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The Metallurgy of Aluminum in 1906

Reduction Capacity Is Being Enlarged and the Output for 1907 Is Expected To Be Several Times as Great as That of 1906

BY JOSEPH W. RICHARDS*

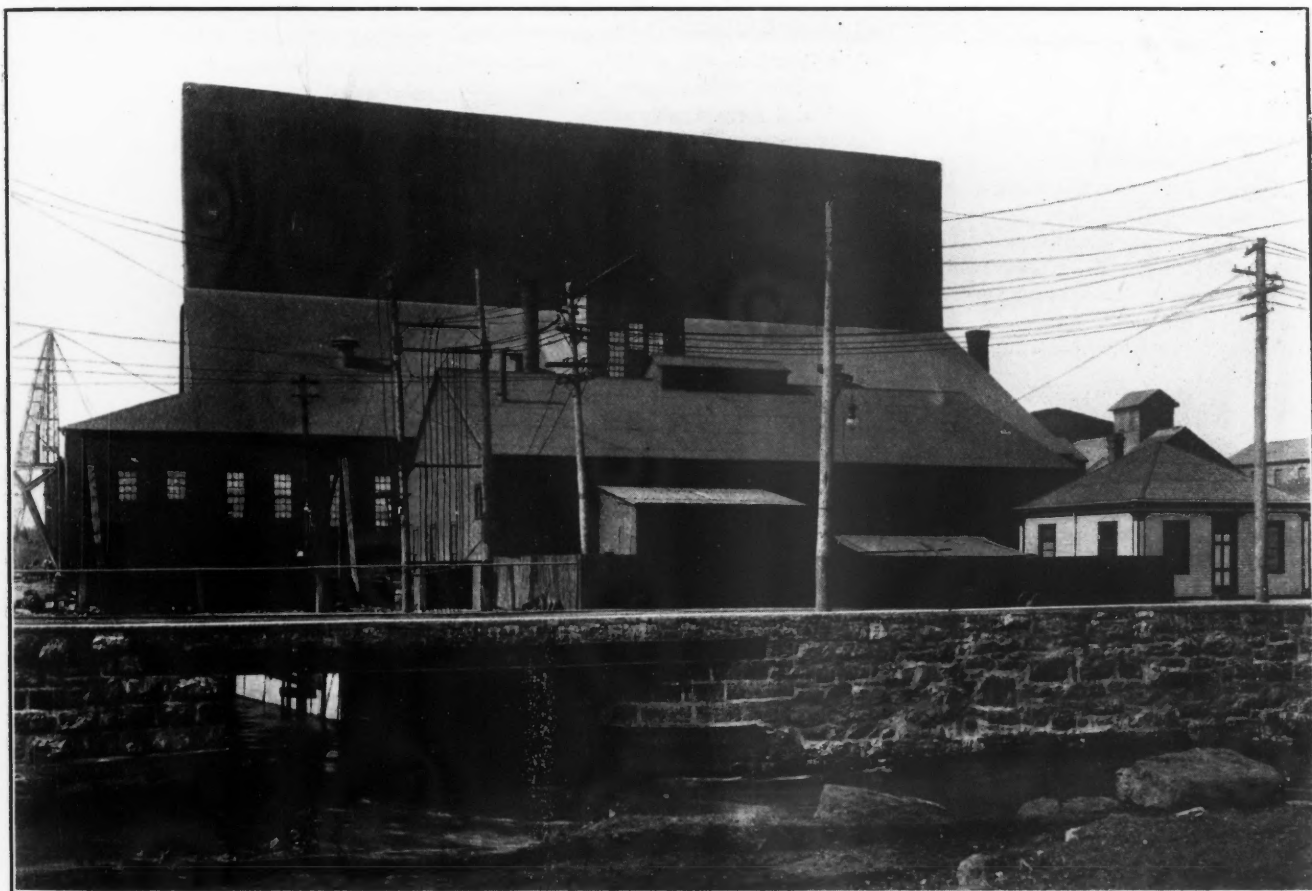
The year 1906 witnessed great activity in all details of the aluminium industry. Four firms in Europe and one in America practically control the industry, being owners of a large part of the beds of bauxite, and also of the best water powers conveniently accessible. The unusually high prices of copper, tin, nickel and zinc, as well as the other metals, during 1906,

PLANTS

United States—The Pittsburg Reduction Company (now the Aluminum Company of America) was the only producer. It owns large bauxite deposits in Georgia, Alabama and Arkansas, obtaining, however, most of its ore from Saline county in the latter State. It has done a large amount of stripping and development

great steel corporation, and it has accordingly spent large sums of money in purchasing bauxite lands both in the eastern district—Georgia and Alabama—and in Arkansas.

Concerning the production of pure alumina, this company has enlarged to great dimensions its chemical plant at East St. Louis. The process used is the



LOWER WORKS, ALUMINUM COMPANY OF AMERICA

stimulated the demand for aluminium to such an extent that much more could have been sold than the companies were able to produce; this condition held strongly all the year, and was, in fact, most marked at the end of the year.

Note—From advance sheets of *The Mineral Industry*, Vol. XV.

Note—In deference to the wishes of Professor Richards, his preferred spelling "aluminium" has been retained in his article, although the regular style of the JOURNAL is "aluminum."—EDITOR.

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work at its mines at Bauxite, Arkansas, also is just completing there a new crushing, grinding and drying plant, and has built a railroad called the Bauxite & Northern, connecting all of its mines in that region with the Chicago, Rock Island & Pacific Railroad and the Missouri Pacific and Iron Mountain systems. This company has realized that reserve stores of bauxite are as essential to the welfare of a large aluminium company as reserves of iron ore are to a

same as heretofore, but the capacity of the plant has been increased several times. The power for the plant is furnished by condensing turbine engines; the evaporating plant is the most complete and largest of its kind ever built.

The carbons used in the reduction are now manufactured entirely by this company, being baked in electrically heated furnaces patented by Chas. M. Hall. The old plant for making carbons, at the upper Niagara works, has been practically torn

down and rebuilt to three times its previous capacity; the buildings are of steel, with traveling cranes and every up-to-date conveying appliance; the new plant has an equipment and capacity equal to that of any other carbon-electrode plant in the world.

The rolling and sheet mills of the company have been correspondingly enlarged; a new mill for this purpose is in course of construction at Niagara Falls. This is of reinforced concrete, and when finished will be one of the largest and most complete sheet-rolling mills in America.

The work thus done by this company within the last three years, in plants and processes entirely outside of the reduction of the metal, has been on a scale which, remembering the former infancy of the aluminium industry, may be properly characterized as "stupendous." The investments thus made in these accessory enterprises have amounted to several millions of dollars.

ENLARGED REDUCTION PLANTS

The reduction plants of this company, at Niagara Falls, Massena, N. Y., and Shawinegan Falls, Quebec, Canada, are all in process of being greatly enlarged. At Niagara Falls the lower plant, using power supplied from the canal of the Niagara Falls Power and Manufacturing Company, which has heretofore been reported as of 12,000 h.p. capacity, has been increased by the building of a very large plant to use 45,000 h.p., consisting of five units of 9000 h.p. each. Two of these units (18,000 h.p.) will be in operation by May, 1907, and the whole plant in June, 1907. At Shawinegan Falls the company is quadrupling its already large capacity and expects the new plant to be finished ready for operation in April, 1907. This plant is nominally controlled by the Northern Aluminium Company, which is a subsidiary company of the American company, and manufactures aluminium chiefly for export; it is expected that this increased capacity will exceed the demands for export, but the company is intent upon providing reserve facilities equal to all possible demands of the near future.

At Massena the company has purchased the entire plant of the St. Lawrence River Power Company, with its canal and power house of 40,000 h.p. capacity, and is actively preparing to dredge out the canal to double this capacity. One of the largest of modern dipper dredges and the most powerful elevator dredges ever built have been installed ready to commence operations as soon as the winter is over. The complete dredging plant has cost over a million dollars. A new power house for this enlarged capacity will be started in 1907, and eight large water wheels, to absorb the capacity of the first canal, have been purchased and will be placed in position in the old power house within a few months. The output of this

plant in 1907 will be from two to three times the output of 1906.

The difficulty of hurrying hydraulic construction work, and the very great difficulty in getting materials moved and work done on contract time, has delayed the plans of this company, as it did that of business in general in 1906, and the construction and installation work which it was expected to have completed by the end of 1906 will be completed between that date and June 1, 1907. At the latter date it is confidently expected that the output of American aluminium will be several times as great as the average output in 1906. The company has been as sensible of the shortage of aluminium in the market during 1906 as have its customers or would-be customers, and hopes by these liberal expenditures of several millions of dollars to keep ahead of all demands in the future.

EUROPEAN REDUCTION WORKS

Great Britain—The British Aluminium Company is undertaking large extensions of its plant in Scotland.¹ It has commenced to construct a dam near Kinloch-levan, which will form a reservoir with a capacity of 20,000 million gallons, supplied by a water-shed of 55 square miles, which has the largest rainfall in Great Britain. This reservoir will be 7.5 miles long by 0.5 mile wide, obliterates three lakes, is 1000 ft. above sea-level and only five miles from the coast. A concrete conduit will convey water 3.5 miles, where it will connect with a short pipe line delivering the water to turbines at about 900 feet head. The dam is of concrete, 0.5 mile long, 80 ft. high in the center, and will cost \$2,000,000; the rest of the water power scheme will cost \$500,000. The horse-power expected from this expenditure is 20,000, but it should be at least 50,000, to correspond with the cost of the water works. The Foyers works will be enlarged from 6000 to 15,000 h.p., by the hydraulic works there nearing completion. The same company has acquired water power at Sarpsfos, Norway, but how much has not been stated. A plant is also contemplated by it in Wales. United States Consul Guenther, at Frankfort, estimates the output of this company in 1906 as 2250 metric tons.

Germany—The Aluminium Industrie Aktien Gesellschaft, operated mostly by German capital, has works at Rheinfelden, Baden (near Basel), at Neuhausen, Switzerland (at the Rhine falls), and at Lend Gastein in upper Austria. This company is financially very successful, having paid 18 per cent. dividends in 1904 and 22 per cent. in 1905, on a capital of \$3,000,000; in 1906 it floated \$5,000,000 additional capital stock, which was taken by a syndicate of Berlin bankers at 150 per cent. premium. It employs 88 officials and 661 workmen, and produced 3675 tons in 1905.² It oper-

ated, however, 24,000 h.p. in 1906,³ and must have produced with this about 5500 metric tons. Active enlargements of this company's plants are in progress, such that it expects to be operating 100,000 h.p. toward the close of 1907, and 120,000 h.p. in 1908. This would give its probable production for 1907 as somewhere about 13,000 tons, and its capacity in 1908 as 27,000 tons. This company also runs an alumina plant at Deutsch Lissa, Silesia, where 200 workmen are employed.

France—The Société Electrometallurgique Française, at Froges, La Praz and Les Sordrettes (St. Michel) has at its command 20,000 h.p.,³ but is said to be producing only 2300 tons annually, which would correspond to about half that power. Enlargements of 12,000 h.p. at Vénéon (Isère) and 10,000 h.p. at Bissorte (Savoy) are said to be contemplated.

The Société des Produits Chimiques d'Alais et Carmague has 11,000 h.p. at Calypso and 2500 at St. Félix, and is said to be contemplating 12,000 additional at St. Jean (Savoy). Consul Guenther reports its output as 2000 tons, which would correspond fairly well with its reported available power.

A new plant of 30,000 h.p. is said to be proposed for Chippis, in the Valais, French Switzerland. Another plant is spoken of at Aube, in the Pyrénées, of 25,000 h.p.; and one in the southwest of France of 10,000, but they are at present only propositions.

Italy—For some time it has been known that bauxite exists in Italy, though probably not of high grade. A company has been recently incorporated, called the Aluminium Society, which expects to start operations early in 1907 in the Pescara valley, where 30,000 h.p. is available, and 14,000 h.p. is already installed for various electro-chemical purposes. The aluminium plant is reported to cover 40,000 sq.m., and to be connected by cableway with its bauxite mines at Lecce di Marsi. The details so far made public are hazy and somewhat confused.

OTHER COUNTRIES

Canada—It is rumored³ that a \$10,000,000 company is being organized in Canada, to utilize Canadian water powers for manufacturing aluminium.

India—Recent discoveries in the central provinces of bauxite carrying 51 to 68 per cent. of alumina, and of deposits in Bengal and near Bombay carrying 43 to 65 per cent., have revived hopes that eventually an aluminium industry to supply the local market might come into existence in India. Alfred Chatterton, who has done so much in the Industrial School at Madras to teach the native metal workers to manufacture aluminium ware, writes of the present situation, in the *Madras Mail*,

¹*Electrochem. and Met. Ind.*, Sept., 1906. From the *London Electrician*.

²U. S. Consular Report. Consul Guenther, Frankfort.

³*Metal Industry*, January, 1907.

⁴R. Piltaval, *Journal de l'Electrolyse*, Oct. 15 and Nov. 1, 1906.

⁵*Metal Industry*, December, 1906.

as follows:¹ "At the present time India absorbs less than 100 tons of aluminium yearly; it could be easily increased to 1000 tons. The Indian army uses it for canteens, water bottles, and cooking pots. Most Europeans in India use aluminium cooking utensils. The natives use so much acetic, tartaric and citric acids in their cooking, in combination with salt, that their food rapidly corrodes aluminium. Since 1898, a good market has been started, and if works were established, with the cheap bauxite, power and labor, aluminium could be produced very cheaply, to supply an established and easily enlarged market."

GENERAL REMARKS

While but few countries are now producing aluminium, yet the prospects are very likely that countries with very abundant and cheap water powers, like Nor-

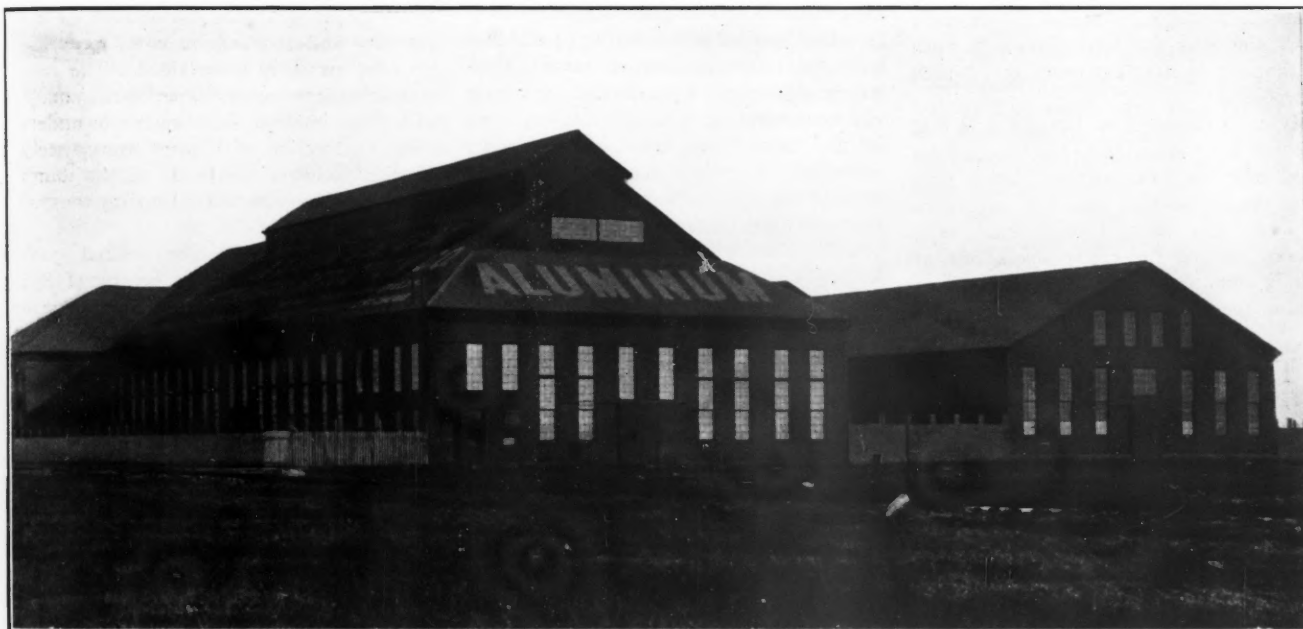
carbon dioxide escapes, and at atmospheric pressure the carbonate first mentioned precipitates. The filtrate from this still contains some carbonate in solution; on warming it to 25 or 30 deg. C., or keeping it in the air, it deposits a carbonate containing 2 to 3 per cent. of carbon dioxide and 50 per cent. of alumina. The bearing of these facts on the possible *modus operandi* of the hot-spring deposition of bauxite is at once evident. At a depth of 320 ft. a hydrostatic pressure of eight atmospheres would exist, under which alumina would dissolve completely in a carbonated water, and could thus be leached out of aluminous rocks and subsequently deposited at the surface practically as bauxite, where the pressure is relieved.

PROCESSES OF REDUCTION

Hall Process—Francis R. Pyne², work-

The minimum melting point is with 5 per cent. alumina, at 915 deg.; another minimum occurs with 10 per cent. alumina, at 980 deg.; between these is a maximum, about 992 deg., at 8 per cent. alumina, corresponding fairly well with the proportions of the possible compound $(AlF_3 \cdot 3NaF) \cdot Al_2O_3$. The bath with 5 per cent. alumina is indicated as probably the best for electrolytic reduction.

The original Hall patents, covering the electrolysis of a melted bath consisting of double fluoride of aluminium and a more positive metal, as the solvent, and alumina dissolved therein, expired April 2, 1906, and as such are now the property of the public. The working of these, or of any melted electrolyte for obtaining aluminium without the use of external heat, operated solely by the internally generated electrical heat of the decomposing current, is



UPPER WORKS, ALUMINUM COMPANY OF AMERICA

way, or with cheap labor and water powers like India and Japan, will not long stay out of the ranks of the producers. The total production in the world, in 1906, was probably not far short of 19,000 metric tons, valued at \$12,500,000, but 1907 will probably double that output, and 1908 double that of 1907. These figures are admittedly guesses; they are given because they are thought to be intelligent ones.

