descending the grades. This is, of course, the best place for the locomotive as it absolutely removes all danger of runaways from breaking apart.

The design of locomotive composed of a number of separate single motor and braking units, is excellent from the manufacturer's standpoint, since it requires practically only one set of patterns which serve, with slight modifications, for all sizes of locomotives. It is obvious, however, that such a locomotive placed at the lower end of a trip when descending a grade, is exceedingly likely to double up and cause a bad accident on account of the light weight and comparative irresponsibility of the individual sections.

The ideal rack-rail system which shall avoid all these troubles, is as yet in the future. The following suggestions which are the results of the experience of many mining men may lead in its direction.

The Ideal Rack-rail System.

This system contemplates the use of a rack-rail of the same hight as the track rail and preferably of a trough or channel section. This hight of rail would necessitate cutting slots in the cross rails of switches, etc., for clearance of the sprockets, but the superior stability of the rail when laid, and the absence of throw rails and other complications would more than make up for this expense. This rail would need to be supported only at intervals of 4 or 5 ft. apart instead of on every tie, thus simplifying the work of installation. Simple cast-steel frogs could be used at switches, the locomotive following the line determined by the track rails. There are thus no movable parts on the rack rail which is practically continuous from end to end, rendering it necessary to gear the sprockets together by a master gear or idler.

The pitch diameter of the sprocket is equal to the tread diameter of the track wheels. The sprocket is geared directly to the motor. The track wheels are connected to the sprocket through a compensating device, preferably an automatically reversing ratchet so arranged that the angular velocity of wheels may at any time exceed that of the sprocket, but the wheels

are caught and driven by the motor whenever their angular velocity tends to become less, as when the locomotive runs off the rack rail and the motor starts to speed up when that strain is removed from the sprocket.

A slight lost motion between the sprocket and axle gear serves to reverse the ratchet, the friction between the sprocket sleeve and motor bracket being sufficiently great at all times to render this positive.

The motors should have spring suspension, as the drive on rack rail is positive, and the shock of starting a load is too great for the gears without some cushion.

The locomotive should consist of a single unit of as heavy weight as possible. The frame should be of cast iron supported on springs at the journals. The wheel-base may be as great as 72 in., but should preferably be about 44 in. This allows of placing the motors in tandem, leaving a large space at the controller end for the motorman.

Air Brake Not Satisfactory on Rack-Rail Locomotive

The locomotive should be provided with a hand-power brake working on a screw and nut so as to be self-locking. The air brake is not satisfactory on a mine rack-rail locomotive, on account of the danger of applying the emergency stop on a grade when the motorman gets frightened, or loses his head. It is not practicable to block up the emergency position as it is required in traction and the service stop is too slow for switching. The screw hand-brake furnishes an emergency stop amply quick for all purposes and has the advantage that the motorman can "feel his trip" on the grades, and can keep a long trip of cars well bunched, with less danger of climbing each other than would be possible with air.

Two sprockets are ample to hold back any load at present handled by locomotives in mines. Where the sprockets are of large diameter with involute teeth of 4 in. or greater pitch, at least two teeth of each are in contact with the rack-rail all the time. With a heavy locomotive and a long wheel-base, there is very little danger of the teeth being forced out of mesh on any grade up to 20 per cent.

The compensating device between sprocket and track wheels being automatic in its action, would allow the locomotive to be driven at full power from one end of the trip to the other, without special attention from the motorman when engaging the rack-rail, as the lost-motion between sprocket and gear would allow the former to place itself in mesh regardless of how the teeth might encounter the rack-rail starter.

The device would have the additional advantage of reversing when the brakes were applied when descending a grade on rack-rail, thus introducing a powerful braking effect due to the wheels slipping in an effort to keep up with the sprocket, an effect which increases as the tires wear.

A locomotive of the type described, running on rack-rail flush with the track rail, could safely be placed at either end of its trip of cars with the assurance that, given reasonable care in installation, it would be as free from danger of accident as any friction traction locomotive running on level track.

Colorado F. & I. Company's Losses by Death

By Lawrence Lewis

A strange fatality has attended the higher officials of the Colorado Fuel and Iron Company during the past four years. Alfred C. Cass, vice-president, died July 4, 1903, of tuberculosis; Julian A. Kebler, who on account of ill health induced by overwork had resigned his position as president and general manager but three months before, died Nov. 20, 1903, of apoplexy; John L. Jerome, who up to a short time before had been treasurer, died Nov. 21, 1903, of heart failure; C. A. Parker, who had given up his position as traffic manager to assume in Cincinnati an even more responsible place with a railroad, died in November, 1904; Frank J. Hearne, chairman of the board of directors and successor to J. A. Kebler as president, died Feb. 25, 1907, of peritonitis; Richard M. Waite, formerly assistant to the president and just on the eve of assuming the duties of vice-president, died April 7, 1907, of diabetes; and John T. Kebler, general manager of the fuel department, died April 12, 1907, of ptomaine poisoning. A review of Mr. Hearne's career was printed in the Journal for May 4.

Richard M. Waite

Richard M. Waite, when still in his early 30's, became one of the leading figures in the Colorado Fuel and Iron Company. Six years and a half ago Mr. Waite was but a voucher clerk in the auditor's office on a salary of $65 a month. One day he suggested to the auditor and to the president an improvement in method in some detail of accounting. The suggestion was adopted and as a reward he was made chief clerk in the president's office. In 1902 he became assistant to the president. When President Julian A. Kebler resigned in 1903, Mr. Waite left the company temporarily; but, yielding to the requests of Frank J. Hearne, he re-assumed his position at an increased salary. Throughout the trying period of reorganization under Mr. Hearne, Mr. Waite acted as Mr. Hearne's right-hand man, with increasing satisfaction to his employers. In the changes incident to the death of President Hearne in February, 1907, Mr. Waite was scheduled for the position of vice-president, and he would have entered upon the duties of that office had he lived a week longer. His death, which was due to diabetes, with which he had been afflicted for some time, occurred at his home in Denver, April 7, 1907.

John T. Kebler

John T. Kebler, younger brother of Julian A. Kebler, was born in Cincinnati 39 years ago. After graduating from the University of Cincinnati, he came in 1889 to Colorado and spent a year prospecting for coal and gaining a thorough knowledge of the coal resources of the State under R. C. Hills, geologist for John C. Osgood. Mr. Kebler was then transferred to Iowa, where he was made superintendent of the White Breast Fuel Company, in which Mr. Osgood was a controlling factor. In 1893, when Mr. Osgood and J. A. Kebler organized the Colorado Fuel and Iron Company, John T. Kebler was recalled to Colorado and made superintendent of the Old Rouse mine near Walsenburg. He was next promoted to the position of superintendent of the western division of the fuel department of the company, with headquarters at Glenwood Springs. In January, 1900, he was made general manager of the fuel department and general superintendent of the Colorado & Wyoming Railway, which positions he held at the time of his death, which occurred in Trinidad, Colorado, April 12, 1907.

Like his elder brother, John T. Kebler was a many-sided man. No one had a more thorough knowledge of the coal measures of Colorado than he. In addition to his technical knowledge he possessed great executive ability and the quality of winning the personal loyalty of his subordinates. When in the fall of 1903 John Mitchell called a strike of the United Mine Workers in Colorado, the burden of breaking the strike fell upon the Colorado Fuel and Iron Company and upon Mr. Kebler. His life was repeatedly threatened and in the midst of the strike his brother died. Lesser corporations and lesser men would have yielded to the demands of the union, but he kept up the fight, going from camp to camp, hundreds of miles apart, cheering disheartened superintendents, snatching sleep at odd moments during more than three months, until the strike was broken and John Mitchell had been given his only noteworthy defeat.

Mr. Kebler was so well known as the general manager of the greatest coal-mining company of the far West that only a few dreamed of his intimate knowledge of the classics and his fine appreciation of literature. He was a member of the Denver, University and Country clubs of Denver and a great favorite.

A mixture of lead wool and graphite is now being successfully used for packing valves.

New Supplies of Anthracite Coal

Recent Discoveries Upset Established Geological Theories, and Point to the Existence of Coal-seams in Unexpected Locations

BY W. E. JOYCE*

A new coal vein just opened in the Black Creek district, of Pennsylvania, furnishes another remarkable proof that the theory which holds it impossible to find coal beneath the red shale or green sandstone is grossly misleading, and is responsible for the slow development made in anthracite mining. Through the Black Creek coal find, geologists who have been regarded as good authority in mining circles are gravely contradicted and commonly accepted theories concerning the terminal moraine are in danger of being labeled for future time as myths. This is, at least, the positive conclusion reached by the man who has disproved such authority by actual demonstration in the Black Creek district, has shown that the leading mining men of the anthracite region were wrong in following the old geological formula, proved beyond the shadow of doubt that coal exists where reports in the Geological Survey say it did not, and gives promise of having mining towns long ago abandoned restored to former life and renewed activity.

Discovery of a New Seam

Such sweeping claims must necessarily be supported by strong and well-balanced evidence. It is supplied by James M. Bohlin, the most profound geological student and most extensive prospector living in the mining region. Mr. Bohlin has prospected not only for others, proved veins and strata for individuals and corporations, but has continued the work on his own account during all of his spare moments of the past 30 years. Although in many instances in the past he proved to mining men representing corporations that coal was available where the written authority said it was not, his position was not regarded seriously. The latest evidence in this direction is too strong to admit of contradiction or be met by derision. Two important disclosures are made in the Honey Brook district of the Lehigh & Wilkes-Barre Coal Company, where the seam was found beneath what was accepted as the red shale, adding 100 years to the life of the mine, and that after Messrs. Richards and Hadesty, then in charge and now general manager and district superintendent, respectively, for the Philadelphia & Reading Coal and Iron Company, had concluded there was no chance of finding coal there. General Manager Stearns, of the Pennsylvania Coal Company, went farther by placing himself on record denying that coal existed where Mr. Bohlin now shows two excellent veins.

Large Sums Spent in Prospecting

Some years ago the Pennsylvania, or Susquehanna Coal Company, purchased an extensive tract in the Black Creek district adjoining the Hazleton territory. This district is shown to be along the edge of the anthracite area in the Geological Survey, and the company hoped to be able to find some paying veins. When Irving A. Stearns took charge as general manager of the company he did not share the notions that coal existed in that belt. The work of prospecting was followed nevertheless. In land and prospecting some $150,000 were spent. In his report to the Geological Survey Mr. Stearns indicated that this money was paid out to prove that no coal existed along the very line that now promises to become the most valuable asset of that corporation. After this, various individuals and small corporations did prospecting in this district with indifferent success. Meantime Bohlin had been conducting experiments, boring and drilling along the Nescopeck mountain, which is supposed to mark the line of the terminal moraine. He was convinced early that from traces found by him adjacent to the valley leading between Black creek and the Nescopeck, that the Black Creek tract would yield mineral.

Among others who took a lease on this land declared barren by the leading mining authorities, was former sheriff of Luzerne county, James G. Harvey, who knows nothing about coal strata or geological vagaries. This fact possibly led him to accept the old prospector's advice in opening his shaft. The result is that Mr. Harvey is now through the Wharton and Buck Mountain veins, and has before him a property too great for his individual capital to properly develop, because his facilities for preparing the output are inadequate, and modern methods will have to be adopted. The work of developing is now in progress while in the Honey Brook district the seam is yielding heavy tonnage.

Familiar Rules of Geology Thrown Aside

In pursuing his investigations Mr. Bohlin long ago refused to follow familiar rules of geology. He became convinced that while undoubtedly correct in the fundamental law, confusion had been thrown about essential features by failure to be specific in discussing what constitutes the top and bottom. This fact he is satisfied has caused most of the mining men to mistake the upper or false for the real strata. The Mauch Chunk red shale, known to be below the coal measures, has a double; the latter appearing above causes the trouble. The Lehigh coalfield, which lies between the Wyoming and Schuylkill regions, has contained scarcely any of the richer coal seams. The geological theory which says the missing seams were washed away by itinerant bergs, Mr. Bohlin regards as nonsense. From the mountain summit overlooking the Nescopeck creek at its source, and which forms the northern boundary line of the anthracite deposits in the middle field, across the valley to the Nescopeck mountain, which is used in geology to mark the route of the terminal moraine, Mr. Bohlin made a thorough investigation. On the Nescopeck he has found coal which is far removed from the accepted boundary. He holds that nature is perfect in her operations of construction and destruction; that the strata are uniform; that the appearance of synclinals and anticlinals can be accounted for by this natural law if time is taken to investigate it, and that it would be quite absurd to accept the theory that wandering glaciers are responsible for the seeming phenomena shown by the appearance of minerals in districts foreign to their unknown bed. He holds that the missing coal veins of the Lehigh field never left that field and are still intact, and will at some future time be supplying heat and energy. The following is Mr. Bohlin's statement:

The Original Coal Measure Has Not Been Touched

The Lehigh coalfield lies between the Lehigh and Susquehanna rivers, forming an apex from which drainage flows each way. The coal veins resemble fissures in an overlying formation, where an underlying one had forced its way upward. The different basins in this field are considered more nearly exhausted than either of the other coalfields. Nevertheless I make the assertion that this field contains more unmined coal than has yet been taken out of the ground; in fact, the original coal measure has not been touched. The structural formation of the various basins indicates a common origin which has generally been accepted as an indication that the different basins are parts of a larger formation which once covered a vast area.

Professor Lesly has advanced the theory that the entire State of Pennsylvania was at one time covered by coal formation.

*Freeland, Pennsylvania.

Mr. Smith, the geologist of Philadelphia, has arrived at the conclusion that only about 17,000 square miles were originally covered by anthracite coal. The quantity of coal contained in the present area, he believes to be only 1 or 2 per cent. of the original quantity.

As only about 484 square miles of productive coal land have been located, it can readily be seen that there is a great latitude for investigation, and conjecture as to what has become of the missing parts. The supposed absence of coal measures over the large area intervening and adjoining the various basins has been explained as being due to glacial erosion. This is an excellent theory, but it will not stand close investigation. It teaches us that thousands of feet of coal measures and other strata from the North Pole south to the so-called terminal moraines were ground away and absolutely lost. Only by a seeming miracle, still unexplained, the small portion was left, probably by oversight. Topographical conditions are also explained by the same double-acting hypothesis.

Every phenomenon presupposes an adequate cause, or, rather, a combination of causes. Pressure, or rather differential pressure is, of course, the underlying cause for every phenomenon. Since the beginning of creation nature has been busy destroying her own work. In fact, destruction and reproduction seem to constitute the scheme of nature. These two factors in the earth's development are the underlying principles in geographical phenomena, action and reaction. In one place the land is removed, in another it accumulates, producing a substance which must be represented by an uplifting elsewhere.

This is exactly what took place when the anthracite formation was produced on the ocean floor. The unequal distribution of the load produced various sized troughs, which again became component parts of the whole.

In brief, this was the process which probably produced present conditions in the anthracite region. This is, of course, only a part of the general process by which the continent became uplifted, and its divisions of land and water formed. This hypothesis is founded on actual existing geological conditions. It can thus readily be seen that we must look for the missing parts under overlying formations which now partly or wholly hide them from view.

From what has been said it will be seen that the present scattered basin represents only that portion of the original coalfield which underwent the greatest uplifting when the overlying blanket formation was formed. I know, from personal investigation, of nearly all the coal basins in the eastern middle coalfields, that they finally turn over and disappear, under such overlying formations, and can therefore be followed and become the source of a future supply of anthracite coal.

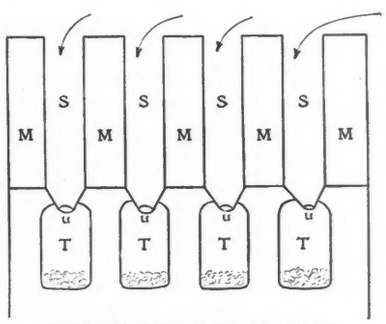
An Experimental Plant for Saving Zinc Oxide

By Paul Speier*

The following details relate to an experimental plant for the recovery of zinc oxide fumes during the distillation process as carried out at the Rosamunde Works in Germany.

The contrivance consists of a system of tubes which has an outlet in a single tube of about 500 mm. diameter. This tube leads to a room which is separate from that in which the distillation takes place, and contains an air-tight chamber of large size. In this chamber the zinc oxide vapors give up those particles having the greatest weight, the filtration being aided by having the vapors pass through a curtain consisting of a large number of fine wires.

From this chamber, which retains as dust only an insignificant part of the oxide, the vapors pass through a second chamber which contains a number of



BAGS FOR ZINC OXIDE RECOVERY

filters *S*, which are cylindrical sacks of very thick fabric. Ordinary sacks are fastened on the end *U* and the zinc oxide collects in them.

The difficulty in the final recovery of the zinc vapors, which ordinarily tend to escape in rather large amounts, lies especially in the fact that the gas is very hot and very dilute, or in other words, it contains more vapor than it does dust. The apparatus shown has two means of overcoming this difficulty. First, a certain cooling of the gases is attained by passing the fumes through a long passage and through the first chamber with its suspended curtain of wires. Second, within the filter *S* the oxides acquire a certain density, since the air *M* which surrounds the sacks is drawn off by a ventilator, so that all the gases are taken out through the fine pores of the filter fabric, leaving the zinc oxide.

I am indebted to the engineers who constructed the plant for the above description and sketch. Plants have been erected for the recovery of zinc oxide which is in solid, or dust form, but the problem of saving vaporized zinc oxide is not so simple and is scarcely out of the experimental stage.

*Breslau, Silesia, Germany.

The Steel Corporation in Duluth

The Minnesota Steel Company, branch of the United States Steel Corporation, has commenced the work of surveying its site in Duluth, Minn., and G. L. Reis, who is to be its manager, is on the ground. It is not probable that any work can be done this year further than to erect some dwellings and tenements for employees, to make railway connections with the ground, and to complete a thorough typographical survey. Mr. Reis does not expect to be able to place foundations for mills, etc., till next year. The plant is intended to include at the start, by-product coke ovens, one modern blast furnace, six or seven open-hearth furnaces, billet and finishing mills to care for the product.

The company has bought a large tract of land facing on St. Louis river and Duluth harbor, with more than three miles of water frontage and 1700 acres of land, in addition to the riparian rights. The site lies some two miles up river from the works of the Zenith Furnace Company, which operates a 200-ton furnace and Otto coking works, and is eight miles from the harbor entrance.

New Zinc Smelters

It is reported that the United Zinc and Chemical Company is planning to build zinc-smelting works at Springfield, Ill.

The zinc-smelting works of Hegeler Bros. at Danville, Ill., which have been under construction for some time past, are nearly ready to go into operation. These works will produce sulphuric acid as well as spelter.

James Latourette, who used to operate a zinc smelter at Marion, Ind., is now building a small plant at Clarksburg, W. Va., which is intended chiefly for the smelting of galvanizers' dross, and similar material.

The smelters at Laurium, Greece, in 1906 treated 180,102 metric tons of ore, which yielded 12,127 tons of lead, containing an average of 1504 to 1793 grams of silver per ton. The result of the year in the western district is considered satisfactory, but there are serious apprehensions of the exhaustion of several of the ore-producing strata belonging to the French Sunium Company's concession, and it is expected that work will very shortly be reduced to a great extent. The opinion of several engineers with regard to the geological formation of the metalliferous area is that deep borings should be undertaken, and it is probable that the various companies interested will join in such prospecting.

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

A chimney should have not less than 25 to 35 sq.in. area for every square foot of grate surface.

The return-steam pipes of a boiler should be as low as possible, or the water will lodge in the pipes and cause a cracking or pounding noise.

One cubic inch of water evaporated under ordinary pressure equals approximately 1 cu.ft. of steam. Steam at atmospheric pressure flows into a vacuum at the rate of 1550 ft. per sec., while it flows into the atmosphere at the rate of 650 ft. per second.

In making steam connections from the boiler to any distant point, expansion joints must be provided on the line. If such joints are not well adapted, as in a straight line, the line should be laid on a 10 to 30 min. curve, so that the curvature will accommodate the expansion.

In case of foaming in a steam boiler, close the throttle and keep it closed long enough to show the true level of the water. If the level is sufficiently high, feeding and blowing will usually suffice to correct the evil. Using dirty water or changing from salt to fresh water sometimes causes violent foaming. If such is the case, check the draft and cover the fires with fresh coal.

For a support for a tension weight, manila rope is better than a wire rope as the latter tends to become crystallized, though appearing perfectly sound on the outside. A manila rope will not break without giving warning of coming failure. As very small sheaves are usually used for conducting the rope from the carriage to the weight, a wire rope being less pliable than manila does not lend itself as easily to sharp bends.

Internal furnace boilers can be used to great advantage in mines or isolated places where the cost of brickwork and castings is considerable, as they are self-contained, that is, they are independent of a masonry setting, cast-iron fronts, buck-stays and tie rods. Such boilers are therefore capable of being moved from place to place with little expense. They are also economical in the consumption of coal, as there is no brick setting to absorb and radiate the heat.

In tubular boilers the hand holes should often be opened and if the boiler is fed in front and blown off through the same pipe, the mud or sediment in the rear end should often be removed. Safety valves should occasionally be raised with caution as they are liable to become fast and therefore useless. The gage cocks should also be kept clear and in constant use. Carefully examine blisters as soon as they appear, and have them trimmed or patched, as required.

The diameter of the slush and water holes from the surface to the mines should be from 2 to 5 in. larger than the diameter of the intended pipe which should be of rough iron. This allows some space outside of the pipe which may be run full of cement paste, thus forming a solid, water-tight casing for the pipe. In case the water is acid and the pipe corrodes, the hole will still have a water-tight lining. If the water contains a great deal of sulphuric acid it is better to use a wooden pipe instead of wrought-iron piping.

The first duty of a fireman when he enters the boiler room is to ascertain how many gages of water there are in the boilers. Never start up nor replenish the fires until the condition of water in the boilers has been determined. Records show that many accidents have occurred and many boilers are ruined from the neglect of this precaution. In case of low water, immediately cover the fires with ashes or fresh coal and close the ash-pit doors. Do not turn on the feed under any circumstances, nor open the safety valve. Leave the steam outlets as they are.

In using a water heater at a boiler plant it has been generally recognized that an open heater is superior to the closed or pressure type, which is in constant need of repairs, besides not being as efficient as an open heater. In operating an open heater the water is brought into direct contact with the exhaust steam. This steam when condensed amounts to nearly one-sixth of the entire feed water and is an important item where the water has to be bought. In a pressure heater it is hard to prevent the tubes from becoming choked with scale, which reduces the efficiency of the apparatus.

The first move in laying a mine track is to put the ties in proper position; they should be placed low in the road, as it is much easier to raise them than to lower them after the rails are spiked on. Where joints occur, the broadest ties should be selected. For a main-haulage road, ties should not be over 30 in. from center to center. At the curves the broadest ends of the ties should be on the outside and the ties should be placed radially to the curve; they should be held rigidly against the rails at both ends by spikes, but the spikes should not be hammered down too tight, as the heads are apt to crack off from bending the neck of the spikes.

In mining a fairly thick 15-ft. seam of coal, dipping from 35 to 45 deg. with a bad roof, one of the best methods is to drive up chutes 8 to 10 ft. in pairs connected by headings for air, and slanted across the dip making the grades of the chute about 30 deg., so that the coal will run down by its own gravity without sheet iron. When the chutes are driven up the required distance, the coal is mined back in short sections, leaving the gob and allowing the roof to fall. Batteries of props should be built across the chute every 20 to 30 ft., so as to prevent the gob from coming down the chute and to keep the face of the workings clear. This method of mining is a little high in cost per ton mined, but a greater per cent. of the coal is won by this system.

The saving of by-products, or the utilizing of waste power, has become common with some of the coal operators in Indiana. The Black Diamond coal mines, owned by Louis Stock, near Boonville, have just completed the erection of a big brick boiler and engine room, and begun preparations to install a new ice plant. This plant will be run in connection with the coal mines and a 20-ton equipment will be put in. A large new boiler has been put in position, and will be used to furnish power for both the mines and the ice plant. The water from the mines will be used for cooling purposes, while the lake water will be used for making the ice. One feature of the new plant will be the installing of filtering apparatus which will take all impurities from the water.

For a deep shaft hoisting engine at high speed, one authority advises the use of a steam brake with an iron band, and lined with wearing segments all around the brake ring. For a comparatively shallow shaft engine, the block brakes acting on a segment of the brake ring and operated by a hand lever are frequently employed. The bands should be in halves, one over and one under the drum, and attached on the opposite side of the drum from the engine by adjusting screws to regulate their length. The other ends should be jointed on opposite sides of the center of the motion of the lever. The band encircling the drum spreads the pressure and reduces its intensity per unit of surface and lessens the compressive and torsional strain on any given point of the drum.

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Contents

"Margin" in Smelting

We have received several letters requesting us to define the term "margin" as used in connection with the purchase of ores and the treatment of the same. Inasmuch as two, at least, of the communications referred to above are from metallurgists actively engaged in smelting, it is evident that there is a misunderstanding as to the use of the term. In expressing our own understanding of it, we do so with the feeling that others may hold different opinions, and we hasten to say that we shall welcome a discussion of the subject, to which our columns are open.

Literally, the margin is the difference between what a smelter realizes from an ore and what he has to pay for it. (We say "smelter" merely for convenience, the same applying of course to the millman, refiner, or treater of ore or metal in any way.) This may be called the "actual margin," but obviously it is a figure that can be arrived at only by periodical balancing of the ledger, and then only when corresponding metallurgical "cut-offs" have been made. The actual margin is consequently equivalent to the margin of profit. Deducting the expenses of smelting, etc., from the actual margin, the profit (or loss) is determined.

All other uses of the term margin refer to estimates or approximations which the smelter makes as a guide in the conduction of his business. In this connection we believe that the commonest use of the term "margin" is the difference between the cost of an ore and the metals extractable from the ore at any given period. In other words, if the value of spelter at St. Louis is 6.1c. per lb. and an ore which will yield 1000 lb. of zinc is purchasable at Joplin for $47 per ton, the margin on that ore is $14 per ton. We take the case of zinc ore, because in the Joplin district that ore is not yet bought generally on a sliding scale, and the margin is an ever-varying and highly important consideration. When ore is purchased on a sliding scale the margin is more uniform, and under a perfect sliding scale it may be quite uniform. However, a perfect sliding scale is rarely devised. It is frequently the case that a uniform margin is undesirable, or at least impracticable. When the prices for the metals are low, the smelter may content himself with a smaller margin than he ought to have on the average in order to keep his ore supply at the desired maximum by paying a bonus, so to speak, to the sellers of the ore. Thus the margin may be variable not only with the time but also with the metal market.

In estimating the approximate margin, therefore, its relation to the actual margin will depend upon the conditions of each individual business. If, for example, a smelter were buying silver on the basis of the daily quotation and were selling its bullion product daily at the market price, which is the practice of the largest producer of silver in the United States, the estimated margin should be close to the actual margin; if, however, the smelter be taking in ore at the daily quotation and selling the product, lead for example, at irregular intervals according to market conditions, there is likely to be a wider difference. Moreover, every smelter necessarily has a large stock of metals in reserve, in transit, etc., the amount of which may rise or fall, which, together with the fluctuations in the market, may cause the actual margin to differ widely from the estimated. Some smelters intentionally introduce the element of speculation in this way; but in the more conservatively managed businesses it is commonly reckoned that these fluctuating conditions will even up in the long run, and the temporary differences from the estimated margin are charged to "quotational profit or loss." Obviously the estimated margin plus or minus the quotational profit or loss will then correspond to the actual margin, assuming, of course, that operating costs, metallurgical extractions, etc., turn out as estimated.

In the purchase of many ores, settlements are made on the average weekly or monthly quotation, while in Europe settlements are frequently made on the basis of the annual average, payments being made according to the monthly averages, with an adjustment at the end of the year. Of course such arrangements tend to reduce the effect of temporary fluctuations and bring the estimated margin and the actual margin closer together.

Our definition of the term margin, therefore, is the difference between the value of the metals extractable from an ore and the cost of the ore, in each case on the basis of the works (although not necessarily on that basis). As commonly employed, however, the term margin means the estimated difference on the basis of

quotations at any given time or period, which may be called the "estimated margin," "approximate margin," "quotational margin," etc., to distinguish it from the actual margin, which can be computed only after the metals extractable from the ore have actually been extracted and sold. There is no necessity for the introduction of the terms "gross margin." "net margin," "margin of profit," etc., which lead only to the confusion that doubtless induced our correspondents to address us upon the subject. The margin which we have defined above is the margin of profit; that is, it is what the profit must come out of. After the smelting costs, etc., have been deducted, the remainder is not the "margin of profit," or "net margin," but is the profit itself. The profit may be either gross or net, according to whether it is the remainder after deducting direct operating costs, or direct operating costs plus amortization and other capital charges.

The Mesabi Iron Miners' Strike

The Mesabi range strike situation cleared up very much immediately after a visit to the range of Governor Johnson, of Minnesota. The governor went to the range for the specific purpose of notifying strike leaders that, while the State had no right nor desire to force any man to work who did not wish to do so, it did intend and would use all the power at its disposal to maintain its position, to see that no man who wanted to work should be interfered with, and that it would take such steps as might be necessary as soon as the need might rise, and that without waiting till bloodshed or riot had begun. About the only argument appealing to striking foreigners is that of the power of the military and the appearance of uniforms, and the governor's statements had a most soothing effect. Without violence and intimidation this strike cannot last, as the leaders cannot hold their men together; and it has been their continual threat, during the earlier days of this strike, that riot and murder would be done to those unwilling to join them. Gov. Johnson did not think it necessary to call out troops to prevent trouble, in which he differs, perhaps, from those that believe prevention is better than cure, and that it is no disgrace to an executive to be ahead of the situation. But it may be quite probable that his precautionary statements will avert open riot. The situation has been a very serious one—with thousands of strikers, foreigners unacquainted with the English language or American institutions, a considerable proportion of them of anarchistic tendencies and without quieting influences of any sort, permitted for some years to carry their red flags and rehearse their anarchistic speeches in public; in possession of dynamite, guns and ammunition, and inflamed by the worst element of outlawed union labor, some trifling incident might have burst into flame of riot from one end of the range to the other. Sheriff's deputies would be of little value in such contingency; it is the uniform only, representing the constituted authority of the country, that will attract and arrest attention.

While the Mesabi range strike has held the center of the Lake Superior stage during the week, the dockmen have not been idle. They have organized into a union, and have signified their intention of affiliating with the Great Lakes longshoremen's association as soon as this strike is over and they are permitted to join. It is not probable that the iron ore roads will permit any organization affiliated with the longshoremen to operate on their docks, and it is quite evident, too, that the docks will resume work in some way, in a very few days. All of them are full of ore, and terminal yards are crowded with loaded cars, so that ore could be shipped for several days with no beginning of receipts from mines. This dock ore will be moved very soon, probably beginning the present week, or sooner. But for mistaken counsel to the dockmen they would have been by this time ready for work at the old scale and without concessions. The iron ore roads cannot afford to place themselves in any position where dock troubles at some lower lake port would shut down the docks, railways and mines, and this would be the logical and inevitable outcome of an affiliation of ore dockmen with the longshoremen's union.

This strike, serious as it might have been, and as it still may be, has not been without its value. In this, reference is not made to the immediate state of the ore market, which has not been all that might be desired for a midsummer market, sales of ore having been of late exceedingly difficult to make, and buyers slow to fill fall requirements. It has had its lesson on other employees of the range roads and mining companies. The universal opinion has been that roads and mines could not stop business, that shipments simply must go forward, that the furnaces would soon shut down without ore, and that the Steel Corporation would never permit such a catastrophe. The men have now learned, and this applies to every class of employees, that the mines and roads can shut down and give no indication of an over-desire to resume, that they can and are willing to fight for a principle, indefinitely, if necessary; that at no matter what cost, agreements must be maintained and the undesirable and lawless unions kept out. On account of the fact that the Steel Corporation is considered a shining mark, it has been obliged during this strike, as during all other unpleasant complications on Lake Superior, to stand the brunt of any fight, and the attitude of the management of the Oliver Iron Mining Company, which is its Lake Superior mine company, and of its two railways, has been beyond criticism. The Western Federation presumed too much on the "shining mark." Its officers were evidently not acquainted with the public sentiment that has, since the organization of the Steel Corporation, grown up in those parts of Minnesota where the Oliver Iron Mining Company is known. This public sentiment rallied immediately to the help of the steel trust. Almost every range town at once took steps, through its citizens, to protect the corporation's property, to guarantee safety to men desirous of continuing work, to keep out agitators and organizers for the Western Federation, and to show in every way its friendship. Without attempting any invidious comparisons, there was a long time when, in northern Minnesota, no such universal feeling would have been aroused by any attempt to injure the big mining companies. That it is so now is due very largely to the broad, liberal, friendly and honest attitude maintained by the Oliver Iron Mining Company under the direction of T. F. Cole and his associates in the management.

The Pittsburg Dust Decision

Some time ago the Jones & Laughlin Steel Company was enjoined from so operating its Eliza furnaces in Pittsburg that gas and dust should escape into the air, causing damage to neighboring property. The furnaces in question used a large pro-

portion of soft Mesabi ores, and all efforts to stop the escape of dust proved unsuccessful. For this reason the court adjudged the officers of the company in contempt, as they had not complied with the law.

The result of this litigation in which the officers and directors of the Jones & Laughlin Steel Company in Pittsburg are defendants has an important bearing upon the dust question. The officers proved that they had made repeated and more or less successful efforts to prevent the emission of dust, but Judge James S. Young in the Common Pleas Court fined them individually for contempt of court because the difficulty had not been entirely removed.

The judge seems to have been conscious of the apparent injustice of the decision for he says: "The evidence in this case shows most conclusively that neither trouble nor expense has been spared by the defendants to prevent the escape of ore dust, and for this purposes $285,000 has been spent and in addition the company has lost $200,000 in shutting down furnaces to make experiments. We are satisfied that the defendants have made every effort to comply with the decree. It is insisted by counsel for defendants that these efforts are conclusive evidence that they have not violated the spirit of the decree, and therefore could not be attached for contempt. We cannot agree with the position that this is a good answer to the charge that the decree has been violated."

In other words no amount of effort to prevent the escape of smoke and dust into the air is sufficient to defend manufacturers from attacks so long as their efforts do not entirely succeed. It is an engineering possibility, although seldon economically practicable, to prevent the escape of dust from a blast furnace, at times, and the use of soft Mesabi ores has increased the trouble. It is impossible to carry on metallurgical operations without the production of some dust and dirt and the escape of some gases and odors which may be considered prejudicial to health. Smelting works are not usually built in residential districts where expensive furnishings are likely to be damaged, but comfortable homes cluster about every prosperous plant. It seems that under the present reading of the law the manufacturers have no assurance that they will not be compelled to suspend operations by neighbors whom the activity of the plant has attracted to the vicinity, unless they purchase outright territory for miles around the site.

This decision brings us no nearer a solution of the problem. No doubt there will be other decisions and other laws less onerous than those at present in force. Communities cannot afford to dispense with all industries for the sake of pure air.

The Result of the Boisé Trial

The final acquittal of W. D. Haywood, secretary and treasurer of the Western Federation of Miners, after the long trial at Boisé, seems to have turned chiefly on two points. He was tried on the charge of conspracy to murder Governor Steunenberg, of Idaho, and the chief witness was Orchard, a former member and active agent of the Federation, who took an active part in the crime, by his own confession. There is no charge so difficult to prove in court as that of conspiracy; the evidence must be either circumstantial, or that of an accomplice, which is always open to doubt or suspicion of motive. In this case there was no question of the fairness of the trial, nor of the honesty of the jury. The twelve men who rendered the verdict of not guilty evidently distrusted the testimony of Orchard, and held that it was not sufficiently corroborated by other evidence; and in this they seem to have been supported by the judge's final charge. Probably this ends the present case, for it is likely that Moyer and Pettitone, the other accused officers of the Federation, will not be brought to trial, now that the case against Haywood has failed.

Notwithstanding the acquittal of the actual defendant, the trial will have a marked effect. While the evidence failed to convince the jury of the technical guilt of the accused man, it has been widely read all over the country, and its main points, we believe, have been generally accepted as true, with a corresponding effect upon public opinion. The same thing may be said of the rebutting evidence. The Western Federation must change its methods, if it is to escape universal condemnation which must, in the end, be fatal to its objects. And in turn the violence with which its violent plans have been met in the past must give way to better methods. If Haywood has been acquitted, his union has not been cleared, and it will suffer the consequences.

One of the first of these is the strong public opinion which has developed in Minnesota, which seems likely to cause the failure of the present strike, and to drive the Western Federation out of the Lake Superior iron ranges. There is little doubt that this was, at least in part, due to the disclosures in the Boisé trial.

Perhaps it is too much to hope for immediate improvement; but it to be hoped that we have in sight at least the beginning of the end, and that murder and violence will gradually cease to be recognized methods in labor disputes. The extent of their use hitherto has been known to some by actual experience, but the general public has known little of it, and has not realized the conditions which the testimony in this case has brought out.

The Tariff on Zinc Ore

The importers of zinc ore into the United States are considerably disturbed over the delay of the United States Circuit Court, in rendering a decision in the appeal of the Government from the recent decision of the Board of General Appraisers in the matter of the importation of zinc ore. A decision was confidently expected by the end of last May, but it has not yet been made. The importations of ore have gone on without interruption, the importers paying the duty under protest, but this is a hardship, inasmuch as even if the decision be in favor of the importers their money has been tied up in the meanwhile with loss of interest. This is the more aggravating in view of the fact that the ruling of the Board of General Appraisers was so sweeping in their favor. Whatever be the decision of the Circuit Court, the case is likely to be taken to the Court of Appeals, which will mean further delay. In view of this situation, and the magnitude of the amount involved, the courts ought to expedite this case with all possible despatch.

THE INDEX to Volume LXXXIII of the ENGINEERING AND MINING JOURNAL accompanies this issue; presenting, as usual, full references to the varide contents of that volume. Subscribers who fail to receive this index, and who need it for reference, are requested to notify us promptly.

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 Vanning Assay of Tin Ores

With regard to R. T. Hancock's letter which appeared in the JOURNAL for July 26, 1907, p. 31, I wish to add a few remarks. As far as my experience goes, the results of vanning tests on tin ores depends to a considerable extent upon the nature of the gangue accompanying the ore, as well as the skill of the vanner, but in no cases have I found that the tin recovered by vanning was 95 per cent. of that found by careful chemical analysis.

Mr. Hancock quotes Mr. Terrel's work in this direction, but as the tin oxide recovered by vanning hardly ever contains more than 75 per cent. metallic tin and often is as low as 65 per cent., it is obvious, as pure SnO_2 contains 78.6 per cent. metallic tin, that it is not much use comparing chemical assay with vanning; unless the percentage of tin in the vanned product is given and also figures as to the quantity of ore used and weight of van obtained.

Cornish ores in many cases run between 30 and 40 lb. of black tin per long ton, or rather under 2 per cent. and an error of say 0.2 per cent. in the analysis, which is quite possible, in the case of an ore containing 40 lb. of black tin to the long ton or about 32 lb. of metallic tin (=1.4 per cent. Sn) would amount to 15 per cent. of the total tin contents.

Mr. R. Pearce, who has had a great experience in tin ores, published in the JOURNAL some years ago a series of careful investigations with regard to the matter under discussion, which I do not reproduce here, but the average result of three different skilled vanners on the same sample showed an average recovery of 78½ per cent. of the tin actually contained in the ore as per chemical analysis. Mr. Pearce employed an artificial mixture representing the minerals generally associated with cassiterite, and had the actual ore as it is mined been used, I dare say the recovery might have even been lower than 78½ per cent.

Taking all these points into consideration I do not think that Mr. Walker in his recent articles on Cornish mining is very far off the mark if he puts the vanning recovery at 75 per cent., in short, the vanning test is generally looked upon as a guide to the tin recoverable within reason, provided careful and up-to-date dressing operations are employed, but not to the total tin which can be found by chemical means.

O. J. STEINHART.

London, July 19, 1907.

Heat Production and the Constituents of Coal

In the JOURNAL of June 29, p. 1242, there appears an article by Professor S. W. Parr, which treats principally of certain instruments used in the analysis of coal, in connection with which, however, reference is made to two features concerning coal, one relating to coal proper, or in other words, fuel free from ash and moisture to which the writer is disposed to attach the term of pure coal; the other concerning itself with sulphur and its treatment.

With reference to the first feature, it is hardly correct to assume that engineers, as a class, refer to the moisture and ash-free composition as "fuel." One of the difficulties in connection with the understanding of any such complicated problem as the general one in question, is that of the proper definition of words used, and there is much confusion and misunderstanding occasioned by the use of the same term by different people to express entirely different things, therefore it is by all means desirable that an agreement be arrived at regarding terms that shall be employed, and a few suggestions are offered later. Personally, the writer considers that the word fuel should be used to designate the generally moist coal composition as it is shipped, received and placed in the furnace, therefore we may have mine-run and lump coal, or screenings, which would be specifically designated as fuel, when it is necessary to employ the word coal in another connection. In other words, fuel would be the general term applied to the product handled in service. It seems, however, that the expression which engineers have generally used to designate the moisture, and ash-free composition has been "combustible" instead of fuel, and inasmuch as the former is decidedly incorrect for the reason that "combustible" includes also nitrogen and water of combination, the writer has endeavored for some years to establish the term "pure coal" as applying to the fuel free from ash and moisture. This particular term has been selected as a simple and convenient vehicle for the conveyance of the idea, therefore it conforms to and is in harmony with the terms "moist coal" and "dry coal;" thus we have (1) Moist coal; (2) Dry coal; (3) Pure coal; (4) Combustible.

It is true that the phrase moisture and ash-free as used largely in Europe is more definite and to the point, but it is a cumbersome expression, inconvenient in use. But things are what we call them; for example, the term "monkey wrench" no doubt does not convey in itself the specific service to which this particularly useful tool is applied, but the expression is well established and thoroughly understood. In the study of radium and radio-active substances, for instance, this same trouble of limited vocabulary presented itself, but was remedied by the invention of new and special terms, rendered possible owing to the fact that the entire field of study was confined to a small coterie of men, for which reason these new expressions could be readily accepted by all concerned, something altogether impossible where the general public is taken into consideration.

It is most desirable that some agreement be reached regarding the use of words and terms, and it would be well if a general discussion by your readers could be secured. The writer would suggest that the following definitions be recognized and used:

1. "Fuel" may be used in all instances where the word coal is required in its proper sense, therefore when the composition is to be considered in any manner which would result in confusion, the term fuel could be used.

2. "Clean Coal." The expression pure coal is sometimes used to designate fuel coal which has not mixed therewith loose rock, slate, clay, etc. This, however, is not a good term, because even these clean pieces of coal contain ash naturally mixed with the combustible matter, and for that reason cannot be considered as being pure, but the words clean coal are calculated to convey the clearest and most definite impression.

3 "Pure Coal." This expression is proposed to designate the fuel free from moisture and ash.

4 "Standardized Pure Coal" to be employed to designate pure coal to which a sulphur correction has been made, as described by Professor Parr.

5 "Combustible." Under this head should be gathered the carbon, hydrogen, sulphur associated with the pure coal, as well as any sulphur derived from pyrites in the ash, because if the roasting of the pyrites results in the liberation of sulphur which is burned, producing heat, such heat is of equal importance to the same quantity which may, for example, be derived from carbon. The idea underlying this suggestion is, that the analysis should conform to the combustion process as closely as possible, because the economic problem involved in the expenditure

of such an enormous amount of money as that required to furnish fuel for industrial fires, demands that the laboratory process shall lend itself to the requirements of industry rather than that the processes of nature be expected to conform themselves to laboratory methods.

An important question involved is the "purity" of the pure coal composition. Contention has been made that sulphur is an impurity. Now, if there are any forms of coal which do not contain this constituent, it might be permissible to consider sulphur as an impurity. Inasmuch, however, as all coal contains sulphur in some amounts, and that the larger portion of it is in combination in some form with the other elements composing the coal (in distinction from that in pyrites) and for the further reason that it does produce heat. it is certainly as truly a portion of the coal as is carbon or hydrogen, notwithstanding the fact that it is an element of inferior quality, and of objectionable character as compared, for example, to carbon. It is obvious that the moisture contained in the fuel is evaporated with the application of heat, passing away and leaving the residue chemically unchanged, therefore it is proper to consider it as something separate and distinct from the coal itself. Likewise when the coal is put on the fire, combustion produces a residue which we call ash. This, however, cannot in any sense be considered as any portion of the coal, because in this connection coal is something which produces heat, although it is one of the components of the fuel composition. Therefore our ultimate conception of coal as a chemical combination is the "pure coal," which is made up of carbon, hydrogen, sulphur, nitrogen and water of combination. If we attempt any further division, it results in the breaking up of the chemical composition into its elements, under which condition it can no longer be considered as coal.

Inasmuch as the expression pure coal is the only one which has to any considerable extent been employed in this country instead of the erroneous expression "combustible", the writer can see no advantage in its abandonment, because in in so doing additional confusion will be caused. Prof. Parr in offering a sulphur correction has evolved a new and distinct scheme having marked value for certain definite purpose. It is not, however, suitable in any sense to take the place of the term suggested. It is something entirely independent of it and should be designated by a separate and distinct name.

It is not true, referring to sulphur, that "it is not now enumerated with the true fuel constituents." The principal trouble which chemists have had with sulphur is due to the fact that laboratory reasonings and processes are followed in the consideration of the problems involved. The greatest and best value of laboratory work should be to furnish information which can be correctly applied to that great and important process, wherein the fuel is used in service, and the analysis should conform in all respects as closely as possible to that of the true combustion process, and the enormous economic significance connected with the burning of one thousand million tons of coal per annum should be a surer guide than the reasonings which may be involved in disconnected laboratory study.

Criticism has been directed to my argument that the heating power of the pure coal is constant for a seam or a particular locality of such seam, and the reason given is that the sulphur is variable. This is, of course, true, sulphur being the only constituent varying in amount large enough to exert sufficient influence to be indicated by the result in calorimetric processes. But to make this matter clear, let us select a locality containing a number of mines working in the same seam—it will be found that the average heating power of the pure coal will be the same in adjoining mines or in fact all of them; and that this may and does hold over quite large areas, even to a whole or a number of counties, in at least a number of instances. It is a fact, however, that fuel which may today be supplied from a particular mine might average higher in sulphur than that supplied the next day; or likewise the quantiy of sulphur may differ between mines of a group from day to day, but after a few samples have been averaged, the pure heating power values will be found to be the same; therefore it does not make any difference to a purchaser if heating power is a little lower to-day owing to high sulphur, because he knows that to-morrow the sulphur will be lower and heating power higher. It follows, therefore, that as far as the establishment of exact values in fuel is concerned, the pure coal may be considered as a constant, and if the source of supply be known, heating power need not be determined.

The question regarding constancy of the heating power of the pure coal has come up recently in Illinois, owing to the fact that an attempt has been made to standardize and locate errors in some of the calorimetric processes employed, and it was found that in referring the results obtained by certain calorimeters to those of the Mahler form of instrument, that disagreement existed between results obtained at different times on different samples, when heating power was reduced to a pure coal basis as was necessarily done, owing to different ash content in various samples tested. Further consideration developed the fact that disagreement was caused by variation in sulphur in the different samples; therefore a sulphur correction has been employed, thereby producing standard quality of test material to be used in comparison of instruments. For this purpose Professor Parr's suggestion is very useful and has done much to assist in eliminating error due to inaccuracy of calorimetric method, and credit is also due in this connection to the Illinois Geological Survey and the Fuel Engineering Company of Chicago. It is my suggestion that this pure coal to which a sulphur correction has been applied be given the name of "standardized pure coal" as before mentioned.

Chicago, July 24, 1907. A. BEMENT.

New Publications

MAP SHOWING THE RAILROADS AND THEIR CONNECTIONS IN THE CONNELLSVILLE COKE REGION IN PENNSYLVANIA. J. B. Hogg. 18x26 in.; paper. Connellsville, Penn., 1907; Published by the author.

THE MINING AND QUARRY INDUSTRY OF NEW YORK STATE. Report of Operations and Productions During 1906. By D. H. Newland. N. Y. State Museum, Bull. 112, Economic Geology 16. Pp. 80. 6x9 in.; paper, 15c. Albany, N. Y., 1907: New York State Education Department.

This is the third of the series of annual reports intended to afford a summary of the current discoveries, developments and production of minerals in the State. The value of crude minerals, including 30 different materials, during 1906 was $37,118,430, an increase of $1,647,443, or about 5 per cent. Progress in iron mining was one of the notable features of the year, the output amounted to 905,367 long tons, the largest reported since 1891 and an increase of 78,318 tons over that for 1905 There were 11 mines under exploitation, the number including three which began production during the year.

ANNUAL REPORT OF THE MINISTER OF MINES FOR THE YEAR ENDING DECEMBER 31ST, 1906, BEING AN ACCOUNT OF MINING OPERATIONS FOR GOLD, COAL, ETC., IN THE PROVINCE OF BRITISH COLUMBIA. Richard McBride, Minister of Mines. Pp. 276; illustrated. 7x10 in.; paper. Victoria, B. C., 1907: Printed by Richard Wolfenden.

Production and progress in the mineral industry of the province are given in assembled tables and in detail. The statistics have been compiled from smelter and mill returns, and the operations of each camp and district are described with great care. The totals for the year are compared with those of the past four years, illustrating the remarkable progress in productive mining during this period. The attention given the various camps, including descriptions of geological features and climatic conditions as well as the extent and nature of the operations renders the volume especially valuable to non-resident investors. An excellent map accompanies the report.

Personal

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

Godfrey D. Doveton, of Denver, Colo., is in the City of Mexico on professional business.

Louis W. Hill, president of the Great Northern Railway, lately visited the Similkameen district.

Victor G. Hills, of Hills & Willis, Denver, has returned from an examination of the Spaulding district, Custer county, Colo.

F. B. Smith, provincial inspector of mines for Saskatchewan, has been inspecting recent coal discoveries in the Eagle Lake district and neighborhood.

Arthur W. Jenks has returned to Portland, Ore., from a trip through eastern Oregon and British Columbia, where he spent several weeks examining mining properties.

T. B. Burnite of the engineering and sales department of the John A. Traylor Machinery Company, Denver, Colo., has been appointed superintendent of the company's works.

J. P. Hutchins has returned to New York from a professional trip to North Carolina, and will leave this week for Nome, Alaska. He expects to be absent about two months.

R. C. Davidson, of London, Eng., is in Montreal, his services having been secured by the Montreal Harbor Commissioners in connection with a project for harbor improvement.

H. S. Denny, of the firm of Denny Brothers, London, has returned from Montreal, and will leave shortly for a two-month's professional trip to the Black Hills, So. Dak., and Butte, Montana.

F. W. Harbord, the English metallurgist, has sailed from England for Sydney, N. S. He is called as a witness on behalf of the Dominion Iron and Steel Company in their action against the Dominion Coal Company.

William Fleet Robertson, provincial mineralogist for British Columbia, is examining Highland valley claims, in the Ashcroft section of Yale district. He will go thence to Nicola valley, where several coal mines are being opened up.

Thomas C. Dougherty, of New York, and W. J. Dickson, representing English capitalists, have returned from an extended tour of the Larder Lake district. They found indications of oil near the Hight of Land, about 25 miles north of Larder.

Prof. Robert H. Richards has returned from six weeks in camp in the White Mountains spent in revising the appendix to his book on ore dressing. He is now in the West, and expects to visit Flat River, Mo., Great Falls, Mont., Salt Lake City, and Denver.

George Mitchell, president of the Mitchell Mining Company, has gone to Mexico where he will inspect the works and reduction plant at the company's property at La Dicha, Guerrero. He will make a tour of inspection over the route of the railroad which the company is building from Port Marques on the seacoast to the mines.

Walter C. Orem has resigned the general management of the Utah Apex Mining Company, of Bingham, which position he has filled since the inception of that organization. He is manager of the Nevada Douglas Copper Company, operating at Yerington, Nev., and will devote practically his whole time to the latter hereafter.

Andrew Mason has retired from his position as superintendent of the New York Assay Office, but will remain in the service as assistant superintendent. Mr. Mason has been connected with the New York office for 53 years, ever since it was first opened, and was previously in the Philadelphia mint. He has been superintendent for many years. His successor as superintendent is Kingsbury Foster, of New York, whose appointment seems to have been made for purely political reasons.

Obituary

Karl Howard, a graduate of the mining department of the University of California, well known to California mining men, died recently at the mine he was developing in Willow Valley, near Nevada City. Mr. Howard was for some years identified with the copper mines at Spenceville, Nevada county, Cal., and took great interest in the copper mining industry of that State.

Robert Watt, a California pioneer banker and merchant, who died recently in San Francisco, first settled in Nevada county, where he was identified with extensive mining interests for many years. From 1851 to 1880 he conducted mining operations in Grass Valley and other districts in Nevada county, and is well remembered by all those who were ever interested in that gold mining region. Mr. Watt leaves a large fortune, the foundation of which was laid in his gold-mining days.

Societies and Technical Schools

Worcester Polytechnic Institute—The commencement of the JOURNAL issued by the institute contains besides a report of the exercises, the names of graduates and the speakers, a number of papers dealing chiefly with electric traction.

Industrial

The Lake Shore Engine works, Marquette, Mich., has secured a site for its new shops in the Ely Park addition to the city, and work has been begun. The Worden-Allen Company, Milwaukee, has the contract for the steel work. H. H. Williams, president and general manager of the company, states that the construction will be of steel and brick throughout. The new plant will include the following buildings: machine shop, 80x240 ft.; foundry, 80x160 ft.; blacksmith shop, 40x130 ft.; pattern shop, 40x60 ft.; pattern storage house, 32x100 ft.; power house, 32x60 ft. In addition there will be an office building. In all the shop buildings will be railroad tracks, to facilitate the handling of materials.

Trade Catalogs

Receipt is acknowledged of the following trade catalogs and circulars:

John Callahan & Company, Chicago and Seattle. "How To Clean a Boiler." Pp. 8, paper, 3½x6 in.

Keystone Lubricating Company, Philadelphia, Penn. "The Test of the Friction Load." Folder, 3x6 inches.

Construction News

Pennington County, South Dakota—A 200-ton cyanide mill is to be built at the Montezuma mine to treat ore and tailings.

Crown King, Yavapai County, Arizona—The DeKalb Mining Company will soon install a hoist and other machinery at its lead-silver mine.

Graniteville, Nevada County, California—The Birchville mine will install additional machinery and new pumps. Fred Wedlin, Graniteville, is superintendent.

Apex, Gilpin County, Colorado—The Apex Gold Mining and Milling Company will erect a new plant at the Bonanza mine. W. S. Barrick, Apex, Colo., is superintendent.

Victor, San Bernardino County, California—A 10-stamp mill is soon to be erected at the Fortuna mine, one of the several properties owned by the Dry Lake Mining Company. A. P. Preciado, Victor, is superintendent.

Central City, Kentucky—The Gish Cannel Coal Company, recntly incorporated to develop cannel coal mines, is in the market for rails, pumps, pipes and mine supplies. S. J. Gish, Central City, is secretary and general manager.

Ladies Cañon, Sierra County, California—The Sovereign Mines Company will shortly build flumes to bring water to its mine between Sierra City and Downieville, and will also erect a 10-stamp mill. Horace A. Moore is superintendent.

Special Correspondence from Mining Centers

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

REVIEWS OF IMPORTANT EVENTS

San Francisco

July 25—The Northern Electric Railway Company has installed a rock-crusher near Oroville, on the Marysville road, for the purpose of furnishing material for ballasting its roadbed. The crusher is successfully utilizing the rock débris from the dredgers of which there is an unlimited quantity. At Folsom, in Sacramento county, another dredging field, the Folsom Developing Company has gone into the rock-crushing business. The company is laying tracks at Dredge from the Southern Pacific Company's line, to the new crusher site. Machinery for the new crusher site is on the way from the East. It is expected to have the crushing plant in operation within the next 60 days. Then all the cobbles that are thrown aside by the big dredges in their search for gold will be crushed, to be used in building construction. The capacity of the new plant will be 50 cars a day. If all these cobble piles made by the dredges are thus utilized, the Anti-Débris people will be deprived of one of their strongest arguments against gold dredging, that it defaces the country with ugly rock piles.

There has been some adverse comment in the fact that the Folsom Development Company has obtained a permit to dredge certain streets which are on the map of that town. The facts are, however, that the only streets upon which the company has operated, while a part of the original townsite, have been practically unused for years and in portions of which mining operations were carried on years ago. The company acquired all the property included in the blocks of land involved, and it was no more than right that if it desired the streets abandoned that they should be so as long as the property of nobody else suffered thereby. Most of the land that is being dredged has been the source of but little revenue to the town or county, while thousands of dollars are put into circulation through the operations of the Folsom Development Company.

A rock crusher is now being put in place near Folsom by the company to crush cobbles turned to the surface by the dredges. It will have the capacity of clearing away the cobble piles as fast as the dredgers pile them up. Many more men will be given employment, a material will be put upon the market for which there is a great demand and the cobble piles will gradually disappear, leaving the land in as good shape, and in many instances better, than formerly.

Reports from up-country and from all parts of Nevada county seem to indicate that the mining industry is unusually active. Many properties are being bonded and considerable outside capital is coming in. Many of the mines, closed down in former years because of lack of methods which would now make them profitable, will again be started up.

The Klau quicksilver mine in the Las Tablas hills, is the last one of the larger San Luis Obispo quicksilver mines to close down, the cause being given as scarcity of labor. Owing to lack of demand for the metal, and its low price, numbers of California quicksilver mines have closed within the past year. The New Idria, of San Benito county, is supposed to be the only one in the State which is making any profit to speak of.

Salt Lake City

July 26—A controlling interest in the Uintah Treasure Hill Mining Company at Park City has been purchased by Jesse Knight, of Provo. The property of the corporation consists of 19 patented and three unpatented lode-mining claims. Development work upon an elaborate scale is to be carried on.

The ore and bullion settlements reported last week by Salt Lake banks reached a total of $558,000.

Six Utah mining companies paid dividends during July to the amount of $365.-500. Contributing to this amount were the Colorado, $120,000; Silver King Coalition, $185,000; May Day, $8,000; Beck Tunnel Consolidated, $40,000; Utah, $3,-000 and Lower Mammoth, $9,500.

The Utah Consolidated Mining Company is carrying out its plans looking toward the construction of a new smelter in Tooele county. There is little likelihood of any construction work being done this year, but the management will probably go to the extent of drawing the plans for the proposed plant and let the contracts for material and equipment for delivery early next year. It is the intention eventually to connect the new smelter and the mine by means of an adit tunnel, but pending its construction an aërial tramway will be utilized for the transportation of ore between the mine and point of reduction. The tramway will be about 13,-000 ft. in length. The company's engineers have recently completed a survey of this line and also that of a standard-gage railroad which is to be built to a point of connection with the Western Pacific, Rio Grande Western and San Pedro, Los Angeles & Salt Lake lines near Garfield. The length of this road will be about 14 miles.

The construction department of the Western Pacific railroad has reported that this road is practically completed as far as Steptoe, Nev., where a junction will be formed with the Nevada Northern railroad. The company expects to inaugurate its first regular train service out of Salt Lake some time in August and will then enter into active competition for business derived through the operation of the mines at Ely and other eastern Nevada mining districts.

The Ibex Gold Mining Company has undertaken the construction of a 12-mile pipe line to supply its camp with water. The property is situated in the Detroit mining district. The company was recently organized and is about to begin an active campaign of development.