ALUMINIUM SALTS

Carbonate—The existence of true aluminium carbonate has been doubted by some chemists. A. Gawalowski³ has studied the question and has prepared a carbonate at ordinary atmospheric pressure which is insoluble in water and contains 8 to 9 per cent. of alumina. Prepared at eight atmospheres pressure, a polycarbonate is obtained, completely soluble to a clear solution in water. On reducing the pressure,

ing in the metallurgical laboratory of Lehigh University, has investigated the melting points of mixtures consisting of cryolite and alumina, thus reproducing one of the mixtures covered by the Hall patents (now expired). In commercial practice more aluminium fluoride than is contained in cryolite is used in the composition of the bath. Mr. Pyne's results were as follows:

MELTING POINTS OF CRYOLITE—ALUMINA MIXTURES.

Cryolite.	Alumina.	Melting Point.	Cryolite.	Alumina.	Melting Point.
100		1,000°C.	93	7	982
97	...	974	92	8	992
96	3	960	90	10	980
95	4	915	85	15	994
94	5	960	80	20	1,015
	6				

still covered by the Bradley patents, according to the decision of the courts, and these latter do not expire until February, 1909. The public is therefore free to use the Hall process, as formerly covered by the Hall patents, but in doing so must not infringe on the manner of working covered by the Bradley patents.

Gin Process—Gustav Gin⁴ seeks to revive the old Deville-Castner sodium-reduction process in a modified form. He would first make aluminium chloride by mixing bauxite with 25 per cent. of its weight of anthracite dust and 10 per cent. of tar, compressing into balls, heating in a retort to redness and passing chlorine, thereby volatilizing aluminium chloride, contaminated by ferric chloride. The latter is removed by pouring liquid zinc into the sublimation chamber, which is then closed and slightly heated, resulting in reducing the iron chloride to the metallic

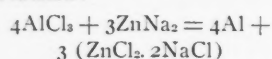
¹Metal Industry, October, 1906.

²Chemisches Central Blatt, 1906, 1, 640.

³Trans. Am. Electrochem. Soc., Vol. X; Electrochem. and Met. Ind., November, 1906, p. 435.

⁴Revue Industrielle, July 14, 1906.

state. The sublimation chamber is then heated to 500 deg. C. and the aluminium chloride vapor allowed to escape through a heated tube, where it comes in contact with melted zinc-sodium alloy, resulting in the reaction:



Both zinc and sodium are said to act as reducing agents under these conditions, giving aluminium containing about 1 per cent. of zinc. This is purified by casting it into the channel of an electric furnace on a refractory hearth, the end terminals being large blocks of aluminium. A channel 16 sq.cm. in cross section by 25 m. total length containing 100 kg. of aluminium needs 10,000 amperes at about 25 volts tension, and is heated to whiteness, so that the zinc volatilizes completely, in a few minutes. The zinc-sodium alloy is produced electrolytically from the slag produced in the reducton, by adding to it NaCl and KCl and electrolyzing it until all the zinc in it and most of the sodium is deposited.

My chief comment on the above is that a person not compelled to use this process could take the same current which produces the ZnNa₂ alloy and with it prepare the same 4Al direct from a Hall bath, without any of the costly operations of making aluminium chloride, reducing it or refining the aluminium from zinc.

The Sulphide Corporation

In 1906 this company, of Broken Hill, N. S. W., produced 135,742 tons of ore, as compared with 238,166 tons in 1905. The falling off in quantity was due to the creep in the Kintore shaft in the Central mine before the new hauling shaft was completed and ready for service. The extraction of ore was almost completely prevented for nearly two months. Later in the year a further extensive settlement of the upper and partially disused stopes at the northern end of the mine occurred along the crown of the lode, throwing the ore-dressing mill completely out of work and affecting the workings by closing important gangways down to the 500-ft. level. Extraction and milling operations were consequently entirely suspended during the last month of this financial year.

It is not expected that much future trouble will be experienced from creeps, as the developments in the workings at the 700-ft. and 1000-ft. levels insure a regular extraction for the new mill, and the mistakes made in failing to secure the ground while mining the upper levels will be avoided. The future policy of the management will be the reverse of what it was hitherto. The larger extraction of ore will be made in the lower workings. By restricting the extraction in the upper levels and carefully filling the ground it is believed that in future little trouble will be experienced from creeps.

During the period covered by the report 26,376 cu.yd. of tailing from the re-treatment plant were sent into the workings for use in refilling stoped ground. The results being satisfactory, the practice will be regularly pursued in the future.

The new main shaft has been sunk below the 900-ft. level, and will be carried down below the 1000-ft. level to enable the large orebodies between the 800-ft. and 1000-ft. levels being worked. The shaft was equipped during the year with an electrical hoist which is operating satisfactorily. The average cost of the electrical power, which is generated by steam in the mine, is under 1d. per horse-power hour.

The lead-concentrating plant treated 136,172 tons of ore, which produced 24,607 tons of concentrates. The total stock of middling, slime and tailing now at the mine amounts to 1,136,302; the increase in 1906 being 4341 tons. The tonnage capacity of the re-treatment plant is now nearly equal to the output of residues from the lead-concentrating plant. During the year plans were drafted for a new lead-concentrating mill for dealing with ore and its residuals in a single continuous operation. A position which is free from injury from any earth movements in the mines was chosen for a site on the North Central mine, and its erection was commenced. It is expected to be completed and ready for operation early in 1907.

Two products will be obtained from this mill, viz.: lead concentrates and zinc concentrates. The value of the products handled last year was as follows: 24,607 tons of concentrate, forming 18.1 per cent. of the material treated, averaged 31 oz. silver, 60.8 per cent. lead and 10 per cent. zinc; 11,912 tons of slime, forming 8.7 per cent. of the material, averaged 15.5 oz. silver, 16.6 per cent. lead, and 21.7 per cent. zinc; and middlings and tailing, forming the remaining 73.2 per cent. of treated material, assayed 6.6 oz. silver, 5.3 per cent. lead, and 20 per cent. zinc per ton. The milling costs, including crushing of ore and maintenance equaled 4s. 6d. per ton.

The magnetic plant practically exhausted the stock of available middling product. The plant was originally designed for dealing with material carrying 26 per cent. zinc, and as the dump became well worked down it was found that the value of the material in zinc rapidly decreased and much care and attention was required to so modify the machinery as to enable it to make a satisfactory extraction. Last year the magnetic plant treated 33,737 tons of middling, having an average assay value of 9.2 oz. silver, 8.5 per cent. lead, and 24.1 per cent. zinc. The zinc-concentrate returns amounted to 11,465 tons, assaying 14.5 oz. silver, 13.3 per cent. lead, and 35.9 per cent. zinc. This represents a recovery of 53.8 per cent. silver, 53 per cent. lead and 50.8 per cent. zinc.

The tailing plant treated 47,326 tons assaying 6 oz. silver, 5.2 per cent. lead, and

21.8 per cent. zinc, from which 17,753 tons of zinc concentrate were obtained, having an assay value of 9 oz. silver, 7 per cent. lead, and 39.6 per cent. zinc. This is equivalent to a recovery of 55.6 per cent. silver, 50.2 per cent. lead, and 68.1 per cent. zinc.

In the granulation mill 23,709 tons of tailing and slime were treated, the average assay value being 7.4 oz. silver, 6.4 per cent. lead, and 20.4 per cent. zinc. The returns were 8013 tons of zinc concentrate assaying 14.8 oz. silver, 11.8 per cent. lead, and 44 per cent. zinc. This amounts to an extraction of 67.3 per cent. silver, 62.1 per cent. lead, and 72.8 per cent. zinc. During the year numerous improvements were made in the process. It was found that when the ore is regularly crushed to an approximately uniform fineness, action is very rapid, complete and satisfactory, while the recovery is high and the grade of the product is good. The limit of the recovery and economy in costs have not yet been properly ascertained. The success attendant upon experiments made with slime induced the company to undertake the erection of a plant immediately for the exclusive treatment of the dump which now contains about 119,673 tons of the material.

The zinc-distilling plant treated 3029 tons of concentrate for a return of 859 tons of spelter. An additional furnace was placed in commission, and ran without intermission. The spelter produced is of high quality, and is easily disposed of in the Orient. The recovery of silver and lead is satisfactory.

The company's smelter at Cockle Creek, near Newcastle, treated 68,742 tons of concentrate and ore for a return of 21,559 tons of bullion containing 86,594 oz. of gold, and 1,532,486 oz. of silver.

Residue from Zinc Smelting

After the distillation of zinc has been completed, the residue raked out of the retort is a cinder composed of unburned coal mixed with the gangue of the ore, the latter being fused to a more or less degree, according to its ingredients. This cinder contains the major portion of the lead (to some extent as metallic globules, to some extent as silicate and other compounds) and practically all of the silver of the roasted ore. The cinder also contains a varying percentage of zinc, ordinarily from 4 to 7 per cent. The proportional weight of the cinder with respect to the roasted ore charged into the retorts varies with the character of the ore, and the practice in its distillation. In the distillation of ordinary ore, assaying 45 to 50 per cent. zinc, the residue generally amounts to 60 to 70 per cent. of the weight of the ore charged, say 66 2/3 per cent. as a mean. Under certain conditions, however, as at Cockle Creek, New South Wales, it may amount to 100 per cent.

Behavior of Carbon and Phosphorus in Steel

A Discussion of J. E. Stead's Explanation of the Banding of Carbon and Phosphorus and the Theory of Incompatibility

BY HENRY M. HOWE*

In an important paper on the "Crystallization and Segregation of Steel Ingots," J. E. Stead gives some very valuable information as to the behavior of carbon and phosphorus in steel.

In order to understand what he reports, let us refresh our memory as to what carbon steel consists of. It is necessary not only for the metallurgist but also for the engineer to understand this constitution of steel, if he wishes to treat intelligently the steel which he uses, and to discuss that treatment.

In its normal or slowly cooled state any true carbon steel² with less than 0.90 per cent. of carbon consists essentially of a conglomerate, such as is shown in Fig. 1, of masses of free iron or "ferrite," and other masses of pearlite, which latter in turn consists of alternate bands or plates of ferrite and of a hard iron carbide (Fe_3C), called "Cementite," interstratified in the ratio of about 6.5 of ferrite to 1 of cementite. The ferrite is often arranged in a net work, surrounding meshes or islands of pearlite, as shown in Fig. 1.

The composition of the pearlite itself is constant, and so is that of the ferrite. As the carbon present is contained wholly in the cementite of the pearlite, the proportion of the whole mass which the pearlite forms increases with the carbon-content of the steel, so that whereas a very low carbon steel consists of nearly pure ferrite, a steel of 0.90 per cent. carbon consists of pure pearlite without any ferrite.

To distinguish the ferrite which forms part of the pearlite from that which exists apart from the pearlite in the form of a net-work or otherwise, the latter is called "free" ferrite or "excess" ferrite.

These constituents of steel, and the general features of their life history, should be familiar to every engineer.

CHANGES BROUGHT ABOUT BY HEATING AND COOLING

Let us now pass on to consider what happens to these substances, the pearlite and the excess ferrite, when the steel is heated and cooled.

The constitution which I have just sketched remains constant in heating un-

til a critical temperature near 700 degrees C., technically called A_1 is reached (See Fig. 2.)

On passing A_1 , the whole of the pearlite is quickly changed into a new substance called "austenite," which is nearly homogeneous, and is what is called a "solid solution" of carbon (or perhaps of an iron-carbide) in iron.

As the temperature rises farther, the excess ferrite in turn dissolves progressively in this austenite, and by the time the temperature has reached the point called A_3 , this dissolving of the ferrite in the austenite has completed itself, so that the mass now consists of a single nearly homogeneous substance, austenite. The temperature of this point A_3 varies from about 700 deg. in case of steel of 0.90 carbon, to about 900 deg. in case of steel practically free from carbon.



FIG. 1. SLOWLY COOLED CARBON STEEL (B. STOUGHTON)

The white network is the excess ferrite or free iron. The zebra-banded islands or meshes are pearlite with white bands of cementite (the iron carbide Fe_3C) and black bands of ferrite. The ferrite in this pearlite looks black, because in polishing it has been furrowed down into grooves, and these grooves look black because they are filled with shadow.

When such steel is again cooled, as indicated by the arrows in Fig. 2, the process which has just been sketched is reversed; that is to say, when the steel cools as far as A_3 , part of the iron contained in the austenite begins to separate out from that austenite in the form of "free" or "excess" ferrite, often in the form of a network, as shown in Fig. 1. This separation of ferrite continues as the temperature sinks from A_3 toward A_1 , so that it is in this region, A_3 to A_1 , that the white network of ferrite shown in Fig. 1 comes into existence.

By the time that the temperature has

finally fallen as far as A_1 , the formation of the "excess" ferrite network has become practically complete, and now a new change suddenly takes place. This change is called the "recalescence," and consists in a sudden spontaneous decomposition of the remaining austenite into pearlite. This brings the steel back into the condition with which we started, a network of excess ferrite, formed in the passage from A_3 to A_1 , surrounding meshes of pearlite formed in crossing A_1 .

THE PHENOMENA OF BANDING

So much for the general idea of the constitution of steel, and of the life history of its constituents. Now let us pass on to consider the phenomena of banding, concerning which Mr. Stead gives us some new information.

It was shown long ago that the ferrite and pearlite of rail steel were sometimes concentrated in bands parallel with the direction of rolling. As the carbon is contained wholly in the pearlite, this is equivalent to saying that there is a longitudinal banding of the carbon itself.

That such a banding should arise in rolling is readily understood, because of the difference in hardness between the pearlite and the ferrite. The pearlite, because of the extremely hard cementite which it contains, is much harder than the excess ferrite, and we can readily understand that this difference in hardness should cause the harder and the softer constituents to be drawn out into parallel bands in the same way in which the cinder and the metallic iron of common wrought iron are drawn out into such bands in rolling.

It is natural to suppose that rolling can induce this banding only when the steel is below A_3 because only then does it consist of two distinct substances. When it is above A_3 it consists of austenite, and because this is homogeneous or nearly so, we see no way in which rolling should cause banding. When the steel is between A_3 and A_1 , it is a conglomerate of austenite and ferrite, of which the latter increases in quantity as the temperature sinks toward A_1 ; when it is below A_1 it is a conglomerate of ferrite and pearlite. Therefore, the condition which should enable rolling to cause this drawing out or banding, is that the steel should be either below A_1 , so that it is a conglomerate of the harder pearlite and the softer "excess" ferrite; or, if above A_1 that it should be only slightly above, so that with the austenite there should be mechanically

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¹Cleveland Institution of Engineers, Sept. 6, 1906.

²The term "Carbon steel" is used to distinguish the structural, rail and other common steels from the "alloy steels" such as the rapid-cutting tool steels, etc. The former consists essentially of iron and carbon. The latter necessarily contains much tungsten, manganese or other elements exclusive of carbon and iron.

mixed a considerable quantity of the softer excess-ferrite.

INFLUENCE OF PHOSPHORUS

The new points to which Mr. Stead calls our attention are (1) that when the steel is heated well above A_3 , that is when the ferrite and pearlite merge together as austenite, this banding of carbon is wholly removed if phosphorus is absent; but (2) that it is persistent or at least recurrent if much phosphorus is present. Further (3), that in phosphoric steels there is a persistent banding of the phosphorus itself.

because the banding has thus been effaced, when the steel again cools below 700 deg. and changes into the normal mixture of pearlite with ferrite, these two components are no longer banded, but are uniformly distributed. Thus the fact that the banding of the carbon in steels free from phosphorus is not persistent is readily understood.

(3) *The banding of the phosphorus.* Before going on to consider the second point, the persistence of the banding of carbon in phosphoric steel, we shall do well to examine the third point, the band-

drawn out into bands by that rolling; and the drawing out of the ferrite into bands incidentally involves drawing out into those same bands the phosphorus which that ferrite contains, so that after rolling the steel consists of bands abnormally rich in ferrite and phosphorus and poor in carbon, alternated with bands abnormally rich in pearlite and poor in phosphorus.

The genesis of this banding of the phosphorus thus understood, there is no difficulty in understanding how it comes to persist. This simply implies that when the steel is changed into austenite by heating above A_3 , the phosphorus does not diffuse, or diffuses only very slowly, away from the bands into which it has been drawn out by the rolling.

INCOMPATIBILITY OF CARBON AND PHOSPHORUS

(2) *The persistence of the banding of carbon in phosphoric steel.* The final question then arises, how is it that the presence of phosphorus leads to persistence of the banding of the carbon, so that exposure to a temperature well above A_3 , which effaces the banding of carbon in non-phosphoric steel, does not efface it in phosphoric steel? Mr. Stead's explanation, as I understand it, is that even in the austenite state there is a certain incompatibility between carbon and phosphorus, so that in that austenite state the carbon does not diffuse into the bands rich in phosphorus, or diffuses only slowly into them. The consequence is that when the steel again cools below A_1 , the phosphoric bands remain abnormally poor in carbon, and the alternate bands relatively free from phosphorus remain abnormally rich in carbon. Hence the former, because of their poorness in carbon, thus become abnormally rich in ferrite; the latter, because of their richness of carbon, become abnormally rich in pearlite.

The sum of this is:

(1) In the passage from the austenite to the pearlite state in cooling from A_3 to A_1 , the phosphorus concentrates in the free or excess ferrite network.

(2) Rolling below (or but little above) A_1 causes (A) a banding of the harder pearlite, alternated with the softer ferrite, and (B) with the latter a banding of the phosphorus which had been concentrated in it.

(3) The slowness of the diffusion of the phosphorus in the austenite state makes this banding of phosphorus persist through any reheating.

(4) The incompatibility of the carbon and phosphorus restrains the carbon from diffusing fully into the phosphoric bands in the austenite state, and so makes the banding of carbon persist.

(5) The persistence of the banding of carbon makes the banding of ferrite and pearlite recur in phosphoric steel when the steel cools from the austenite state above A_3 into the pearlite state below A_1 .