Oil has been discovered near Virgin City, Washington county. It was encountered at about 600 ft. depth and the flow from several wells amounts to well up into the hundreds of barrels a day. Coal deposits exist in this region. Engineers in the employ of the San Pedro, Los Angeles & Salt Lake are looking over the district and if it proves to be important, a branch line of railroad will be built.

Denver

July 27—The Golden Cycle mill, at Colorado City, of 700 tons daily capacity, built by Philip Argall, has entered the lists against the smelter trust, by making a treatment charge on Cripple Creek ores of $4, for ore of a value of $8 per ton, and paying the freight; and also agreeing to accept sampler controls on contract ores. As the company gets about 300 tons per day from its own mine, it will give the mill room for 400 tons of custom ores. At the present railroad rate of $1 per ton, it will give the company $3 for treatment. If it can make this pay, and is not bought out by the powerful competitor, it will be a tremendous stimulus to the mining and marketing of the low-grade ores of this still marvelous district.

The railroad rates on high-grade ores are excessive, as the roads have charged for many years at the rate of 3 to 5½c. per ton-mile from Cripple Creek to Denver for ores from $40 to $300 per ton value, and are now proposing to make the same rates to the mills at Colorado City. Two cents per ton-mile would pay well,

as the actual cost to the roads should not be over 0½c. per ton-mile. So there is ample margin of profit for reduction in rates, rather than an advance. If the rates are made as proposed for the Colorado City mills, it would mean 8 to 14c. per ton-mile, as the distance is about 45 miles.

The rock in the Cripple Creek mines always stood well, and so careless timbering was the rule rather than the exception, and surface rights were not respected. Hence the cave on Stratton's Independence of a stope said to be from the 300 level to the surface, and 500x600 ft. in extent, putting the Midland Terminal tracks and the Victor water works out of commission. The orebodies have been stoped from the 500 level to the surface, but the exact extent of the cave has not been given.

Dividends amounting to $600,000 have been declared in the Cripple Creek district for the six months ended June 30, 1907. Tonnage of ore for the same period was 290,427 tons, the gross value of which amounted to $7,179,811.

The State has won its suit to collect $350,000 inheritance tax from the W. S. Stratton estate.

Duluth

No step has yet been taken by the Oliver Iron Mining Company toward the development of lands that may have, or will, come to it under the Great Northern orelands contract, and it is now of course impossible that any tonnage shall be shipped from Great Northern lands by the Oliver company this season. This fact, coupled with the improbability of any material shipments from the new Coleraine district, now under tremendous development by the Oliver company, places an enormous burden on mines already opened. The district to feel the brunt of this pressure is Hibbing, and the Oliver shipments from there for this year will amount to 9,000,000 tons. The Hull mine, surface development of which was commenced 18 months ago, will this season turn out a vaster tonnage than perhaps any mine in the world. It is now engaged in stripping and mining on such a scale that the place is scarcely recognizable after a few months' absence. It is a very large and desirable orebody and some remarkable records in low costs of stripping and mining have been made there of late. The Mountain Iron mine, last year chief shipper from Lake Superior, will this year fall below 2,000,000 tons, and it is probable that several of those mines from which large shipments have been expected may disappoint their operators.

There has been a very important development in certain parts of the Menominee range during the past year or two, equaled by nothing on Lake Superior aside from the Mesabi. This has been especially noticeable in the Iron River and Stambaugh districts, on the west side of Iron county. Immediately around Iron river there is much activity; there is the new James mine, belonging to the Mineral Mining Company, in which are officials of the Pewabic Mining Company. The James was explored some years ago by Crerar, Clinch & Co., of Chicago, but was abandoned on account of the outlook for iron in 1904, which for a few months was not as rosy as the iron trade might have wished. The James company has now developed, on the levels reached by former operators and beneath them, good deposits of ore, and a considerable shipment will be made this year. Just south of the James is the Konwisky fee, also leased by the Mineral Mining Company, and under development by a large shaft and drifting. The same company has another property south of the James, on which diamond drills are operating, and on which a large body of ore has been proved to exist.

Toronto

Premier Walter Scott, of Saskatchewan, is in communication with the Department of the interior at Ottawa with the object of having the coal seam recently discovered near Eagle Lake developed by the Provincial Government for the use of settlers. Crude tests show a 50-ft. seam of lignite of good quality, occurring a few feet from the surface, about six miles north of Eagle lake. The find is regarded as of great value, owing to the scarcity of fuel in the district, and Premier Scott is desirous to secure the mining rights for the Provincial Government.

An exploring party headed by Dr. Dowling, of the Canadian Geological Survey, sent out into the Rocky Mountain region by the German Development Company of Montreal and Ottawa, an organization backed by Berlin capitalists, has reported the discovery of coal deposits near the Yellow-head Pass where the mountain will be crossed by the Grand Trunk Pacific.

London

The output of the St. John Del Rey Mining Company, of Brazil, for the year ended February 28 was 79,461 oz. of bullion realizing £263,755. This gold was obtained from 139,040 tons of ore. The working costs in Brazil were £204,336, and after allowing for other costs the profit for the year was £47,779. Of this profit, £5110 is transferred to funds to provide for new works, and £9823 to bond redemption account. Interest on debenture bonds takes £6811, and preference share dividend £10,498. The dividend on the ordinary shares absorbed £14,339, being at the rate of 2½ per cent. One of the subjects now engaging the attention of the directors is the paying off of the debenture bonds. In 1891 bonds to the amount of £189,000 were created and of these £83,420 have been redeemed to date. In March, 1908, bonds to the amount of £75,435 become due, and at the present time there is no expectation that the necessary funds can be obtained out of revenue. Arrangements are being made for the renewal of as many bonds as possible, and probably about £50,000 will be renewed in this way, leaving £25,000 to be provided out of revenue. The company, though somewhat hampered with large capital account and debenture debt is in excellent financial position, for it has a reserve fund of £80,000 invested in first-class securities. This fund, however, is kept in hand for unforeseen eventualities and will only be used as a last resource when all other methods of providing capital fail. It should be mentioned that the company has now been in existence seventy-six years.

Johannesburg

June 17—The returns for the month of May show how little the economic war raged against the mines by the Transvaal Miners' Association has so far affected the output. In spite of the strike of practically 90 per cent. of the white underground men, scarcely any stamps have been hung up. There are two reasons for this: In the first place the coolies and Kafirs are not "green" at the work, the Chinamen being now skilled men. For this reason the white men could not have struck at a more inopportune time. Had they waited for thousands of raw Kafirs to arrive, they would have had a better chance of winning their fight. In the second place the loyalty of the few men who remained at work, and of the entire staffs, managers, mine captains, etc., has been such that they have all gone into the mines to superintend the work, and have been successful in keeping the stamps running.

On May 31 there were in South Africa 53,409 Chinese coolies available for the mines. If this number could be maintained there would be little difficulty in keeping the present mills at work, but unfortunately by the end of the year nearly 20,000 coolies will have served their time, and will return to China in all probability.

The announcement made day before yesterday by the prime minister at Pretoria that the Chinese would be repatriated as their contracts ended has caused a powerful impression here. People have hoped against hope that the threat of repatriation would not be exercised, and even now many believe that the declared intention of the Government will not be carried out. The prime minister reiterates the old argument that there is any amount of Kafir labor to be obtained for the mines, but the experience of the past is entirely against such an assertion. The first crowd of coolies will leave the East Rand mines for China this month.

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

The trial of W. D. Haywood, secretary and treasurer of the Western Federation of Miners, for conspiracy to murder former Governor Frank Steunenberg, which has been followed with the greatest interest by everyone connected with mining, resulted on Sunday morning, July 28, in acquittal. The acquittal was on technical points and was foreshadowed in Judge Fremont Wood's charge to the jury in which he interpreted the law on conspiracy, circumstantial evidence and the corroboration of a confessed accomplice.

Mesabi Range Strike—Late reports from Duluth, Minn., state that striking iron-ore miners are returning to work in increasing numbers. Firmness on the part of the mining companies, the visit to the district of Governor Johnson, and the attitude of the citizens, who are determined to prevent violence and bloodshed, all contribute to a material relief of the situation which appears to be improving daily and hourly.

Arizona

YAVAPAI COUNTY

Logan Copper Company—This company has resumed work after an idleness of over two months. A hoisting plant is to be installed at once, and sinking continued to a depth of 200 ft. before laterals are run.

Monica Mines Company—This company is making extensive improvements at its mines, near Kirkland, in the Weaver district. A new mill will be installed during the coming year.

Octave Mining Company—This company is operating its 40 stamps on good ore, running the mill two shifts.

California

CALAVERAS COUNTY

Duryea—The men working this old claim in Chili gulch contemplate working the old tailings with a dredge. The bed of tailings is about 35 ft. deep, 60 ft. wide and extends about two miles.

Mokelumne Mining Company—This company will run its gold dredge by electricity hereafter.

INYO COUNTY

Black Cañon—Water has been piped 1000 ft. down Marble cañon to this mine, and a track and ore-car system is being put in both tunnels.

California-Nevada Mining Company—This Denver company has begun operations in a group of 10 claims at the head of Black cañon, 15 miles from Bishop.

Ragtime—These claims at Skidoo have been bought by Chatterton & Condon, of Goldfield, Nevada. The new owners, it is reported, will proceed to develop on a large scale.

NEVADA COUNTY

Banner—The pumps of this mine, Nevada City, have been started, and it is expected that in about five weeks the underground works will be unwatered.

Mountain View—At this mine, Cañon creek, near Washington, high grade ore is being mined.

Murchie Mining Company—The old Independent vein in this mine, Nevada City, lost years ago, has again been found in the face of the 400-ft. drift.

PLACER COUNTY

Golden West—Operations are about to be resumed on this drift mine, the tunnel having been found to be intact.

RIVERSIDE COUNTY

San Jacinto Land Company—It is stated that English capitalists have an expert at work in the Temescal tin mines, on which they have secured an option.

SAN BENITO COUNTY

Dallas Mining Company—R. W. Dallas, J. M. Couch and L. B. Hawkins are opening a deposit carrying sapphires, at a point close to the Kings county line.

SAN LUIS OBISPO COUNTY

Twin Peaks Asbestos Company—This company has been organized to work asbestos deposits near the city of San Luis Obispo. The directors are C. H. Brown, C. N. Gabe, H. G. Wheeler and J. A. Renetzy.

SISKIYOU COUNTY

Helena Mining Company—This property at Callahan, also known as the McKean, will resume operations shortly.

Colorado

BOULDER COUNTY

Kohinoor Development Company—This company at the annual meeting held at Milwaukee, Wis., increased its capital stock from $10,000 to $25,000 and elected the following officers: W. B. Lewis, president; Arthur Mortimer, vice-president; Jaocb Poppert, secretary-treasurer; John D. Kohlmann, manager.

Slide—The shaft building and machinery were damaged to the amount of $3000 by fire, and are to be replaced. Senator H. M. Teller, of Denver is the owner, the property being located at Gold Hill.

CLEAR CREEK COUNTY

Eclipse—Eastern people have taken a bond and lease on this property on Alps mountain for $33,000, and are going to construct a new mill at the mouth of Eclipse gulch, the ores to be conveyed by wire tramway from mine to mill.

Freeland Development and Transportation Company—At the annual stockholders meeting the following officers were elected: president, J. R. McKinnie, Colorado Springs; vice-presidents, Charles Brewer, and J. J. Elliott; secretary-treasurer, G. E. Armstrong, manager, George E. McClelland, Idaho Springs, Colo.

Hoosac Mining and Tunnel Company—At the annual meeting of the stock holders held in Denver the following officers were elected; president and general manager, E. D. Quiglay, Idaho Springs, Colo.; vice-president, A. T. Thompson; secretary-treasurer, H. S. Maddock. The company is operating near Idaho Springs.

Ohio Belle Group—Louisiana people have taken a lease and bond on this property in the sum of $20,000. The group is situated in the Montana district.

Snowdrift—This group in Griffith district has been sold to Dr. C. A. Black, of Memphis, Tenn., and Frank A Babcock, of Denver. The property is credited with a past production of $100,000.

GILPIN COUNTY

..On account of a cloudburst which washed away several miles of tracks of the Colorado & Southern Railroad on July 9, operations have been hampered, to the extent that at a number of mines it was necessary to lay off the working forces, so as to economize in the use of coal for pumping purposes. Mills using steam power were obliged to hang up stamps until coal could be brought in.

Aduddell—A big strike is reported in the 400-ft. level, where 7 ft. of gray copper ores have been opened up. A. D. Bellis, Central City, is manager. The property is being operated under a lease and bond.

Eureka—It is reported that this property in Eureka district has been sold by J. C. Jenkins, Central City, Colo., to Harvey Finch and associates of Pontiac,

Mich., the consideration being $45,000. The property has been a consistent producer during the past few years, worked under the leasing system.

Eureka Mining Company—Indian Territory capital has become interested in the Eureka group in Black cañon, Pine Creek district, and machinery is to be installed. J. G. Striffler, Tolland, Colo., is in charge of operations.

Frontenac Syndicate, Ltd.—English capitalists have purchased the Frontenace group of claims in South Willis gulch, Russell district, and Henry P. Lowe, of Denver has been made managing director. An electrical plant of 100 h.p., and compressor is to be installed, a new and large shaft building is to be erected and heavy operations are planned. W. H. Parenteau, Central City, Colo., is superintendent.

Gilpin Ore and Reduction Company—This new company, capital stock $200,000, with H. W. Kane and H. I. Jones, of Central City and T. Dunstone, of Black Hawk, incorporators, is making arrangements for the purchase of one of the large mills on North Clear creek to be remodelled into a concentration plant.

Iroquois—Chicago people have become interested in this group near Russell gulch and will arrange for the installation of machinery. T. R. Cudahy, Central City, is manager.

San Juan—This property on Quartz hill is being sampled by Collins & Wiley, of Idaho Springs, and there is prospect of early resumption.

Smuggler Group—Deeds have been filed conveying to H. H. Temple, of Kansas City, Mo., for a consideration of $22,000 this group of 10 lode claims and one placer claim, Wisconsin district. Arrangements are to be made for installation of machinery.

Square Deal Mining Company—Three carloads of machinery have been received at Rollinsville depot for the new dry process mill for this company on the Gettysburg property in Lump gulch. The Krom process is to be used. A. M. Waillard, Gilpin, Colo., is manager.

LAKE COUNTY—LEADVILLE

Golden Eagle—Preparations for extensive mining through the Yak tunnel, and the shaft, are being made by this company, which controls the Forest Queen property.

Highland Chief—A vigorous campaign is being carried on by lessees, and shipping will soon be resumed.

Jennie June—This mine in East Tennessee park, is prepared to ship steadily.

Nisi Prius—A new lessee on the property will install an electric plant.

Penn—From the No. 1 shaft of the property, on Breece hill, 100 tons of iron ore are being shipped daily and an equal amount is being taken from the Gorman and Lanphier lease, on the No. 3 shaft.

Silent Friend—This property on Little Ellen hill is on a steady shipping basis; a new plant of machinery is installed. The ore hoisted is a carbonate carrying gold.

Swisher—This tunnel on Sugar Loaf mountain, has been driven a distance of 1000 ft., and the lessees have reached a body of ore in the vein which runs high in gold.

Idaho

SHOSHONE COUNTY

Antimony—This mine near the mouth of Pine creek and about two miles from Kingston has been bonded to G. W. Harris. The property has produced considerable antimony ore but has been idle several years.

Peacock Copper Mining Company—This company has been organized by Wallace men to develop a group of five claims located in the St. Joe district adjoining the properties of the Wonderful and the Eagle mining companies. J. H. Nordquist is president.

Snow Storm—The mine is shipping 525 tons of ore per day directly to the smelters and 125 tons to the leaching plant. There are 176 miners on the payroll and 50 surface men. A single round of holes in the No. 3 west stope recently broke down 100 tons of ore.

Michigan

HOUGHTON COUNTY—COPPER

Baltic—Sinking is going on in all four shafts of this property. No. 2 shaft is down to the 11th level; No. 3 to the 16th level, and Nos. 4 and 5 are down to the 15th and 13th levels, respectively. At No. 3 shaft a steel rock house is being erected, and a new stone dry or change house is to be erected, to accommodate about 400 men. Two Nordberg compound heads have been ordered for the mill which will increase the capacity 50 per cent.

Champion—The rock house at E shaft is being raised and enlarged to admit the increase of the bin capacity to about 800 tons each. All rock houses at the mine will be similarly changed to take care of a greater tonnage of rock. At E shaft a new hoist has been installed and two large hoists of 5000 ft. rope capacity have been ordered for shafts B and C. Two Nordberg compound heads have been ordered, which will make a total of six heads. Large settling tanks are being placed in the wash to reduce loss in tailings.

Copper Range Consolidated—The shaft on the Globe property is down 263 ft. or 35 ft. in rock; at this point a sump is being cut to take care of the water. The shaft house and hoist are nearly completed and sinking will be resumed in the near future. The lode is expected to be cut at a depth of 800 to 900 ft.; crosscuts will be driven at different points to intersect the formation.

Hancock—The new shaft on this property is down 130 ft., and concrete pillars are being placed for the collar of the shaft. The combined engine, compressor and boiler house is completed, and foundations for the machinery are placed. The work of assembling the new Sullivan hoist is going forward with all possible haste. No. 1 shaft of the old property is down a little below the 11th level, and stations are being cut for drifting on this level. At the 9th and 10th levels good copper rock is being hoisted.

Missouri

ST. FRANCOIS COUNTY

St. Joseph Lead Company—O. M. Bilharz, consulting engineer of the company, informs the JOURNAL that the fire at the No. 2 mill and the roasting furnaces at Hoffman shaft caused much less damage than reported in the issue of July 13. The building of the roasting plant only was destroyed, this plant being a half mile distant from the mill. The fire did little damage to the roasting furnaces, 14 of which are in operation. Operations have not been interfered with and the output has not been reduced in the least, the other roasting plants being fully able to take care of the mill product.

Nevada

ESMERALDA COUNTY—GOLDFIELD

Daisy—The crosscut on the 210-ft. level this week intersected a 4-ft. vein that gives high assay returns. It is believed to be a continuation of the rich vein that was stoped in the 150-ft. level. Lessees in several parts of this mine are mining large orebodies and are regularly shipping high-grade ore. Negotiations have been closed for the purchase of the Daisy Annex claims, and the directors have options over another neighboring group.

Mohawk Combination—The combined leases on this property are producing 200 tons of ore per day, and arrangements are being made for increasing the output. At present the value of the ore shipped is $15,000 per day, but in the fall months this value will be doubled. The vein in the 275-ft. level of the Kalfus shaft is 20 ft. wide, and is gold bearing throughout, all of shipping grade.

NYE COUNTY—MANHATTAN

Express—Mining has been resumed on this property, and the shaft will be continued to the 100-ft. level. The outcrop is over 4 ft. wide, and carries ore of milling grade.

Granny—Some rich ore is being sacked and shipped. A pumping plant has been ordered to enable sinking to be resumed on the double compartment shaft.

Mustang—Rich ore is being sacked in the workings at the 150- and 250-ft. levels. Some of the ore is so rich that it has to be stored in a vault.

Otero—The north and south crosscuts at the 100-ft. level are in ore. The vein runs through a porphyry and schist formation similar to that in the Mustang mine.

Wolftone—A new vein 5 ft. wide has been cut that runs at right angles to the main vein.

NYE COUNTY—TONOPAH

Jim Butler—A large tonnage of milling ore is being raised daily. Shipments at present average 50 tons per week, all this ore being obtained from the development work.

Tonopah—Preparations are being made to reopen the Red Plume shaft, near the Midway. The electric hoist is in place, and the gallows frame and shaft are to be thoroughly repaired. The hoists on the Mizpah and Silver Top claims are kept busy day and night raising a large tonnage that is going forward to the smelters and mills.

Pennsylvania

BITUMINOUS COAL

Pittsburg Coal Company—This company makes the following statement for the half-year ended June 30:

	1906.	1907.	Changes.
Earnings.....	$2,384,422	$2,525,109	I. $140,687
Depletion of coal lands	$ 369,844	$ 351,880	D. $ 17,964
Depreciation of plant.....	568,184	494,824	D. 73,260
Interest on bonds	588,058	550,293	D. 37,765
Total charges..	$1,526,086	$1,397,097	D. $128,989
Net earnings...	$ 858,336	$1,128,012	I. $269,676

There was a decrease of 407,614 tons in coal mined, but an increase of 27,427 tons in coke made.

South Carolina

CHEROKEE COUNTY

Ross—Another carload of tin ore has been shipped from this mine, near Gaffney. The orebody is located on a tract of 890 acres owned by S. S. Ross. About 60,000 lb. of ore have been shipped from the mine, which is worked by means of a 150-ft. shaft.

South Dakota

CUSTER COUNTY

Canton—The machinery for the concentrator is being set up, and the company will soon resume work in its gold mine.

St. Louis—The American Mica Company has taken over this property on a bond, and has commenced unwatering and developing. The mine is 7 miles east of Custer.

LAWRENCE COUNTY

Beaver Creek—The first steam dredge ever used in the Black Hills is being installed for placer work on the company's 1000 acres in the Bear Gulch district.

Gilt Edge Maid—Superintendent R. N. Ogden is conferring with stockholders on plans for early resumption. The property has been idle since the first of the year.

Pluma—A cyanide annex is being built on the 40-stamp mill. A vein said to be the mother lode of the Homestake vein, has been encountered.

PENNINGTON COUNTY

Cochran—This property, south of Rochford, is developing a large body of free-milling and cyaniding ore. A small Huntington mill treats the ore during the summer months.

Utah

JUAB COUNTY

Tintic Ore Shipments—From the Tintic district for the week ending July 26, 132 carloads of ore were shipped: Ajax, 2; Beck Tunnel, 8; Carisa, 4; Colorado, 6; Centennial Eureka, 44; Eagle & Blue Bell, 3; Godiva, 2; Grand Central, 6; Gemini, 5; Lower Mammoth, 10; Laclede, 1; Mammoth, 11; May Day, 3; Scranton, 7; Swansea, 1; Tintic Iron, 4; Uncle Sam Consolidated, 5; Victor Consolidated, 2; Yankee Consolidated, 4.

Lower Mammoth—The management of this company has ordered a larger electric hoist, and will open the mine below the 1700 level.

SALT LAKE COUNTY

City Rocks—The management reports the strike of another high-grade shoot of ore in this property at Alta.

Canada

BRITISH COLUMBIA—ATLIN DISTRICT

Atlin Consolidated Mining Company—This Guggenheim organization has commenced the season's work on Tar flats, where it last year installed a 70-ton Bucyrus steam shovel capable of handling 3000 cu.yd. of gravel per day.

Pine Creek—J. M. Ruffner's steam ditcher machinery, weighing about 30 tons, has been received and placed on a scow. More laborers are required to operate the plant.

Spruce Creek—A gold nugget weighing 56 oz. was found on June 23 on unoccupied ground covered with tailings.

BRITISH COLUMBIA—BOUNDARY DISTRICT

British Columbia Copper Company—A new record was made at this company's smelting works during the last week in June, when 13,647 tons of ore were smelted. Of this quantity 9209 tons came from the company's mines; the remainder was custom ore.

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore from the Cobalt camp for the week ending July 20 were as follows: Coniagas, 275,180 lb.; Hudson Bay, 45,170; Nipissing, 63,550; Silver Queen, 87,000; Silver Leaf, 43,518; total, 514,418 pounds.

Cochrane—A vein containing large quantities of native silver has been encountered 5 ft. below the surface.

Mexico

ZACATECAS

Proaño—L. H. Taylor, Jr., No. 2030 Land Title Building, Philadelphia, Penn., informs the JOURNAL that he has secured control of these famous old mines at Fresnillo.

Africa

RHODESIA

The gold output reported for June was 54,918 oz. bullion, being 2250 oz. more than in May, and 7254 oz. more than in June, 1906. For the half-year ended June 30 the total was 264,466 oz. bullion in 1906, and 291,775 oz. in 1907; an increase of 27,309 oz. The bullion reported this year was equal to 259,670 oz. fine gold, or $5,367,379 in value.

Europe

SPAIN

A special report from Cartagena, Spain, states that the drainage product for that part of the iron sierra known as the Llano del Beal, where many rich mines are unable to work beyond a certain depth, owing to the water, has hitherto not been the success that was anticipated, owing to unexpected difficulties and unending flow of water. The syndicate that was formed to undertake the work on payment of a royalty on the production from the mines within the zone affected, has decided to study some further project for reducing the water.

South America

CHILE

Compania Minera de Gatico—This company, which has its offices at Santiago and its works at Gatico, Chile, is the successor of the Sociedad de Minas y Fundiciones de Gatico, a company which had previously absorbed several smaller concerns, including the operations owned by Artola Huos, Gatico and Cobija. The present reduction works include one 36x84-in. water-jacket furnace and a cylindrical converter, the capacity being 100 tons of bar copper per month. A new furnace, 38x144 in., is nearly completed, and will double the producing capacity. George W. Waters, Gatico, Chile, is manager of the company.

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, July 31—The strength which has been displayed in the Atlantic seaboard bituminous trade has been recognized by consumers and these are endeavoring to lay in a large portion of their winter supply. At the same time supplies of coal are large and transportation both on land and water is good, there being no delays due to storms or fogs and accordingly large supplies of coal are going forward to the consumer which will undoubtedly cause the present demand to ease off. No one is looking for dullness in the trade from now on and the feature remains, as in the past, the unusual condition in water transportation. A few in the trade still contend that there must be a reaction in the price of water freights but it seems to be the general consensus of opinion that prices will not materially react. Along the Sound there seems to be a shortage of vessel tonnage due to the fact that barge transportation companies are seeking outside freights which are higher.

The markets throughout the middle West show strength, although transactions are on a small scale.

In the South there seems to be no diminishing in activity and prices hold firm. The anthracite market is dull and shows little activity except in small steam sizes.

Coal-traffic Notes

Shipments of coal and coke originating on the Pennsylvania Railroad Company's lines east of Pittsburg for the year to July 20, were as follows, in short tons:

	1906.	1907.	Changes.
Anthracite.....	2,337,723	3,106,737	I. 769 014
Bituminous.....	17,145,604	20,829,195	I. 3,683,591
Coke.....	6,984 699	7,734 995	I. 750,296
Total.....	26,468,026	31,670,927	I. 5,202,901

The total increase this year was 19.7 per cent.

New York

Anthracite

July 31—The market for prepared sizes is dull and uninteresting, there being no special features to report. However, the trade in small steam sizes seems to be brisk and supply is fairly well up to the demand. Aug. 1 will see an increase of 10c. per ton on prepared sizes which will then be as follows: Broken, $4.65; egg, stove and chestnut, $4.90. Small sizes will remain as formerly at $3 for pea; $2.50 for buckwheat; $1.90@2 for rice and buckwheat No. 2; $1.50@1.60 for barley; all f.o.b., New York harbor.

Bituminous

The tone of the Atlantic seaboard soft-coal trade continues strong, and there seems to be a good demand for coal with a fairly large supply. Freight rates to the far East continue at their former high level. Trade in the far East is extremely active and the list of orders in the hands of shippers does not grow less and some urgency is noted upon a small proportion of these orders. More small craft seem to be reaching the lower ports than heretofore, but this is limited in character and a proportion of light craft and small tonnage will have to be shipped from New York harbor shipping ports. Trade along the Sound is growing in activity, especially with the higher grades of coal.

New York harbor trade is the dullest of any point on tide-water, yet the demand absorbs all the coal coming forward and fair grades of coal find a market when not already placed; the amount of unplaced coal is not large because producers do not care to take the chance of being caught with much coal on this market. Good grades of steam coal can be bought at or about $2.60 f.o.b. New York harbor shipping ports. All-rail trade continues to be dull, and stocks are fairly intact. Transportation from mines to tide is good although the transportation records this year are not as good as last year. Car supply is up to all demands.

There is practically no change in the coastwise vessel market, and freights are quoted from Philadelphia to Boston, Salem and Portland, $1.10; to Lynn, Newburyport, Bath, Gardiner and Bangor, $1.25; to Portsmouth, $1.15; to the Soumd, 90c.; with towages where usual.

Birmingham

July 29—All the mining companies in Alabama have contracts on hand which will keep them busy for some time, and no delays are experienced in the operation of the mines. The Tennessee Coal, Iron & Railroad Company is pushing the work at the mines looking to the largest possible output. Good prices obtain for coal in this State. The railroads are paying $1.72, and more per ton for coal at the mines against 95c.@$1.10 eight years ago. Miners are greatly in demand.

Coke is again very strong, and all offerings are quickly taken at good prices. More inquiries are being received here for coke and the indications point to the production for several months ahead being covered before the summer is over.

Chicago

July 29—The wholesale coal market continues quiet but firm. Much coal from western mines, that in former summers was shipped to Chicago, is now finding other markets, and the local demand is larger than ever before. Eastern coals are quiet. Anthracite sales are increasing as is natural for the end of the month, but are not heavy, and the market foresees the same rush for anthracite with the coming of cool weather. Considerable Eastern coal is being stored, and the market for Eastern products is in general fairly satisfactory to dealers.

Fine coals from Illinois and Indiana mines are in greatest demand, but shipments are so large that prices are no higher than last week. Run-of-mine brings $1.65@2; screenings sell for $1.25 @1.55, and such lump and egg as finds a market is quoted at $1.75@2.65. The harvesting trade uses much of the better grades of Western coals.

Hocking is firm at $3.15, Youghiogheny brings $3.30 for three-quarter inch and Pittsburg No. 8 is at $2.90 for 1¼-inch, the demand for the latter two kinds being light. Smokeless is said to be holding up well to the circular prices of $3.35 for run of mine, and $3.65 for lump. There is little Eastern coal seeking a market to escape demurrage.

Cleveland

July 24—The local coal market is showing soft spots in prices. The trouble does not seem to lie with any overplus in the city, but with the heavy supplies and overproduction at the mines. Pittsburg No. 8 slack is quoted 40@50c. at mines, making the local price $1.30@1.40 on track. Dealers admit transactions at lower figures on special sales. Cambridge slack is particularly weak, with a number of sales reported during the week at $1.25@1.30. The lake trade in coal is unusually heavy, but there are indications that consumers up-lake are well stocked up.

Coke shows a slight improvement. Large interests have held out for advanced prices and the result has been an improvement in spot deliveries. Furnace is quoted at $2.25@2.50 and foundry at $3@3.50 for last half delivery.

Indianapolis

July 29—The railroad companies in Indiana have sent out men to induce the people along their lines to store coal during the summer months and not wait until winter, when the roads may be unable to furnish cars sufficient for the demand.

The "check-off" of $8 a man from the pay roll of the 300 miners at the New Summit mine, near Linton, on account of the stampede strike for eight days in violation of the State agreement, has aroused much bitterness and only 10 per cent. of the men accepted their pay with the deduction. Those refusing to accept their pay envelops threaten to bring suit for collection. This action, however, is being discouraged by the miners' officials, for the reason if the individual miners go into court and break any part of the State agreement between the miners and operators, it might be an entering wedge for the operators to annul any feature of the agreement which is distasteful to them.

Pittsburg

July 30—The coal market shows but little change compared with last week. Prices remain firm on a basis of $1.20 for mine-run coal at the mine, but slack continues weak. Sales this week have been made around 40c. a ton. The Monongahela River Consolidated Coal and Coke Company made some additional shipments to the lower ports during the week and all the mines are busy. The Pittsburg-Buffalo Company expects to be taking coal out of the new Rachel shaft early in August. The shafts being sunk by this company are the largest coal shafts in the world. A strike of about 2,000 miners in the Youghiogheny field is seriously restricting the production of the Pittsburg Coal Company. The men were called out by the United Mine Workers for the alleged reason that the annual agreement was being violated.

The Pittsburg Coal Company makes the following statement of coal and coke production for the half-year ended June 30:

Coal:	1906.	1907.	Changes.
Pittsburg Dis.....	8,707,073	8,374,965	D. 332,108
Hocking Dis.....	682,777	607,271	D. 75,506
Total mined.....	9,389,850	8,982,236	D. 407,614
Coke made	216,771	244,198	I. 27,427

This shows a decrease of 4.3 per cent. in coal, but an increase of 12.6 per cent. in coke.

Connellsville Coke—There are no new developments in the coke market this week. Prices continue firm on the basis of $2.50 to $2.75 for standard Connellsville coke and $3 to $3.25 for foundry coke, for any delivery. The *Courier* in its summary for the week gives the production at 405,107 tons in both fields. The shipments amounted to 14,197 cars distributed as follows: To Pittsburg, 4692 cars; to points west of Connellsville, 8609 cars; to points east of Connellsville, 896 cars.

Foreign Coal Trade

Imports and exports of coal in Belgium for the six months ended June 30 were, in metric tons:

Imports:	1906.	1907.	Changes.
Coal..	2,602,660	2,589,150	D. 13,510
Coke.....	183,307	184,951	I. 1,644
Briquets.....	64,486	77,458	I. 12,972
Total.....	2,850,453	2,851 559	I. 1,106
Exports:			
Coal.....	2,453,441	2,246,529	D. 206,912
Coke.....	428,380	418,823	D. 9,557
Briquets.....	212,020	214,006	I. 1,986
Total.....	3,093,841	2,879,358	D. 214,483

The imports and exports nearly balance each other; the total excess of exports this year being only 27,999 tons, against 243,388 tons last year.

Iron Trade Review

The suspension of operations in the ore fields is cutting down production and shipments at the rate of about 1,000,000 tons a week but the loss will not prove serious as at the rate of shipments last month it is estimated that fully 45,000,000 tons would have been brought down this season compared with 38,500,000 tons last year. It is conceded now that this great tonnage will not be needed and the loss of a few million tons will not be felt. The strike came at a time when pig iron was declining and it had the effect of temporarily checking the decline.

In the South business is dull on new contracts, but production is being pushed along as much as possible. It is reported that some Northern consumers are considering entering the Alabama market for spot iron. The middle West is not active although the furnaces are making all the iron they can.

Pig Iron Production—The American Iron and Steel Association reports the production of pig iron in the United States for the half-year ended June 30 as follows, in long tons; comparison being made with the first half of last year:

	1906.	1907.	Changes.
Coke & anthracite.	12,395,179	13,272,248	I. 877,069
Charcoal iron.....	207,722	205,796	D. 1,926
Total.....	12,602,901	13,478,044	I. 875,143

The total increase this year over the first half of 1906 was 6.9 per cent. The gain was wholly in coke iron, charcoal iron production being practically stationary. As compared with the second half of 1906—when the output was 12,704,290 tons—there was an increase of 773,754 tons, or 6.1 per cent. Fuller comment on these figures is reserved until next week.

United States Steel Corporation—The preliminary statement for the quarter ended June 30 shows income account as follows:

Net earnings for quarter.....	$45,503,705
Depreciation, reserve, etc.....	$6,723,230
Interest and sinking fund.....	6,936,963
Dividends	8,846,432
Special Appropriations.....	19,500,000
Total	$42,006,625
Final surplus.....	$3,497,080

The dividends paid were $6,304,919 on preferred and $2,541,513 on common stock. Of the special appropriations for additional property, new plants, construction and discharge of capital obligations, the sum of $10,000,000 was for construction work in connection with the new Gary and Duluth plants.

The earnings for the half-year ended June 30 compare with last year as follows:

	1906.	1907.	Changes.
First quarter..	$36,634,490	$39,122,492	I. $2,488,002
Second quart'r	40,125,033	45,503,705	I. 5,378,672
Half year....	$76,759,523	$84,626,197	I. $7,866,674

The unfilled orders on the books on July 1 amounted to 7,603,878 tons of material; which compares with 8,043,858 tons on April 1; 8,489,718 tons on Jan. 1; and 6,809,589 tons on July 1 of last year. The board declared the usual dividends of 1¾ per cent. on preferred and 0½ per cent. on common stock.

Baltimore

July 30—Imports for the week included 1681 tons ferromanganese, 1584 tons spiegeleisen and 605 casks ferrosilicon. One cargo of manganese ore, 5000 tons, arrived from Brazil. Receipts of iron ore were 17,000 tons from Cuba.

Birmingham

July 29—Alabama pig iron is quiet, but the future prospects are looking better. Reports circulated here during the past week were to the effect that consumers, getting their iron heretofore from Northern furnaces, were considering the advisability of jumping into the Southern field and taking up all the spot iron they could locate, and also making contracts for deliveries during the next six months. The iron manufacturers are getting out all iron possible in order that when the time comes for the handling of the cotton crop there will be no delay.

The differences or fight between the Amalgamated Association of Iron and Steel Workers and Sons of Vulcan, the unions among the puddlers, will cause a shutting down of the Birmingham rolling mills (Tennessee-Republic) earlier than was intended. The Sons of Vulcan still insist on a contract being given them, which has been refused by the company. There is a fairly good demand for finished iron and steel at good prices.

Chicago

July 29—The market for pig iron continues very quiet, with no signs of radical weakening, but rather a slight increase in

the business being contracted for on future deliveries. Sales of quick-delivery iron are small and scattering. Inquiries are numerous for iron to be delivered in the first quarter of 1908, indicating a probability of good contract business in the near future. Iron and steel products in general are dull, the nearest approach to activity being in the structural iron trade.

Southern No. 2 foundry iron brings $20 Birmingham ($24.35 Chicago) for the last quarter of 1907, and $18.50@19 for the first quarter of 1908. Quick-delivery iron brings $20@21 Birmingham. Northern No. 2 is at $25 for last-quarter deliveries, with 1908 iron about $24, and third-quarter deliveries, $25.50.

Coke is quiet, but a trifle stronger, with contract business increasing. Connellsville 72-hour brings $5.75, and West Virginia 72-hour, 25@35c. lower than Connellsville.

Philadelphia

July 31—More uncertainty prevails this week as to what pig-iron prices are likely to be for winter delivery. Both basic and bessemer iron have weakened, but producers decline to admit that the weakness is permanent. Foundry iron has weakened. This was immediately followed by a number of orders, indicating a fair demand. Forge is also weaker. No. 2 is quoted at $22.50@23; forge, $20.50@21; basic, $22, and low phosphorus, $27.50.

Steel Billets—Business has been done at $32. The present policy seems to be to go slowly as to covering. The actual consumption is heavy, and there is considerable new business.

Bar Iron—Early and spot deliveries are more numerous in small lots, ranging from 1.85@2c.

Sheet Iron—An excellent demand, both in large and small lots, is again reported, and the situation is strong.

Pipes and Tubes—The mills keep filled up with large orders for merchant pipe, but very little new business has been done in tubes.

Plates—Large car-building orders have been placed and mills are asked to bid on work. The orders are to be placed at once.

Structural Material—The State mills are gathering in a good deal of business for fall construction, for which outside prices are charged. Prices, it is said, are shaded as usual on heavy orders.

Scrap—The scrap market is quiet and buyers have disappeared. No. 1 steel scrap is offered at $17.50. Railroad at $19, machinery scrap at $19.

Pittsburg

July 30—There have been no transactions in pig iron of any consequence as it is believed there will be a decided decline in prices when the trouble in the Lake Superior ore regions is adjusted. A settlement is confidently expected to be made before the end of the week. No concessions are to be made to the strikers and men who refuse to return to work under the old conditions will be dropped, and their places will be taken by new men. It is known that the United States Steel Corporation has a large number of men at various works that are available for the ore regions. At the Ohio works of the Carnegie Steel Company it is estimated nearly 3000 men have been engaged during the past few months as laborers, and most of them can be spared. The new men are foreigners, and were employed upon their arrival in this country, and sent to different parts of the country, where they could be of service and also available in the event of trouble.

There is no change in the markets for finished steel products, and the mills are still well filled with orders and specifications on old contracts are satisfactory.

The hearing of arguments before the board of conciliation in the wage dispute of the Republic Iron and Steel Company and the Amalgamated Association of Iron, Steel and Tin Workers closed today. The sessions began last Wednesday at Cambridge Springs, Penn. It is likely the board will make an award within the coming week, and that an agreement will be reached on the basis of last year's scale.

Pig Iron—Late last week a sale of 1500 tons of bessemer pig iron was made for prompt delivery at $22.50, Valley furnaces, and this price may be regarded as the maximum for August delivery. It was learned during the week that the United States Steel Corporation has offered to take 15,000 tons of bessemer for August at a flat price of $22, Valley furnaces, and negotiations are pending. About 1000 tons of No. 2 foundry iron were sold during the week at the same price as bessemer, $22.50, Valley furnaces, but some large producers refuse to quote less than $23.50. No transactions in gray forge are noted and the price is nominal at the last sale several weeks ago, $22.90, Pittsburg.

Steel—The market remains about the same as last week, and shipments of billets continue to improve. Bessemer billets are firm at $30 and open-hearth at $31.50@32. Plates remain at 1.70c., and steel bars at 1.60c.

Sheets—Specifications on contracts are very heavy, but new business is light. Black sheets are still quoted at 2.60c., and galvanized at 3.75c. for No. 28 gage. The decline in spelter has prevented the contemplated advance in galvanized sheets.

Ferro-Manganese—The market is quiet but prices remain unchanged, prompt ferro being quoted at $65 in small lots, and for future delivery prices range from $61@62 a ton.

Metal Market

NEW YORK, July 31.

Gold and Silver Exports and Imports

At all United States Ports in June and year.

Metal.	Exports.	Imports.	Excess.
Gold:			
June 1907..	$23,872,140	$ 2,140,769	Exp. $21,731,371
" 1906 .	3,256,392	2,369,080	" 887,312
Year 1907..	36,300,732	21,444,074	" 14,856,658
" 1906..	31,610,714	62,537,778	Imp. 30,927,064
Silver:			
June 1907..	5,360,599	3,448,712	Exp. 1,911,887
" 1906..	4,518,386	3,760,012	" 758,374
Year 1907..	33,437,227	22,367,777	" 11,069,450
" 1906..	29,219,209	23,676,828	" 5,542,381

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

Gold and Silver Movement, New York

For week ending July 27 and years from Jan. 1.

Period.	Gold.		Silver.	
	Exports.	Imports.	Exports.	Imports.
Week.....	.....	$ 69,387	$ 923,580	$ 12,434
1907.....	28,864,125	6,486,030	26,653,057	1,119,008
1906.....	5,903,003	46,042,245	35,850,548	1,240,894
1905.....	37,919,443	845,445	18,480,684	2,273,513

There was no gold exported for the week; the silver went chiefly to London. Imports for the week, both gold and silver, were from the West Indies and Panama.

The joint statement of all the banks in the New York Clearing House for the week ending July 27 shows loans $1,123,163,700, an increase of $17,913,700; deposits, $1,095,772,900, an increase of $22,781,600, as compared with the previous week. Reserve accounts show:

	1906.	1907.
Specie.....	$194,450,900	$210,451,500
Legal tenders.....	89,470,800	72,750,400
Total cash	$283,921,700	$283,201,900
Surplus.....	$18,892,475	$ 9,258,675

The surplus over legal requirements this year shows an increase of $170,600 as compared with the previous week.

Specie holdings of the leading banks of the world, July 27, are reported as below, in dollars:

	Gold.	Silver.	Total.
Ass'd New York	.....	.....	$210,451,500
England.....	$182,249,145	.....	182,249,145
France.....	562,242,995	$196,749,030	758,992,025
Germany	171,755,000	47,600,000	219,355,000
Spain..	77,915,000	128,530,000	206,445,000
Netherlands....	28,639,500	28,811,500	57,451,000
Belgium.	16,176,665	8,088,335	24,265,000
Italy.....	163,300,000	23,102,000	186,402,000
Russia.....	584,480,000	33,540,000	618,020,000
Aust.-Hungary.	127,720,000	61,945,000	189,665,000
Sweden.....	20,690,000	.....	20,690,000

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

The Treasury Department has bought 200,000 oz. silver for the Mint; 100,000 oz. at 69.421c., delivered at New York, and 100,000 oz. at 69.84c., delivered at New Orleans.

Shipments of silver from London to the

East are reported by Messrs. Pixley & Abell as follows, for the year to July 18:

	1906.	1907.	Changes.
India	£ 9,886 963	£6,736,174	D. £ 3,150,789
China	116,600	.....	D. 116,600
Straits	1,750	544,012	I. 542,262
Total	£ 10,005,313	£7,280,186	D. £ 2,725,127

Imports for the week were £180,000, all from New York. Exports were £1600 to Egypt and £170,100 to India; £171,700 in all.

Imports and exports of gold and silver at the port of San Francisco for the half-year ended June 30 are reported as below:

Imports:	Coin	Bullion	Total
Gold	$735,321	$1,306,042	$2,041,363
Silver	102,346	1,578,655	1,681,091
Exports			
Gold	2,200	3,456	5,656
Silver	577,986	745,835	1,323,821

The export movement has been light this year.

The movement of gold and silver in Great Britain for the half-year ended June 30 is reported as follows:

Gold:	1906.	1907.
Imports	£23,036,991	£23,447,012
Exports	17,561,343	17,561,849
Excess, imports	£ 5,475,648	£ 5,885,163
Silver:		
Imports	£10,337,731	£ 8,908,993
Exports	11,050,920	9,169,210
Excess, exports	£ 713,189	£ 260,217

Of the silver imported this year £5,718,455, or 64.1 per cent of the total, came from the United States.

The movement of gold and silver in France for the five months ended May 31, is reported as follows:

Gold:	1906.	1907.
Imports	Fr. 316,272,000	Fr. 95,069,000
Exports	86,929,000	73,123,000
Excess, imports	Fr. 229,343,000	Fr. 21,946,000
Silver:		
Imports	68,821,000	66,657,000
Exports	63,687,000	63,012,000
Excess, imports	Fr. 5,134,000	Fr. 3,645,000

Imports of copper and nickel coins were 45,000 fr. in 1906, and 40,000 fr. in 1907; exports were 119,000 fr. in 1906, and 150,000 fr. this year.

Prices of Foreign Coins

	Bid.	Asked.
Mexican dollars	$0.54	$0.56
Peruvian soles and Chilean	0.49¼	0.50½
Victoria sovereigns	4.85	4.87
Twenty francs	3.80	3.86
Spanish 25 pesetas	4.78¾	4.80

SILVER AND STERLING EXCHANGE.

July.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.	July.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.
25	4.8690	68¾	31⅝	29	4.8720	69⅛	31 11/16
26	4.8715	69	31¾	30	4.8825	69⅜	31 11/16
27	4.8715	69⅛	31 13/16	31	4.87⅛	69⅛	31 11/16

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

Other Metals

July.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. Cts. per lb.	Spelter. New York, Cts. per lb.	Spelter. St. Louis, Cts. per lb.
25	21 @21¼	20¼ @20¾	94	41	5.25	5.95	5.80
26	21 @21¼	20¼ @20¾	92	40½	5.25	5.90	5.75
27	21 @21¼	20 @20¼	.....	40¼	5.25	5.90	5.75
29	21 @21¼	20 @20½	90	40	5.25	5.85 @5.90	5.70 @5.75
30	21 @21¼	20 @20½	87	40	5.25	5.85 @5.90	5.70 @5.75
31	21 @21¼	20 @20¼	86	40	5.25	5.85 @5.90	5.70 @5.75

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 electroytic copper are for cakes, ingots or wirebars, and represent the bulk of the transactions as made with consumers, basis, New York, cash. The price of cathodes is 0.125c. below that of electrolytic. The lead prices are those quoted by the American Smelting and Refining Company for near-by shipments of desilverized lead in 50-ton lots, or larger. The quotations on spelter are for ordinary western brands; special brands command a premium.

Copper—There is little or no change from last week, and the market continues exceedingly dull. Buyers still hold back, being apparently reluctant to begin, though their stocks are diminishing in volume from day to day, and must soon be exhausted. This stagnant condition of the market is causing a great deal of concern. Orders on the part of domestic consumers, as already intimated, are not forthcoming, in spite of lower prices quoted from day to day, at which, however, some small business is being done for export. There have been rumors of a reduction in price on the part of one of the large producers, but this has as yet not been officially confirmed. The market closes weak at 21@21½c. for Lake copper; 20@20½c. for electrolytic in ingots, cakes and wirebars; 19½@19¾c. for casting.

The expectation of lower prices for refined sorts has induced a great deal of selling in the London standard market, causing a sharp break in both spot and three months' options, which close weak at £86 and £82 10s. respectively.

Refined and manufactured sorts we quote: English tough, £90; best selected, £94; strong sheets, £100.

Exports of copper from New York for the week were 1087 tons. Our special correspondent reports the shipments from Baltimore for the week at 822 long tons.

Copper Sheets—The base price of copper sheets is now 28c. per pound.

Copper Wire—The base price for sizes from No. 0000 to No. 8 is now 24¼@25¼c. per pound.

Tin—The market has been exceedingly uninteresting, with no business, practically. The London market was rather weak and quotations to domestic consumers were made on basis of importation prices. Spot tin is quoted at 40c., while the London market closes easy at £182 for spot, £181 for three months.

Lead—The quotation for desilverized lead remains unchanged at 5.25c. New York. Independent sellers are quoting considerably below the price of the American Smelting and Refining Company, and it is reported that business has taken place in St. Louis at 5c., against 5.17½c., the price for desilverized.

The London market is easing up and supplies are reported as being more plentiful. The close is steady at £19 10s. for Spanish lead, £19 12s. 6d. for English lead.

St. Louis Lead Market—The John Wahl Commission Company reports as follows: Lead is dull, with very little doing. Prices are nominally 5c. for Missouri brands.

Spanish Lead Market—Messrs. Barrington & Holt report from Cartagena, Spain, under date of July 15: The price of pig lead has been 97 reales per quintal; silver, 14 reales per ounce and exchange 28.16 pesetas to £1. The price of lead, on current exchange, is equal to £19 5s. 6d. per long ton, f.o.b. Cartagena. Exports for this week were 100 tons desilverized lead to Liverpool.

Spelter—The decline in the market has not yet been checked. Consumers assume a waiting attitude, being well supplied for some weeks ahead. The close is easy at 5.85@5.90c. New York, 5.70@5.75c. St. Louis.

Reports from abroad are altogether of a similar character, and a further decline brought the quotation down at the close to £23 2s. 6d. for good ordinaries, £23, 7s. 6d. for specials.

Zinc Sheets—The base price is now $8.35 per 100 lb.—less discount of 8 per cent.—f.o.b. cars at Lasalle and Peru, in 60-lb. cases for gages No. 9 to 22, both inclusive; widths from 32 to 60 in., both inclusive; lengths from 84 to 96 in., both inclusive. The freight rate to New York is 27.50c. per 100 lb.

Spanish Zinc Ore Market—Messrs. Barrington & Holt report from Cartagena, Spain, under date of July 15, that the market is quiet. Shipments for the week were 4850 tons blende to Antwerp.

Antimony—The market remains quiet and buying is from "hand to mouth." It is reported that the situation abroad is better and that prices are inclined to be higher. Quotations are 11@11½c. for Cookson's; 10@10½ for Hallett's; 9¼@10¼ for ordinary brands.

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

Quicksilver—Current prices in New York are $41 per flask of 75 lb. for large quantities and $42 for smaller orders. San Francisco orders are $38@39 per flask, according to quantities, for domestic orders, and $37@37.50 for export. The London price is £7 per flask, but £6 16s. 3d. is quoted by jobbers.

Platinum—A further advance has taken place in the platinum market, but as before no definite reason is ascribed by the refiners. It is probable that the scrap, which was thrown on the market in such large quantities when prices were at their maximum, has been nearly used up, creating a temporary scarcity of the metal. At any rate the demand does not seem to be extraordinary, and would hardly account for the rise. Quotations are as follows: Ordinary metal, $28; hard metal, $29.50; scrap is quoted at $22 @23 per ounce.

Missouri Ore Market

Joplin, Mo., July 27—The highest price paid for zinc ore was $50 on an assay base of $45@47.50 per ton of 60 per cent. zinc. It is reported that one bin sold on a base price of $48. The average price was $45.54.

The highest settling price for lead was $62, ranging down to $60 for best grades, but one choice bin of this mineral was sold for Monday's delivery at $64 per ton. The average price was $59.80.

The company that has been purchasing heavily and holding up prices, this week dropped $1 per ton on its base offerings, and although a heavy shipper from last week's purchases, bought little ore this week.

Output conditions are no less favorable than at the beginning of the month, the large new mills started being offset by a decrease in other quarters. Some mines have been placed on single shifts, and a number are running short-handed from lack of men. An Idaho man is in Joplin now booking the best miners for situations in the Cœur d'Alenes mines.

Following are the shipments of zinc and of lead from the various camps of the district for the week ending July 27:

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville.	3,943,930	879,780	$119,075
Joplin	2,730,180	294,770	74,377
Galena	1,009,300	130,230	27,280
Alba-Neck City	944,560	.....	23,131
Oronogo	601,500	35,720	15,160
Duenweg	507,560	87,390	14,548
Prosperity	442,430	71,470	12,541
Granby	660,000	20,000	9,000
Aurora	430,710	17,900	8,626
Spurgeon	248,920	59,120	6,255
Baxter Springs	58,470	69,360	3,489
Cave Springs	86,130	.....	2,024
Wentworth	86,130	.....	1,894
Stott City	63,690	.....	1,449
Sarcoxie	62,690	.....	1,441
Zincite	45,660	3,690	1,183
Playter	40,680	.....	956
Totals	11,962,840	1,669,430	$322,429
Seven months	363,073,360	54,852,300	$10,603,316

Zinc value, the week, $272,502; 30 weeks, $8,453,525
Lead value, the week, 49,927; 30 weeks, 2,149,791

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

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

Wisconsin Ore Market

Platteville, Wis., July 27—The ore market held its own this week both by a good production and also in price, 60 per cent. zinc selling at $48. All the ore produced has been sold, leaving no surplus in the bins. Lead is still off and as stated last week is expected to stay at $29 per 1000 lb. for some time to come. The ore-bins are full as the producers refuse to sell while the market is so low.

There have been several new contracts let the last week for new mills to be built in this district, and new strikes of ore are being made daily, all tending to make this district rank among the foremost in the northwest.

Following is the shipment of the district, by camps, for the week ending July 27, 1907:

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	76,450	.....	....
Benton	342,060	.....	.....
Buncombe-Hazel Green	302,000	55,000	.....
Linden	341,630	.....	.....
Highland	256,500	.....	.....
Galena	215,000	.....	.....
Mineral Point	162,400	.....	.....
Livingston	145,000	.....	.....
Cuba City	87,400	.....	.....
Harker	69,530	.....	.....
Rewey	65,000	.....	.....
Total for week	2,062,970	55,000	.....
Year to July 27	59,205,575	2,329,720	335,060

Chemicals

New York, July 31—The general market is stationary and the volume of business is small. Metallic salts are inactive and are influenced by the reactions in the metal markets.

Copper Sulphate—The demand for this salt continues fair with supplies up to all requirements. There has been no change in prices, quotations remaining at $7 per 100 lb. for carload lots and smaller quantities ruling at $7.25, according to seller and terms of sale. It is reported that independent dealers have shaded carload prices to $6.875 per 100 lb., but sales at this figure are rare.

Nitrate of Soda—The market is very strong on the South American coast, but is rather quiet here. Supplies seem to be ample for all demands. Prices remain firm at 2.50c. for 96 per cent. spot delivery, with 95 per cent. bringing 2.45c. For 1908 delivery these grades are quoted at 2.47½c. and 2.42½c. respectively. Dealers are loath to quote on 1909 salt.

Mining Stocks

New York, July 31—The market has been decidedly weaker and prices closed lower than a week ago. Amalgamated copper sold off during the week and closed at $88, a net loss of $4. American Smelting common closed $2.25 lower, at $114.75, and U. S. Steel common closed about the same as last week. The feature of the curb trading was the heavy selling of Nipissing, by what is believed to be Boston interests. This stock was attacked and sold down from 10⅝ to 7⅞. This was brought about by rumors that the next dividend would be passed, although the last dividend was paid only 11 days ago. This report was emphatically denied from headquarters; the strike situation, while clearer, has also had a weakening effect upon the Cobalt stocks. Nevada stocks were active and considerable business was done in them.

Boston

July 30—The weak position of copper is reflected in the mining-share market and liquidation has been noticeable in spots the past week. Prices in the stock market are lower for leading shares but the market is almost entirely professional. Amalgamated is off $5.62½ to $87.87½, Copper Range dropped $2.37½ to $78, and North Butte $2.75 to $79.75; Utah Consolidated went off $2.25 to $44.50, and Trinity, after stiffening to $24, fell back to $21. In some cases slight recoveries are to be recorded, but they are unimportant.

Calumet & Hecla, which hung around $800, is $2 below this tonight. The company's annual report was issued July 26.

Arizona Commercial and Shannon have gone off slightly, while Boston & Corbin owned and managed by the same people, has gone up on the curb. Arizona is off $2.50 to $22.50 and Shannon has lost $1.25 to $16. Corbin, on the curb, has risen $3.25 to $17.87½ with the final tonight $15.87½. Butte Coalition is off $1 net for the week to $24.25; Calumet & Arizona $2 to $165; Centennial $1.50 to $28; Franklin $1.50 to $13; Michigan $1 to $13; Old Dominion $2 to $42; Osceola $1.50 to $126.50; Quincy $3 to $115; Tamarack $6 to $101; and Wolverine $6.50 to $157. Nipissing has been heavily sold on the curb and is off $3.50 to $7.87½. The American Gold Dredging Company, a

favorite speculation a few years ago, has been liquidated and stockholders are getting a final p yment of 99c. a share on surrender of stock certificates. There are 90,000 shares outstanding.

Colorado Springs

July 27—There has been greater strength in the mining stock market on the local exchange the past week than for several months. Trading was confined to the mines list almost exclusively. The most active traders have been Dante, Elkton, El Paso, Gold Sovereign and Isabella. Under heavy selling Gold Sovereign showed the most strength. The entire market seems to have a better tone.

STOCK QUOTATIONS

NEW YORK	July 30	
Name of Comp.	Clg.	
Alaska Mine	1	
Am.Nev.M.&P.Co.	....	
Amalgamated	88	
Anaconda	56½	
Balaklala	....	
British Col. Cop.	9¾	
Buffalo Cobalt	2⅝	
Butte & London	....	
Butte Coalition	24⅝	
Butte Cop. & Zinc	....	
Cobalt Contact	....	
Colonial Silver	1¾	
Cum. Ely Mining	9⅛	
Davis Daly	12	
Dominion Cop.	5⅞	
El Rayo	4½	
Foster Cobalt	68	
Furnace Creek	⅛	
Giroux Mine	8	
Gold Hill	1⅞	
Granby, New	....	
Greene Gold	1⅞	
Greene G. & S	1⅝	
Greenw'r & D.Val.	75	
Guanajuato	3⅜	
Guggen. Exp.	212½	
Hanapah	¾	
McKinley Dar.	⅛	
Micmac	3¾	
Mines Co. of Am.	1½	
Mitchell Mining	3⅛	
Mont.Sho. C.(New)	....	
Nev. Utah M. & S.	4⅞	
Newhouse M. & S.	14¾	
Nipissing Mines	8½	
Old Hundred	2⅝	
Silver Queen	1⅛	
Stewart	1⅞	
Tennessee Cop'r	....	
Union Copper	¾	
Utah Apex	6¾	
West Columbus	10	

N. Y. INDUSTRIAL		
Am. Agri. Chem	....	
Am. Smelt. & Ref.	114¾	
Am. Sm. & Ref., pf.	106	
Bethlehem Steel	....	
Colo. Fuel & Iron.	31¾	
Federal M.& S., pf.	83	
Inter. Salt	16	
National Lead	59¾	
National Lead, pf.	98	
Pittsburg Coal	....	
Republic I. & S.	27¾	
Republic I.& S., pf.	84	
Sloss-Sheffield	56	
Standard Oil	500	
Tenn. C. & I	....	
U. S. Red. & Ref.	....	
U. S. Steel	36¾	
U. S. Steel, pf.	100½	
Va. Car. Chem	27	
Va. I. Coal & Coke	....	