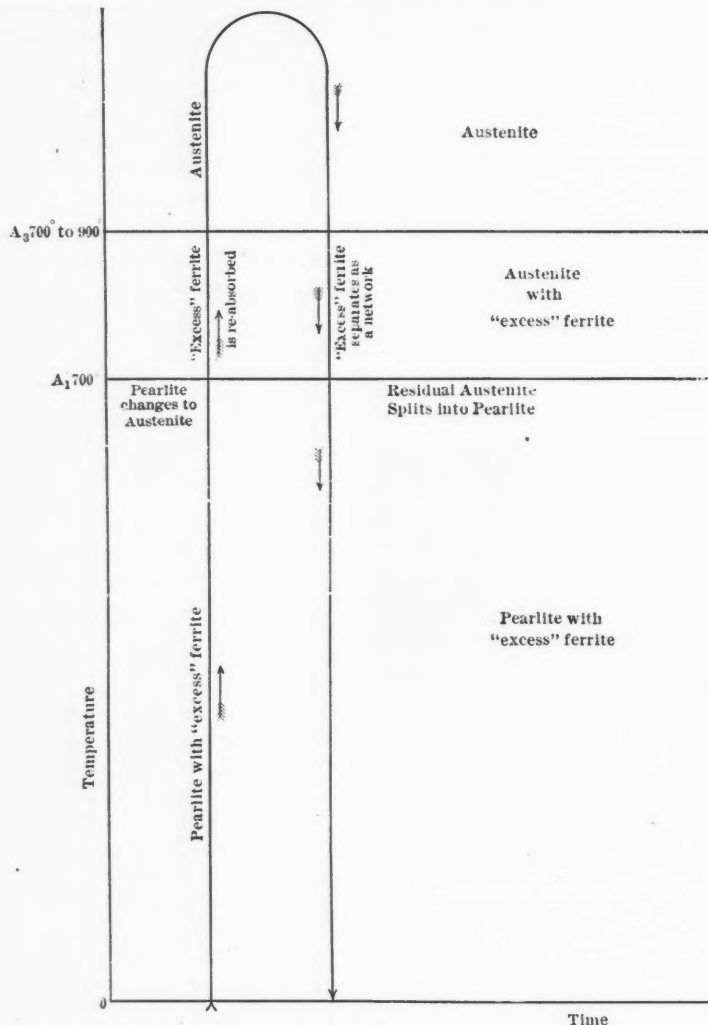


FIG. 2. CHANGES IN THE CONSTITUTION OF CARBON STEEL WITH RISE AND FALL OF TEMPERATURE

Let us take up these three points separately.

(1) *The transitoriness of the banding of carbon in non-phosphoric steel.* If non-phosphoric steel is rolled at temperatures materially below A_1 , so that there is much drawing out of the ferrite and the pearlite into bands, with implied banding of the carbon, this banding is slowly effaced if the steel is held long enough above A_3 to allow the carbon to diffuse from the parts which had been pearlite into those parts which had been occupied by the ferrite network, and hence had been free from carbon while the steel was below A_1 . And

ing of the phosphorus itself, and its persistence. Mr. Stead's explanation seems to be as follows:

When, with the cooling of the steel across A_3 — A_1 , the excess-ferrite network gradually forms, a disproportionately large quantity of the phosphorus present leaves the austenite to associate itself with this ferrite network, so that, when the steel has cooled below A_1 , a large part of the phosphorus has been concentrated into the ferrite network, and an unduly small part of it remains in the pearlite meshes. If in this state of affairs the steel is rolled, the softer ferrite and the harder pearlite are

It is not pretended that the above theory is fully proved; but at least it serves the true purpose of every theory, to group the facts in a comprehensible way, and to show the path by which the theory itself can be confirmed or replaced by a better.

The above steps, from (3) on, rest on the assumption of an incompatibility between carbon and phosphorus in the austenite state. This indeed sounds a little like Nature's abhorrence of a vacuum, but the idea is more reasonable than the language. What is implied is no more than that in the austenite state the phosphorus diffuses only slowly, and that the carbon diffuses only slowly into those parts of the austenite which are rich in phosphorus. This latter idea seems to be a necessary part of the explanation; because the mere persistence of the banding of phosphorus due to the slowness of its diffusion, would not explain the persistence of the banding of the carbon which the persistence of the banding of the ferrite and pearlite implies as its own cause.

ADDITIONAL EVIDENCE

Mr. Stead presents further evidence to show incompatibility between carbon and phosphorus. First, he heated to whiteness a pile composed of plates of pure iron free from phosphorus and carbon, between which was powdered some phospho-carbide of iron containing 1 per cent. of carbon. This treatment welded all the plates together, and after the mass had been slowly cooled it was found that the carbon had left the phosphide joint completely and diffused into the plates of pure iron.

The complete freedom of the phosphoric joint from carbon seems to imply an even greater degree of incompatibility between carbon and phosphorus than the explanation which I have above offered calls for. It seems to imply one of two things.

Either (1), in the austenite state, the carbon and phosphorus, instead of diffusing into each other like two gases, tend rather to draw apart, each withdrawing from the other.

Or (2), there is such mutual repulsion between carbon and phosphorus in the birth of the excess-ferrite network as the steel cools across the region A_2 A_1 , as to cause a bodily withdrawal of the carbon from the phosphoric joint.

These explanations certainly remind us unpleasantly of vacuum-abhorrence, and we naturally hope for some easier one. There is a third and easy explanation which, unfortunately, breaks down on examination. It is as follows:

The birth of the network of excess ferrite in the cooling of the steel from A_2 to A_1 indeed implies an expulsion of the carbon from the space which that network occupies. While the steel is austenite, any such pre-existing network is effaced, and the carbon diffuses from the meshes into the space where the network had been. When the network of ferrite re-forms, the

carbon is expelled from it, precisely as an impurity contained in freezing water is expelled by the freezing ice and concentrated in the mother water. Here, then, is a forcible expulsion of carbon; those molecules of carbon which had been in the space where the ferrite network now forms, migrate from their position in that space into a new position in the meshes between the network. This migration, though it is in itself astounding like every other operation of nature taken by itself, yet is now as familiar as the falling of an apple to the earth, itself intrinsically as marvelous. Now, may not the presence of phosphorus in the austenite cause an increase in the quantity of this ferrite network which forms in cooling from A_2 to A_1 , and thus increase the width of each ferrite band in that network, and narrow the meshes of pearlite between that network, and thus finally increase the distance which the carbon has to migrate in order to remove itself from that network and leave it carbonless? May not the expulsion of carbon which Mr. Stead finds, be of this nature, implying that the pearlite itself is richer in carbon, so that the carbon-content, at which the steel consists of pearlite alone when slowly cooled, instead of being 0.90 per cent., as usual, may be much higher?

THE MIGRATION OF CARBON

This acceptable explanation breaks down when we consider it farther. If his report is accurate, and there are few metallurgical observers at once so competent and so experienced as he, we are forced to think that the migration of the carbon away from the joints between his plates is not of the kind here considered. Had the carbon, which was initially 1 per cent. in his joints, simply diffused out into the adjoining plates uniformly, so that the percentage of carbon left in the joint was the same as that in the plates between those joints, then when the steel cooled from A_2 to A_1 , and the ferrite network formed, even if the higher phosphorus in the joint should cause a thicker network of ferrite and smaller meshes of pearlite there, this would not in itself imply, it would not even suggest, a migration away from the joint, unless for microscopic distances. It would imply only that in the joint the network of ferrite would be thicker, and the meshes of pearlite smaller than elsewhere. There would still be the same quantity of carbon in the joints as in the plates themselves between those joints; and the only difference between the joints and the plates would be (1) that the joints would have more phosphorus than the plates and (2) that in the joints the ferrite network would be thicker, and the pearlite meshes thinner, and hence richer in carbon than in the plates. The carbon would not be bodily removed from the joints into the plates; it would simply be concentrated in smaller and richer meshes of pearlite in the joints than in the plates.

The freedom of the joints from carbon therefore seems to imply something more, a bodily migration of the carbon, not simply from network into meshwork through microscopic distances, but away from the joints into the steel plates between those joints through macroscopic distances, leaving the joint free from carbon for a thickness great enough to permit Mr. Stead to take samples which he determined by analysis to be free from carbon if, as I infer from his positive statement that the joint was free from carbon, he proved this freedom by chemical analysis.

In another test by Mr. Stead, in an ingot which contained 0.30 carbon and 0.50 phosphorus, the phosphorus appeared to exist in the form of phosphide eutectic in the center of the ferrite network which surrounds the meshes of pearlite, or of pearlite mixed with ferrite. When this ingot, and also another containing 0.30 carbon and 0.30 phosphorus, were forged out, they consisted of lenticular bands of ferrite rich in phosphorus, and, of course, free from carbon as all ferrite is, alternated with bands of pearlite. This concentration of the phosphorus in the envelopes of the carbonless ferrite which surround the meshes of pearlite or of mixed pearlite and ferrite, seems to Mr. Stead so complete as to indicate strongly a sort of incompatibility between the phosphorus and carbon. At least, it would seem to indicate that, when, in crossing the critical range A_2 — A_1 , the excess ferrite separated out of the austenite, the phosphorus separated out along with it in undue proportion, leaving little phosphorus (and perhaps none), in the eutectoid of pearlite formed when the temperature at last sank past A_1 .

The silver-lead veins of the Slocan, British Columbia, are extremely irregular. They are generally narrow and the pay-streaks are thin. Exceptions to this generalization are to be found in certain wide veins, like one at least on the South Fork of the Kaslo, and certain thick stopes of ore such as are to be seen in the Slocan Star mine. The general association of siderite with the ore is highly characteristic of the entire region; there are few of the silver-lead mines which do not show it to some degree. The tendency of the veins toward impoverishment in both galena and blende with depth is strongly marked, the proportion of siderite first increasing and finally the proportion of quartz. The ore shoots are rather short, and the stretches of barren vein between them are rather long; the stopping area of the veins is therefore comparatively small and the cost of prospecting is correspondingly high. The silver-lead ore is generally of high grade in silver, which has made it possible to operate certain of the mines at the excellent percentage of profit that has been shown most brilliantly by the Payne and the Slocan Star.

Alaska United Gold Mining Company

This company owns the Ready Bullion and 700-ft. mines on Douglas island, Alaska, with two mills, one of 120 stamps and one of 100 stamps. During the year 1906, which is covered by the report, the company operated the Ready Bullion mine and the 120-stamp mill, the 700-ft. mine being temporarily leased to the Alaska Treadwell Company. This lease will terminate during the current year. The capital stock is \$1,000,000 in 200,000 shares of \$5 each; 180,200 shares are outstanding and 19,800 are owned by the company.

The statement of earnings for the year is as follows, averages being computed on tons milled:

	Amount.	Per ton.
Free gold and base bars..	\$290,007	\$1.2252
Sulphurets	171,393	0.7241
Interest	2,408	0.0102
Rental, 700-ft. claim.....	3,600	0.0152
Total receipts.....	\$467,408	\$1.9747
Mining and development..	\$237,768	\$1.0046
Milling	72,821	0.3077
Sulphuret expenses.....	25,758	0.1088
General expenses.....	12,986	0.0548
Construction and repairs	12,762	0.0539
Total expenses.....	\$362,095	\$1.5298
Net earnings.....	\$105,313	\$0.4449

The balance brought forward from 1905 was \$374,716, making a total of \$480,029. From this appropriations were made of \$75,000 for depreciation and \$126,140 for dividends of 14 per cent. on stock; a total of \$201,140, leaving a balance of \$278,889 undivided.

The average assay value of the ore, based on a large number of samples, was \$2.28 per ton, showing a saving of 86.6 per cent.

The mine statement shows 135 ft. shaft sinking during the year; 89 ft. stations and skip chutes; 1171 ft. raises; 14 ft. crosscuts; 2018 ft. drifts. The ore raised and sent to mill was 236,690 tons. Ore reserves at the close of the year were 1,070,944 tons, of which 184,384 tons were broken in stopes.

The mill of 120 stamps crushed during the year 236,690 tons of ore, at a total cost of \$72,821, or \$0.3077 per ton. The average duty was 5.71 tons per stamp per day. The running time of the full mill for the year was 345 days 7 hours 8 minutes, during which time steam was used for power 266 days 12 hours 7 minutes, and water for power 78 days 19 hours 1 minute.

The average number of men employed during the year was 148, and the average wages paid were \$3.13 per day. There were two fatal, two serious and nine slight accidents during the year.

The work of installing water power at the mine was completed during the year, the total expenditure for the year being \$3306. On the afternoon of Aug. 1 a fire broke out in the coal bunkers of the steam-power plant and quickly spread to the boiler house, engine rooms and 120-stamp mill. After two hours' work the

fire was gotten under control and extinguished. The total cost to date of repairs to steam plant occasioned by this fire is \$2953. After the water-power system had been installed the fire mains were so connected that either fresh water under 200-lb. pressure or salt water from the fire pumps, or both, could be used in case of fire. The fire mains were extended to the Ready Bullion main shaft, and all the necessary valves, fire hydrants and giants installed. It is worthy of mention that 15 minutes after the fire alarm sounded for the fire of Aug. 1 there were twelve 1-in. streams of water, under a pressure of 200 lb., playing on the fire and mill buildings. It has been decided to use crude oil as fuel in all of the steam-power plants on Douglas island. For this purpose a steel tank with a storage capacity of 30,000 bbl. is being installed. The foundation for this tank has been completed and the work of erecting is now in progress. The work has been done at a cost of \$2382.

The ore reserves in the 700-ft. mine have now sufficient tonnage to warrant again starting the 100-stamp mill. When the new hoist is installed at the Mexican main shaft, the ore for both the Mexican 120-stamp mill and the 100-stamp mill of the 700-ft. claim will be hoisted and crushed at the Mexican No. 2 shaft and the expense divided between the two mines. The trestle connecting the two mills has been completed and the reconstruction of the 100-stamp mill of the 700-ft. claim is well under way and the mill will soon be in readiness to receive ore. The above work has been done at a total expense of \$2834 to date.

Copper Range Consolidated Company

The annual report for the year 1906 of the Copper Range Consolidated Company, which also includes reports of the Baltic Mining Company, the Copper Range Company, the Trimountain Mining Company and the Copper Range Railroad Company, shows a net income of \$3,193,109.41 and assets amounting to \$40,844,737.67. The total production from which the earnings were derived, that of the Baltic, Trimountain and one-half that of the Champion, was 32,382,983 lb., a decrease of 331,876 lb. from the previous year, due entirely to a falling off in the Trimountain.

The average cost of copper sold and delivered was as follows: Champion, 8.21c. per lb.; Baltic, 8.37c.; Trimountain, 11.4c.; Copper Range Consolidated Company, 9c. per lb.

The Copper Range Consolidated Company paid dividends of \$6 per share in 1906, amounting to \$2,304,810; expended in new construction \$392,990.42, and there was left a surplus from the year's operations of \$495,308.99.

The Baltic stamped 649,932 tons, an in-

crease of 45,223 tons compared with the year 1905. The yield per ton was 22.15 lb., a decrease of 1.63 lb., so that the increase in the product of the mine was only 12,873 lb. Notwithstanding the increased tonnage of rock treated, the mass and barrel work was less than the preceding year, which, with the decrease in the smelting returns of the mineral smelted, largely accounts for the reduced yield per ton. The first three months of 1907 show an increase in production of about 20 per cent. over the corresponding period of 1906.

The Champion stamped 671,785 tons, an increase of 67,302 tons over the previous year, and the refined product increased 1,247,560 lb. The output here is limited at present by the equipment at the stamp mill and mine, but when contracts for additional machinery already made are filled, which it is expected will be done by August 1, the production should be materially increased.

The falling off in the tonnage of Trimountain rock stamped was due to the necessity of opening a large amount of unproductive ground. The bottom levels of the mine now being opened give indication of considerable improvement, and if the present improvement continues it ought to show a material increase in 1908.

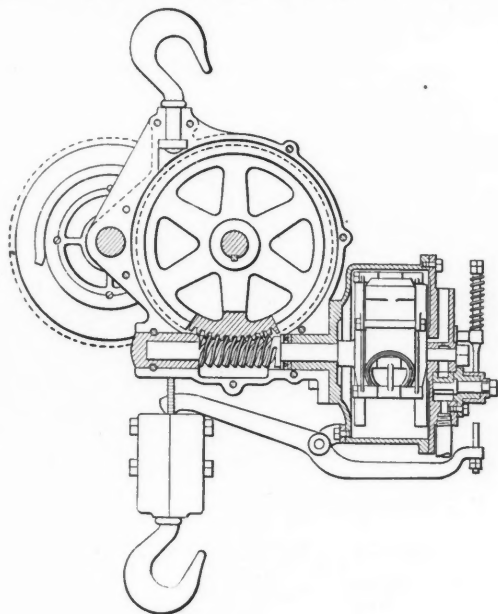
The sinking of the Globe shaft has progressed slowly, due to the continuance of quicksand. The shaft has reached a depth of 223 ft., which is within 5 ft. of solid rock. Preparations have been made for rushing the work after rock is reached. After the shaft has reached solid rock it will be necessary to sink it in rock five to six hundred feet before encountering the Champion lode. This sinking will be accomplished probably within the year, and at the same time crosscuts will be driven to intersect the lode above the point of intersection of the shaft.

Contracts will be let for the building of a generating station on the lake frontage of the Michigan Smelting Company property, from whence electric power for all purposes will be distributed to the different operations. The waste heat of the smelting works will be used as far as possible. The initial installation will give a capacity of 2000 kw. in duplicate, and will supply all the power at present used for every purpose, except for hoisting engines and compressors. A provision will be made so that the power can be increased by installing additional generating machinery.

The insoluble anode slime from which the gold and silver are recovered in electrolytic copper refining is variable in composition, as might be expected, depending on the grade of material being handled. It is chiefly metallic in nature, and a common composition would be: Silver, 40 per cent.; gold, 2; copper, 25; selenium and tellurium, 5; arsenic and antimony, 10; lead, silica, sulphuric acid, etc., 18.

The Imperial Air-motor Hoist

In the Imperial air-motor hoist here shown the motor is a positive-action reversible air engine with no dead centers and a practically uniform torque. It is wholly inclosed, dust-proof, splash oiling, with every bearing bushed and bathed in oil. The steel worm on the motor shaft runs in an oil pocket, its thrust taken by a roller bearing, and meshes into a worm wheel of bronze, a pinion on the worm-wheel shaft engaging the drum-shaft gear. On the larger sizes there is an additional speed reduction. The hoisting rope under-runs a groove which always permits an exact equalization of the two sides on the drum. The hook turns on ball bearings; the load may be turned in any direction without twisting the ropes. The hoist is made in five sizes with capacities ranging from 1000 to 10,000 pounds,



IMPERIAL AIR-MOTOR HOIST

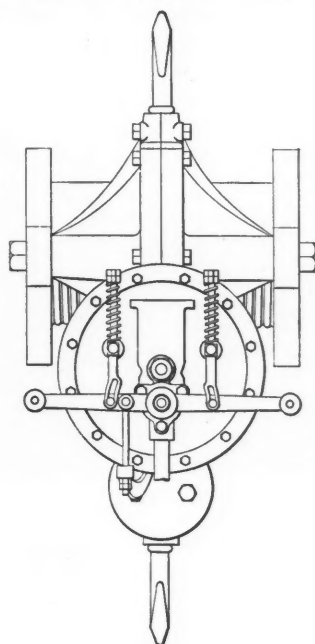
using the ordinary air pressures. It is built by the Ingersoll-Rand Company, 11 Broadway, New York City.

Some attention is being paid to the iron and bauxite deposits in the north of Ireland at present. A good deal of the bauxite used in the manufacture of aluminum comes from this district, and owing to the increased demand for aluminous ores, extensive prospecting operations have been conducted throughout the counties of Antrim and Derry. A company called the Derry & Antrim Ore Company has recently been formed by Scotch and north country people to develop several groups of deposits thus discovered. They are in the neighborhood of Portrush and Bushmills. Some of the ore runs to 56 per cent. of alumina; and deposits of low-grade iron ore have also been opened up. The progress of this venture is keenly watched by those interested in the products.

Gypsum in Northwestern New Mexico

Extensive deposits of gypsum occur at many places in New Mexico, particularly in the southeastern and northwestern parts of the territory, but they are developed only at Ancho, on the line of the Rock Island Railroad, where a plaster mill has been in operation for several years. Deposits in northwestern New Mexico are described by Millard K. Shaler, of the United States Geological Survey, in bulletin No. 315 entitled: "Contributions to Economic Geology, 1906."

The gypsum along the western base of the Sierra Nacimiento has been known for more than half a century. The Sierra Nacimiento consists of a north-south trending series of even-crested ridges and serrated peaks. It is approximately 35



tween Gallina and Senorita, the same gypsum bed was observed at many places.

East of Lajara the bed, if present, is completely covered by flat-lying Tertiary sediments, which overlap the Mesozoic section from the west. At Senorita the gypsum bed outcrops above a limestone bed 50 ft. in thickness, from which lime has been burned for local use. A 6-ft. bed, which outcrops about one-half mile west of the gypsum outcrop, furnishes a good grade of sub-bituminous coal. About 3 miles west of San Miguel copper mine, a bed of massive white gypsum 60 ft. thick outcrops. The deposit at this point is easily accessible by the wagon road to Bernalillo, and could be mined over an extensive area.

At the head of a tributary to Rio Salado, at an elevation between 7500 and 8000 ft., the gypsum bed reaches a maximum thickness of about 100 ft. Near the mountains the bed is conformable with the underlying rocks, but within a short distance, the gypsum bed practically flattens out. In appearance the gypsum is identical with that analyzed from near San Miguel mine. For several miles in a zone extending northward from this locality, the gypsum bed outcrops continuously.

Accident and Old-age Insurance

In some continental mining countries of Europe state legislation has provided for accident and old-age insurance. By the provisions of the law in Belgium all mining companies are compelled to pay a compensation equal to 50 per cent. of the actual earnings of the injured person during the time of disability. In the case of total or permanent disability a pension equal to two-thirds of the average annual earnings is granted. In the case of fatal accidents the widow and children of the deceased, or his immediate family, receive an annual pension which amounts to two-thirds of his average annual earnings. Further provisions of the law are that the employers must not make deductions from the wages of the employees to cover this insurance, and must not enter into contracts waiving the right of compensations. To cover their liabilities, employers are required to deposit guarantees of funds in a state bank or with an insurance board. Other countries have similar laws.

miles long, extending from the latitude of Gallina, N. M., on the north to the latitude of Cabezon on the south. The gypsum deposits along the western base of the range lie near the top of the "Red Beds" series. They are apparently at all places underlain by a bed of bright yellow, poorly consolidated sand, and are overlain by dark shales and yellowish brown sandstone of Dakota or Jurassic age, from which they are occasionally separated by a thin bed of limestone.

At Gallina, on Gallina Creek, near the northern limit of the gypsum outcrop, a bed of massive white gypsum appears within the limits of the village, where it has been, to a very limited extent, quarried and burned. The gypsum bed may be traced eastward from Gallina for many miles, as it outcrops along Gallina creek in the southward-facing bluff of Mesa Blanca Capulin. It had a thickness here of more than 40 feet. Farther south, be-

A mining cost of \$2@2.25 per ton of material may be assumed as a broad generalization of the conditions which obtain in many districts of the West. Such a figure is obtainable in a vein of solid ore of fair stoping width, say 6 ft. The cost of mining increases inversely as the proportion of pay ore to total vein area decreases, and directly as the occurrence of the orebodies becomes small and irregular, all of which factors increase the amount of development work that must be done.

Revival of the South Crofty Tin Mines, Cornwall

A Number of Small Mines Will Be Worked by One Central Corporation, New Equipment and New Methods Being Introduced

BY EDWARD WALKER

At the East Pool mine, Cornwall, modern methods have been introduced gradually, the money being provided out of the profits of the mine. Its neighbor, South Crofty, affords an example of the policy of the clean sweep, carried out by the reconstruction of the company and by the subscription of a large amount of new capital. Moreover, the reorganization is being effected by London money and by

Charleton, Dickinson & Co. So far this company has acquired the South Crofty, the Botallack, near Lands End, the South Phoenix, near Liskeard, and two or three other less important properties. It has also created a stir by acquiring from the landlords mining rights on the Tehidy estate, which includes many of the most important mines in the Camborne district. The policy is to make the mining staffs of

policy is the selection of one of the mines, the South Phoenix, as a center for experiments on the treatment of tin ores. The dressing plant to be erected there will be a remarkably comprehensive one, all possible concentrating tables and slimers being provided. Special provision will be made at all the mines for electric installations, either gas driven or the current brought from other sources.



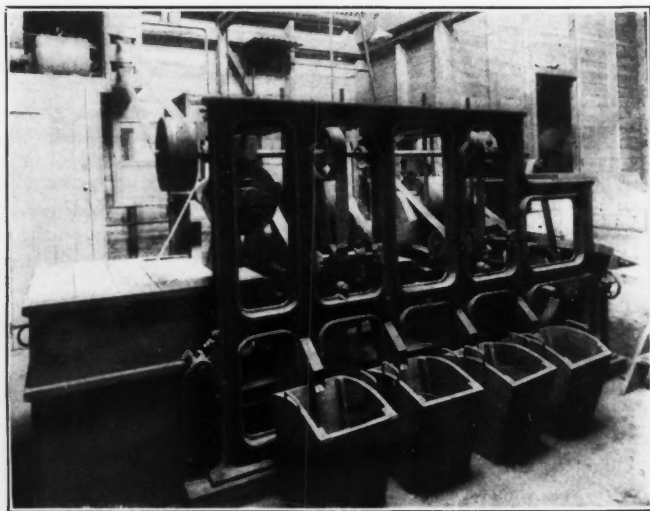
CORNISH STAMPS AT SOUTH CROFTY



FRAME FOR CALIFORNIA STAMPS, SOUTH CROFTY



SINKING NEW SHAFT AT SOUTH CROFTY



HUMBOLDT-WETHERILL MAGNETIC SEPARATOR

the advice of a London firm of mining engineers, thus affording a further contrast.

South Crofty is in effect the headquarters of the recently formed Cornish Consolidated Tin Mines, Limited, the leading spirits of which are Francis Allen and E. W. Meyerstein, both of London. The consulting engineers to the company are

the various mines to some extent interdependent, so that the mines may exchange their specialists and the experience gained at each mine may be used for the benefit of all. In this way the aloofness characteristic of the Cornish mining man will be broken down.

Another interesting point in Mr. Allen's

For many years the South Crofty mine was controlled by Cornishmen interested in adjoining mines. The mine required further funds and there was no alternative but to sell the property.

REMOVAL OF TUNGSTEN

The cause of the non-success of South

Crofty was the large and varying tungsten contents. The ore is of a different composition from that at East Pool, though the two mines are on the same lode. South Crofty ore in some places runs very high in tungsten; in fact it can in many places be handpicked to contain wolframite almost entirely. At several spots in the mine the ore has been untouched owing to the preponderance of this mineral. Otherwise in respect to tin and arsenic the ore is like that at East Pool.

When Mr. Allen took over the mine the first thing done was to provide a magnetic separator similar to that at East Pool and Clitters, and the practice at the latter mine was followed. At first unsatisfactory results were obtained, and the trouble was attributed to the tungsten existing in the form of scheelite. Recently this supposition has been exploded, and want of experience is now supposed to be the cause of the poor extraction of tungsten.

At the time of my visit the magnetic concentrator was running on material

OTHER MINES AND MODERN METHODS

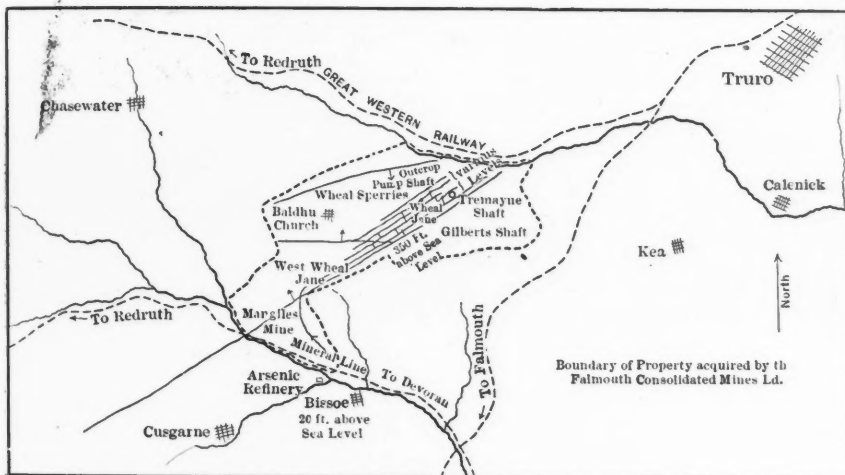
The earliest introduction of modern methods of ore dressing was effected by an Anglo-German group at the Clitters mine, near Tavistock. The work at this mine was described fully in a paper by F. Dietzsch, read before the Institution of Mining and Metallurgy a year and a half ago. The group has been working independently and the most important new proposition they have taken up recently is the Wheal Jane and its allied mines.

These mines lie west of Truro; their location is shown in the accompanying map. They were worked more than 50 years ago and yielded enormous amounts of tin and copper. They were worked from an adit level which started near the river at Bissoe bridge, and, as was usual in those days, the vein was followed only as far as it paid. In many parts the vein was broken by quartzite intrusions, which were mistaken for the walls, and recent explorations have shown that the veins are much wider than was originally supposed.

The Jane lode dips flatly to the north and a spur vein dips similarly. The Sperries vein dips to the south, and the intersection of these three veins at depth will be looked forward to with very great interest.

At the time of writing no surface works have been undertaken, as the whole of the energies have been concentrated on the northern section of Wheal Jane. The company is fortunate in having a large number of shafts at different points, which will save much expense.

A detailed account of all the new moves in Cornwall would occupy more of your space than would be desirable. A great number of properties are being reopened, and the Wilfley and Buss concentrators are the chief new machines introduced at the dressing works. Researches recently made in the Cornish tin mines show that want of capital and the low price for tin were the causes for their former abandonment, and not the exhaustion of the lodes. In fact, I may say that no tin lode in Cornwall shows any exhaustion at depth, and that there is every encouragement to pursue development.



MAP OF FALMOUTH CONSOLIDATED MINES

very high in tungsten, with the object of removing the small proportion of tin and iron, and thus producing a marketable tungsten of high grade. As the company now has the services of a high-class electrical engineer, the magnetic concentration difficulty should be removed before long.

It is intended also to operate all the new machinery by electricity, and at first the current is to be supplied by the local electric tramway company. Later on the mine will erect its own electric generators.

The company is now erecting 40 head of California stamps, for which a special concrete foundation has been built. The illustrations accompanying this article show the old stamps still at work and the frames and foundations of the new California stamps. I also give illustrations of the magnetic separator and of the commencement of work in connection with the sinking of the new shaft.

It is now more than 20 years since any operations were conducted and the various levels, shafts and winzes were in bad condition. The manager, Henry C. Jenkins, has spent more than a year tracking out the old workings and clearing things up, and the mine is now in a condition for systematic development. The chief vein is much flatter than is usually found in the Cornish tin deposits, and riding on top of it is a very strong elvan dike, which is so hard that it is possible to mine the tin vein without any timbering.

FALMOUTH CONSOLIDATED MINES, LTD.

The company which has been formed to operate Wheal Jane is called the Falmouth Consolidated Mines, Ltd. The company has acquired a considerable tract of land, which includes the Wheal Jane, the West Wheal Jane, and the Nangiles mines on one lode, and the Sperries and the Falmouth on another lode.

Rights of Crossing Electric Power Lines

So many electric power lines have been built in Shasta county, California, extending to the various mines, etc., that there has been trouble about the crossing of the lines. The old ordinance made it very difficult for a new company to cross with any safety. A new ordinance has now been passed, in which it is conceded that the senior company has a right to maintain its wires above the junior company. The junior company must give 30 days' notice to the senior that it desires to cross its line at a certain point. Within the 30 days the senior company must elevate its wires so that those of the junior may pass under at a safe distance from the ground, and at a safe distance from each other. The expense of raising the wires of the senior company must not exceed \$350 in any instance, and this expense must be borne by the junior company. Should the senior neglect or fail to raise its wires within the 30 days, the junior may stretch its wires above the senior wires.

The cost of a modern zinc smeltery in Belgium or Rheinland, for the treatment of blende, i.e., with full roasting capacity, is about \$14.50 per ton (of 2000 lb.). Such a plant will be equipped with gas producers and Rhenish regenerative furnaces. A similar plant in the United States would probably cost \$17.50@18 per ton. The plant at Pueblo, Colo., which practically duplicates the one at Overpelt, Belgium, cost more than \$18 per ton, but there were various misfortunes in connection with its construction.

The Calamine Dressing Works at Monteponi

By ERMINIO FERRARIS*

This mill, which is one of the largest in Sardinia, has now been in operation for just 20 years. It is 74 ft. in height from the lowest floor to the uppermost, and is 150 ft. in length, not including the engine house at the left. Throughout the mill, the sizing is done by means of the Ferraris shaking screen, shown in the elevation, of which there are two systems, or sets. A third section of the mill, at the right, not shown in the elevation, is in-

Tungsten in Park County, Montana

SPECIAL CORRESPONDENCE

The discoveries of scheelite made in Park county some months ago have been sufficiently developed to show them to be of value. The discovery was made in one of the old tunnels of the mines of the Kimberly-Montana company, formerly known as the Bear Gulch mines, at Jardine. These properties have been extensively worked for several years for gold, and large quantities of scheelite were taken out and thrown on the dump. Now this material is being gathered from

Collection of California Minerals at Los Angeles

The Chamber of Mines at Los Angeles is beginning to make a collection of specimen ores from all mining districts tributary to that city, it being the intention to exhibit these to illustrate the condition of the mineral industry. San Francisco already has a large collection belonging to the State, at the museum of the State Mining Bureau in the Ferry building, and this is being constantly added to. Some of the counties are preparing sets of specimens from their mines to be placed as separate exhibits in the mining bureau. Another large collection of ores and min-



CALAMINE DRESSING PLANT, MONTEPONI

tended for the crushing and dressing of the mixed ores from the two principal sections.

The mill treats 20 tons per hour of zinc ore, containing 10 per cent. zinc, with a gangue of dolomite, besides some lead ore. The concentrate, after roasting, shows a yield of 47 per cent., besides which there is considerable mixed ore of zinc and iron, which is sent to the magnetic separator. The water used in the mill is clarified by allowing the mud to settle in large flat basins, after which it is returned to the top of the mill by means of centrifugal pumps. The entire plant requires 195 h.p. for its operation.

*Director-General, Societa di Monteponi, Monteponi, Sardinia.