ST. LOUIS	July 27		
N. of Com.	High.	Low.	
Adams	.40	.30	
Am. Nettie	.05	.03	
Center Cr'k	2.50	2.15	
Cent. C. & C.	68.75	68.00	
C.C. & C. pd.	81.00	80.00	
Cent. Oil	110.00	100.00	
Columbia	7.00	4.50	
Con. Coal	28.00	27.00	
Dee Run	150.00	130.00	
Gra. Bimet.	.40	.35	
St. Joe	17.00	15.00	

BOSTON	July 30	
Name of Comp.	Clg.	
Adventure	....	
Allouez	45	
Am. Zinc*	34	
Arcadian	6	
Atlantic	....	
Bingham	15	
Boston Con.	26½	
Calumet & Ariz.	165	
Calumet & Hecla	798	
Centennial	28	
Con. Mercur	.45	
Copper Range	78	
Daly-West	15¾	
Franklin	13	
Greene—Can	15⅜	
Isle Royal	18¾	
La Salle	....	
Mass	5⅞	
Michigan	13½	
Mohawk	....	
Mont. C. & C.(new)	....	
Nevada	14¼	
North Butte	80⅜	
Old Colony	....	
Old Dominion*	42⅜	
Osceola*	125	
Parrot	....	
Phoenix	....	
Quincy	115	
Rhode Island	5¼	
Santa Fe	3¼	
Shannon	16⅜	
Tamarack	102	
Trinity	21⅞	
United Cop., com*	62⅛	
U. S. Oil	10¾	
U. S. Smg. & Ref.	48¾	
U.S.Sm.& Re.,pd.	43½	
Utah Copper	45	
Victoria	....	
Washington	....	
Winona	7¾	
Wolverine	157	
Wyandotte	1¼	

*Ex. Div. †Ex. Rights.

BOSTON CURB	
Ahmeek	....
Ariz. Com	....
Black Mt.	5¼
East Butte	9
Hancock Con.	10
Keweenaw	8½
Majestic	2¼
Raven	1 7/16
Shawmut	.49
Superior	10
Superior & Pitts.	16⅛
Troy Man	1½

LONDON	July 31		
Name of Com.	Clg.		
Dolores	£1	7s	6d
Stratton'sInd.	0	2	6
Camp Bird	1	0	9
Esperanza	2	3	11½
Tomboy	1	11	3
El Oro	1	8	9
Oroville	0	16	6
Somera	1	6	3
Utah Apex	1	5	0
Ariz.Cop.,pfd.	3	3	1
Ariz.Cop.,def.	3	2	3

Cabled through Hayden, Stone & Co., N. Y.

S. FRANCISCO	July 24
Name of Comp.	Clg.
COMSTOCK STOCKS	
Belcher	.37
Best & Belcher	1.15
Caledonia	.46
Challar	.11
Con. Cal. & Va	.70
Crown Point	.34
Exchequer	.47
Gould & Curry	.17
Hale & Norcross	.64
Mexican	.69
Ophir	2.35
Overman	.20
Potosi	.13
Savage	.65
Sierra Nevada	.45
Union	.35
Utah	.07
Yellow Jacket	.95
TONOPAH STOCKS	
Golden Anchor	.18
McNamara	.28
Montana-Pitts.ex.	.09
North Star	.22
Rescue	.15
GOLDFI'D STOCKS	
Black Ants	.05
Blue Bull	.34
Columbia Mt.	.59
Comb. Frac.	2.45
Conqueror	.14
Daisy	2.12
Florence	5.50
Frances-Mohawk	1.10
Goldfield Con.	8.60
Grandma	.16
Great Bend	.76
Red Hills	.54
St. Ives	.95
BULLFROG STOCKS	
Amethyst	.29
Bonnie Claire	.50
Mayflower Con.	.38
Montgomery Mt.	.14
Original	.07
MANHAT'N STOCKS	
Gold Wedge	.07
Manhattan Mg.	.06
Pine Nut	.07
Ruby Wonder	.20
Stray Dog	.17
Yellow Horse	.04

NEVADA	July 31
(Weir Bros. & Co., New York)	
TONOPAH STOCKS	Clg.
Tono'h Mine of N.	13.37½
Tonopah Exten.	1.62½
Montana Tonop'h	3.05
Belmont	3.06½
Tonopah Midway	.92
West End Con.	.80
Jim Butler	.98
GOLDFI'D STOCKS	
Sandstorm	.40
Kendall	.28
Red Top	3.75
Jumbo	3.75
Goldfield Mining	1.45
Dia'dfield B. B. C.	.25
Atlanta	.60
Mohawk	16.50
Silver Pick..	.60
Laguna	1.45
BULLFROG STOCKS	
Mont. Shoshone C.	6.50
Tramps Con.	.41
Gold Bar	.69
Bullfrog Mining..	.14
Bullfrog Nat. B.	.22
Homestake Con..	...
MANHAT'N STOCKS	
Manhattan Con..	.46
Manhat'n Dexter.	.13
Jumping Jack	.08
Stray Dog	.16
Indian Camp	.07

COLO. SPRINGS	July 27
Name of Comp.	Clg.
Acacia	8¾
Black Bell	....
C. C. Con	....
Dante	5⅛
Doctor Jack Pot	....
Elkton	54
El Paso	41
Findlay	55
Gold Dollar	....
Gold Sovereign	4½
Isabella	23¼
Index	....
Jennie Sample	5¾
Jerry Johnson	....
Mary McKinney	56
Pharmacist	....
Portland	1.15
Un. Gold Mines	....
Vindicator	79
Work	16½

New Dividends

Company.	Payable.	Rate.	Amt.
Amalgamated	Aug. 26	$2.00	$3,061,758
Am. Zinc, Lead & Smg	Aug. 1	0.75	45,000
Arizona Copper, pfd	July 30	0.54	1,007,705
Arizona Copper, def	July 30	0.54	137,040
British Columbia	Sept. 4	0.40	122,000
Boston & Montana	.....	12.00	1,800,000
Cambria Steel	Aug. 15	0.75	675,000
Camp Bird, Ltd	Aug. 3	0.24	196,800
Dos Estrellas	July 1	0.60	1,800
Newhouse	Aug. 31	0.50	300,000
New River Coal, pfd	Aug. 1	1.50	56,425
North Star	July 2	0.20	59,000
Philadelphia Gas	Aug. 1	0.75	434,296
Silver King Coalition	July 31	....	187,500
Tenn. C. I. & R. R., com	Aug. 1	1.00	225,536
Tenn. C. I. & R. R., pfd	Aug. 1	2.00	4,960
Tenn. Copper	Aug. 15	2.00	350,000
United Copper	Aug. 6	1.75	787,500
United Verde	July 25	0.75	225,000
United Zinc, pfd	July 15	0.50	9,778
U. S. C. I Pipe & Fdy., com.	Sept. 2	1.00	121,063
U. S. C. I. Pipe & Fdy., pfd.	Sept. 2	1.00	121,063
Utah (Fish Springs)	July 16	0.03	3,000
Work	July 1	0.01	15,000

Assessments

Company.	Delinq.	Sale.	Amt.
Alpha, Nev	July 30	Aug. 20	$0.05
Bader, Cal	July 24	Aug. 13	0.05
Birchville, Cal	July 10	Aug. 1	0.02
Cedar Creek, Ida	July 13	Aug. 3	0.003
Chollar, Nev	Aug. 19	Sept. 12	0.10
Christmas, Utah	July 15	Aug. 6	0.005
Crown Point, Nev	July 24	Aug. 14	0.10
Emerald, Utah	Aug. 15	Sept. 7	0.01½
Grand Pacific, Cal.	Aug. 10	Oct. 2	0.02
Loon Creek, Ida	July 17	Aug. 5	0.01
Mexican, Nev	July 15	Aug. 5	0.10
Morrison, Utah	July 19	Aug. 3	0.01
Mt. Pleas't Con., Cal.	July 29	Aug. 19	0.03
Patterson Creek	Aug. 3	Aug. 26	0.10
Reindeer, Ida	Aug. 18	Aug. 27	0.01
Sheba G. & S., Utah	July 30	Nov. 2	0.10
Skylark, Utah	July 10	July 27	0.005
Union Con., Nev	Aug. 12	Sept. 3	0.10
West'n Mines Co., N.	Aug. 1	Aug. 31	0.02
Zeibright, Cal	July 15	Aug. 6	0.05

Monthly Average Prices of Metals

AVERAGE PRICE OF SILVER

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

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

AVERAGE PRICES OF COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1906.	1907.	1906.	1907.	1906.	1907.
January	18.310	24.404	18.419	24.825	78.869	106.739
February	17.869	24.869	18.116	25.236	78.147	107.356
March	18.361	25.065	18.641	25.560	81.111	106.594
April	18.375	24.224	18.688	25.260	84.793	98.625
May	18.475	24.048	18.724	25.072	84.867	102.375
June	18.442	22.665	18.719	24.140	83.994	97.272
July	18.190	21.130	18.585	21.923	81.167	95.016
August	18.380	.....	18.706	.....	83.864	.....
September	19.033	.....	19.328	.....	87.831	.....
October	21.203	.....	21.722	.....	97.269	.....
November	21.833	.....	22.398	.....	100.270	.....
December	22.885	.....	23.350	.....	105.226	.....
Year	19.278	.....	19.616	.....	87.282	.....

New York, cents per pound. Elecrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

AVERAGE PRICE OF TIN AT NEW YORK

Month.	1906.	1907.	Month.	1906.	1907.
January	36.390	41.548	July	37.275	41.091
February	36.403	42.102	August	40.606	.....
March	36.662	41.313	September	40.516	.....
April	38.900	40.938	October	42.852	.....
May	43.313	43.149	November	42.906	.....
June	39.260	42.120	December	42.750	.....
			Av. year	39.819	.....

Prices are in cents per pound.

AVERAGE PRICE OF LEAD

Month.	New York.		London.	
	1906.	1907.	1906.	1907.
January	5.600	6.000	16.850	19.828
February	5.464	6.000	16.031	19.531
March	5.350	6.000	15.922	19.703
April	5.404	6.000	15.959	19.975
May	5.685	6.000	16.725	19.688
June	5.750	5.760	16.813	20.188
July	5.750	5.288	16.525	20.350
August	5.750	.....	17.109	.....
September	5.750	.....	18.266	.....
October	5.750	.....	19.350	.....
November	5.750	.....	19.281	.....
December	5.900	.....	19.609	.....
Year	5.657	.....	17.370	.....

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

AVERAGE PRICE OF SPELTER

MONTH.	New York.		St. Louis.		London.	
	1906.	1907.	1906.	1907.	1906.	1907.
January	6.487	6.732	6.337	6.582	28.225	27.125
February	6.075	6.814	5.924	6.664	25.844	25.938
March	6.209	6.837	6.056	6.687	24.563	26.094
April	6.078	6.685	5.931	6.535	25.781	25.900
May	5.997	6.441	5.846	6.291	27.000	25.563
June	6.006	6.419	5.948	6.269	27.728	24.469
July	6.006	6.072	5.856	5.922	26.800	23.850
August	6.027	.....	5.878	.....	26.938	.....
September	6.216	.....	6.056	.....	27.563	.....
October	6.222	.....	6.070	.....	28.075	.....
November	6.375	.....	6.225	.....	27.781	.....
December	6.593	.....	6.443	.....	27.938	.....
Year	6.198	.....	6.048	.....	27.020	.....

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

CHEMICALS, MINERALS, RARE EARTHS, ETC.—CURRENT WHOLESALE PRICES.

ABRASIVES—		
Bort, good drill quality, carat..		$85.00
Carborundum, f.o.b. Niagara Falls, powd	lb.	.08
Grains	"	.10@.17
Corundum	"	.07@.10
Crushed Steel, f.o.b. Pittsburg	"	.05¾@.06
Emery, in kegs: Turkish flour	"	.01½@.02½
Grains	"	.03½@.04½
Naxos flour	"	.01½@.02½
Grains	"	.03½@.04½
Chester flour	"	.01½
Grains	"	.03½@.04½
Peekskill, f.o.b. Easton, Pa., flour	"	.01½@.01½
Grains, in kegs	"	.02½@.02½
Garnet, per quality	sh ton	25.00@35.00
PumiceStone, Am. Powd.	100 lb.	1.60@2.00
Italian, powdered	"	.01¼@.01½
Lump, per quality	"	.03@.20
Rottenstone, ground	"	.02½@.04½
Lump, per quality	"	.05@.25
Rouge, per quality	"	.05@.30
Steel Emery, f.o.b. Pittsburg	"	.07½@.07¾
ACIDS—		
Acetic 28%	lb.	.02¼@.02½
Boric	"	.09¾@.10
Hydrofluoric, 30%	"	.02¾@.03
" 48%	"	.06
" 60%	"	.10
Hydrochloric acid, 20°, per lb		1.25@1.50
Nitric acid, 38°	per lb.	4.25@4.62½c.
Sulphuric acid, 50°, bulk, per ton		$12 up.
60°, 100 lb. in carboys		.85@1.12½
60°, bulk, ton		16.00@18.00
66°, 100 lb. in carboys		1.00@1.25
66°, bulk, ton		18.00
Oxalic	"	.08¾@.09¼
ALCOHOL—Grain	gal.	2.46¼
Refined wood, 95@97%	"	.70@.75
ALUM—Lump	100 lb.	$1.75
Ground	"	1.85
Chrome Alum	lb.	.04¼
ALUMINUM—Sulphate, com'l.	"	1.25@1.60
AMMONIA—24 deg.	lb.	.04¼@.05¼
" 26 "	"	.04¾@.05¾
AMMONIUM—		
Bromide	lb.	.23
Carbonate	"	.07½@.08
Muriate grain	"	.06½@.06¾
Lump	"	.09½@.09¾
Sulphate, 100 lb		3.10@3.12½
Sulphocyanide com		.30
" " chem. pure	"	.40
ANTIMONY—needle, lump	lb.	.09@.10
ARSENIC—White (nominal)	"	.07½@.07½
Red	"	.07½@.07¾
ASPHALTUM—		
Barbadoes	per ton.	40.00@80.00
West Indies	"	20.00@60.00
Egyptian	lb.	.14@.18
Gilsonite, Utah ordinary	per ton.	35.00
Trinidad	"	30.00@32.50
California	"	22.50@30.00
BARIUM—		
Carb. Lump, 80@90%	lg. ton.	30.00@35.00
Powdered 80@90%	lb.	.02@.02½
Chloride com'l	ton.	40.00 up
Nitrate powdered, in casks	lb.	.05½@.06
Blanc Fixe	per lb.	.02¼
BARYTES—		
Am. Ground	sh. ton.	14.00@21.00
Floated	"	22.00
Foreign floated	"	19.50@22.50
BISMUTH—Sub-nitrate	lb.	1.50
BLEACHING POWDER—35%, 100 lb.		1.25@1.40
BLUE VITRIOL—(copper sulphate), carload, per 100 lb		7.00
BONE ASH	lb.	.02½@.04
BORAX	"	.07½@.08
CALCIUM—Acetate, gray	"	2.35@2.40
Acetate, brown	"	1.60@1.65
Carbide, ton lots f.o.b. Niagara Falls, N. Y., for Jersey City, N. J.	sh. ton.	65.00
Chloride, f.o.b. N. Y.	"	14.75@19.75
CEMENT—		
Portland, Am. 500 lb	bbl.	1.55@1.60
Foreign	"	2.25@2.90
"Rosendale," 300 lb	"	.85
(in sacks)		.65
Slag cement	"	.75@1.25
CHROME ORE—		
New Caledonia 50% ex. ship N. Y.	per lg. ton	17.50@20.00
Bricks, f.o.b. Pittsburg, M.	"	175.00
CLAY, CHINA—Am. common ex-dock, N. Y.	"	8.50@9.00
Foreign	"	11.50@17.50
COBALT—Oxide	lb.	2.50
COPPERAS—Bulk	100 lb.	$0.55
In bbls	"	.65@.75
In bags	"	.60@.70
CRYOLITE	lb.	.06½@.06¾
FELDSPAR—Ground best	sh. ton.	14.00
FIRE BRICK.		
American	per M.	30.00@40.00
Imported	"	30.00@45.00
St. Louis No. 1	"	16.00
" No. 2	"	14.00
Extra	"	20.00@23.00
FIRE CLAY.		
St. Louis mill, dom	per ton	2.50
FLUORSPAR—		
Domestic f.o.b. shipping port:		
Lump	lg. ton.	8.00@10.00
Ground	"	11.50@13.50
Foreign crude ex. dock		8.00@10.00
FULLER'S EARTH—Lump	100 lb.	.80@.85
Powdered	"	.85@.90
GRAPHITE—		
American, ore, common	lb.	.01@.10
Artificial	"	.06
Ceylon, common pulv	"	.02½@.03½
Best, pulverized	"	.04@.08
German, com. pulv	"	.01½@.01½
Best, pulverized	"	.01½@.02
Italian, pulverized	"	.01@.02
GYPSUM—		
Fertilizer	sh. ton.	7.00
Powdered	sh. ton.	10.00
INFUSORIAL EARTH—		
Ground Am. best	lb.	.01¾
French	lg. ton.	56.00
German	lb.	.02½@.02¾
LEAD—Acetate (sugar of) brown	lb.	.07¾
Nitrate, com'l	"	.09½@.09¾
MAGNESITE—Greece.		
Crude (95%)	lg. ton.	7.00@8.00
Calcined, powdered	sh. ton.	32.50@40.00
Bricks, domes, per qual. f.o.b. Pittsburg	M.	160@200
MAGNESIUM—		
Chloride, com'l	100 lb.	.80@1.15
Sulphate (Epsom salt)	100 lb.	.90@1.00
MANGANESE—		
Crude powdered:		
70@75% binoxide	lb.	.01¼@.01¾
75@85% binoxide	"	.01½@.02
85@90% binoxide	"	.01¾@.05
90@95% binoxide	"	.06½
Ore, 80%-85%	sh. ton.	35.00@60.00
MARBLE—Flour	sh. ton.	9.50@10.00
MINERAL WOOL—		
Slag, ordinary	"	19.00
Selected	"	25.00
Rock, ordinary	"	32.00
Selected	"	40.00
MONAZITE SAND—		
Guar. 97%, with 5% Thorium oxide, nominal	lb.	.08 and up.
NICKEL—		
Oxide, crude, lb. (77%) for fine metal contained		.47
Sulphate, single	lb.	.13@.18
" double	"	.09@.11
NITRATE OF SODA—100 lb. 96% for 1907		2.55
95% for 1908		2.47
95% for 1909		2.50
96% is 5½c higher per 100 lb.		
OZOKERITE—best	lb.	.14@.17
PAINTS AND COLORS—		
Litharge, Am. powdered	"	.07½@.07¾
English glassmakers'	"	.08½@.08¾
Lithopone	"	.03¾@.07
Metallic, brown	sh. ton.	16.50@22.00
Red	"	16.00
Ocher, Am. common	"	8.50@9.00
Best	"	16.00
Dutch, washed	lb.	.02½@.03
French, washed	"	.01½@.02½
Paris green, pure, bulk	"	.26
Red lead, American	"	.07½@.07¾
Foreign	"	.08½@.08½
Turpentine, spirits bbl., per gal.		.60½
White lead, Am., dry	lb.	.06¾@.07
American, in oil	"	.07½@.07½
Foreign, in oil	"	.10½@.10¾
Zinc white, Am. extra dry	"	.05½@.05½
Foreign, red seal, dry	"	.07½@.07¾
Green seal, dry	"	.08½@.08½
PHOSPHATES—Acid		.65@67½c per unit
*Fla., hard rock		10.25@10.50
land pebble 68%		5.75@6.00
†Tenn., 78@80%		6.50@7.00
75%		6.00@6.25
68@72%		4.00@4.25
‡So. Car. land rock		5.75@7.25
" " river rock		
POTASSIUM—		
Bicarbonate crystal	lb.	$.08½@.09
Powdered or granulated	"	.09@.09½
Bichromate, Am	"	.08¾@.09
Scotch	"	.11
Bromide	"	.16
Carbonate (80@85%	"	.03¾@.04
Caustic, ordinary	"	.04½@.05½
Elect. (90%)	"	.05½@.06
Chloride (muriate), 100 lb		1.90
Chlorate, powdered	"	.09½@.09½
Crystals	"	09@09½
Cyanide (98@99%)	"	.18@.19
Kainite, long ton, bulk, 8.50; bags, 9.50.		
Permanganate	lb.	10@10½
Prussiate, yellow	"	.16@.16½
Red	"	.33@.35
Sulphate	100 lb.	2.18½@2.21½
PYRITE—		
Domestic, non-arsenical, furnace size, f.o.b. mines	per unit	11@11½c
Domestic, non-arsenical, fines, per unit, f.o.b. mines		10@10½c.
Imported non-arsenical, furnace size, per unit		.13½@.14
Imported, arsenical, furnace size, per unit		.12½@.13
Imported fines, arsenical, per unit.		.08½@.09
" " non-arsenical, per unit		10½@11c.
SALT—N. Y. com. fine 280 lb.	bbl.	.72@1.18
N. Y. agricultural	sh. ton.	3@4.40
SALTPETER—Crude	100 lb.	4.25@4.50
Refined, crystals	"	4.75@5.75
SILICA—		
Ground quartz, ord'ry	lg. ton	13.00@15.00
Silex	"	13.00@30.00
Lump Quartz	"	2.50@4.00
Glass sand	"	2.75
SILVER—Nitrate, crystals	oz.	.43½@.45½
SODIUM—		
Acetate	lb.	.04¼@.04½
"Alkali," per 100 lb., 58/48		.80@.87½
Bicarb. soda, per 100 lb		1.20@1.50c.
Soda, caustic, per 100 lb., 76/60		1.75@1.85
" " powdered		.02¾@.03¼
Salt cake, per 100 lb		.65@.85
Soda, monohydrate, per lb		1.4@1.75c.
Bichromate	lb.	.07½@.07½
Bromide	"	.16
Chlorate, com'l	"	.09@.09½
Cyanide, ("100% KCN")	"	.18@.19
Hyposulphite, Am	"	1.35 up
German	"	1.60@1.70
Phosphate	100 lb.	1.80@1.90
Prussiate	"	.09½@.10½
Sal soda, f.o.b. N. Y	100 lb.	.70@.85
Foreign, f.o.b. N. Y.	"	.80@1.00
Silicate, com'l	100 lb.	.75@1.15
Sulphate, com'l, (Glauber's salt)	100 lb.	.50@.60
" " calcined		.65@.85
STRONTIUM—Nitrate	lb.	.08½@.08½
SULPHUR—		
Louisiana (prime) to New York, Boston or Portland	lg. ton	22.12½
To Philadelphia or Baltimore	"	22.50
Roll	100 lb.	1.85@2.15
Flour	" "	2.00@2.40
Flowers, sublimed	" "	2.20@2.60
TERRA ALBA—French & Eng.	100 lb.	.85@1.00
TALC—Domestic	sh. ton.	15.00@25.00
French	"	20.00@25.00
Italian, best	"	35.00@40.00
TIN—Bi-chloride, 50%	lb.	.12¼
Crystals	"	.24¾ up
Oxide, lb		.47@.49
URANIUM—Oxide	"	3.50
ZINC—Metallic ch. pure	"	.15
Chloride solution, com'l 20°	"	.02½
Chloride, granular	"	.04¾@.05
Dust	"	.05½@.06½
Sulphate	"	.02½@.02½

*F. o. b. Florida or Georgia ports. †F. o. b. Mt. Pleasant. ‡On vessel Ashley River, S. C.

Note—These quotations are for wholesale lots in New York, unless otherwise specified, and are generally subject to the usual trade discounts. Readers of THE ENGINEERING AND MINING JOURNAL are requested to report any corrections needed, or to suggest additions which they may consider advisable.

Metal and Mining Companies—U. S.