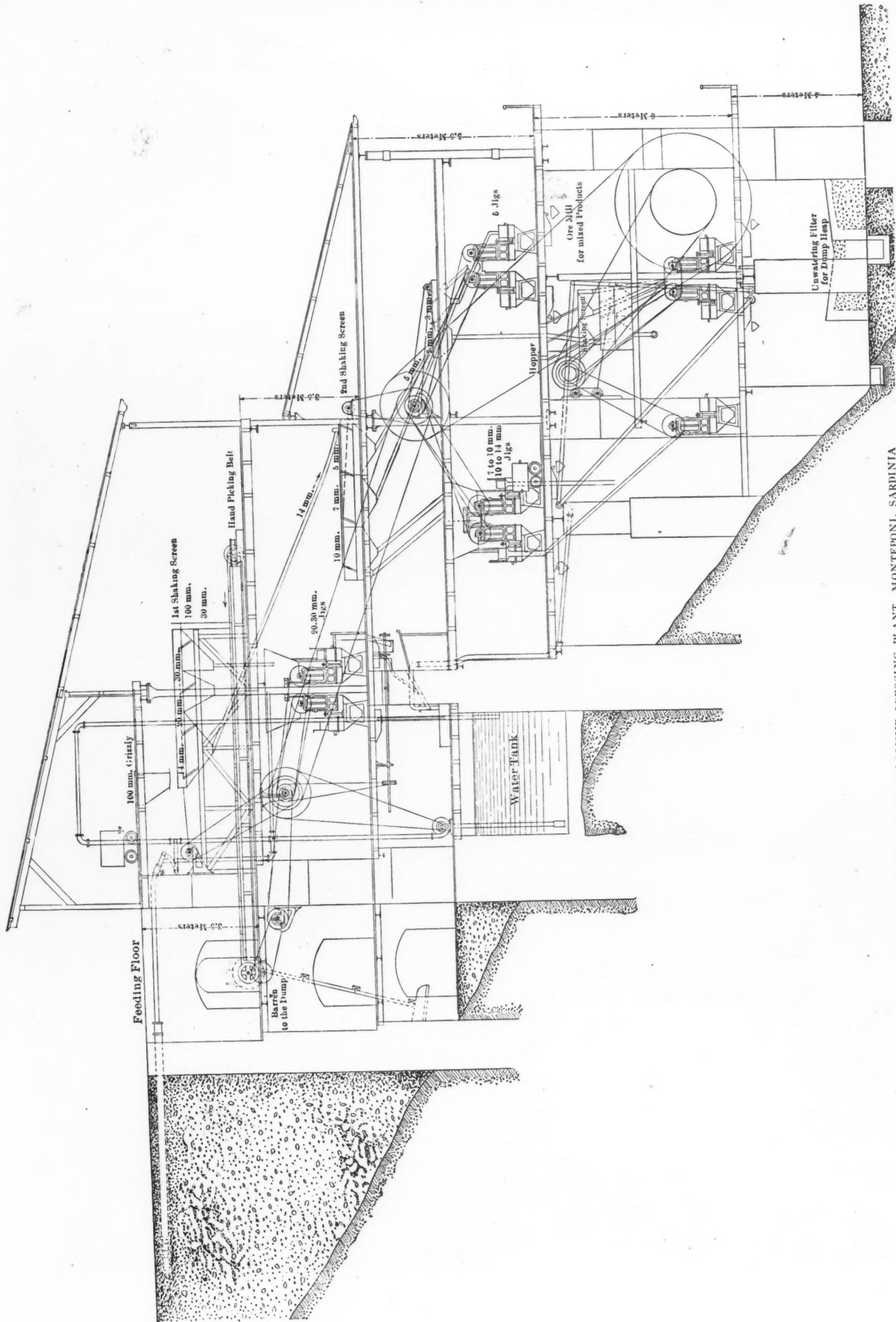
the waste and shipped to market. The mineral has also been discovered at Crevasse, a few miles from the Kimberly-Jardine property.

The richer ore from the Jardine mines is shipped to Louis Strauss & Co., of New York, and the lower grades are concentrated before shipping. What few shipments have been made bring a value of from \$460 to \$1000 per ton, and one car shipped to New York netted over \$39,000.

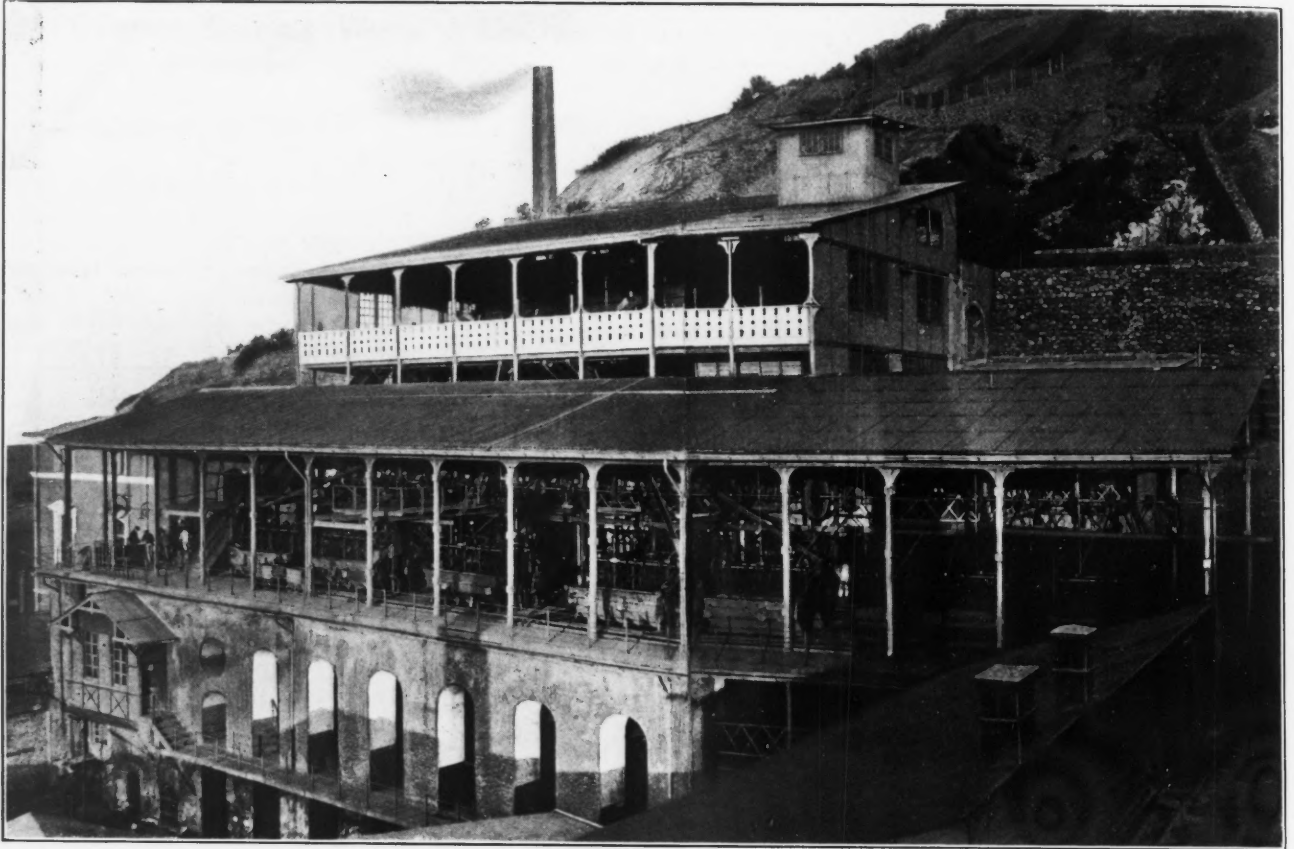
Tungsten has been discovered in different forms in other places in Park county besides Jardine and Crevasse. At the latter place it is found in pockets in the mine. At Jardine most of the scheelite is a hard, flinty substance much resembling quartz.

erals is that of the University of California at Berkeley, which is open to the public, but is mainly used by the students.

In order to do hand picking effectively there must be a systematic method. The pickers should not have to do any breaking of the ore, which should be done by a jaw-crusher, if the quantity be sufficient to warrant the installation, or otherwise by men sledging with long-handle hammers. The broken ore may be delivered to a stationary picking table, or to a movable one. The former is the cheaper to install. Among the movable tables the circular revolving table is cheap and convenient. A traveling belt is also very convenient to pick from.



SECTIONAL ELEVATION OF CALAMINE DRESSING PLANT, MONTEPONI, SARDINIA



THE CALAMINE DRESSING PLANT, MONTEPONI, SHOWING OPEN CONSTRUCTION AND JIGS



IGLESIAS, THE CHIEF TOWN OF THE MINING DISTRICT OF SARDINIA

The Reform of the United States Mineral Land Law

BY R. W. RAYMOND

It needs to be said again that the United States possesses, strictly speaking, no general mining law. What is usually so called is comprised in a few sections of the Revised Statutes and a few supplementary Acts of Congress, governing the sale of the mineral lands of the public domain. Even in the Territories, the insular possessions and the District of Columbia—where the Federal government might constitutionally do what the State governments now do (if it is done at all), namely, regulate the operations of the mining industry under the "police power" of the sovereign—I think little or nothing of that kind has been attempted. When we speak of the United States mining law, its defects and its need of reform, we ought not to forget that we are talking of nothing more than the terms upon which the United States disposes of its public mineral lands. This caution, I think, is now necessary, because some of the proposed schemes of reform go beyond that limited sphere, and include features of mine inspection and regulation which belong to the police power heretofore exercised by the States. Apart from the constitutional and political aspects of the question, any introduction into Federal legislation of such isolated features of foreign systems would be most perilous. Either the whole thing, or none of it. Either let the Federal government create a complete mine-engineering department of the Civil Service, prescribe the training of its members, give them steady employment, regular promotion, and final retirement upon pension, or let it keep its hands off the mining industry altogether. I will not here argue the question, which course would be the wiser. I need scarcely say on which side I stand, as the result of nearly half a century of study and observation at home and abroad. But I wish to emphasize at present only the unwisdom of grafting one system upon the other, and thereby weakening both.

THE MINERAL-LAND LAWS

Considered simply as rules for the sale of land, the United States mineral-land laws contain numerous provisions which ought to be amended, and numerous omissions which ought to be remedied. In this aspect, they comprise regulations for the free exploration and possessory occupancy of the public mineral lands, their exploitation during such occupancy, and their sale outright. Confining ourselves to the laws governing lode-locations and patents, we find in them many infelicities, obscurities, gaps and positive errors, with regard to the conditions of exploration, the nature and rules of the possessory title, and

the character of the rights conveyed by the final patent or deed of the United States. I have repeatedly criticized these defects, especially those which are involved in the vague and forever uncertain "extra-lateral right," arising under "the law of the apex." As the original author of these two, now familiar, phrases, I may fairly assume that the opinions with which I accompanied my first use of them are generally known. All the more weight, I trust, will be attached to the present declaration of my judgment that, bad as it is, the "extra-lateral right" ought not now to be the first object of attack, in any endeavor to reform the law.

EXTRA-LATERAL RIGHTS

Several attempts at such a reform have been made. They have all failed, for the simple reason that they covered too much. Including amendments of administrative detail with radical changes of principle, they encountered the opposition of the opponents of any of their many provisions. Those who disliked one feature made alliance with those who disliked another feature to kill the whole scheme. It is but fair to add that the abolition of the "extra-lateral right" was the most vehemently disputed proposition. Popular in certain regions, it was regarded with superstitious hostility in many others, as a measure calculated to restrict the freedom of prospecting, and diminish the rewards of private explorers, and the owners of "adjoining locations." After observing the course and fate of repeated attempts to abolish the "extra-lateral right," I became convinced that this question ought to be handled by itself, as a single issue, and fought out, after a "campaign of education," in a battle not complicated with other issues.

Recently, a new difficulty has arisen to confirm my opinion. Namely, I find that good and competent judges, who formerly agreed with me as to the evils of the "extra-lateral right," are now inclined to oppose its abolition. Their reasons are: (1) that the obscurities and uncertainties of "the law of the apex" have been measurably cleared up by decisions of the United States Supreme Court, so that we now know, more accurately than we did, "where we are at;" and (2) that the public mineral land has been, in the lapse of time, so covered with locations made under the present law, and creating vested rights thereunder, that any change in the nature of mining titles would introduce more confusion and uncertainty than it could cure.

While I do not concede that these reasons are conclusive, I must admit that they are formidable, and that they are advanced by authorities entitled to respect. Moreover, I feel that, thus supported, they would probably be fatal, at this time, to any new scheme of legislation, involving the abolition of the "extra-lateral right" of lode-locators. In my judgment it will

never be too late to get rid of that awful blunder; and I hope to live long enough to see it thoroughly exposed and finally abandoned by the United States, as it has been abandoned by all other civilized nations—even those among whom it had been recognized for centuries. It is not creditable to us as Americans that we have adopted by accident, and still embrace with infatuation, a principle so thoroughly tested and unanimously rejected by the rest of the world, and that we should persistently assert the necessity of this absurd system to a small portion of the mining industry of the country, when the overwhelming mass of that industry, carried on in every one of our States, finds the universal modern civilized form of mining titles infinitely more conducive to its security and prosperity. I say "infinitely," because $x \div 0 = \infty$, in which equation, let x represent the number (or the cost, whichever you choose) of litigations over mining titles under the "law of the apex," while zero represents the total absence of all such litigations as cannot be at once decided under the ordinary rules of the common law, and upon the simple evidence of surveys.

I would like to see this issue brought to battle. Nevertheless, I think there is, at least, one other which ought not to be put in peril at the same time, and might be victoriously contested first. To indicate this more immediately important issue, and to urge its presentation in advance and by itself, is the chief purpose of this article.

RECORDING LOCATIONS

Under the present United States statutes, and the interpretative decisions of the Supreme Court, the location of a lode on the public domain withdraws therefrom the surface included within the location, together with the extra-lateral right thereto attached. No documentary contemporaneous proof of such an appropriation of public land is required by the United States, the owner of the land. Local legislatures, or the inhabitants of mining districts, may make such rules, not inconsistent with the United States law, for the recording of locations, and the subsequent maintenance of possessory tenure, as they may think advisable; and, in fact, most of the Pacific States and territories now require a record to be made in the office of a county clerk or recorder. But nowhere is it necessary that the fact of location shall be made known to the Land Office of the United States. That office never hears of it until (perhaps after years of possessory occupancy and exploitation) the locator or his grantee applies for a survey, as a step in the proceedings for a patent. Then, for the first time, his claim is brought to the notice of the real owner of the land; and even then it is not certain that the land can be sold to him. There must be first a survey, and then an advertisement of the application

for 90 days, after which, if no unknown prior claimant arises as a contestant, the United States decides that it really owns the tract in question, and proceeds to sell it and give a deed for it.

In other words, there is not today in the possession of the General Land Office a single map or record, showing what mineral lands the Government really owns, and has a right to sell. Was there ever such a ridiculous exhibition of reckless carelessness in the administration of real estate?

REMEDY FOR PRESENT ABUSES

The way in which this state of things was reached is an interesting piece of history, and may partly excuse the course of congressional legislation on the subject. But I will not go into that story now. Whatever excuse once existed has long since passed away; and the simple, feasible remedy should be applied at once, by requiring all persons initiating by location possessory rights to portions of the public domain, to communicate that fact to the United States.

Such a requirement might involve the survey of the public mineral lands—a thing which should have been done long ago, instead of leaving such surveys to be made for the benefit and at the cost of individual applicants, and "tied" to all sorts of natural or temporary "monuments" and "stakes."

Here is a reform which could be carried through. In my judgment it precedes in immediate importance even the question of the "extra-lateral right"; for what is the use of disputing over the way in which, or the terms upon which, the United States shall sell its mineral lands, until it knows what it has to sell?

Iron Ore of Cleveland, England

In the discussion of a paper on "The Ironstone of Cleveland," read before the Institution of Mining and Metallurgy, Arthur E. Pratt stated that the iron in the raw ore is usually between 29 and 33 per cent., the latter figure being reached only in the best deposits. Phosphorus is from 0.65 to 0.75 per cent., sulphur 0.15 to 0.25 per cent., silica 9 to 15 per cent., while moisture varies from below 5 up to 20 per cent., the usual amount being somewhere between 8 and 10 per cent. The highest figure just quoted refers to samples of "small stone," the average moisture in this material running about 17 per cent. The amount of CO₂ present in the ore has been given as 25 per cent., but is more usually 21 to 22 per cent.

In the calcined stone the iron varies from 37 to 42 per cent., being usually just over 40 per cent.; silica is present up to 19 per cent.; moisture and CO₂ are, of course, absent, while all the iron is in the ferric

state. The phosphorus, which is unaffected by calcination, is relatively increased, being somewhere between 0.85 and 1 per cent. Sulphur is partially removed, thus counteracting the relative increase.

The composition of a given sample of Cleveland ironstone will depend on (1) from what part or the district it has been mined, and (2) whether the middle seam only is being worked, or portions of the top and bottom seams as well.

As the Cleveland ironstone is of approximately constant composition throughout the whole of the deposit, it is not possible, as with the Northamptonshire ironstones, to obtain a self-fluxing mixture by using together calcareous and silicious varieties. In calculating a furnace-charge it is the usual practice to reckon in the alumina with the silica as an acid.

Oil and Gas in Southeastern Kansas

The earliest exploitations of oil and gas in the Independence quadrangle were begun in what is now Miami county, about 100 miles northeast of Independent. Here oil was first discovered in the spring of 1855, on Wea creek, east of Paola. Wells were drilled from time to time, with varying success, but it was not until after 1893 that much development work was done or the importance of the field was realized. During the last half of 1903 and the first half of 1904 many new companies were formed and much drilling was done. Success followed, principally in Fall River and Verdigris River valleys. Within the immediate proximity of Neodesha almost every well is productive. Montgomery county, which embraces approximately the southern three-fourths of the Independence quadrangle, did not produce much oil until the last half of 1903. Early in July of that year drilling was begun with success on the now famous Banks land, about a mile northeast of Bolton.

Though small bodies of oil are frequently found at depths of a few hundred feet below the surface, the larger deposits occur at greater depths in and near the Cherokee formation. At Coffeyville, where the strata overlying the Cherokee are thinner than at any other points in the quadrangle, three oil sands are encountered at depths of 350, 600 and 900 ft. The best wells, yielding oil of 32 deg. B., derive their oil from the middle or 600-ft. sand.

The oil of the Independence quadrangle has an asphaltum base. It is dark brown or black in color and heavy, but varies greatly in specific gravity from place to place.

Valuation of Zinc Ore

In the purchase of zinc ore the formula $0.95 P \left(\frac{T-8}{100} \right) - R$ works out as follows in the case of an ore assaying 48 per cent. zinc, the London price of spelter being assumed at £28 per ton of 2240 lb., and the returning charge £2 12s. 6d. per ton of ore:

$$0.95 P = 0.95 \times £28 = 26.6.$$

$$\frac{T-8}{100} = 0.48 - 0.08 = 0.40.$$

$$R = £2 \ 12s. \ 6d. = £2.625.$$

$$£26.6 \times 0.40 - £2.625 = £8.015 = \$38.95.$$

The value per 2240 lb. of ore is \$38.95. Dividing that result by 1.12 gives the value per 2000 lb. of ore, thus: $\$38.95 \div 1.12 = \34.78 .

The same result is obtained when the price of spelter and the returning charge are converted into terms of dollars and cents per 2000 lb. Thus, £28 per 2240 lb. = 6.075c. per pound = \$121.50 per 2000 lb.; 0.95 per cent. of this is \$115.43; the returning charge of £2 12s. 6d. per 2240 lb. is equivalent to \$11.39 per 2000 lb. The value of the ore per 2000 lb. is consequently $\$115.43 \times 0.40 - \$11.39 = \$34.78$. Another method, which is very convenient, is to convert the expression $T-8$ into pounds and multiply by the price of the spelter per pound. Thus, $T-8 = 40$; $40 \times 20 = 800$ lb. $0.95 (6.075 \times 800) - \$11.39 = \$34.78$.

Copper Refining Practice

The output of a refining tank depends upon the total current passing through it, the number of electrodes in series, the time the current flows and the electrochemical equivalent. In the multiple system of electrolytic copper refining the theoretical amount per ampere day per pair of electrodes in series is almost precisely an avoirdupois ounce. The amount actually deposited is always less than this, due to chemical solution of the cathode, grounds and short circuits between electrodes. The re-dissolving of the cathodes will amount in practice to 0.5 to 1.0 per cent. of the amount deposited. This action is chiefly at the surface of the bath. Metallic copper is also slightly soluble in cupric sulphate. If the tanks are well insulated from the supporting piers, and care is taken to support the circulating pipes carrying the electrolyte from tank to tank, by either rubber sections or miniature waterfalls, the current shunted around the tanks by grounds should not average over 1 per cent. of the total. Short circuits between electrodes, caused either by direct contact between anode and cathode or by indirect contact between the electrodes and the tank, will amount to about 5 per cent. under best commercial conditions. In this way the net current efficiency is usually from 90 to 95 per cent.

Method for Analysis of Gold-Silver Bullion

By J. E. CLENNELL*

The rapid method here described was adopted for the approximate analysis of bullion produced by Mjynbouw Maatschappij Redjang Lebong, Sumatra. It could no doubt be applied with slight modifications in other cases. It is possible to make all the determinations on the same weighed portion of bullion, but it is preferable to make an independent assay of the gold and silver on a separate portion.

The elements to be determined are: Gold, silver, selenium, lead, copper, iron, zinc.

GOLD

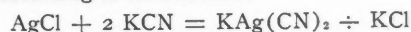
Dissolve 1 gram of the bullion drillings in a conical flask with two successive washings (25c.c. each) of 75 per cent. nitric acid, boiling each time, diluting with an equal volume of water, and decanting after again boiling. Finally wash the residue once or twice by decantation with hot water. Treat all the liquid poured off as described under silver. Fill up the flask containing the undissolved residue, invert into a porcelain crucible, drain off the water, dry, ignite and weigh. This residue will in general be nearly pure gold, but it may be examined by dissolving in aqua regia, diluting, allowing to stand for some time for settlement of any insoluble matter, consisting of very small quantities of chloride of silver, carbon and silica. After carefully decanting the dissolved gold and washing with distilled water, the residue is collected, dried at a moderate temperature, and weighed. The weight so found is deducted from the total weight of residue insoluble in nitric acid to obtain the true weight of gold. The minute quantity of silver present is, perhaps, best determined by wrapping this residue (insoluble in aqua regia) in lead foil and cupelling.

SILVER

The united liquids poured off in the previous nitric-acid treatment, together with the water washes, are heated to boiling in a flask, *A*, and mixed with about 5c.c. of concentrated hydrochloric acid. Shake well until the AgCl begins to settle clear. Pour off the bulk of the liquid into another flask, *B*, and heat this to boiling. When the small quantity of suspended AgCl in *B* has settled clear, pour the liquid through a filter into another flask or beaker, *C*. Wash the bulk of the AgCl in *A* 5 or 6 times by decantation with boiling water, pouring off the liquid through the filter each time, and retaining the precipitate as much as possible in the flask. See that the filtrate passes through

quite clear. Treat all the liquid collected in *C*, as described under selenium.

The silver may now be determined in various ways. It was found with this bullion that tolerably accurate results could be obtained by the method of G. Denigès, carried out as follows: Place the flask *A* containing the bulk of the AgCl under the funnel containing the filter used as detailed above. Measure out a quantity of a solution of cyanide of potassium or sodium, containing a little alkali, and of known cyanide strength, say about 1 per cent. The quantity of cyanide solution taken must be more than sufficient to dissolve the whole of the AgCl according to the reaction:



Run this through the funnel into flask *A*; agitate thoroughly without diluting. When the bulk of the precipitate has dissolved, which requires some time, decant the liquid through the same filter, collecting in flask, *B*. Dissolve the small residue of AgCl in *A* by means of a few c.c. of concentrated ammonia; when quite dissolved, dilute and pass through the same filter into *B*, finally washing once or twice with water. To the filtrate add 10 c.c. of 1 per cent. potassium iodide, and immediately titrate the residual cyanide with standard silver nitrate until a permanent yellowish turbidity remains. Deduct the amount of AgNO₃ used from the AgNO₃ equivalent of the total quantity of cyanide added. The difference is the amount corresponding to the KCN converted into KAg(CN)₂, from which the amount of silver may be calculated:

1 c.c. standard AgNO₃ (as generally used) = 0.00828 gram Ag.

1 gram Ag requires 1.208 grams KCN.

The silver may be determined much more rapidly and conveniently by Volhard's method, but in this case either a smaller quantity of the bullion must be taken (say 0.1 or 0.2 gram) or the solution must be made up to a definite volume and an aliquot part taken. In using this method it was generally found convenient to add a slight excess of standard thiocyanate and titrate back with a standard silver solution of equivalent strength. The liquid after titration by Volhard's method cannot, of course, be used for the determination of iron, and the estimation of the other elements present would probably be inconvenient. This estimation is therefore always made on a separate portion.

In my experience at Redjang Lebong, the results by Volhard's method were generally lower and those by Denigès' method higher than the fire assay, the latter being made with the usual corrections as described in a former paper. (This JOURNAL, Dec. 8, 1906, p. 1057.)

SELENIUM

Evaporate the filtrate collected in *C* to dryness on the water bath, adding 0.5 gram sodium chloride. At the finish add about

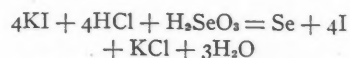
10 c.c. of conc. hydrochloric acid and again evaporate to dryness, repeating this operation if the residue is considerable. Dissolve in the least quantity of hot dilute HCl; add 5 to 10 c.c. of conc. HCl and boil thoroughly. Hold a piece of paper moistened with KI at the mouth of the flask and continue to boil, with occasional additions of fresh HCl, until the paper no longer shows any discoloration, which indicates that the last traces of HNO₃ are expelled. Then dilute to 50 c.c. or 100 c.c., according to the amount of dissolved salts, boil and filter if necessary, washing well with boiling water. Examine the small insoluble residue on the filter for silica and traces of silver chloride. Treat the liquid as follows:

Pass a current of purified SO₂ gas into the hot liquid for some time until the latter smells strongly. Boil till the red precipitate turns to a dark violet, almost black; allow to settle, covered, for a few minutes and filter while still hot, preferably collecting the precipitate on a paper previously dried at 100 deg. C. and weighed. Wash thoroughly with boiling water, adding a little SO₂ water and HCl from time to time. See that the filtrate is perfectly clear and gives no further reaction with SO₂ on boiling. A crystalline precipitate of lead chloride will probably separate on cooling, but this is of no consequence. Treat the filtrate as described under lead.

This method of separating lead and selenium was found to be much more satisfactory than that described by H. Rose ("Handbuch der Anal. Chem.," Vol. II), in which the lead is precipitated first with sulphuric acid. The liquid cannot be boiled with this acid without loss of selenium, and unless heated to white fumes the precipitation of lead is incomplete. The addition of alcohol also introduces difficulties and complications. So far as I am aware the method of separation here detailed is quite new.

The estimation of the selenium in the precipitate may be made in the ordinary way, by drying in an air oven at 100 deg. C. and weighing the paper and precipitate together, inclosed in a weighing tube or bottle. This is probably the safest method, but it is always advisable to examine the selenium for small quantities of gold, which may have been dissolved in the nitric acid treatment. This may be determined by wrapping the weighed filter paper and contents in a considerable excess of lead foil, scorifying and cupelling.

As the drying and weighing at 100 deg. C. is somewhat tedious, attempts were made to utilize the volumetric method, depending on the reaction of selenious acid with potassium iodide:



Under suitable conditions this was found to give good results with pure solutions of selenious acid, but it was found difficult to convert the selenium into selenious

*Metallurgical engineer, London.

acid without loss. The method tried was as follows:

Wash the precipitate off the paper as much as possible into a porcelain evaporating dish; drain the water back through the filter into a flask. Add to the precipitate in the dish 10 c.c. of 75 per cent. nitric acid and 0.5 gram of NaCl. Add the water previously poured off and evaporate on the water bath. Digest the paper in another dish with hot 25 per cent. nitric acid, adding the liquid to that in the first dish when the residue adhering to the paper is completely dissolved. Treat the evaporated residue with HCl, as already described, till all HNO₃ is expelled, cool and add 0.5 to 1 gram of potassium iodide

and titrate the iodine liberated with $\frac{N}{100}$ thiosulphate (2.48 gram Na₂S₂O₃·5H₂O per liter), with addition of starch indicator near the finish, until the bluish-black tint changes to orange red. It is essential to standardize on a selenious acid solution of known strength and not to depend on the theoretical standard calculated from the equation.

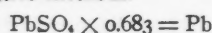
A further check may be made by using the resulting liquid containing the red selenium in suspension for a colorimetric test. Checks are made by taking measured volumes of the standard Na₂SeO₃ solution, adding HCl + KI, and removing the iodine by addition of thiosulphate until the resulting mixture has the same tint as the liquid derived from the bullion.

LEAD

To the filtrate from the selenium precipitate add 10 c.c. conc. sulphuric acid and evaporate to a small bulk. Finally boil in a conical flask with constant agitation over a spirit flame until copious white fumes are given off. Cool, dilute to about 50 c.c. and add 10 c.c. of alcohol. When thoroughly settled (preferably after standing over night), filter, wash with dilute and finally with absolute alcohol. Treat the filtrate as described under copper.

Wash the precipitate off the filter into a clean flask, add ammonia, then acetic acid in slight excess; boil till all is dissolved, or if any residue remains, filter this off, wash with hot dilute ammonium acetate, and examine. Pass the hot clear filtrate through the original filter paper, first moistening the latter with dilute ammonia. Wash with hot water and a few drops of acetic acid. Again add 5 to 10 c.c. of conc. H₂SO₄ and boil to white fumes.

The lead sulphate should now be pure and the lead may be estimated by the ordinary gravimetric or volumetric methods. After settling for some hours, with addition of dilute alcohol, it may be collected on a weighed perforated crucible containing an asbestos filter, ignited gently and weighed as PbSO₄. The quantity is generally too small for satisfactory results by volumetric methods.



COPPER

Boil the filtrate from the PbSO₄ thoroughly to expel alcohol. Pass a current of H₂S gas into the hot liquid till it is saturated. Filter, wash with H₂S water; treat filtrate as described under iron. Wash the precipitate off the paper as much as possible into a clean flask A. When settled, pour back the liquid from A through the same paper into another flask, B, retaining the precipitate in A. Add to A 5 c.c. conc. HNO₃, warm gently till dissolved, adding a little KClO₃ if necessary. Add the liquid poured off into B and again heat until only yellow particles of sulphur remain. Filter through the same paper, dry and burn the paper and add the ash. Again heat to boiling. Filter and estimate the copper volumetrically by the iodide method, or when only a little is present, add ammonia in slight excess, filter, and determine copper by the colorimetric method.

The liquid after the latter test may be examined for cadmium by adding KCN till colorless, then H₂S.

IRON

Transfer the filtrate from the copper sulphide to an evaporating basin. Boil to expel the excess of H₂S. Add HNO₃, boil, then add ammonia in slight excess. Boil, filter; treat the filtrate as described under zinc. The iron is generally determined by colorimetric test as follows:

Dissolve the precipitate by passing 10 to 15 c.c. of hot 25 per cent. HCl through the filter, collecting the liquid in a Nessler tube. Wash once or twice with water; cool the tube, add 5 c.c. strong (say 5 per cent.) KCNS. In another tube place an equal amount of HCl and also 5 c.c. of KCNS. Dilute to nearly the same volume as the first solution and run in standard ferric chloride (1 c.c. = 0.1 mg. Fe) to the second tube until the tints are alike.

In rare cases when sufficient iron was present for a volumetric assay, the ferric hydrate was dissolved in dilute sulphuric acid, boiled with aluminum turnings till the iron was completely reduced to the ferrous condition, cooled and titrated with permanganate.

ZINC

As practically no other metal was present in the filtrate from the iron, it would seem that zinc might be determined directly by acidulating with HCl and titrating with ferrocyanide at a suitable temperature. It was generally found, however, that the results were unsatisfactory, perhaps owing to the presence of nitrates, unless a separation was made. This was carried out by acidulating very slightly with sulphuric acid, and precipitating the warm solution (at about 70 deg. C.) with H₂S.

The zinc sulphide is then easily filtered off and the zinc determined by any of the usual methods. Dissolve the ZnS in a

slight excess of HCl. Boil, filter, dilute; heat in a porcelain basin to 70 deg. C. Run in standard ferrocyanide till a drop taken out gives a distinct brown color with a drop of uranium acetate on a white plate. Add 1 or 2 c.c. ferrocyanide beyond this point. Allow to stand in a moderately warm place for 10 minutes, then titrate back with standard ZnCl₂ until a drop no longer gives a color with the uranium indicator. The standard solutions in use were each adjusted so that 1 c.c. = 0.0025 gram Zn.

GENERAL REMARKS

An analysis by this method can generally be carried out in two days. On the first day the gold, silver and selenium are determined and the lead precipitated as sulphate in the filtrate from the selenium. On the second day the lead, copper, iron and zinc are determined. The results obtained usually agreed satisfactorily, and left about 0.25 per cent. unaccounted for. This system of analysis is only applicable to the "cyanide" bullion, "mill" bullion containing too large a proportion of gold.

Imports and Exports of Metals in Germany

Imports and exports of metals in Germany for the three months ended March 31 are reported as below, in metric tons:

	Imports.	Exports.	Excess.
Copper.....	30,740	14,975	Imp. 15,765
Tin.....	3,067	1,793	Imp. 1,274
Lead.....	12,751	7,247	Imp. 5,504
Zinc.....	6,572	21,715	Exp. 15,143
Nickel.....	621	296	Imp. 325
Aluminum.....	827	323	Imp. 504

Imports and exports of metallic ores, other than iron, are reported as follows:

	Imports.	Exports.	Excess.
Gold ore.....	11	.....	Imp. 11
Silver ore.....	1,124	.....	Imp. 1,124
Copper ore.....	7,469	788	Imp. 6,681
Tin ore.....	3,018	70	Imp. 2,948
Lead ore.....	33,300	511	Imp. 32,789
Zinc ore.....	46,242	8,077	Imp. 38,165
Manganese ore.....	90,533	1,170	Imp. 89,423
Chrome ore.....	4,691	41	Imp. 4,650
Tungsten ore.....	551	41	Imp. 510
Uranium ore, etc.....	285	.....	Imp. 285
Nickel ore.....	7,824	.....	Imp. 7,824

Imports of pyrites were 145,736 metric tons; exports were 3243 tons, showing net imports of 142,493 tons.

Hand sorting seldom receives the degree of attention which it deserves. It is one of the simple things that is disregarded in the desire to have a mill, do everything by machine, and crowd the ore through. The advantages that may be derived from hand sorting are coming more and more to be recognized and it is being introduced as an accessory process in some of the largest and most expensively equipped mills. A good deal of the zinc ore of Wisconsin, Leadville, Colo., and Park City, Utah, is prepared by hand sorting only. No one need therefore be ashamed to resort to this simple process or feel that in doing so he is not up to date and economical.

Experiences with Austrians as Iron Miners

BY ROBERT B. BRINSMADE*

If the proverb "distance lends enchantment" could be expressed "distance creates illusion," it would be more concise, for the opinion formed of far away persons or things may often be depressing instead of enchanting.

In the Rocky Mountain camps one often hears the tales of English-speaking miners from the East concerning the degradation of mine labor wrought by the invasion of Austrian paupers. As this oral testimony seemed to be corroborated by the popular magazines, so full of the subject during the anthracite-coal strike, it was not with a feeling of exhilaration that I took charge of an eastern iron mine employing chiefly that class of labor.

Well conducted native boarding-houses (and such we had) form the key to success in the creation of a stable Austrian mining force. That such was the case was made evident to the rival operators, who attempted to lure away our best men by tempting wage offers. Our men sometimes left, but two or three days of Canadian-French or Irish board at American prices, usually started the truants toward home. The boarders were either single men or those with wives still in Europe. The rule was two men to a bed and these sometimes furnished their own bedding. The crowding apparently was not detrimental to health in the isolated cottages, ventilated by the fresh air of this rural village. When not allowed to come up at the lunch hour, the Austrian miners, going on shift underground, were not only lacking "a full dinner pail" but they were without any. The custom of eating but two meals a day is usual with Slavic peasants.

RACIAL CHARACTERISTICS

The men whom till now I have called Austrians, belonged to two distinct branches of the Slavic family. Half were Galician Slovaks from around Cracow; the rest, who called themselves "Russians," were really from northern Hungary and belonged to the Rousniak or Little Russian people. Much alike in dress, in habits of living, and in spoken language, they yet had important differences. The Slovaks were Roman Catholics, used the Latin alphabet, and were better educated than the Rousniaks who were members of the Russian church and employed Greek chirography.

The statement that successful mine management requires some knowledge of ethnology may appear ridiculous to some, but not to the mining engineer, dependent on Slavic miners, who finds his operations half-manned day after day, on ac-

count of religious holidays. The Slovak saints' days, from the Roman Catholic calendar, seldom coincided with the holidays of the Rousniaks taken from the Russian church with its old-style chronology; this was a fortunate thing for our mining operations. January 7, 1905, was the Christmas, and January 14 the New Year of the Russians, as a date by old style reckoning, is 13 days behind a corresponding one by our calendar. This with 19 Slovak and 30 Rousniak holidays made a total of 49 holidays, only 12 of which fell on legal rest days.