Name of Company and Location.		Author-ized Capital	Shares. Issued.	Par Val.	Dividends. Total to Date.	Latest. Date.	Amt.
Alaska Mexican, g.	Al'ka	$1,000,000	180,000	$ 5	$1,626,381	July 1907	$ .30
Alaska Treadwell,g.	Al'ka	5,000,000	200,000	25	9,435,000	July 1907	1.00
Alaska United, g.	Al'ka	1,000,000	180,200	5	306,340	Jan. 1907	0.30
Amalgamated, c,.	Mont	155,000,000	1,530,879	100	53,646,546	Aug. 1907	2.00
Am.Sm.&Ref.,com.	U. S.	50,000,000	500,000	100	10,625,000	July 1907	2.00
Am. Sm. & Ref. pf.	U. S.	50,000,000	500,000	100	24,463,053	July 1907	1.75
Am. Smelters, pf. A	U. S.	17,000,000	170,000	100	1,430,000	Mar. 1907	1 50
Am. Smelters. pf. B	U. S.	30,000,000	300.000	100	3,000,000	June 1907	1.25
Am.Zinc,Lead&Sm.	Kan.	3,750,000	80,000	25	60,000	Aug. 1907	.75
Anaconda,c.	Mont	30,000,000	1,200,000	25	36,950,000	July 1907	1.75
Annie Laurie, g.	Utah	5,000,000	25,000	100	465,061	July 1905	.50
Arizona, c.	Ariz	3,775,000	3,682,520	....	6,182,361	Apr. 1906	.05
Atlantic, c.	Mich	2,500,000	100,000	25	990,000	Feb. 1905	.02
Beck Tunnel, g.s.l.	Utah	100,000	1,000,000	0.10	555,000	May 1907	.04
Bingham & N.H.,c.g	Utah	2,000,000	226,000	5	22,600	Sept. 1906	.10
Boston & Montana.	Mont	3,750,000	150,000	25	47,875,000	Nov. 1906	12.00
Bull.Beck.&Cham.g	Utah	1,000,000	100,000	10	2,688,400	Apr. 1907	.10
Bunker Hill & Sull.	Ida	3,000,000	300.000	10	9,126,000	July 1907	.60
Butte Coalition,c.s.	Mont	15,000,000	1,000,000	15	1,800,000	June 1907	.50
Calumet & Arizonac	Ariz	2,500,000	200,000	10	8.000.000	June 1907	5.00
Calumet & Hecla,c.	Mich	2,500,000	100,000	25	103,400,000	June 1907	20.00
Camp Bird, g., s.	Colo	5,500,000	820,000	5	4,079,500	Aug. 1907	.24
Carisa, c.g.	Utah	500,000	500,000	1	55,000	Nov. 1906	.01
Central Eureka, g.	Cal	400,000	398,425	1	778,921	Mar. 1906	.07
Columbus Con. c.	Utah	1,500,000	300,000	5	165,000	July 1907	.20
Combi'tion Co.G'f'd	Nevada	400,000	320,000	1	688,000	Sept. 1906	.15
Con. Mercur, g.	Utah	1,000,000	1,000,000	1	1,205,000	Dec. 1906	.02½
Continental, z.l.	Mo	550,000	22,000	25	209,000	July 1907	.50
Copper Range Con.	Mich	38,500,000	383,781	100	5,326,458	July 1907	2.00
Creede United, g.	Colo	2,000,000	1,625,000	1	214 053	July 1906	.00½
Cripple Creek Con g	Colo	2,000,000	2,000,000	1	180,000	Mar. 1905	.00½
Daly Judge, g. s. l.	Utah	300.000	300,000	1	225,000	Apr. 1907	.37½
Daly West, g. s. l.	Utah	3,600,000	180,000	20	5,607,000	Mar. 1907	.60
De Lamar, g. s.	Ida	400,000	67,180	5	2,926,370	May 1905	.72
Dillon, g.	Colo	1,250,000	1,250,000	1	21,875	July 1905	.01
Doctor Jack Pot.	Colo	3,000,000	3,000,000	1	268,000	July 1906	.00½
Doe Run, l.	Mo	10,000,000	59,062	100	1,346,444	July 1907	.50
Elkton Con., g.	Colo	3,000,000	2,500,000	1	1,879.460	June 1907	.01½
El Paso, g.	Colo	2,500,000	2,450,000	1	1,022,750	June 1906	.01
Fed. Sm., com.	Idaho	10,000,000	60,000	100	2 348 750	June 1907	5.00
Federal Sm., pf.	Idaho	20,000,000	120,000	100	2,861,250	June 1907	1.75
Findley, g.	Colo	1,250,000	1,250,000	1	325,000	Aug. 1906	.01
Frances-Mohawk,g	Nevada	1,000,000	910,000	1	323,000	July 1907	0.10
Gemini-Keystone	Utah	500,000	5,000	100	1,850,000	July 1906	10.00
Gold King Con	Colo	5,750,370	5,750,370	1	1 407.504	May 1905	.01
Grand Central, g.	Utah	250,000	250,000	1	1,278.000	May 1907	.04
Gwin Mine, Dev., g.	Cal	1,000,000	100,000	10	35,000	Mar. 1906	.25
Hecla, s. l.	Idaho	250.000	1,000,000	0.25	1,280,000	June 1907	.10
Homestake, g.	S. D.	21,840,000	218,400	100	22,244,040	Apr. 1907	.50
HornSilver,g.s.c.z.l	Utah	10,000,000	400,000	25	5,622,000	June 1907	.05
Inter'l Nickel, pf.	N. Y.	12,000,000	87,415	100	786,736	Aug. 1907	1.50
Iron Silver	Colo	10,000,000	500,000	20	4,050,000	July 1907	.10
Jamison, g.	Cal	3,900 000	390,000	10	278,470	July 1907	.02
Jerry Johnson.	Cal	2,500,000	2,500,000	1	61,700	Apr. 1906	.03
Kendall, g.	Mont	2,500,000	500 000	5	1,120,000	July 1907	.02
Liberty Bell,g. s.	Colo	700,000	130,551	5	110,857	Jan. 1906	.15
Lightner, g.	Cal	125,000	102,255	1	295.694	Aug. 1906	.05
Lower Mammoth, g	Utah	190,000	190,000	1	19,000	July 1907	.05
Mammoth, g. s. l.	Utah	10,000 000	400,000	25	2,120,000	Oct. 1906	.05
Mary McKinney, g.	Colo	1,500,000	1,304,252	1	801,765	Apr. 1907	.03
Mohawk, c.	Mich	2,500,000	100,000	25	1,400,000	July 1907	5.00
Mont Ore Purch.	Mont	2,500,000	80,833	25	9 437 274	Jan. 1907	15.00
Nevada Hills, s.g.	Nevada	1,000,000	200,000	5	20,000	Mar. 1907	.10
New Century, z., l.	Mo	300,000	300,000	1	228,800	June 1907	.01
Newhouse M. & S.c.	Utah	6,000,000	600,000	10	300,000	July 1907	.50
New Idria, q.	Cal	500 000	100,000	5	920,000	July 1907	.20
New Jersey Zinc	U. S.	10,000,000	100,000	100	8.400,000	Feb. 1906	3.00
North Butte	Mont	6,000,000	400,000	15	5,000,000	June 1907	2.00
North Star, g.	Cal	2,500,000	250,000	10	1,436,989	July 1907	.20
Northern Light,g.s.	Utah	2,000,000	400,000	5	20,000	Feb. 1904	.05
Old Dominion Cop.	Ariz	7,500,000	281,589	25	280,843	May 1906	.50
Old Gold	Colo	2,101,150	2,101,150	1	10,506	Mar. 1906	.05
Ophir, g. s.	Nevada	302,400	100,800	3	1,797,400	July 1904	.25
Osceola, c.	Mich	2,500,000	96,150	25	7,035,650	July 1907	7.00
Parrot,c,s.	Mont	2,300,000	229,850	10	6,692,724	Mar. 1907	.25
Pennsylvania g.	Cal	5.150.000	51,500	100	284,925	July 1905	.10
Pitts. L. & Z., l.z.	Mo	1,000,000	1,000,000	1	20,000	July 1907	.02
Portland, g.	Colo	3,000,000	3,000,000	1	7,507,080	July 1907	.04
Quincy, c.	Mich	3,750,000	110,000	25	17,460,446	June 1907	4.50
Rob Roy, z.	Mo	15,000	15,000	1	9,600	May 1906	.03
Rocco Homest'k,l.s.	Nevada	300,000	300,000	1	112 000	Dec. 1905	.02
Sacramento, g, q.	Utah	1,000,000	1,000,000	1	258,000	Nov. 1906	.00½
Salvator, g. s. l.	Utah	200 000	200,000	1	6,500	Aug. 1904	.01
St. Joseph, l.	Mo	20,000,000	1,000,000	10	5,238,357	June 1907	.15
Silver Hill, g s.	Nevada	108,000	108,000	1	81 000	June 1907	.05
Silver King, g. s. l.	Utah	3,000,000	150,000	20	11,000,000	Jan. 1907	.33½
Shannon, c.	Ariz	3,000,000	300,000	10	450 000	July 1907	.50
Snowstorm, s. l.	Ida	1,500,000	1,500,000	1	360,000	July 1907	.03
Spearfish, g.	S. D.	1,500,000	1,500,000	1	165,500	Jan. 1905	.01½
Standard Con., g. s.	Cal	2,000,000	178,600	10	5,139,061	Mar. 1907	.10
Stratton'sIndepend	Colo	5,500,000	1,000,007	5	4 895,865	Apr. 1906	.12½
Swansea, g. s. l.	Utah	500,000	100,000	5	329,500	Mar. 1907	.05
Tamarack, c.	Mich	1,500,000	60,000	25	9,420,000	July 1907	4.00
Tennessee, c.	Tenn	5,000,000	175,000	25	1,443,750	Aug. 1907	2.00
Tomboy, g. s.	Colo	1,750,000	300,000	5	900 000	June 1906	.48
Tonopah of Nev.	Nevada	1,000,000	1,000,000	1	3,250,000	July 1907	.25
Tonopah Belmont.	Nevada	2,000,000	1,295,007	1	518,003	Apr. 1907	.10
Tonopah Ext'nsion	Nevada	1,000,000	928,433	1	278,530	Apr. 1906	.15
Tonopah Midway.	Nevada	1,000,000	1,000,000	1	300,000	Jan. 1907	.05
Uncle Sam, g.s.l.	Utah	500,000	500,000	1	130 000	Oct. 1906	.01
United Cop. com.	Mont	75,000,000	450,000	100	5,962,500	Aug. 1907	1.75
United, c. pf.	Mont	5 000,000	50,000	100	1,500,000	May 1907	3.00
United, z. l., com.	Mo.-Kan.	500,000	92,400	5	27,450	Oct. 1903	.05
United, z. l., pf.	Mo.-Kan.	500,000	19 556	25	293,028	July 1907	.50
United, (Crip'le C'k)	Colo	5,000,000	4,009,100	1	280,071	Apr. 1905	.00½
United Verde, c.	Ariz	3,000,000	300,000	10	18,810,322	July 1907	.75
Un.States,pf.g.s.c.l*	Utah	37,500,000	750,000	50	3,937,500	July 1907	.87½
U.S. Red. & Ref. Pf.	Colo	4,000 000	39,458	100	946,317	July 1907	1.50
Utah, g.(Fish Sp'gs)	Utah	1,000.000	100,000	10	270,000	July 1907	.03
Utah Con., c.	Utah	1,500,000	300,000	5	6,936,000	July 1907	1.50
Victoria, Utah	Utah	250,000	250,000	1	177,500	Mar. 1907	.04
Vindicator Con., g.	Colo	1,500.000	1,500,000	1	1,605,000	Apr. 1907	.03
Wolverine, c.	Mich	1,500,000	60,000	25	4,050,000	Apr. 1907	10.00
Work, g.	Colo	1,500,000	1,500,000	1	105,000	July 1907	.01
YankeeCon	Utah	500,000	500,000	1	140,000	Jan. 1907	.03
Yellow Aster, g.	Cal	1,000,000	100,000	10	913,789	May 1907	.10

*Previous to consolidation $1,436,250 were divided.

Coal, Iron and Other Industrials—United States.

Name of Company and Location.		Author. ized Capital.	Shares. Issued	Par Val. $	Dividends. Total to Date.	Latest. Date.	Amt.
Ala. Con., C. & I., pf.	Ala	$2,500,000	24,638	100	$905,265	May 1905	$1.75
Allis-Chalmers, pf.	U S	25,000,000	200,000	100	3,213,750	Feb. 1904	1.75
Amer. Ag. Chem., pf.	U. S	20,000,000	181,530	100	7,375,870	Apr. 1907	3.00
American Cement	Pa.	2,000,000	200,000	10	1,108,000	July 1907	.40
American Coal	Md	1,500,000	50,000	25	2,195,000	Mar. 1907	7.50
Associated Oil	Cal	21,000,000	21,000,000	1	630,000	Aug. 1905	.01½
Bethlehem Steel, pf.	Pa.	15,000,000	150,000	100	900,000	Nov. 1906	.75
Cambria Steel	Pa.	50,000,000	900,000	50	8,887,500	Aug. 1907	.75
Caribou Oil	Cal	100,000	80,000	1	56,000	July 1905	.07
Central C. & C., com.	Mo	5,125,000	51,250	100	1,998,750	July 1907	1.50
Central C. & C., pf.	Mo	1,875,000	18,750	100	1,289,064	July 1907	1.25
Central Oil	W. Va.	1,500,000	60,000	25	182,500	May 1904	.25
Claremont Oil	Cal	500,000	450,000	1	58,500	June 1905	.01
Col. & Hock. C. & I,pf.	Ohio	7,000,000	69,244	100	176,086	July 1907	1.50
Consolidated Coal	Ill.	5,000,000	50,000	100	350,000	July 1904	1.00
Consolidation Coal.	Md	10,250,000	102,500	100	9,109,150	July 1907	1.50
Crucible Steel, pf	Pa.	25,000,000	250,000	100	2,125,000	June 1907	1.50
Empire S. & I., pf.	N. J	5,000,000	25,000	100	712,500	July 1907	3.00
Fairmont Coal,	W. Va.	12,000,000	120,000	100	1,384,000	Feb. 1907	3.00
Four Oil	Cal	500,000	300,000	1	105.406	July 1905	.01
General Chem. Com.	U. S.	12,500,000	74,103	100	1,745,125	Mar. 1907	2.00
General Chem., pf.	U. S.	12,500,000	100,000	100	4,690,178	July 1907	1.50
George's C'k Coal	Md	2,500,000	22,000	100	1,188,000	July 1904	3.00
Imperial Oil	Cal	1,000,000	100,000	100	880,000	July 1905	.20
International Salt.		30,000,000	182,280	100	927,060	Dec. 1906	1.00
Jeff & Cl'f C. & I., cm	Pa.	1,500,000	15,000	100	330,000	Aug. 1905	5.00
Jeff. & Cl'f. C. & I.,pf.	Pa.	1,500,000	15,000	100	825,500	Aug. 1906	2.50
Kern River Oil	Cal	2,000,000	20,000	100	39,500	May 1905	.13
Lehigh Coal & Nav.	Pa.	17,378,500	346,901	50	25,614,693	May 1907	2.00
Maryland Coal,pf.	Md	2,000,000	18,850	100	1,592,560	June 1907	4.00
Monon R. Coal, pf.	Pa.	10,000,000	100,000	100	3,504,945	July 1907	3.50
Monte Cristo Oil.	Cal	500,000	500 000	1	120,000	July 1905	.01
National Carbon, pf.	U. S.	4,500,000	45.000	100	2,047,500	May 1905	1.75
National Lead, com.	N. Y.	15,000,000	149,054	100	1,974 966	July 1907	1.25
National Lead, pf.	N. Y.	15,000,000	149,040	100	16,324,328	June 1907	1.75
Nat'l Steel & Wire,pf.	N. Y.	5,000,000	25,778	100	631,561	May 1906	1.75
New Central Coal	Md	1,000,000	50,000	20	350,000	May 1907	.40
New River Coal, pfd.	W. Va.	4,000,000	37,617	100	169,276	Aug. 1907	1.50
Pacific Coast Borax.	Cal	2,000,000	19,000	100	2,086,500	Aug. 1905	1.00
Peerless Oil	Cal	1,000,000	92,000	10	396,320	May 1905	.14
Penna. Salt	Pa.	3,000,000	60,000	50	14,528,000	Apr. 1907	3.00
Penna. Steel, pfd.	Pa.	25,000,000	168,214	100	7,615,744	May 1907	3.50
Phila. Gas, com	Pa.	28,953,029	579,061	50	8,050,040	Aug. 1907	.75
Phila. Gas, pf.	Pa.	5,744,813	114,896	50	1,583,505	Mar. 1905	1.25
Pittsburg Coal, pf.	Pa.	32,000,000	297,010	100	11,434,962	Apr. 1905	1.75
Pocahontas Coll., pf.	W. Va.	1,500,000	15,000	100	460,000	May 1907	1.50
Republic I. & S., pfd.	Ill.	25,000,000	204,169	100	4,893,246	July 1907	3.75
Sloss-Sheffield, com.	Ala	7,500,000	75,000	100	9,480,250	 1907	1.25
Sloss-Sheffield, pf.	Ala	20,000,000	67,000	100	3,294,500	July 1907	1.75
Standard Oil	U. S.	100,000,000	970,000	100	334,530,000	June 1907	9.00
Tenn. C. & I., com.	Tenn	22,553,600	225,536	100	3,131,988	May 1907	1.00
Tenn. C. & I., pf.	Tenn	248,000	2,480	100	385,480	May 1907	2.00
Texas & Pacific Coal.	Texas	2,000,000	20,000	100	1,960,000	June 1907	1.50
Thirty-three Oil.	Cal	500,000	100,000	5	430,000	July 1905	.10
Union Oil	Cal	10,000,000	100,000	100	1,118,766	May 1905	.80
U. S. SteelCorp.,cm.	U. S.	550,000,000	5,083,025	100	66,041,541	July 1907	.50
U. S. Steel Corp., pf.	U. S.	360,281,100	3,603,141	100	181,149,227	May 1907	1.75
Va. Carolina Ch., pf.	U. S.	20,000,000	180,000	100	12,180,869	July 1907	2.00
Westmoreland Coal.	Pa.	3,000,000	60,000	50	8,580,000	Oct. 1905	2.50

Canada, Mexico, Central and South America.

Name of Company and Location.		Author-ized Capital.	Shares. Issued.	Par Val. $	Dividends. Total to Date.	Latest. Date.	Amt.
Amistad y Conc'rdia.	Mex	$480,000	9,600	50	$258,064	Jan. 1905	$1.71
Buffalo, s.	Ont.	1,000,000	900,000	100	108,000	July 1907	.03
Butters' Salvador, g.	Salv	750,000	150,000	5	600,000	Apr. 1905	.25
Coniagas (Cobalt).	Ont.	1,000,000	1,000,000	1	20,000	July 1907	.02
Cariboo McKin'y, g.	B. C.	1,250,000	1,250,000	1	546,837	Feb. 1904	.04
Consolidated M & S.	B. C.	5,500,000	48,338	100	594,100	May 1907	2.50
Copiapo, c.	Chile	1,125,000	112,500	10	3,000,900	Oct. 1904	1.20½
Crow's Nest Pass	B. C.	3,500,000	140,000	25	2,018,648	July 1907	.62½
Dominion Coal, com.	N. S.	15,000,000	150,000	100	2,250,000	July 1907	1.00
Dominion Coal, pf.	N. S.	3,000,000	30,000	100	3,330,000	Jan. 1905	4.00
Dos Estrellas, g. s.	Mex	150,000	3,000	50	1,020,585	July 1905	13.65
El Oro, g. s.	Mex	5,750,000	1,080,000	5	3 823,200	July 1907	.37
Esperanza, s. g.	Mex	2,275,000	455,000	5	6,721,649	July 1907	1.32
Foster Cobalt, s.	Ont.	1,000,000	1,000,000	1	50,000	Jan. 1907	.05
Granby Con.	B. C.	15,000,000	135,000	100	2,563,630	Mar. 1907	3.00
Greene Con. Copper.	Mex	8,640,000	864,000	10	5,814,200	Mar. 1907	.40
Greene Con. Gold.	Mex	5,000,000	500,000	10	300,000	July 1905	.20
GreenGold-Silv'r,pfd	Mex	3,000,000	300,000	10	120,000	Mar. 1907	.40
Guanajuato	Mex	3,000,000	540,000	5	74,250	Oct. 1906	.07½
Guggenheim Expl.	Mex	17,000,000	105,000	100	3,435,000	July 1907	2.50
Kerr Lake, s.	Ont.	3,000,000	600,000	5	300,000	July 1907	.15
LeRoi No. 2, g.	B. C.	3,000,000	120,000	25	716,400	Feb. 1907	.24
McKinley-Darragh,s	Ont.	2,500,000	2,000,000	1	100,000	Mar. 1907	.02
Mexican Coal & Coke	Mex	5,000,000	50,000	100	600,000	Dec. 1905	3.00
Mex. Con. M. & S. Co.	Mex	2,500,000	240,000	10	480,000	May 1907	.50
Mines Co. of Am.	Mex	2,000,000	2,000,000	1	2,705,000	July 1907	.02
N. Y. & Hond. Ro.	C. A	1,500,000	150,000	10	2,292,000	July 1907	.10
Nipissing, s.	Ont	6,000,000	1,200,000	5	1,140,000	July 1907	.15
North Star	B. C.	1,500,000	1,300,000	1	351,000	Dec. 1904	1.00
N. S. St. & Coal, com.	N. S.	5,000,000	49,876	100	938,228	July 1907	1.50
N. S. St. & Coal, pf.	N. S.	1,030,000	10,300	100	396,550	July 1907	2.00
Penoles*	Mex	250,000	2,500	100	8,213,375	Mar. 1907	20.00
Platanillo	Mex	500,000	206,989	1	5,580	Sept. 1906	.00½
Reco, g. s. l.	B. C.	1,000,000	958,000	1	327,082	Apr. 1906	.02
Silver Queen, s.	Ont.	1,500,000	1,500,000	1	120,000	Jan. 1907	.08
Slocan Star	B. C.	500,000	500,000	1	575,000	Dec. 1904	.05
St. Eugene Con.	B. C.	3,500,000	3,202,000	1	402,120	Oct. 1905	.02
Tezuitlan Copper	Mex	1,000,000	10,000	100	.....	July 1907	2.00
Tilt Cove, c.	N. F.	1,000,000	89,000	2	21,360	Jan. 1905	.48
Tretheway, s.	Ont.	1,000,000	1,000,000	1	80,000	Mar. 1907	.04
Tyee, c.	B. C.	940,000	180,000	5	136,800	Dec. 1904	.24

*Mexican Currency

THE MINING INDEX.

The editors of this paper read all the important publications of the world that relate to mining and the treatment of minerals. This index is published as a reference for all interested and to make it impossible for readers of the ENGINEERING AND MINING JOURNAL to miss any important article published anywhere.

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ABRASIVES

3869 — CALIFORNIA — Diatomaceous Deposits of Northern Santa Barbara County, Cal. R. Arnold and R. Anderson. (U. S. Geol. Surv. Bull. No. 315, 1907; 10 pp.) Considers the principal features of the most important deposits of infusorial earth and tripoli, and gives some notes as to their physical and chemical properties.

ALUM

3870—ALUM DEPOSITS—The Gila River Alum Deposits. C. W. Hayes. (U. S. Geol. Surv. Bull. No. 315, 1907; 8½ pp.) Gives the results of an inquiry into the geological relations and important features of these New Mexico alum deposits.

ANTIMONY

3871 — ANALYTICAL METHOD — The Determination of Small Amounts of Antimony by the Berzelius-Marsh Method. C. R. Sanger and J. A. Gibson. (Journ. Soc. Chem. Ind., June 15, 1907; 4½ pp.) A thorough investigation into all the factors which affect the determination of traces of antimony by this evolution method. 80c.

BAUXITE

3872—BAUXITE DEPOSITS—Des Gisements de Bauxite. C. Helson. (L'Echo des Mines, June 20, 24 and 27, 1907; 2½ pp.) Deals with the bauxite deposits of the world, giving a general description of some varieties of bauxite, with analyses and notes on its use; also deals with the geological relations of French bauxite deposits, and French methods of exploitation. 60c.

CEMENT

3873—IOWA—Portland Cement Materials near Dubuque, Iowa. E. F. Burchard. (U. S. Geol. Surv., Bull. No. 315, 1907; 6 pp.) Investigates the natural resources of this territory with a view to the production of portland cement, and gives analyses of the limestones and shales.

3874—WYOMING—Portland Cement Materials in Eastern Wyoming. S. H. Ball. (U. S. Geol. Surv., Bull. No. 315, 1907; 13 pp.) Considers the suitability of several deposits of limestone and shale in Wyoming as a raw material for portland cement manufacture, and studies briefly the economic features which must be taken into account.

COAL AND COKE

3875—ALASKA COAL FIELDS, G. C. Martin. (U. S. Geol. Surv., Bull. 314, 1907; 7 pp.) Deals with the geology of the coal-bearing rocks in Alaska, and takes up the character of the coal as shown by several analyses.

3876—COAL HANDLING—Die Kohlenförderung im Abbau. A. Gerke. (Zeit. des Oberschlesischen B. u. Hüttemännischen Vereins, Apr., 1907; 6 pp.) Discusses various systems of loading and conveying coal underground and of hoisting it, with special reference to reduction of costs in these departments of coal mining. 40c.

3877—COAL MINING—Rib Drawing in the Connellsville Coke Region. G. S. Baton. (Mines and Minerals, July, 1907; 1½ pp.) Gives some notes on the methods used in rib drawing in this region, and discusses the means adapted to mining thick seams under moderately heavy cover. 20c.

3878—COAL MINING—The Panel Retreating System. S. J. Jennings. (Mines and Minerals, July, 1907; 2½ pp.) Gives an account of the adaptation of the panel system for mining thin seams of anthracite, and includes comparative costs of three systems of working. 20c.

3879—COAL MINING—Working Flat and Pitching Anthracite Seams. M. S. Hachita. (Eng. and Min. Journ., July 6, 1907; 3½ pp.) Deals with methods employed in coal mining when one seam overlies another, and contains some notes on the use of manways and chutes in pitching seams. 20c.

3880—COAL WASHING—Description of Washing Plants in Operation. W. G. Wilkins. (Proc. Eng. Soc. W. Penn., June, 1907; 20 pp.) Describes two complete washing plants, including the breaking, crushing and handling machinery. 40c.

3881—COAL WASHING—Modern Methods of Washing Bituminous Coal. F. W. Parsons. (Eng. and Min. Journ., July 6, 1907; 3½ pp.) Describes the construction and operation of a modern coal washing plant, with drawings of machines used. 20c.

3882—COAL WASHING—Process of Coal Washing. S. Diescher. (Proc. Eng. Soc. W. Penn., June, 1907; 22 pp.) Deals with the theory of jigging coal, describes the construction of several forms of jigs, and takes up the principles of calculating screen sizes and capacities. 40c.

3883—COAL WASHING. S. B. Peck. (Eng. and Min. Journ., July 13, 1907; 1½ pp.) General summary of the methods of improving the quality of coal by the elimination of impurities by washing. 20c.

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3885—COKE—The Future of West Virginia as a Coke Producer. Neil Robinson. (Eng. and Min. Journ., July 6, 1907; ½ p.) Discusses the present supply of coking coal in West Virginia, and the amount in reserve applicable to iron making. 20c.

3886—COKE—The Manufacture of Coke from Western Coal. R. S. Moss. (Min. World, July 6, 1907; 1½ pp.) Deals with the construction of a special type of coke-oven applicable to coking Western coals. 20c.

3887—COKE BURNING—The Carbonisation of Durham Coking Coal and the Distribution of Nitrogen and Sulphur. A. Short. (Journ. Soc. Chem. Ind., June 15, 1907; 3½ pp.) Refers to the carbonisation of Durham coal in patent coke-ovens, with analyses of the by-products and the distribution of gases in them. 80c.

3888—COMPOSITION OF COAL—Heat Production and the Constituents of Coal. S. W. Parr. (Eng. and Min. Journ., June 29, 1907; 4 pp.) Consider the effect which the various impurities in coal have upon its heating value and discusses modifications in methods of determining them dependent upon these effects. 20c.

3889—ELECTRIC POWER—Alternating Current in Coal-mining Operations. George R. Wood. (Eng. and Min. Journ., July 6, 1907; 6 pp.) Deals with the use of the alternating current in coal mining, and shows how low first cost and cheap fuel favor the central plant and power transmission. 20c.

3890—ELECTRIC POWER PLANT at the Cambrian Collieries. (Engineer, Lond., July 5, 1907; 2½ pp.) Contains details of boiler installations and the arrangement and equipment of the generating station for this colliery where electricity is largely used. 40c.

3891—EXPLOSION at Urpeth Colliery. J. B. Atkinson. (Min. Engineering, July, 1907; 4 pp.) Gives some notes on an explosion in this colliery which was caused by flame from a permitted explosive, and in which there was considerable difficulty in determining the relative influence of coal-dust and fire-damp. 20c.

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3894—KANSAS—The Atchison Mine, Atchison, Kansas. C. M. Young. (Mines and Minerals, July, 1907; 1 p.) Brief account of the equipment and methods of mining on this property which is the deepest bituminous mine in the United States. 20c.

3895—MINE GASES—Zur Theorie der plötzlichen Gasausbrüche. A. Becker, (Oest. Zeit. f. B. u. H., June 15 and 22, 1907; 4½ pp.) Conclusion of article previously mentioned in this Index. 60c.

3896—NEW MEXICO—New Development in Coalfields of New Mexico. Edward K. Judd. (Eng. and Min. Journ., July 6, 1907; 3½ pp.) An outline of coal mining in New Mexico, dealing with mine operations, washeries, coking plant and market for the product. 20c.

3897—NEW ZEALAND—Working of the New Zealand State Coal Mine. John Plummer. (Min. World, July 20, 1907; 1 p.) Gives some brief and general notes on the industrial and mining conditions in this Government colliery. 20c.

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3899—RESCUE APPARATUS—Bericht über Versuche mit Atmungsapparaten. Grahn. (Glückauf, June 22, 1907; 5 pp.) An account of tests made upon several types of breathing apparatus, giving figures on their efficiency and suitability, also notes on their physiological effects on the users. 40c.

3900—SHAFT SINKING—Die Gefrierschacht-Anlage der Grube Klein-Rosseln bei Stieringen (Lothringen.) Jungst. (Glückauf, May 25, 1907; 3½ pp.) An account of the application of the freezing process to the sinking of a shaft for the Klein-Rosseln coal mine in Lorraine. Details of piping and refrigerating apparatus are given. 40c.

3901—VENTILATION—Practical Experiments in Coal-mine Ventilation. W. D. Owens. (Eng. and Min. Journ., July 13, 1907; 1½ pp.) Describes a series of mine tests made for the purpose of investigating disputed points concerning the action of fans. 20c.

COPPER

3902—ANALYTICAL METHOD—Estimation of Copper by Titanium Trichloride. E. L. Rhead. (Min. Reporter, July 4, 1907; 1 p.) Abstract of paper in Journ. of Chem. Soc., London, Oct., 1906. Gives the procedure for a copper assay in which an acid solution of a cupric salt is reduced by titanium trichloride. Results of tests upon the accuracy of the method are included. 20c.

3903—ASSAYING COPPER MATTE, The use of Zinc in. D. M. Levy. (Bull. No. 33, I. M. M., June 20, 1907; 1½ pp.) Discussion of the above paper which was previously mentioned in this Index.

3904—BRITISH COLUMBIA COPPER COMPANY'S MOTHER LODE MINE, Boundary District of British Columbia. E. Jacobs. (Can. Min. Journ., July 1, 1907; 5 pp.) Describes the extent of operations of this copper company, its equipment and the methods of mining and smelting. 20c.

3905—COPPER MINING on the Colorado River. J. G. Hately. (Min. World, June 29, 1907; 1 p.) Some brief notes on the different copper minerals found in this region. 20c.

3906—COPPER REFINERY of Rio Tinto Co., Port Talbot, Wales. Edward Walker. (Eng. and Min. Journ., July 20, 1907; 1½ pp.) Describes the apparatus and processes of refining Spanish precipitate and bars in the new refinery of the Rio Tinto Co. 20c.

3907—DETERMINATION OF COPPER—The Iodometric Determination of Copper. F. A. Gooch and F. H. Heath. (Am. Journ. Sci., July, 1907; 9½ pp.) Contains an experimental study of the accuracy of the various steps in the procedure for determining copper by this method, these points previously having been subject to much dispute. 60c.

3908—ELECTROLYTIC COPPER—The Electrolytic Process of Copper Recovery. W. Stoeger. (Min. Journ., July 6 and 13, 1902; 1 p.) Translation from "Metallurgie," giving an account of the theory and the operating details of a process for producing copper directly from ores by electrolysis. 60c.

3909—ELECTROLYTIC COPPER REFINING PLANT, How to Outline an. C. C. Christensen. (Eng. and Min. Journ., July 20, 1907; 1 p.) Gives the author's ideas as to the various conditions which must be considered and the calculations which must be made in designing an electrolytic copper refining plant. 20c.

3910—LOW-GRADE COPPER CAMPS, Three Large. E. A. Ritter. (Min. World, July 20, 1907; 1½ pp.) Deals principally with the geological features and the origin of the copper deposits of Bingham, Utah, Ely, Nev., and the Boundary district, B. C. 20c.

3911—MINE WATER—Precipitating Copper from Butte Mine-water. A. F. Bushnell. (Eng. and Min. Journ., June 29, 1907; 2 pp.) Gives a few details of the methods of extracting copper from mine-water by the box and the tower systems. 20c.

3912—NEVADA—A Visit to Ely, Nevada. J. W. Abbott. (Min. and Sci. Press, June 15, 1907; 2 pp.) Gives an account of the present condition of mining development at this mining camp. 20c.

3913—SERVIA—The Copper Mines of Servia. Walter Harvey Weed. (Eng. and Min. Journ., July 20, 1907; 1 p.) Some brief notes on the character of the ore deposits and the extent to which the principal mining companies have carried their operations. 20c.

3914—SMELTING of Copper Ores. J. W. Richards. (Electrochem. and Met. Ind., July, 1907;) Solves a number of problems connected with the smelting of copper ores, such as the calculation of the charge, heat losses, composition of matte, etc. 40c.

3915—SMELTING—Waste Heat Boilers for Copper Smelting Furnaces. (Engineering Record, July 6, 1907; 1 p.) Describes an interesting installation of waste heat boilers at the Colusa-Parrot Mining and Smelting Company's plant at Butte, Mont., with drawings of the furnaces and flues, and connections between the boilers and the furnaces. 20c.

3916—UTAH AMALGAMATED COPPER COMPANY. (S. L. Min. Rev., June 30, 1907; 2½ pp.) Some general information upon the mining situation in this district and the extent of development attained by this company. 20c.

3917—WASHINGTON—Report on a Copper Property in Washington. Milnor Roberts. (Pacific Miner, June, 1907; 2 pp.) Describes the outcrop and occurrence of minerals in various places in the Cascade mountains of Washington, and gives assays of the copper-bearing minerals. 20c.

3918—WYOMING—Copper Deposits of the Hartville Uplift, Wyoming. S. H. Ball. (U. S. Geol. Surv., Bull. No. 315, 1907; 14 pp.) Some notes on the character of the formation and the ore deposits of the Hartville region.

FELDSPAR

3919—MAINE—Feldspar and Quartz Deposits of Maine. E. S. Bastin. (U. S. Geol. Surv., Bull. No. 315, 1907; 10 pp.) Contains a few notes on the methods of mining feldspar and quartz as practiced in Maine, and the uses to which they are put.