The holidays are generally 24 hours long, commencing at 6 p.m., before the marked date. A few, like the Slovak June 29, last but 12 hours; others last 36 hours until 6 a.m. on the following morning. On the night before a holiday, except on Good Friday and similar fast days, liberal consignments of beer arrive at the boarding houses. However, most of the men will be sober enough to go to work at 7 p.m., and only a few of the reckless will prolong their potations beyond the prescribed limit. At the celebrations accompanying a native wedding or christening, the intoxication is apt to be more unrestrained.

DIVIDED CLANS

The Slovaks and Rousniaks always boarded with members of their own race, and did not fraternize freely. During extended drinking bouts, the two races sometimes came to blows. The drill men were mostly Slovaks; the muckers, Rousniaks; this condition may be partly ascribed to the better education and more active mentality of the former. The fact that the Slovaks, who had arrived earlier and had the first chance to learn drilling, disliked to take Rousniak muckers as helpers, had much to do with this backwardness, for our three or four Rousniak drillers were certainly no laggards.

The usual difference in holiday dates made it possible to operate continuously by suspending development. During a Slovak lay-off the few Rousniak drillers would be supplemented by the American scalers and shift-boss to break as much ore from the stopes as the reduced force could handle. When the Rousniaks stayed away, the Slovak drillers would be bunched for drilling the stopes, while their helpers, much to their disgust, would be required to shovel and tram.

Except for occasional internecine brawls from prolonged drinking, the Slavs were quiet and good-natured. Though unruly spirits would sometimes stir up their fellows to disregard their pledged work and disobey orders, yet a little firmness and tact was always sufficient to restore discipline. The boarding-house keepers being older and longer in America than the rest, were the natural leaders, and the only instance where they failed to keep their agreement with the management, was when American busybodies had so

stirred up their followers as to render them temporarily beyond control.

RELATIVE EFFICIENCY

As rock-drill runners, the Slavs are far from ideal. A bright young Slovak, who might on first trial put in one drill-hole a shift, can, after a few months' practice, put in five 6-ft. holes per shift, while a first-class American runner would be finishing six or seven in the same ground. But though the Slovak may learn to put in holes, he does so at the expense of the drill, for whose preservation not only care but some mechanical aptitude is requisite.

This deficiency as a mechanic may arise from the fact that the small holdings and monotonous routine of Austrian peasant life has not developed in him that "gumption" that is the natural attribute of the American pioneer farmer. It may arise from his failure to learn English, due not only to the great difference of our language from the semi-oriental Slavic tongue, but also to his clannish living-habits outside of work. The instructions of the American shift-bosses are thus imperfectly understood, and few competent native bosses can be developed until the younger Slavs, educated wholly or partly in our schools, shall attain maturity. The minor trouble of their unpronounceable surnames, was avoided by disregarding entirely the native spelling, in order to inscribe the pay-roll with the Slavic names spelled phonetically by the English alphabet.

The Slavic drillman's lack of care is very evident. Thus, instead of setting the nuts on a new tripod with the leverage of the appropriate spanner, he will hammer the spanner handle until either something breaks, or the nut thread is so strained that it can never be set in future without a sledge. He invariably prefers a hammer for a stuck bit, to an adjustment of the machine's alinement; and the effect of his fondness for the sledge cure-all is the despair of every drill-repairing machinist.

But in spite of their shortcomings, our Slavs were hardy and industrious laborers, most of them in the flower of youth. They rendered possible the working of a low-grade mine, into which sufficient of the region's Americans could not be tempted, except at prohibitive wages.

Experience has shown that it is easiest for pickers to throw the sorted material in front of them, and this arrangement is easily made with tables of annular form, in connection with which a conical surface may be arranged inside the ring, around the vertical axis, with radial partitions to separate different classes of ore which will slide down the cone into proper receptacles. With stationary tables, and endless belts where picking is done from both sides, it is generally necessary for the pickers to throw the sorted ore backward instead of forward.

*Mining engineer, Lawrence, Kan.

An Alternating-current Coal-mining Installation

The McKell Coal and Coke Company Employs a Central Power Station with High Potential Transmission and Transformers Where Required

BY T. W. SPRAGUE AND C. K. STEARNS *

After operating the Kilsyth mine for a number of years using electric haulage of the rack-rail type and making other uses of electric power in and about the mines, generating the current at 275 volts close to the bank mouth, the McKell Coal and Coke Company, of the Loup Creek territory in the New River field of West Virginia, realized the necessity of supplying electric power for similar and other purposes at their new operations farther up the creek.

The first plan considered was the placing of other power plants at each operation. Lack of water during a portion of the year was an obstacle in the way of this plan; and, further, it meant a large

RELATIVE POSITIONS OF THE VARIOUS PLANTS

A glance at the map (Fig. 8) will show the relative positions of the initial plant at Kilsyth, the new operations opening at Oswald, Sidney Graham and Tamroy, the latter being about one-half a mile south of Graham. The map also shows roughly the outcrop line of the Sewell seam of coal, which is the best known seam of the New River district. It will be noted that the topography is such that this seam outcrops along the branches of Mill creek, a tributary of Loup creek, at distances of over a mile from the pit mouths, as well as along the upper branches of Loup creek, afford-

already existing power plant, which it is necessary, or at least advisable, to maintain in its existing shape for the present.

GENERAL STATION EQUIPMENT

The power requirements of the McKell operations, like all mining operations, are steadily and constantly increasing, and this fact, with the present needs, fixed the size of the first unit to be installed for the transmission work at 500 kw., with a station proportioned for a second unit within the same building, and space available for an extension of the building to accommodate a third unit, should it be found necessary.

The existing boiler plant, consisting of

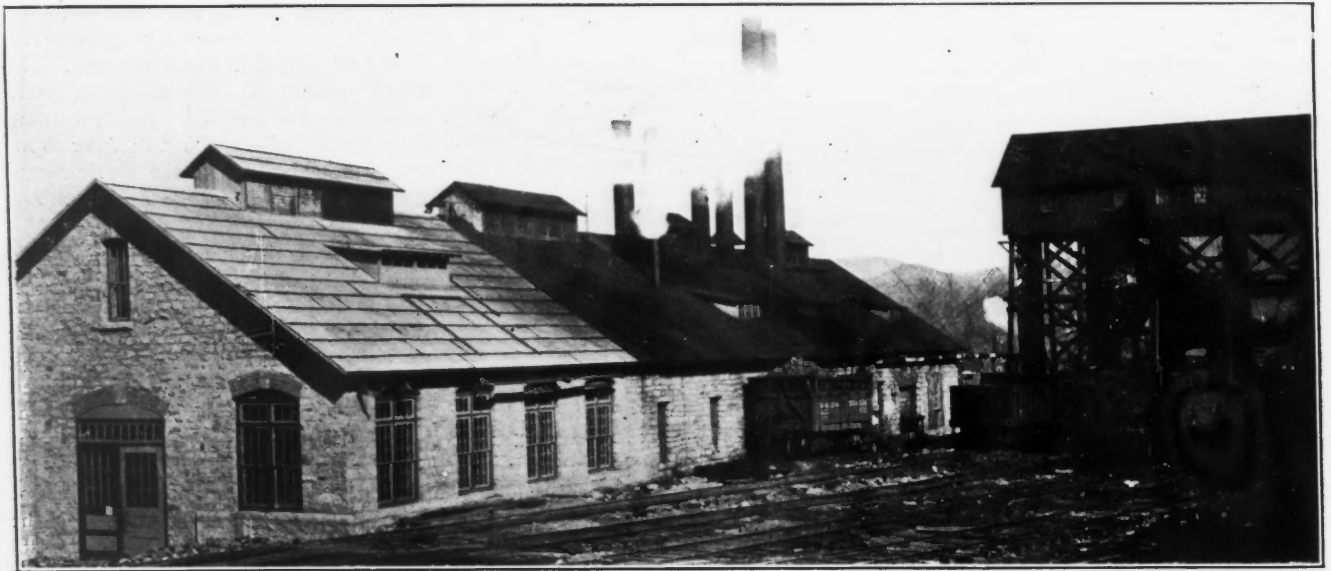


FIG. 1. MAIN POWER HOUSE AT KILSYTH

increase in operating expense, each plant requiring its own engineers and firemen. Moreover, the distances between the new operations and from the existing plant to the new operations is too great to allow of direct current or low-voltage transmission. Further than this, the installation of such individual low-tension power plants would only meet the requirements temporarily. The extent of the coal to be mined eventually and handled over the tipples now being installed is so great that the cost of distributing electric power over the entire territory from these stations in the form of direct current would largely offset the economy of its use.

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ing an excellent opportunity to convey power over the surface at a high potential and thus reach the distant points of the field.

The establishment of a central station from which power could be distributed to the many points needed was the logical solution of the problem, and naturally the location of this station, other things allowing, should be, as its name indicates, in the center of the entire property. This, as has already been said, was not feasible, owing to lack of suitable water supply. And this requirement led to the final choice of Kilsyth, for the new generating apparatus, being the nearest point to the power center where a water supply was available, and it further offered the advantage of combining the new with the

four horizontal tubular boilers, was increased by the addition of four Robb-Mumford 72-in.x18-ft. boilers of the same general type, having 4-in. charcoal-iron tubes.

The engine is a Reynolds Corliss 26x42 in. running at 120 r.p.m. with a normal steam pressure of 115 lb. This engine is direct connected to a 500-kw. 24-cycle, 6600-volt 3-phase Bullock generator, revolving-field type, with 24 poles. It is separately excited by a 20-kw. generator wound for 230 volts, direct connected with an 8½x8-in. American Ball engine running at 375 r.p.m.

The switchboard consists of three panels of Vermont marble. The generator panel carries the usual direct-current instruments for the exciter circuit, three al-

ternating-current ammeters, and a three-phase indicating wattmeter. It also carries the controlling wheel of the field rheostat, its switch, a synchronizing plug for an additional generator, and an operating lever controlling a triple-pole, single-throw non-automatic, 6600-volt oil switch, placed 3 ft. in the rear of the board. A swinging bracket attached to the board carries an alternating-current

current generators already installed may be used for excitation in case the regular exciter is out of commission for any reason.

Lightning arresters are placed where the line wires leave the power house, through ventilating cupolas and disconnecting switches at the same point allow the cutting out of the entire equipment, from the line wires when shut down.

ond-growth chestnut 35 ft. in length, with 7 in. top diameter and 12 in. diameter 6 ft. from the butts. At crossings 40-ft. poles are used, and protection is provided in case of breakage. The poles are set from 5 to 7 ft. in the ground.

From the Oswald sub-station (No. 2 on the map) to the Graham sub-station (No. 3 on the map) the same form of construction is used, but the size of the wire is



FIG. 2. INTERIOR GRAHAM SUB-STATION

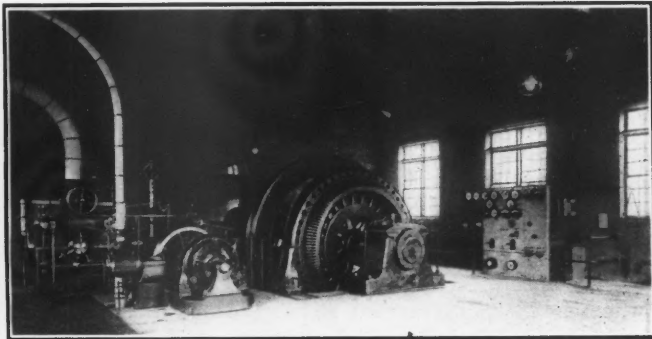


FIG. 3. 500-KW. A. C. UNIT IN KILSYTH POWER HOUSE



FIG. 4. GRAHAM SUB-STATION



FIG. 5. INTERIOR SYDNEY FAN HOUSE



FIG. 6. GRAHAM FAN HOUSE

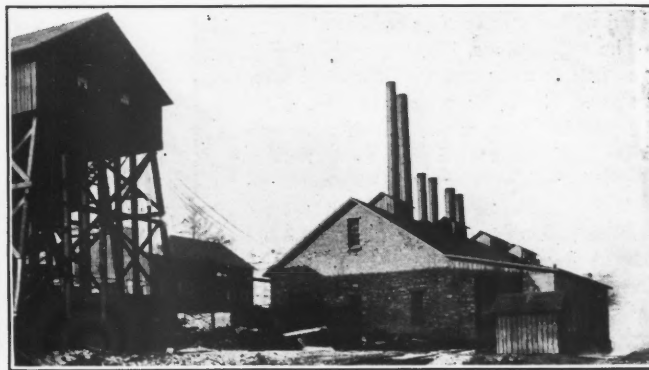


FIG. 7. MAIN POWER HOUSE, KILSYTH, BOILER ROOM END

voltmeter with illuminated dial, and a Lincoln synchronizer.

The feeder panel carries three alternating current ammeters, a power factor indicator, a static ground detector, a three-phase recording wattmeter, and an operating lever controlling a triple-pole, single-throw automatic 6600-volt oil switch, with overload relay.

The exciter panel carries the usual direct-current meters and equipment with the addition of a lighting switch and a switch by which current from the direct-

TRANSMISSION-LINE CONSTRUCTION

The transmission line from Kilsyth to the Oswald sub-station (No. 1 to No. 2. See map) consists of three No. 2/0 copper wires carried on high tension porcelain insulators, supported by iron pins. The three wires are placed in the form of a triangle, in cross section about 28 in. on a side. The top wire insulator is carried on an iron ridge pin, and the other two are held by iron pins supported by a Southern pine cross arm 3 ft. long, 26 in. from the top of the pole. The poles are largely sec-

only No. 4. The amount of copper installed is sufficient to supply double the present capacity of the sub-stations with a line drop of 10 per cent.

At each sub-station are located transformers reducing the alternating current to a voltage of 160 for conversion to direct current at 250 volts, through rotary converters.

At Oswald the sub-station is equipped with a 300-kw. rotary with equivalent transformer capacity, all of Bullock manufacture. This sub-station supplies direct

current for locomotive haulage, coal cutting and minor uses in the Sydney mine close by the station, and also for the same uses in the Oswald mine, the bank mouth of which is across the stream from the sub-station. At Graham a 200-kw. rotary supplies the Graham mine, the pit mouth of which is near the location of the fan shown as No. 6, in Fig. 8.

SUB-STATION EQUIPMENT DETAILS

Each sub-station is designed for an increase in capacity to double the present installation, and each contains a four-panel switchboard. The alternating 6600-volt current first passes through an automatic oil switch placed in a concrete cell at the rear walls of the building and controlled from the switchboard. The same panel carries three alternating-current ammeters and voltmeter on a swinging panel. The second panel carries an ammeter for low-tension alternating current, and three single-pole, double-throw, main switches for the rotary.

In operation these switches are thrown down for starting, thus connecting the rotary to half voltage taps in the transformers, and the regular running position is up. Field break-up switches are placed on the frames of the rotaries themselves as are also the equalizer switches for future equipment. The direct-current panels carry the usual generator and feeder equipment for two main circuits, and an auxiliary lighting circuit. The main circuit and the feeder circuits are protected by circuit breakers, and both alternating-current and direct-current lines are provided with complete lightning-arrester equipments. The incoming and outgoing lines pass through tiled openings in the rear walls and the alternating-current lines are provided with disconnecting switches.

The sub-stations, like the main station, are of stone with concrete floors and foundations. The roofs are of the slow burning wooden type covered with a composition, and supported by steel trusses. The sub-stations are located so as to reduce the direct-current distributing distance as much as possible, and at the same time to place them where the small attention required may be conveniently given by employees at the tipples, or on other portions of the outside works. The main direct-current circuit breakers in each station are provided with a contact device by which a bell, located at any point where some employee is within sound, is rung and lamps are also lighted, when the circuit breaker is out, giving both a visible and audible alarm.

OPERATION OF THE MINE FANS

The three mines are provided with Clifford-Capell fans, and owing to the heavy demand for power which these fans when run at their full capacity will make, they are operated by alternating-current motors entirely independent of the sub-stations. The Sydney and Oswald fans located at

No. 4 and No. 5, respectively, Fig. 8, are 11 ft. in diameter 4 ft. 4 in. in width, with a 9-in. shaft, and are rated to deliver 100,000 cu.ft. of air each per min., against a 3-in. water-gage pressure. Under these conditions the fans would run at 230 r.p.m. and require about 80 h.p. each.