3920—NEW YORK—Feldspar and Quartz Deposits of Southeastern New York. E. S. Bastin. (U. S. Geol. Surv., Bull. No. 315, 1907; 5 pp.) Notes on the geological relations of these deposits, including description of the two principal quarries.

FULLERS EARTH

3921—FULLER'S EARTH—Properties and Tests of Fuller's Earth. J. T. Porter. (U. S. Geol. Surv., Bull. No. 315, 1907; 23 pp.) Sums up the results of tests to determine the suitability of fuller's earth as an oil clarifier, and discusses several theories to account for its peculiar properties.

GOLD AND SILVER

3922—ALASKA—Gold Fields of the Solomon and Niukluk River Basins. P. S. Smith. (U. S. Geol. Surv., Bull. 314, 1907; 10½ pp.) Enumerates the different producing fields of these river basins, and gives the leading facts relating to them.

3923—ALASKA—The Circle Precinct. A. H. Brooks. (U. S. Geol. Surv., Bull. 314, 1907; 17½ pp.) Notes on the development of various creeks within this district, with a few statistics of gold production during past years.

3924—ALASKA—The Kougarog Region. A. H. Brooks. (U. S. Geol. Surv., Bull. 314, 1907; 18 pp.) A general investigation into the suitability of this region as a mining district, which appears to be one where considerable capital is necessary for successful mining operation. 20c.

3925—ALASKA—The Nome Region. F. H. Moffit. (U. S. Geol. Surv., Bull. 314, 1907; 19 pp.) An investigation of the probable bed-rock sources of Nome placer gold, and the processes governing its present distribution.

3926—AMALGAMATION—Pan Amalgamation. H. W. Bangle. (Min. and Sci. Press, June 29, 1907; 3 pp.) Outlines the chemical reactions which take place in the process of pan amalgamation and gives various hints to ensure the most efficient operation of such a plant. 20c.

3927—BLACK SAND—Utilization of Black Sand. R. H. Richards. (Eng. and Min. Journ., June 29, 1907; 1½ pp.) Contains description of a device for saving gold and platinum and valuable minerals from black sands, the essential feature being the application of hydraulic classification to an ordinary sluice. 20c.

3928—BLACK SANDS—The Auriferous Black Sands of California. David T. Day. (Mines and Minerals, July, 1907; 1½ pp.) Gives an official statement of the scope of the work undertaken by the Government in investigating black sands, and the results accomplished by it, pointing out some of the wrong ideas held by misinformed people concerning these sands. 20c.

3929—CALIFORNIA—Geology of the Bodie District, California. R. P. McLaughlin. (Min. and Sci. Press, June 22, 1907; 2 pp.) Describes the chief geological features of this district, which was a large producer of gold in the past. 20c.

3930—CALIFORNIA—Geology of the Coffee Creek Mining District. N. S. Stines. (Min. and Sci. Press, July 6, 1907; 1 p.) Gives in brief a few of the principal points connected with the geology of the country and the mining and the milling of the ore from this district of Trinity Co., Cal. 20c.

3931—CYANIDATION—The Filtration of Slime by the Butters Method. E. H. Hamilton. (Min. and Sci. Press, June 22 and 29, 1907; 10 pp.) Gives some notes on the inception, design and methods of working of this process of slime handling, illustrated by several drawings of filter-frames and pump-connections. 40c.

3932—CYANIDATION—Vacuum Slime-filters. A. G. Kirby. (Min. and Sci. Press, July 13, 1907; 2 pp.) Shows the importance of maintaining perfect working conditions in vacuum filters and gives some of the experiences of the author in plants using both the Moore and the Butters systems. 20c.

3933—CYANIDE PRACTICE at the Homestake Mill. F. L. Bosqui. (Min. and Sci. Press, July 6, 1907; 3 pp.) Gives some notes upon the present cyanide practice of the Homestake mill. 20c.

3934—CYANIDE PROCESS—Recent Improvements in the Cyanide Process on the Witwatersrand. E. M. Weston. (Eng. and Min. Journ., July 13, 1907; ½ p.) Gives some notes on the use of "wad" which contains various proportions of manganese dioxide as a means of increasing extraction from cyanide solutions. 20c.

3935—DALY-JUDGE MINING COMPANY, Report on the Property of the. P. A. Gow, A. M. Howat, G. S. Krueger, and F. H. Parsons. (Bull. Colo. Sch. of Mines, May, 1907; 40 pp.) A complete report upon the situation and operations of this mine, including notes on the geology, surface and underground equipment, mining system and methods of concentration. 60c.

3936—GOLD DREDGING—La Dragage de l'Or dans les Monts Ourals et en Siberie. (Revue Mineralurgique, June, 1907; 1½ pp.) Gives brief information upon dredging apparatus and working costs in Siberia and the Ural district of Russia.

3937—GOLD DREDGING PRACTICE at Ruby, Montana. J. P. Hutchins. (Eng. and Min. Journ., June 29 and July 13, 1907; 7 pp.) Tells how the Conrey Placer Mining Co. has met a series of difficult conditions in handling clayey gravel and boulders. 20c.

3938—INDIA—Report on the Gold-bearing Deposits of Loi Twang, Shan States, Burma. T. D. La Touche. (Records, Geol. Surv. of India, Vol. XXXV, Part 2, 1907; 12 pp.) Sums up the results of an investigation on the extent of the gold-bearing deposits of these States, giving information as to the mode of occurrence and the results of assays.

3939—MEXICO—Proaño, a Famous Mine of Fresnillo, Mexico. John A. Church. (Eng. and Min. Journ., July 13, 1907; 3 pp.) An account of the early history and present condition of this mining camp, which is characterized by a remarkable abundance of veins, and practically no faulting. 20c.

3940—MEXICO—The Historic Mines of Proaño. P. W. Meyers. (Min. World, July 6, 1907; 3 pp.) Gives an outline of the history of mining in this camp and contains a few notes on present conditions of mining operations. 20c.

3941—MEXICO—The Mines of La Luz, Guanajuato, Mexico—I. John A. Church. (Eng. and Min. Journ., July 20, 1907; 5½ pp.) Deals principally with the geological features and the vein system in the La Luz region of Guanajuato, where mining operations are now being resumed. 20c.

3942—NEVADA—Some Interesting Nevada Mining History. (Pacific Miner, June, 1097; 6 pp.) A review of the discovery, development and present condition of the mines in and about Goldfield, Bullfrog and Rhyolite. 20c.

3943—NOVA SCOTIA—The Gold Mining Industry in Nova Scotia. E. Percy Brown. (Can. Min. Journ., July 15, 1907; 5 pp.) Reviews the past progress and present state of the gold mining industry in Nova Scotia, pointing out some of the reasons for its present stagnation.

3944—NOVA SCOTIA—The Richardson Mine. Percy Brown. (Can. Min. Journ., June 15, 1907; 3½ pp.) Describes the mining and milling practice of this company, which uses the bromo-cyanide process for treating its stamped tailings. 20c.

3945—PLACER MINING—Examining a Placer Property. George W. Maynard. (Min. World, July 6, 1907; 1 p.) Gives an account of the methods used in sampling a placer property, panning the samples, and assaying the concentrates. 20c.

3946—SILVER AND LEAD MINES, The Great. T. A. Rickard (Min. and Sci. Press, June 22, 1907; 1½ pp.) Summarizes and compares briefly the relative outputs of the largest lead and silver mines of the world. 20c.

3947 — SILVER-LEAD SMELTING PRACTICE.—IV and V. T. S. Austin. (Min. and Sci. Press, June 15 and July 13, 1907; 1½ p.) Gives very brief mention of the loss of gold in refining base bullion separating slag from matte in copper smelting. 40c.

3948—SOUTH AFRICA — The Giant Mines of Rhodesia. (South African Mines, June 1, 1907; 1½ pp.) Reviews the extent of mining operations in several Rhodesian districts. 20c.

3949—STAMP MILLING—A Light Battery Frame. F. A. Thomson. (Bull. Colo. Sch. of Mines, May, 1907; 4 pp.) Describes the erection of a stamp battery and its foundation in a district where no timber larger than 8x8 and less than 20 ft. long was available. 60c.

3950—TIBETAN GOLDFIELDS. M. Maclaren. (Min. Journ., June 22, 1907; 1½ pp.) Sums up the present state of our knowledge upon the character and extent of the gold-bearing area of Tibet, the extent of which is considerable. 40c.

3951—YAK TUNNEL—The Yak Mining, Milling and Tunneling Company. H. C. Armington and H. W. Stotesbury. (Bull. Colo. Sch. of Mines, May, 1907; 18 pp.) Gives some notes on the methods of tunneling, timbering, hauling and disposal of waste as used in this drainage tunnel. 60c.

GRAPHITE

3952—WYOMING—Graphite in the Haystock Hills, Laramie County, Wyo. S. H. Ball. (U. S. Geol. Surv., Bull. No. 315, 1907; 2 pp.) Gives a brief statement of the occurrences of graphite in this district, and the commercial conditions attending its possible exploitation. 20c.

GYPSUM

3953—NEW MEXICO—Gypsum in Northwestern New Mexico. M. K. Shaler. (U. S. Geol. Surv., Bull. No. 315, 1907; 6 pp.) Mentions briefly the stratigraphy of the region where these gypsum deposits occur, and considers the possibility of exploiting them.

IRON AND STEEL

3954—ALABAMA—The Brown Iron Ores of the Russellville District, Alabama. E. F. Burchard. (U. S. Geol. Surv., Buil. No. 315, 1907; 8 pp.) Studies the geological relations and characteristics of the brown iron ores of the Russellville district of Alabama.

3995—ALABAMA—The Clinton or Red Ores of the Birmingham District, Alabama. E. F. Burchard. (U. S. Geol. Surv., Buli. No. 315, 1907; 21 pp.) Studies the geological relations and characteristics of the Clinton beds of Alabama, including a few notes on mining development.

3956—ALABAMA—The Gray Iron Ores of Talladega County, Ala. P. S. Smith. (U. S. Geol. Surv., Buil. No. 315, 1907; 23 pp.) Describes the mines and prospects in this district, with a few statements as to their probable origin, and their economic importance.

3957—ANALYSIS OF IRON, report of Committee on Standard Methods for the. (Trans. Am. Fdymen's Assn., May, 1907; 3 pp.) Gives procedures for the determination of silicon, sulphur, phosphorus, manganese and total carbon as adopted by the Committee on Standard Methods of Analysis.

3958—BLAST FURNACE—V. Horace Allen. (Iron Tr. Rev., July 11, 1907; 2 pp.) Considers some of the principles of slag formation and the best classes of flux to use in the formation of the particular slag best adapted to an ore. 20c.

3959—BLAST FURNACE GAS—Production Économique de la Force Motrice au moyen des gaz métaliurgiques. C. Dantin. (Génie Civ., June 29, 1907; 4 pp.) Reviews European practice in the utilization of blast furnace gas as a source of power, especially as exemplified at the works of the Société Cockeriil, at Seraing, Belgium. 40c.

3960—BLAST FURNACE PRACTICE. T. F. Witherbee. (Paper read before the A. I. M. E., New York meeting, Apr., 1907; 13 pp.) A discussion of two papers on this subject by F. L. Grammer and J. E. Johnson, Jr., which were previously read before the Institute.

3961—CAST IRON—Manganese in Cast Iron. H. E. Field. (Trans. Am. Fdymen's Assn., May, 1907; 3½ pp.) Treats of the general effect of the use of manganese in cast iron in relation to its influence on hardening carbon content.

3962—CAVING SYSTEM on the Menominee Range. Reginald Meeks. (Eng. and Min. Journ., July 20, 1907; 4 pp.) Describes the different systems of mining now in use on this range, and briefly outlines general mining conditions there. 20c.

3963—CONVERTING SMALL CHARGES —Procédé de Production d'Acier en Petites Masses. (La Metallurgie, May 29, 1907; 1 p.) Describes a process of blowing small amounts of pig iron to steel in a converter, ferrosilicon being added when the carbon flame appears, in order that the oxidation of the silicon may furnish sufficient heat to offset the previous cooling of the bath by the blowing. 20c.

3964—CONVEYING APPARATUS FOR ROLLING MILLS — Hebe und Transportmittel in Stahl- und Walzwerksbetrieben. G. Stauber. (Stahl u. Eisen, July 10, 1907; 86 pp., 1 plate.) Describes various types of machines and contrivances for lifting, carrying and controlling material and apparatus in rolling mills, including many detailed illustrations. 40c.

3965— CUPOLA FURNACES—Cubilot a Récupération Système A. Baillot. C. Dantin. (Génie Civ., June 15, 1907; 1 p.) Gives a general outline of the Bailott type of regenerative cupolas, and a brief description of an installation of this system in a French foundry. 40c.

3966—EDUCATION—Die Giesserei-Anagen der Koniglichen Fachschule für die Eisenund Stahlindustrie des Siegener Landes zu Siegen. (Stahl u. Eisen, July 3, 1907; 4 pp.) Contains a brief account of the appliances and methods of instruction carried out in a foundry trade school at Siegen, Germany. 20c.

3967—ELECTRIC SMELTING—Heroult Electric Steel Process. (Electrochem. and Met. Ind., July, 1907; 2½ pp.) Gives a number of illustrations of the largest plants in this country, producing steel by the Heroult process. 40c.

3968—FOUNDRIES of the Atlas Engine Works, Indianapolis. (Iron Tr. Rev., July 11, 1907; 2½ pp.) Describes and illustrates many features of the foundry and equipment of this company. 20c.

3969—GAS ANALYSIS—L'Enregistrement et l'Analyse Automatiques de l'Anhydride Carbonique dans les Gaz. L. Fabre. (Rev. de Chim. Industrielle, June 15, 1907; 1½ pp.) A description of the Haliwach's apparatus for automatically determining and recording the amount of carbon dioxide in gases. 40c.

3970—GERMAN STEEL PLANTS, Modern Machinery in. F. C. Perkins. (Iron Tr. Rev., Juiy 4, 1907; 2 pp.) Describes different types of modern heavy machinery used in steel manufacturing plants in Germany. 20c.

3971—IRON AND STEEL PLATE—History of the Manufacture of Iron and Steel Sheets. W. C. Cronemeyer. (Proc. Eng. Soc. W. Penn., May, 1907; 19 pp.) Outlines the development of the processes now used in rolling iron and steel into sheets, and gives brief notes on the art of covering the piates with other protective metals. 40c.

3972—IRON MINING Operations in the Mesabi. (Iron Tr. Rev., July 4, 1907; 2 pp.) Reviews the extent and nature of operations of stripping and mining in various mines on the Mesabi range. 20c.

3973—IRON ORE DEPOSITS—A Study of the Iron Ore Deposits of Almeria. (Min. Journ., July 6 and 13, 1907; 1½ pp.) Contains a general description of the geological features of these deposits and takes up the discussion of various theories as to their origin. To be continued. 40c.

3974—IRON PIGMENT—Southern Red Hematite as an Ingredient of Metailic Paint. E. F. Burchard. (U. S. Geol. Surv., Bull No. 315, 1907; 5 pp.) Gives notes on some occurrences of iron ore in the South which could profitably be expioited for use as pigment.

3975—IRON PIGMENT—The Mineral Paint Ores of Lehigh Gap, Pennsylvania. E. C. Eckel. (U. S. Geol. Surv., Bull. No. 315, 1907; 2½ pp.) Deals briefly with the geology and character of the iron pigment deposits of Lehigh Gap. 20c.

3976—MAGNETITE DEPOSITS of the Cornwali Type in Berks and Lebanon Counties, Penn. A. C. Spencer. (U. S. Geol. Surv., Bull. No. 315, 1907; 4 pp.) Gives the results of an investigation into the probable method of origin of the above deposits.

3977—MINNESOTA—Coleraine District Mesabi Range. (Min. World, July 6, 1907; 1½ pp.) Contains a brief review of the methods of mining and stripping on this range, and the manner of washing the ore which is rather low-grade in some places. 20c.

3978—ORE HANDLING on the Mesabi Range. (Iron Tr. Rev., July 18, 1907; 1 p.) Describes the methods in use for analyzing ore shipments and the subsequent mixing of the ore in order to secure uniform shipping cargoes. 20c.

3979—PHYSICAL PROPERTIES OF STEEL. F. W. Harbord. (Engineering, June 14, 1907; 2 pp.) Paper read before the Iron and Steel Institute; an inquiry into the relations existing between the process of manufacture of steel, and its physical properties. Tests were carried out on bessemer, Thomas, and acid and basic Martin steel. Published in German in Metallurgie, June 8, 1907. 40c.

3980—RAILS—Experiences with Limber and Stiff Rail Sections. P. H. Dudley. (Iron Age, July 4, 1907; 4 pp.) Compares the relative durability of stiff and flexible rail sections and deals with the effect of slag, mill treatment and the use of dry blast upon the quality of the rails. 20c.

3981—RAILS—How May the Quality of Steel Rails Be Improved? Henry M. Howe. (Eng. and Min. Journ., July 6, 1907; 2½ pp.) Discusses briefly the various operations in the manufacture of steel rails which are likely to cause flaws, and suggests improvements in the process of manufacture in order to prevent failure. 20c.

3982—RAILS—Open-Hearth Steel Rails. B. Talbot. (Iron Age, June 27, 1907; 2 pp.) Paper read before the Am. Soc. for Testing Materials, June, 1907, giv-

ing some notes on the methods of rolling and the results of drop tests upon rails made by the continuous process which is a modification of the open-hearth method of manufacture. 20c.

3983—RAILS — The Corrugation of Rails. (Engineering, June 14, 1907; 3½ pp.) Investigates possible causes of inequalities in rails, and gives much experimental data upon the composition and physical properties of rails which have become corrugated after short service. 40c.

3984 — RAILS — The Manufacture of Steel Rails. J. C. Bayles. (Cassier's Mag., July, 1907; 5½ pp.) Considers the influence of the bessemerizing process upon the quality of steel from which rails are rolled, and shows that variation of moisture in the blast is probably responsible for differences in quality of the finished product. 40c.

3985—ROLLING MILL WORK, Notes on. B. H. Reddy. (Iron Tr. Rev., June 27, 1907; 2 pp.) Outlines and comments on a few methods in use for designing rolls for steel mills. 20c.

3986 — SHEET METAL MANIPULATION. F. I. Ellis. (Proc. Eng. Soc. W. Penn., May, 1907; 9 pp.) Contains a summary of the present state of rolling and shearing metals. 40c.

3987—SPECIFIC HEAT—Die spezifische Wärme des Eisens. P. Oberhoffer. (Metallurgie, June 22 and July 8, 1907; 24½ pp.) Describes the course of a thorough investigation undertaken to determine the specific heat of iron. 60c.

3988 — SPECIFICATIONS — The Enforcement of Specifications. C. B. Dudley. (Iron Age, June 27, 1907; 5 pp.) Presidential address before the Amer. Soc. for Testing Materials, June 20, 1907, considering the relations between the consumer and producer and the present attitude adopted in enforcing specifications. 20c.

3989—STEEL WORKS—Gas and Electric Power in Continental Steel Works. J. B. van Brussel. (Eng. Mag., July, 1907; 16 pp.) Gives a general outline of the extent to which gas and electric power have been applied in large iron and steel works in Continental Europe. 40c.

3990 — TEMPERED STEEL — Récherches sur les Constituants des Aciers Trempés Effectués au Laboratoire d'Essais du Conservatoire national des Arts et Métiers, a Paris. P. Breuil. (Buil. Soc. de l'Ind. Minéraie, T. VI. 2 livr., 1907; 131 pp., 50 piates). Studies the properties and structure of tempered steel, and discusses in detail the results obtained.

3991 — TUNGSTEN-STEEL — Kohlenstoff-Wolframstähle. T. Swinden. (Metallurgie, June 8, 1907; 25½ pp.) Paper read before the Iron and Steel Inst., studying the effects of varying amounts of carbon upon steel having a fixed content of tungsten. Analyses of the different steels, results of strength tests, of heat treatment and metallographical examinations are given. 40c.

3992—VIRGINIA IRON INDUSTRY. J. J. Porter. (Manufacturers' Rec., June 27 and July 4, 1907; 5 pp.) Conclusion of article previously mentioned in this Index, dealing with the character of the fluxes and fuels commonly used, and with the cost and profits of making pig iron at various plants. 40c.

3993—WYOMING—The Hartville Iron Ore Range, Wyoming. S. H. Ball. (U. S. Geol. Surv., Bull. No. 315, 1907; 15 pp.) A preliminary description of the Hartville range, taking account of the geological features of the country, and the extent and distribution of the ore.

3994—WYOMING — Titaniferous Iron Ore of Iron Mountain, Wyoming. S. H. Bali. (U. S. Geol. Surv., Bull. No. 315, 1907; 7 pp.) Studies the geology of the Iron Mountain deposits of titanium iron ore, and considers their commercial possibilities.

LEAD

3995—ARIZONA—Lead-Silver Deposits of Mowry, Ariz. R. B. Brinsmade. (Mines and Minerals, July, 1907; 2 pp.) Gives a few notes on the milling and smelting methods in this camp, but deals principally with the caving method of mining, whereby 80 per cent. of the ore is won without the use of timbers. 20c.

3996—LEAD SMELTING—Ueber den Blei-Röstreaktionsprozess. R. Schenck and W. Rassbach. (Metallurgie, July 8, 1907; 13 pp.) An experimental inquiry into the nature of the reactions which take place in the roast reduction process of lead smelting, and the particular conditions which make for the best efficiency during the roasting and the subsequent reaction. 40c.

MICA

3997—NORTH CAROLINA—Mica Deposits of Western North Carolina. D. B. Sterrett. (U. S. Geol. Surv., Bull. No. 315, 1907; 23 pp.) Describes the general geology and occurrences of mica in this State and gives an account of operations as they are now carried on at the principal mines.

3998—ONTARIO—Mica in Ontario. E. T. Corkill. (Can. Min. Journ., June 15, 1907; 3½ pp.) Reviews the mica industry of Ontario, giving the latest information upon it. 20c.

3999—WYOMING—Mica in the Hartville Uplift, Wyoming. S. H. Ball. (U. S. Geol. Surv., Bull. 314, 1907; 21 pp.) Describes briefly the mica prospects in Wyoming, and the commercial conditions which affect their operation.

NICKEL

4000—ELECTROLYSIS OF NICKEL SOLUTIONS—Periodische Erscheinungen bei der Elektrolyse von Nickelsalzen. A. Thiel and A. Windelschmidt. (Zeit. f. Elektrochem., June 14, 1907; 8½ pp.) An inquiry into the causes of periodic variation in voltage and amperage which occurs during the electrolysis of nickel salts in oxalic acid solution, and determined to be due to the formation and breaking up of a hydroxide having the composition Ni $(OH)_3$. 40c.

4001—NICKEL DETERMINATION — Eine neue Bestimmungsmethode des Nickels und ihre Anwendung in der Analyse zur Trennung des Nickels vom Kobalt und Zink. H. Grossmann and B. Schück. (Chem. Zeit., May 25, 1907; 2 pp.) Gives the procedure for a new method of determining nickel, also of separating it from cobalt and zinc by the use of dicyandiamidine solution as a reagent and gives data as to the accuracy of the procedure. 20c.

4002—OREGON—Nickel Deposits of Nickel Mountain, Oregon. G. F. Kay. (U. S. Geol. Surv., Bull. No. 315, 1907; 7½ pp.) Gives the results of a brief study of these nickel deposits to determine their probable extent and their source.

PETROLEUM

4003—ALASKA — Petroleum at Controlier Bay. G. C. Martin. (U. S. Geol. Surv., Bull. 314, 1907; 14 pp.) Reviews the different occurrences in this Alaskan region, considers the outlook for profitable exploitation, and mentions the difficulties of drilling and operating.

4004—CALIFORNIA—Preliminary Report on the Santa Maria Oil District, Santa Barbara County, California. R. Arnold and R. Anderson. (U. S. Geol. Surv., Bull. No. 317; 69 pp.) Gives detailed information as to the geological formations and the extent of developments in the exploited area.

4005 — CALORIMETER for Volatile Liquid Fuels, Specially Adapted for Petrol. W. H. Rawles. (Journ. Soc. Chem. Ind., June 29, 1907; 1½ pp.) Describes the construction and the manner of operating a modification of Darling's apparatus adapted to determine the calorific power of liquid fuels. 80c.

4006—DRILLING—Illustrated Notes on the Drilling of Oil Wells. George Rice. (Ores and Metals, July 5, 1907; 1 p.) Gives a general account of the various tools used in drilling wells, and fishing for lost parts, and the use of sand pumps and casings. 20c.

4007—NEW SOUTH WALES — Shale Mining in New South Wales. (Petrol. Rev., July 6, 1907; 1 p.) Outlines briefly the progress of recent developments in the shale mining industry in this country. 20c.

4008—ONTARIO—The New Tilbury and Romney Oil Fields of Kent County, Ontario. Eugene Coste. (Paper read before the Can. Min. Inst., Toronto meeting, 1907; advance copy; 7½ pp.) Describes the extent of the above oil fields, the nature of the oil and gas, method of drilling, price and transportation.

4009—TRINIDAD—The Oil Fields of Trinidad. (Petrol. Rev., July 6, 1907; 2 pp.) Mentions the different features which point to the presence of new oil fields and considers a new theory bearing upon the origin of the famous asphalt lake. 40c.

PHOSPHATE ROCK

4010—ARKANSAS — Developed Phosphate Deposits of Northern Arkansas. A. H. Purdue. (U. S. Geol. Surv., Bull. No. 315, 1907; 11 pp.) Outlines the extent of development among various phosphate beds, and gives a general theory as to their origin. 20c.

4011—PENNSYLVANIA — Phosphorus Ore at Mount Holly Springs, Penn. G. W. Stose. (U. S. Geol. Surv., Bull. No. 315, 1907; 9 pp.) Contains an account of the discovery, development and origin of the phosphorus ore at this place, and deals briefly with the manufacture of phosphorus from the material.

4012 — PHOSPHATE DEPOSITS in Western United States. F. B. Weeks and W. F. Ferrier. (U. S. Geol. Surv., Bull. No. 315, 1907; 14 pp.) Enumerates various deposits of phosphate-bearing material of importance throughout the Western States and comments briefly upon their geological features. 20c.

RARE METALS

4013—CARNOTITE in Rio Blanco County, Colo. H. S. Gale. (U. S. Geol. Surv., Bull. No. 315, 1907; 9½ pp.) Enumerates the principal known deposits of this mineral in Rio Blanco county.

4014 — THALLIUM — Contributions to the Chemistry of Thallium.—II. L. F. Hawley. (Journ. Am. Chem. Soc., July, 1907; 7½ pp.) Gives a new method for the gravimetric determination of thallium and describes the characteristics of various thallium compounds. 60c.

4015—PERU—Vanadium in Peru. J. J. Bravo. (Min. World, July 6, 1907; ½ p.) Gives some notes on a few occurrences of vanadium ore in this country. 20c.

SALT

4016—INDIA—Note on the Brine-well at Bawgyo, Northern Shan States. T. D. La Touche. (Records, Goel. Surv. of India, Vol. XXXV., Part 2, 1907; 4 pp.) Contains a few notes on the geological features and methods of working this brine-well where operations have to be interrupted every nine hours in order to let the well fill up again.

4017—SALT MAKING—Treatment of the Pan Scale of Salt Pans, and of its Products. F. Bale. (Journ. Soc. of Chem. Ind., May 31, 1907; 1 p.) Relates to recent improvements in working up the scale left in evaporating pans, and recovering useful products from it. 80c.

SAND

4018—GLASS-SAND INDUSTRY of Indiana, Kentucky and Ohio. E. F. Burchard. (U. S. Geol. Surv. Bull. No. 315, 1907; 16 pp.) Detailed descriptions of some of the chief glass-sand properties in these States, with a few notes on the methods of preparation in the local glass-making industry.

4019—GLASS SANDS—Notes on Various Glass Sands, Mainly Undeveloped. E. F. Burchard. (U. S. Geol. Surv., Bull. No. 315, 1907; 6 pp.) Enumerates the greater part of the known subordinate occurrences of glass-sand in various States.

SULPHUR

4020—UTAH—The Cove Creek Sulphur Beds, Utah. W. T. Lee. (U. S. Geol. Surv., Bull. No. 315, 1907; 5 pp.) Gives some general statements as to the character of the ore and its probable origin.

TIN

4021—DETINNING—Electric Detinning of Tinplate Scrap. G. Crudo. (Min. Journ., July 13, 1907; ½ p.) Contains a few general observations on the technical and industrial features connected with the recovery of tin from scrap by electricity. 20c.

4022—TASMANIA—Mount Bischoff Tin Mine, Tasmania. R. Stokes. (Min. World, July 13, 1907; 3 pp.) Gives a general idea of the location and character of this tin mine, and a description of the process of milling the ore. 20c.

4023—TASMANIA — Mount Cleveland Tin Field, Tasmania. (Aust. Min. Stand., June 5, 1907; 2 pp.) Outlines the scope of operations and the financial conditions of the chief producing companies in this field. 20c.

4024—TASMANIAN TIN INDUSTRY—III. R. Stokes. (Min. World, June 29, 1907; 2 pp.) Describes briefly the methods of bucket dredging and lode mining as practiced in the Tasmanian tin-field. 20c.

4025—WASHINGTON—A Tin Deposit Near Spokane. A. R. Whitman. (Min. and Sci. Press, July 13, 1907; 1 p.) Very brief notes on the occurrence of tin ore in this district and the economic conditions which now influence its exploitation. 20c.

ZINC

4026 — GALVANIZING — Zingage à Chaud et Galvanisation Electrolytique. (La Metallurgie, June 19, 1907; 1 p.) A general review of the art of galvanizing both by the method of dipping objects in a zinc bath, and by electrolytic means. 20c.

4027—MILL — New Kimberly-Wilfley Mill. (Min. World, July 13, 1907; 1 p.) Describes by a flow-sheet and brief comments the concentrating process to be used in treating a zinc-iron sulphide ore in Colorado. 20c.

4028—MILLING "SHEET GROUND" ORE in Joplin District. Doss Brittain. (Eng. and Min. Journ., July 13, 1907; 6 pp.) Gives an account of the present methods of milling sheet ground ore as practiced in Joplin where the low grade of the deposit requires large scale operations. Various flow-sheets of typical mills and details of jigs are included. 20c.

4029—ORE REDUCTION—New Process of Reducing Zinc Ore. (Lead and Zinc News, June 3, 1907; 3½ pp.) A summary of the patent specification of a new process of zinc ore smelting in which the ore and materials necessary for carrying out the reaction are placed in a furnace chamber in which the charge is rotated by means of a current of gas or air, the reaction taking place during the rotation. 20c.

4030—TENNESSEE—The Zinc Belt of Claiborne and Union Counties, Tennessee. W. C. Clarke. (Mines and Minerals, July, 1907; 1 p.) Gives a brief outline of the various zinc formations in this district, and the prospects of taking up their development. 20c.

ECONOMIC GEOLOGY—GENERAL

4031—ALABAMA—Limestone and Dolomite in the Birmingham District, Alabama. C. Butts. (U. S. Geol. Surv., Bull. No. 315, 1907; 9 pp.) Describes briefly the principal limestone formation in this district, and gives analyses.

4032—ALASKA—Geology and Mineral Resources of Iron Creek. P. S. Smith. (U. S. Geol. Surv., Bull. 314, 1907; 7 pp.) Reviews the physiography and general geological features, and describes the present state of mining development.

4033—ALASKA—Reconnaissance in the Matanuska and Talkeetna Basins, with Notes on the Placers of the Adjacent Regions. S. Paige and A. Knopf. (U. S. Geol. Surv., Bull. 314, 1907; 21 pp.) Gives some information upon the general geology of this territory, and discusses the economic aspects of copper and gold occurrences.

4034—ALASKA—Reconnaissance on the Pacific Coast from Yakutat to Alsek River. E. Blackwelder. (U. S. Geol. Surv., Bull. 314, 1907; 6½ pp.) An account of an exploration of the northwestern part of the coastal strip of southeastern Alaska, describing briefly the geological formations and mineral indications.

4035—ALASKA — The Bonnifield and Kantishna Regions. L. M. Prindle. (U. S. Geol. Surv., Bull. 314, 1907; 22½ pp.) Sums up the results of investigations as to the extent of the resources in gold and coal to be found in these regions.

4036 — BRITISH COLUMBIA—Reconnaissance Up West Fork of Kettle River. H. F. Evans. (Min. World, July 13, 1907; 1 p.) Brief mention of an exploration and the rock outcrops of the region around the west fork of Kettle river. 20c.

4037—BRITISH COLUMBIA—The Geology and Ore Deposits of Franklin Camp, B. C. R. W. Brock. (Paper read before the Can. Min. Inst., Toronto meeting, 1907, advance copy; 16 pp.) Contains some brief notes upon the character of the ore deposits in this camp and the chief geological features. 20c.

4038—GENESIS OF ORE DEPOSITS—Der Stammbaum der Erzlagerstätten. O. Stutzer. (Oest. Zeit. f. B. u. H., June 29, 1907; 2½ pp.) Deals with the origin of ore deposits, citing the silver deposits of Freiberg as examples illustrating the themes touched upon. 20c.

4039—GENESIS OF ORES. H. V. Winchell. (Min. and Sci. Press, July 13, 1907; 3 pp.) Address delivered before the Mont. School of Mines, June 5, 1907, outlining prevalent modern theories of the genesis of ore deposits, giving special attention to some points which have hitherto been neglected in text-books. 20c.

4040—INCLINATION OF STRATA — Neuer Stratameter und Bohrlochsneigungsmesser. Freise. (Oest. Zeit. f. B. u. H., June and 22, 1907; 5½ pp.) Supplements two previous articles of this character, and discusses the construction and application of some devices for determining the direction of strike and dip of strata which are penetrated by deep bore-holes. 60c.

4041—INDO-CHINA—Note sur la Géologie et les Mines de la Région Comprise entre Lao-Kay et Yunnan-Sen. H. Lantenois. (Ann. des Mines, T. XI, 4 livr., 1907; 121 pp.) Continuation of article previously mentioned in this Index. The present instalment contains chapters on coal, lignite, copper and iron mines, and gives some notes on several deposits of miscellaneous minerals.

4042—METAMORPHOSIS—The Metamorphic Cycle. C. K. Leith. (Journ. of Geol., May-June, 1907; 10½ pp.) Deals with the changes undergone by sedimentary and eruptive rocks under the influence of metamorphic agencies. 60c.

4043—ORE DEPOSITION—The Formation and Enrichment of Ore-Bearing Veins. George J. Bancroft. (Paper read before the A. I. M. E., New York meeting, Apr., 1907; 23 pp.) A discussion of various theories of ore formation and a presentation of the author's own views on this subject tending to show that volcanic action and circulation of rich solution are the primary factors in vein-formation.

4044—ORE DEPOSITS—Ein Beitrag zur Kenntnis der Tektonik der Erzlagerstätten am Schneeberg bei Sterzing in Tirol. B. Granigg. (Oest. Zeit. f. B. u. H., July 6, 1907; 5½ pp.) Deals with some principles applicable to the study of veins and ore deposits in determining their extent and sources. 40c.

4045—ORE DEPOSITS — Suggestions for Field Observation of Ore Deposits. S. F. Emmons. (Min. and Sci. Press, July 6, 1907; 2½ pp.) Gives some hints upon the principal points to be considered in the examination of ore deposits with a view to determining their structure and geological history. 20c.

MINING—GENERAL

4046—ALASKA—Lode Mining in Southeastern Alaska. C. W. Wright. (U. S. Geol. Surv., Bull. 314, 1907; 28 pp.) Notes on the occurrance of gold and copper ores in the principal producing districts and those likely to become so.

4047 — ALASKA — Non-metalliferous Mineral Resources of Southeastern Alaska. C. W. Wright. (U. S. Geol. Surv., Bull. 314, 1907; 8 pp.) Mentions the occurrences of marble, granite and gypsum and the probable markets for these substances.

4048—ALASKA—The Mining Industry in 1906. A. H. Brooks. (U. S. Geol. Surv., Bull. No. 314; 20 pp.) A review of the progress in the mining industry during 1906, summing up by districts the work accomplished.

4049—COLORADO FUEL AND IRON COMPANY—How One Corporation Helped Its Employees. Lawrence Lewis. (Eng. and Min. Journ., June 29, 1907; 5 pp.) Outlines the development of the system of the above company for bettering the welfare of its employees through the establishment of clubs and reading rooms. 20c.

4050—FEDERATED MALAY STATES—Gold and Tin Mines of the Federated Malay States, with Especial Reference to Pahang. J. B. Scrivenor. (Min. Journ., June 22 and 29, 1907; 1½ pp.) Conclusion of article previously mentioned in this Index. 60c.

4051—MINE ACCOUNTING—A Card System of Mine Accounts. R. S. Handy. (Min. and Sci. Press, July 13, 1907; 4½ pp.) Describes a card system for the keeping of detail cost accounts of the different departments as distinguished from the general bookkeeping accounts. 20c.

4052—MINERAL CLAIMS—State Provisions for Location of Lode Claims. R. S. Morrison. (Ores and Metals, June 20, 1907; 1 p.) Tells how the discoverer of minerals in Colorado must proceed in order to secure his rights under Federal Statutes. 20c.

4053 — MINING LAW — Extralateral Rights. (L. A. Min. Rev., June 22, 1907; ½ p.) Continuation of article previously mentioned in this Index. 20c.

4054—MINING LAW—Grubstake Contracts in Law. R. L. McWilliams. (Pacific Miner, June, 1907; 1 p.) Discusses several aspects of the grubstake contract, and sums up the latest views on the question as now held by the courts. 20c.

4055—MINING LAW—Re-locating Mineral Lands. R. W. Raymond. (Eng. and Min. Journ., July 20, 1907; 1½ pp.) A discussion of court decisions dealing with the rights of original locators and relocators of mineral claims on public lands. 20c.

4056—NEW YORK—The Mining and Quarry Industry of New York State. D. H. Newland. (N. Y. State Museum, Bull. 112, 1907; 80 pp.) Reviews the progress of the mining industry in this State during 1906, and gives statistics of output of all the mineral and quarry products. 20c.

4057 — ORE HANDLING — Conveying Methods at New Kleinfontein. (South African Mines, June 22, 1907; 1 p.) Gives some notes on the various systems of conveying ore in use at this property, the system being designed to handle ore in stopes, on the surface, in the mills and the cyanide plant. 20c.

4058 — PROSPECTING — Interesting Cases of Misleading Prospecting. G. H. Ashley. (Min. World, July 6, 1907; 1 p.) Discusses some cases when the use of the prospecting drill is likely to be misleading, and the caution necessary in using it in a faulted region. 20c.

4059—PROSPECTING—Some Notes on the Use of Well Drills in Prospecting for Minerals, with Examples of Cost of Operation. (Eng. Contracting, July 3, 1907; 2 pp.) Gives detailed statements as to the cost of drilling wells for prospecting purposes by percussion drills. 20c.

4060—PURCHASING DEPARTMENT—The Work of a Purchasing Department. (Min. and Sci. Press, June 22, 1907; 1½ pp.) Contains notes on the organization of the purchasing department of a mining company, with hints on the placing of contracts and the quality of material to be specified. 20c.

4061 — ROOF SUPPORTS — Concrete Roof Supports. (Mines and Minerals, July, 1907; 1½ pp.) Describes the successful application of concrete supports

in the mines of the Philadelphia & Reading Coal and Iron Co., of Pennsylvania, and gives some notes on the method used in replacing timbers by concrete. 20c.

4062—SHAFT CONSTRUCTION — The Turned-back Shaft at the Salisbury Mine. R. Meeks. (Eng. and Min. Journ., July 13, 1907; 1 p.) Describes how two different turns were made in a shaft which had been ruined by caving, in order that the new shaft might be brought out near the ore-bins served by the old shaft. 20c.

4063—SHAFT SINKING—Das Schachtabteufen nach dem Gefrierverfahren von Poetsch. Kegel (Bergbau, June 20, 1907; 2 pp.) Conclusion of article previously mentioned in this Index. 20c.

4064—SHAFT SINKING—The Syracuse Shaft on the Mesabi. (Eng. and Min. Journ., July 13, 1907; 2½ pp.) A description of shaft sinking through quicksand by a novel application of the pneumatic process after the failure of many other methods. 20c.

4065—SHAFTS — Schachthochbrechen mit Erweiterung von unten nach oben. Herbst. (Glückauf, June 22, 1907; 3½ pp.) Describes some of the methods used in eniarging old shafts and starting a new one, by working from below to above, illustrated by diagrams of timbering and manner of installing hoisting apparatus. 40c.

4066—SIBERIAN MINES and Mining Conditions. A. L. Simon. (Bull. No. 33, I. M. M., June 20, 1907; 11 pp.) Discussion by members of the Institution of the above paper which was previously mentioned in this Index.

4067—SIGNALLING—Die elektrischen Schachtsignalanlagen. Schmiede. (Glückauf, July 6, 1907; 4 pp.) Describes several systems of electric signals applicable to hoisting shafts in mines, giving details of the electric circuits. 40c.

4068—SOUTH AFRICA—Two Rhodesian Ventures Reviewed. (S. African Mines, June 22, 1907; 1 p.) Gives a few notes on the mineralogical features of the Somabula diamond fields and on the character of the low grade deposits of the Falcon mine. 20c.

4069—STOPING with the Air-hammer Drill. G. E. Wolcott. (Eng. and Min. Journ., July 26, 1907; 2 pp.) Record of practical experience in stoping and other mine work with the air-hammer drill at Cripple Creek. 20c.

4070—SURVEYING—A Graphic Solution of the Direct Solar Observation. J. Underhill. (Bull. Colo. Sch. of Mines, May, 1907; 5 pp.) Develops a method whereby reference to a series of diagrams will give the graphical solution of the spherical triangle in which three sides are given and the azimuth angle is required. 60c.

4071—SURVEYING — Some Practical Points on Mine Surveying. L. C. Hodson. (Eng. and Min. Journ., July 20, 1907; 1½ pp.) Reprint from the "Iowa Engineer," May, 1907, giving a number of hints on up-to-date methods of mining surveying as compiled from the author's experience. 20c.

4072—TUNNEL—The Cost of a Small Rock Tunnel. F. L. Pruyn. (Compressed Air, June, 1907; 2 pp.) Gives cost details as calculated by the author while driving a small rock tunnel, and discusses briefly the relative importance of various parts of the work. 20c.

4073—TUNNELING—Mining Operations in New York City and Vicinity. H. T. Hildage. (Paper read before the A. I. M. E., New York Meeting, Apr., 1907; 38 pp.) Describes the construction of the railroad tunnels beneath New York City and its rivers, with illustrations of the cutting shields and the methods of shoving them.

4074—TUNNELING—Western Practice in Tunnel Driving. W. P. J. Dinsmoor. (Mine and Quarry, June, 1907; 2 pp.) General description of methods employed in driving tunnels and handling muck, as carried out in the Cripple Creek district. 20c.

ORE DRESSING

4075—MAGNETIC SEPARATION—Improved Magnetic Separating Machinery. R. T. Clegg. (Min. World, July 20, 1907; 1 p.) Describes the construction of a roaster and magnetic separator for the treatment of ores containing lead, zinc, copper and iron in combination. 20c.

METALLURGY—GENERAL

4076—BLAST FURNACE VS. REVERBERATORY. J. W. Neill. (Min. and Sci. Press, June 29, 1907; 1½ pp.) An exposition of various features which must be considered in determining whether the blast furnace or reverberatory is more suitable for ore smelting. 20c.

4077—ELECTRIC FURNACE in Steel Making and Copper Smelting. T. Scott Anderson. (Eng. and Min. Journ., June 29, 1907; 1 p.) Reviews briefly the general question of electric ore smelting, and describes several forms of furnaces for this purpose patented by the author. 20c.

4078—FURNACE CHARGES—Calculation of Furnace Charges. R. Chauvenet. (Min. Reporter, July 18, 1907; 1½ pp.) Gives methods of solving the various problems relating to calculating furnace charges. 20c.

4079—INSOLUBLE RESIDUE—Determination of Insoluble Residue. (West. Chem. and Metallurgist, June, 1907; 3 pp.) Gives the methods used in various large smelters for determining insoluble silicious residue, and definitions as to just what is meant by this term by different chemists. 60c.

4080—MELTING POINTS OF ALLOYS—Ueber die Veränderung des Schmelzpunkets der eutekischen Gemische. C. Benedicks and R. Arpi. (Metallurgie, June 22, 1907; 3 pp.) Studies the peculiar action of eutectic mixtures which under certain conditions may be heated above their melting points without fusing. 40c.

4081—METALLIFEROUS WASTE—The Systematic Treatment of Metalliferous Waste. L. Parry. (Min. Journ., July 6 and 13, 1907; 3½ pp.) Discusses some economic principles which bear upon the utilization of waste products of smelting, takes up their sources of supply and methods of treatment. To be continued. 60c.

4082—ORE REDUCTION—The Electrolytic Reduction of Low-grade Ore. Day Allen Willey. (Elec. Rev., July 13, 1907; 2½ pp.) Describes the plant and operating methods of the Tacoma Smelting and Refining Co., of Washington, where lead and copper ores are reduced by the use of electric furnaces. 20c.

4083—SLAG—Disposal of Slag from Smelting Works. Herbert Lang. (Eng. and Min. Journ., June 29, 1907; 2 pp.) Brief notes on methods used by a company in Lower California for the disposal of its slag, which is being used in the construction of a breakwater. 20c.

4084—SMELTER FUMES—Search for the Causes of Injury to Vegetation in an Urban Villa Near a Large Industrial Establishment. Persifor Frazer. (Paper read before the A. I. M. E., New York meeting, Apr., 1907; 58 pp.) A detailed account of the methods pursued in investigating the sources of injurious smelter fumes and their effect upon vegetation.

4085—SMELTER SMOKE—Gases vs. Solids; An Investigation of the Injurious Ingredients of Smelter Smoke. (Journ. Am. Chem. Soc., July, 1907; 20 pp.) Gives the results of a thorough investigation into the injurious effects of solids and gases in smelter smoke, including many analyses of the different ingredients of smelter fumes. 60c.

4086—SMELTER SMOKE—The Determination of Arsenic and Other Solid Constituents of Smelter Smoke, with a Study of the Effects of High Stacks and Large Condensing Flues. W. D. Harkins and R. E. Swain. (Journ. Am. Chem. Soc., July, 1907; 28 pp.) 60c.

4087—SMELTER SMOKE—The Disposal of Smelter Smoke. Herbert Lang. (Eng. and Min. Journ., June 29, 1907; 1½ pp.) Suggests the application of a flue for the purpose of conveying smelter fumes to a considerable distance from the works where its liberation will be harmless and gives estimates as to cost and the power necessary to produce suction. 20c.

4088—SMELTING FLUX—Developing a Silicious Ore Supply. (Mineral Wealth, June 15, 1907; 2½ pp.) Deals with the methods employed and the results accomplished by several operators in the Shasta county belt for obtaining a reliable supply of silicious ore for use as flux in their copper furnaces. 20c.

4089—SOUTH WALES — Mining and Metallurgy in South Wales. Edward Walker. (Eng. and Min. Journ., July 13, 1907; 1½ pp.) A review of the present situation as regards mining and metallurgy in this district, giving a few causes for the decadence of the district as a copper smelter. 20c.

4090—THIN METALLIC SECTIONS—A New Apparatus for Polishing Metal Sections. K. W. Zimmerschied. (Journ. Am. Chem. Soc., June, 1907; 5½ pp.) Describes the construction and operation of a machine designed to polish metal sections, and suitable for individual use in large laboratories. 60c.

MINING AND METALLURGICAL MACHINERY

4091—AIR COMPRESSOR PRACTICE—Standards of Efficiency in Air Compressor Practice; The Air Compressor as an Air Meter. Frank Richards. (Pract. Engr., July 12, 1907; 1 p.) Takes up the proper definition of efficiency as applied to air compressors, and discusses the influence of temperature and the effect of inlet valves upon it. 20c.

4092—CAGE GUARDIAN—The Hanley Cage Guardian. Albert Hanley. (Trans. Min. Inst. of Scotland. Vol. XXIX., Part 4, 1907; 2½ pp.) Contains several detailed drawings and a description of a device to guard a cage from excessive speed, breakage of guides or hoisting rope.

4093—COMPRESSED AIR: Its Production and Use. (Compressed Air, June, 1907; 2½ pp.) Deals with the conditions which should be found in a perfect compressor, and considers several valve systems and transmission problems. 20c.

4094—CRANES—Vertical vs. Horizontal Cranes; A Comparison. (Pract. Engr., July 12, 1907; 1½ pp.) Sums up the relative merits of vertical and horizontal cranes, and considers their structural strength and cost of construction. 20c.

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4096—FAN VENTILATORS for Mines. Robt. Grimshaw. (Eng. and Min. Journ., July 20, 1907; 1 p.) Gives a number of calculations relating to the relative efficiencies of steam and electrically-driven fans. 20c.

4097—GAS-CALORIMETER — Beasly's Recording Gas-Calorimeter. (Engineering, July 12, 1907; 2 pp.) Describes the features of this new type of recording gas-calorimeter, which gives a continuous record of the calorific power of the gas, and which has been found to adapt itself readily to considerable variations in the heating power of the gas under test. 40c.

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4099 — GAS PRODUCERS — General Principles in the Construction of Modern Gas Producers. R. E. Mathot. (Eng. Mag., July, 1907; 18 pp.) Contains many points bearing upon the construction and installation of gas producing plants and comments upon various new features of design. 40c.

4100—HOISTING ROPES — Kritische Stellen im Schachtförderseile. W. Wirtz. (Bergbau, June, 20, 1907; 3 pp.) An interesting consideration of weaknesses in hoisting ropes, pointing out the places where they are most likely to develop. 20c.

4101—LOCOMOTIVE EXPLOSION—Explosion of Air Locomotive. (Mines and

Minerals, July, 1907; 2½ pp.) Considers some probable causes which might have led to the explosion of this locomotive which occurred while it was being recharged with compressed air. 20c.

4102—MINE EQUIPMENT—Recent Improvement at the Clausthal Mines. Bergrat Schennen. (Min. Journ., June 22 and 29, 1907; 2 pp.) Translation from Glückauf, June 1, 1907, of the above article which was previously mentioned in this Index. 60c.

4103 — OIL FUEL — Changing from Wood Fuel to Crude Oil. J. E. Anderan. (Power, July, 1907; 1 p.) A short account of the changes made in a wood-burning plant when oil fuel was substituted, showing pump connections, details of burners, and arrangement of boilers. 20c.

4104—PIPE LINES—Wood versus Iron for Pipe Lines in Coal Mines. John H. Haertter. (Eng. and Min. Journ., July 6, 1907; 4 pp.) Compares the relative merits of cast iron and wood pipes and gives details of methods of laying and cost. 20c.

4105—PIPE PROTECTION—Economical Devices for Mines. (Mines and Minerals, July, 1907; 1 p.) Gives a few brief notes on various devices for protecting iron pipe as used by the Phila. & Reading Coal & Iron Co. 20c.

4106—PRODUCER GAS for Power. J. A. Charter. (Iron Age, June 27, 1907; 2½ pp.) Gives a general description of the principal features of a gas producer plant and the engine which it is to operate. 20c.

4107—PUMPING MACHINERY—Some Notes on Pumping Machinery. A. Munsey-Thompson. (Journ. Transvaal Inst. Mechan. Eng., Apr., 1907; 12 pp.) An extended discussion of the advantages of different types of pumps and their proper fields of application. 60c.

4108—PUMPING—Notes on Pumping Conditions and Limitations. W. S. Pardoe. (Trans. Eng. Soc., School of Pract. Sci., Toronto, No. 19. 1905-1906; 10 pp.) Describes different types of pumps and considers the conditions under which each type is most efficient.

4109—PUMPS—Les Pompes Centrifuges Basse et a Haute Pression. H. Legros.. (Pub. de l'Association des Ingénieurs de l'Ecole des Mines de Mons. T. I. 1907; 64 pp.) Contains a very thorough study of the principles relating to centrifugal pumps and considers various factors which produce variations in pressure and their effects.

4110—PUMPS—Steam Pumps versus Turbine Pumps. R. C. Williams. (Power, July, 1907; 1 p.) Compares the relative costs and efficiencies of reciprocating and turbine pumps. 20c.

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4115—SURVEYING INSTRUMENTS—Markscheiderische und geodätische Instrumente vom königl. ungar. Oberbergrate Prof. O. Cseti. E. Dolezal. (Oest. Zeit. f. B. u. H., May 18 June 1, 8, 15, 22 and 29, 1907; 22 pp.) Describes and illustrates the construction and characteristic features of improved surveying instruments adapted to mining and geological work. $1.40.

4116—TEMPERATURE MEASUREMENT—Principle and Operation of the Fery Radiation Pyrometer. C. H. Wilson and F. Maeulen. (Sch. Mines Quart., Apr., 1907; 8½ pp.) Gives notes on the operation and discusses the principle of this laboratory instrument for measuring temperatures over 500 deg. C., by sighting a telescope into a furnace and reading the result directly on a scale. 60c.

4117—TOOL ROOM CARE and Economy. F. G. de Saussure. (Eng. and Min. Journ., June 15, 1907; 2 pp.) Outlines a complete plan for storing tools and keeping track of them, and of checking the losses and the cost of repairs to broken tools. 20c.

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4120 — ATMOSPHERIC NITROGEN — The Fixation of Atmospheric Nitrogen. F. Howles. (Eng. Rev., July, 1907; 7½ pp.) Treats of two methods of producing high tension electric arcs for converting atmospheric nitrogen into an available form, and describes many types of furnaces used in the process of fixation. 20c.

4121—LIME BURNING—Der belgische Schachtofen zum Brennen von Kalk. J. Lambock. (Tonindustrie Zeit., May 11 and 18, 1907; 4 pp.) Deals with the cost of burning lime in Belgian cupola furnaces, giving data on fuel consumption, capacity, quality of product, etc. 40c.

4122—SULPHURIC ACID—Procédé de Concentration de l'acide Suifurique. O. Offenbach. (Rev. des Produits Chim., June 1, 1907; 1½ pp.) Describes the process of concentrating sulphuric acid, and gives critical comments on the various steps. 20c.

4123—SULPHURIC ACID—The Influence of Physical Condition and Chemical Composition of Commercial Lead on its Durability for Pan-concentration of Sulphuric Acid. W. B. Hart. (Journ. Soc. of Chem. Ind., May 31, 1907; 7 pp.) Very complete review of the various processes of refining work lead and of the effects of the impurities left in the lead by these processes upon its use in sulphuric acid manufacture. 80c.

ANALYTICAL CHEMISTRY

4124—ASSAYING—Assayers' Pouring Mold. J. J. Bailey. (Min. Rep., May 23, 1907; ½ p.) Describes an ingenious device for use by assayers whereby the lead button is separated from the slag in the mold itself without the necessity of hammering the slag off after cooling. 20c.

4125 — ELECTRO-ANALYSIS — Einrichtung zur Ausführung Elektroanalytischer Schnellmethoden. A. Classen. (Zeit., f. Elektrochem., May 3, 1907; 5 pp.) Gives the results of an investigation of the principles and factors bearing on rapid analysis by electrolysis. 40c.

4126 — ELECTRO-ANALYSIS — Ueber Einen neuen Apparat für Elektrolytische Schnellmethoden. F. C. Frary. (Zeit. f. Elektrochem., June 7, 1907; 1½ pp.) Describes several new types of apparatus for making rapid electrolytic determinations, including those using wire gauze and mercury electrodes. 20c.

4127—FERROCYANIDES—A Method for the Qualitative Separation and Detection of Ferrocyanides, Ferricyanides and Sulphocyanides. P. E. Browning and H. E. Palmer. (Am. Journ., Sci., June, 1907; 2½ pp.) Gives the results of successful attempts to determine a method for the detection of small amounts of ferrocyanides and ferricyanides in the presence of each other. 60c.

4128 — IRON DETERMINATION — A Method for the Estimation of Iron in the Presence of Titanium. F. A. Gooch and H. D. Newton. (Am. Journ. of Sci., May, 1907; 3 pp.) Outlines a procedure for the volumetric determination of titanium, and tabulates the results of tests upon the accuracy of the method . 60c.

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4130—METAL ELECTROLYSIS—The Effect of Sulphuric Acid on the Deposition of Metals when Using a Mercury Cathode and Rotating Anode. L. G. Kollock and E. F. Smith. (Journ. Am. Chem. Soc., June, 1907; 9½ pp.) Investigates the effect of varying amounts of sulphuric acid in the solution upon the electrolytic decomposition of certain metallic substances. 60c.

4131—SOLUBILITY. E. C. Bingham. (Am. Chem. Journ., July, 1907; 26 pp.) An inquiry into the nature of chemical solubility, and an investigation into the effects which various factors have upon this property.

4132—TELLURIDE ORES—Some Experiences in Assaying Telluride Ores. J. N. McLeod. (Min. World, May 18, 1907; 1 p.) Gives the experiences encountered in assaying unusual samples of telluride ores, and discusses the losses which took place during the assay. 20c.

4133—TIN—Die Quantitative Trennung des Zinns von Mangan, Eisen und Chrom durch Elektrolyse. N. A. Puschin. (Zeit. f. Elektrochem., Apr. 19, 1907; 2 pp.) Gives procedures for determining tin by electrolysis in the presence of manganese, iron and chrome, and tabulates the results of experiments wherein the accuracy of the methods was tested. 20c.

4134—TIN—The Electrolytic Determination of Tin with the Use of a Rotating Anode. L. F. Witmer, (Journ. Am. Chem. Soc., Apr., 1907; 4½ pp.) An investigation into the possibility of determining tin by this method, showing that tin may be precipitated rapidly and accurately upon a rotating anode from ammonium sulphide electrolyte. 80c.

4135—TIN CATHODES—the Use of Tin as a Cathode for the Rapid Quantitative Electrolytic Deposition of Zinc, Copper, Silver, Cadium and Nickel. L. T. Sherwood and G. Alleman. (Journ. Am. Chem. Soc., July, 1907; 9½ pp.) Investigates the suitability of tin cathodes as substitutes for platinum during the electrolytic determination of the above elements, and tabulates the results of all the tests made. 60c.

4136—TITANIUM—The Colorimetric Determination of Titanium. J. H. Walton, Jr. (Journ. Am. Chem. Soc., Apr., 1907; 4 pp.) Comments upon various methods of determining titanium colorimetrically and develops a new procedure whereby the bad effect of an excess of ferric chloride is largely eliminated allowing a satisfactory and rapid determination of the titanium. 80c.

MATERIALS OF CONSTRUCTION

4137—CEMENT—Ueber den Erhärtungsprozess der hydraulischen Bindemittel. (Portland-zement, Puzzuolane und Trasse, Romanzemente). Dr. Rohland. (Stahl u. Eisen, May 8, 1907; 4 pp.) Discusses a theory of the setting of cements, and considers the effects of various solutions which are added to the water which is used in the mixing. 40c.

4138—CONCRETE—Comparative Tests of Sandstone and Slags as Concrete Aggregates. H. S. Kesner and F. W. Doolittle. (Min. Reporter, July 4 and 18, 1907; 4 pp.) Contains the results of crushing tests of different samples of concrete made from various slags and crushed stone, and sums up the general conclusions obtained from the figures. 40c.

4139—FERRO-CONCRETE and its Applications. T. J. Gueritte. (Trans. No. of England Inst. Min. and Mechan. Eng., Mar., 1907; 14 pp.) Contains general principles used in designing reinforced concrete, and comments upon various engineering structures in which it has been used.