All three fans are placed with shafts parallel with the mine entries on concrete foundations, with steel and concrete housings and the motors are placed in concrete houses with wooden roofs. The fans are arranged for exhausting, but can be changed to run as blowers by altering the

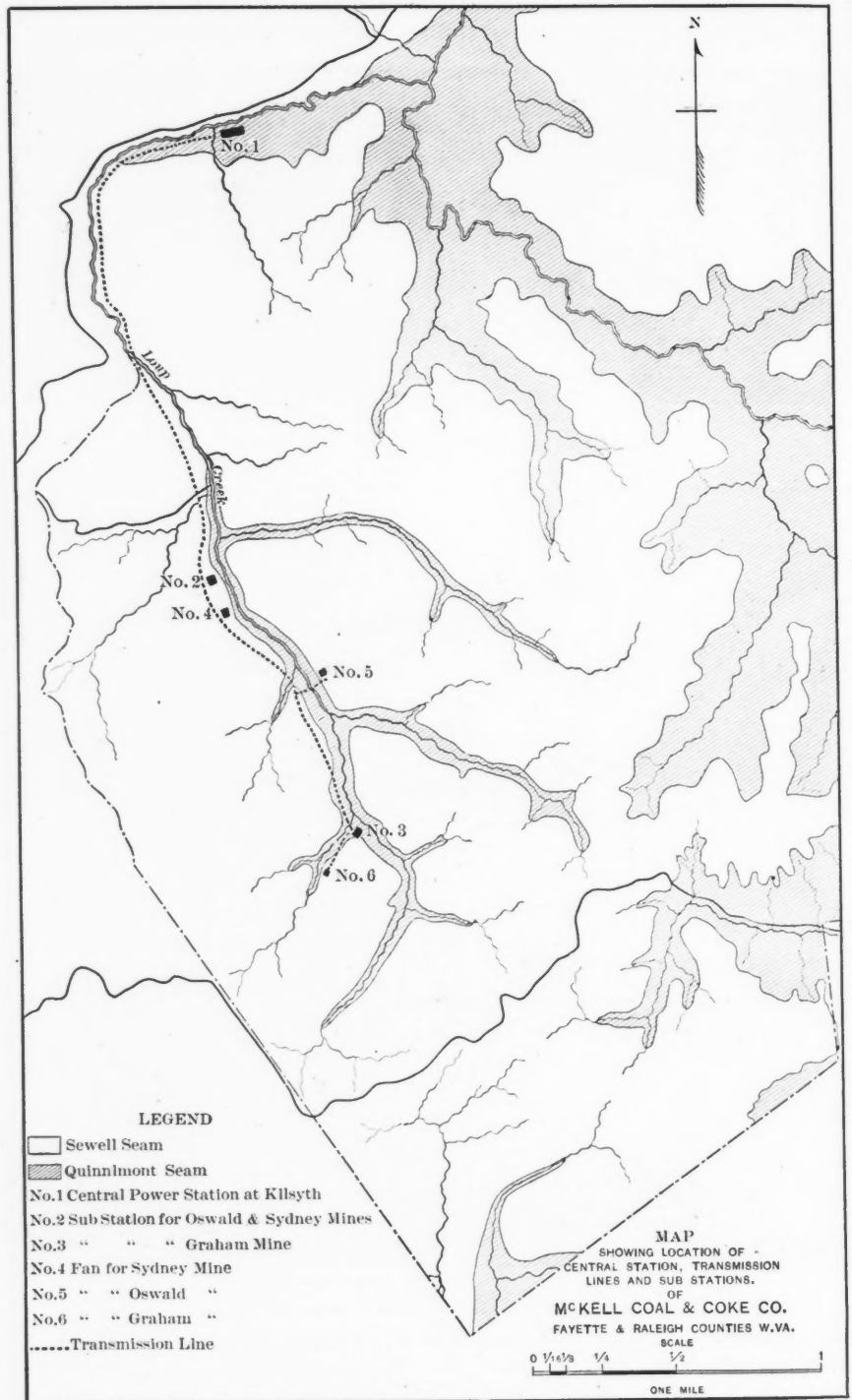


FIG. 8

The Graham fan is of the same pattern, 9 ft. in diameter, 3 ft. 6 in. wide, with a 7-in. shaft, and is intended to deliver 75,000 cu.ft. of air per min., against a 2-in. gage pressure. This requires a speed of 200 r.p.m., and about 40 h.p. for driving.

position of the fan and air-passage gates.

Each fan house is provided with lightning-arrester equipment and disconnecting switches, where the lines enter the fan houses, and the high-tension current is controlled by an oil switch placed so that

it prevents anyone unaccustomed to the plant from accidentally touching the high potential apparatus. From the oil switch the current is carried overhead along the roof to three transformers which reduce the voltage to 440, for which the motors are wound. The fans are belted to the motors, which are of the standard three-phase induction type, controlled by compensators.

Each motor is provided with large and small pulleys, allowing a variation in speed, the present requirements being much below the expected ultimate requirements for which the motors are installed. Banks of lamps on the secondary of the transformers, which lamps are normally to be burning, will show an interruption of the current and a visible signal will also be arranged to show an interruption of the fan itself through the same cause or trouble with the motor or belt connection. The fan motors, transformers and electrical equipment are of the General Electric Company's manufacture.

FLEXIBILITY OF SYSTEM

The location of the Oswald fan No. 5 is a good illustration of the adaptability and flexibility of the system. At the time the installation was started, it was planned to place this fan near the sub-station No. 2. Later on it developed that a location more than a half mile away would materially increase the efficiency of the work of the fan. Were a low-tension generating plant installed at No. 2, the cost of copper to connect a fan requiring 80 h.p. at No. 5, would be considerable, and, of course, the same statement is true were it necessary to take direct current from the sub-station. The cost of connecting on the high-tension lines running from Oswald to Graham, and passing within a short distance of No. 5 is entirely negligible, and would not be of great importance had it been found desirable to place the Oswald fan at some other point, even much more remote from the bank mouth.

In the same way induction or synchronous motors for various purposes may be placed practically at any points needed in the entire territory covered by the map, at a nominal copper cost, the voltage of 6600 reducing the size of conductors so that the principal item of expense in such distribution is very materially cut down.

It is equally feasible to place other rotary transformer stations at distant points on the property for direct-current distribution underground, and if such distribution is needed at points in the workings midway between the outcrops on the main creek, and its branches, and those on the head waters of Mill creek, the high-tension current may be carried overhead to a point above the center of such a needed distribution and thence down a bore hole to an underground transformer station similar to the sub-station already described.

The efficiency of the transmission under the working conditions herein described is over 80 per cent., that is of the horsepower delivered by the engine, 80 per cent. is made available at the sub-stations in the form of 250-volt direct current. The efficiency of the fan motor drives is approximately 78 per cent. from engine to fan motor belt.

Other uses of power will probably be added later, and it is also possible that it will be found advantageous to discontinue the small high-speed belted engines at the Kilsyth station, and either run the direct-current generator by induction motors or place rotaries there for the Kilsyth haulage.

Improvements in the Schuylkill Coal Region

SPECIAL CORRESPONDENCE

There are indications of unusual activity in the Schuylkill field of the anthracite region in the matter of improvements at the various collieries. In a number of places some important improvements have been completed. Preparations are being made for a record year so far as the output is concerned.

At the Pine Knot colliery a number of long and expensive tunnels have been driven, opening up new beds. The water from the Mine Hill Gap workings has been located and tapped, and the Payne water-level drift has been reopened. At Thomaston colliery the slope has been reopened to the first level, and a tunnel 1000 ft. long is being driven across the basin to the Primrose vein. All the water has been taken from the Lebar slope and an air shaft sunk to the level of the heading, making the connection. At Glendower colliery a connection has been made between the Skidmore and the Buck Mountain vein.

At the Phoenix Park colliery a tunnel is being driven to the Peach Mountain vein. It will be 810 ft. in length, with an air tunnel from the Diamond to the Tracy veins. A bore hole has also been sunk 770 ft. from the surface to the sixth lift. This will be used for an air line and will carry power to run pumps and air drills. At the Mt. Hope workings, St. Clair, many important changes have been effected. A modern breaker has been erected containing two sets of shakers, two new spiral separators, two sets of small rods and two new jigs. The breaker has a capacity of 400 tons. A tubular boiler of 150 h.p. has been installed in the boiler house in place of the old nest of boilers. A new slope has been sunk to the Mammoth vein, with turnouts at the bottom. The Ellsworth colliery, just above St. Clair, is erecting a breaker with 400 tons capacity. This is

one of the best individual paying plants in the county.

The Darkwater Coal Company, at Broad Mountain, is also expending a large sum in improvements, a double-track tunnel having been driven from an elevation at the head of the breaker to the double-track slope sunk last year in the main basin of the Skidmore vein. An additional slope for hoisting rock and a pump way, 650 ft. deep, has been sunk in the Skidmore vein and a big pair of hoisting engines erected. To tap the water from the old Reppler mine, operated at this point, many years ago, and which has been a menace, two tunnels have been driven. Two Jeansville pumps have also been installed in the pump house. On the surface two steam shovels are in operation, stripping the Mammoth vein in the main basin. At the Pine Hill colliery a new breaker was recently placed in operation to replace that destroyed by fire. The building is of concrete up to the floor line. The old engines have been remodeled, while a new dynamo engine of 892 amp. has been installed. Two pump houses, each 22 ft. high, have been built, and when completed the sides and top will be covered with reinforced concrete. Two Scranton duplex pumps, 40x14x36 ft., will be used. Several long tunnels opening up new veins have been driven. The Red Ash and Black Heath veins have been worked out, but there is ample coal left for working.

At the Lytle colliery elaborate improvements are being rapidly completed. A number of tunnels have been driven, one to connect the Holmes and Four Foot veins, one from the Middle split of the Mammoth to the Black Heath west and on the same level to the Skidmore east. At the Oak Hill colliery the water has been tapped from the workings of the Charles Hill colliery. The main holes run from 22 to 25 ft. in length and are 15 in number. When the valves were opened the pressure at some points was 155 lb. to the square inch. A new breaker has been completed to handle the finer sizes of coal.

At Heckscherville, Cain Brothers have completed a model little plant, the breaker having a capacity of 400 tons. A tunnel has been driven to the Seven Foot vein from the Skidmore level. At the Buck Run colliery a fine electric-haulage system has been established, consisting of a 100-kw. 250-volt General Electric engine, driven by a McEwen machine and operating two 8-ton locomotives.

Fastening the rope to a shaft drum by several coils is not necessary. Experience has shown that a pull of one ton, with one coil around the drum, will resist eight to 10 tons; with two coils around the drum it will resist a weight of 64 to 100 tons, with three coils around the drum it resist 512 to 1000 tons.

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

As a general rule, the deeper a mine, the more dangerous the coal dust.

It is possible to initiate an explosion of coal dust by dropping a mass of finely ground coal upon a large flame in the bottom of a vertical box. For the purpose of throwing further light on the action of coal dust as an explosive agent, this experiment is valuable.

The coalfields of North Carolina are confined principally to Chatham and Stokes counties, the coal in each district being associated with Triassic sandstone. The Cumnock mines in Chatham county are the only ones that have thus far been worked on a commercial scale.

The coal-mine death roll in Pennsylvania during 1906 was 500 approximately, 200 dying as the result of gas or powder explosions. In West Virginia, during the same year, mine explosions caused 88 deaths, while in the early months of 1907, the list of fatalities was increased by more than 100.

With two exceptions, May, 1905, and January, 1903, the production of anthracite coal during April, 1907, was greater than that of any other single month. The production for April was 5,916,583 tons. The greatest output for any single month was in May, 1905, when the production was 6,605,159 tons.

For transmission of power a seven-wire iron rope is often used. At several anthracite collieries the driving sheaves of such ropes are lined with flexible material, such as leather or rubber packing, both of which give good results. It has been found by experience that the span should be at least 50 ft. which gives a deflection of about 2 inches.

At several continental collieries, electric generating plants have been established in connection with the mining operations. Steam turbines are employed and electricity is not only generated for the needs of the colliery, but current is supplied for lighting and power purposes in adjoining districts. Some mines in America are located favorably for the successful adoption of such a plan.

The silvery luster shown by many of our best grades of coke is said to be due principally to the decomposition of some of the gases evolved during the process of coking, and the deposition of a thin coating of pure carbon on the surface of the coke cells. This thin coating protects the cells from alteration in the air, and is accountable for the durability shown by many cokes. The carbon coating also

adds strength to the coke and improves its appearance.

In mixing good portland cement little water is required to make a good mortar. Neat cement will take, by weight, 17 to 20 per cent. of water, and a quick-setting cement requires more water than one that is slow to set. In case the mixture requires more water it indicates an excess of free lime. Slag and natural rock cements require more water than portland cement. Too much water retards the setting and weakens the mortar.

The demand for coal along the Pacific Coast creates a high price for that fuel. It fetches \$2.50 to \$3 per ton at Nanaimo, B. C. Values are not stated separately for the collieries of Vancouver island in the statistics of the Minister of Mines for British Columbia, but making allowance for the Crow's Nest production at its known value, the average for the Vancouver island coal appears to have been a little upward of \$3 per ton (2240 lb.) in 1904. The coal of Vancouver island is of good quality.

The footings under the buildings about mines ought to be proportioned according to the thickness of the wall. The weight of such buildings as boiler and engine houses will seldom exceed two tons per square foot when distributed uniformly over the footings. The width of the footings for light buildings should be proportional, so that the pressure on the soil will be the same per square foot under all parts of the building. Unequal pressure on the soil due to one wall being higher than another will cause openings or cracks to appear in the foundation.

In driving rooms or chambers where they are close together, and are to be driven over 300 ft., a counter heading should be driven across the chambers or rooms from one of the chambers, which is well adapted for haulage purposes. The distance from the gangway to the counter should be about 200 ft. All the chambers formerly driven from the gangway, are then driven from the new counter. The advantages derived from following this plan are: First, it minimizes the interruption on the main gangway road; second, it gives a quick handling of the loaded and empty cars by drivers, or it saves time in disposing of empties and collecting loaded cars; third, it saves rails.

In working a seam having a thickness of 3 ft. or less, several anthracite companies have found that the most economical

method of operation is to drive chambers from 26 to 30 ft. wide, with 45-ft. centers; gob is packed to the roof on one side of the chamber, and the tracks are laid close to the rib, about 6 ft. from the rib to the center of the road. This system saves timber to a great extent, as the gob acts as props. The support offered by the gob is stronger than timber; besides, it gives a permanent support for the roof, while timber decays, and consequently the roof will cave when it is undertaken to rob the remaining pillars. In robbing pillars, it is not necessary to move the gob again because the roads in the chambers are next to the pillars; thus the coal is more cheaply produced than otherwise.

The Crow's Nest Pass coalfield is situated on the western slope of the Rocky mountains. According to Dr. George M. Dawson (*THE MINERAL INDUSTRY*, Vol. VII, p. 200) it has an area of at least 200 square miles, and contains numerous superimposed coal seams, ranging in thickness from 2 to 30 ft. The chief mining in this field is done by the Crow's Nest Pass Coal Company, the history of which is practically the history of the field. This company was incorporated by Dominion charter in 1897. It owns about 250,000 acres of land. It began mining at Coal Creek in 1897. Legislative restrictions prevent the Crow's Nest Pass Coal Company from charging more than \$2 per ton for mine-run coal at the mines. The coal is of good quality. The mining rate in the field in 1905 was 70c. to \$1.15 per ton of screened coal.

China can justly claim to be the first country to utilize her coal deposits, but as in many other instances, she has gone through ages without any advance in methods of development. There has been considerable increase in the output during the last decade, but although there are a few modern operations, the vast majority of the mines are still worked by crude methods. The entries are low and winding. The miners carry the coal out of the mines or to the hoisting shaft in baskets, or load it on sleds; sometimes on four-wheel trucks. Where shafts are used, the coal is hoisted by means of a windlass operated by five or six men. In effecting drainage, the water is raised up steep inclines by a gang of boys with small water baskets; at the top of the incline the water flows into a ditch, and is carried away. Ventilation is accomplished by means of a furnace or by driving the air down the shaft or incline by means of wooden box fans operated by men.

Metallics

At some mines the tamping consists of fine drillings packed in paper tubes or cartridges. This is good practice, but if the same time were spent in drilling the hole an inch or two deeper the results might be even better.

Excessive tamping is especially apt to cause trouble in soft ground, where single jack and auger are used; in such ground the miner finds plenty of talcy tamping in the vein filling itself. When a fuse is jerked out by another blast, it is also difficult to find it in such ground.

The drawbacks of tamping are several. The fuse is liable to be injured by sharp rocks in the tamping or by being crushed between the sides of the hole and the tamping stick, and a missed hole results. When a good supply of tightly rammed tamping has been used and the hole misses, it is no enviable job picking the tamping out of the hole.

Important principles in magnetic separation are the production of a magnetic current of the minimum intensity and maximum density; the production of a homogeneous magnetic field; passage of the material to be separated through the magnetic field as near as possible to the attracting pole of the magnet, and in an even, regular sheet, at the proper speed.

At Iola, Kan., the smelting of zinc residue containing 10-15 oz. silver, 0.03 oz. gold, and about 6 per cent. lead, was abandoned as unprofitable after a long trial, although 91 per cent. of the silver, 92.5 per cent. of the gold and 92 per cent. of the lead were recovered. It may be assumed therefore that the cost of smelting was considerably in excess of \$10 per ton.

The European zinc smelter will not pay for lead in ore unless it be in excess of 8 per cent. Lead in excess of 8 per cent. is paid for at 50 per cent. of the price quoted in London. It should be remarked, however, that the price paid for silver and lead cannot fairly be considered by itself, but must be viewed with regard to the terms under which the zinc in the ore is paid for. For example, a smelter may make a comparatively low returning charge on the ore, contemplating that a concession in that respect will be offset by a profit on lead and silver for which he pays nothing to the seller of the ore.

Comparatively little copper is put upon the market in cathode form, although this is an ideal shape from which to make brass and copper castings. The wirebars and ingots never give a conductivity equal to that shown by samples from the cathodes from which they are made. This is partly due to the absorption of some impurities from the furnace lining and products of combustion, and partly to mechanical pocketing of impurities in the cathodes during the electrolytic process. These particles of impurities are asso-

ciated with nodules and a smooth part of the cathode is naturally selected as a sample to draw out into wire.

In general, the European zinc smelter is not disposed to pay more than 60 per cent. of the assay value of silver in the ore, and that rate only on the silver in excess of 150 grams (about 5 oz.) per 1000 kg. If the price of silver be 50c. per oz., or 8.5 centimes per gram, the rate paid will be about 5 centimes; with silver at 55c. per oz., or about 10 centimes per gram, the rate paid will be about 6 centimes. An ore assaying 10 oz. per ton would therefore suffer in the first place a deduction of 5 oz., and the remaining 5 oz. would be paid for at the rate of 36c. per ounce (silver being 60c. per ounce in the market), making the silver value of the ore to the miner \$1.80 per ton.

While tamping is recommended by most authorities on blasting with dynamite, it must be done with discretion. The most important service of tamping is to hold the fuse in the hole and to prevent its being jerked out of the dynamite when hit by flying rocks from another blast. Another is to prevent the possibility of flying sparks from the spitting fuse burning the charge before the cap is ignited. For these purposes very little tamping is necessary and that of a clayey nature is best. Burning the charge by a spitting fuse occurs from time to time, and accounts for occasional burned holes, "the stinkers" of the miner, even when strong caps are used and the powder is well thawed.

The presence of much copper in the slime from electrolytic tanks is objectionable in the silver refinery process and must be removed before cupelling the dried slimes to avoid making very rich slags. The other impurities give little trouble, except possibly tellurium, which requires prolonged furnace treatment to burn it off. The copper is present in very finely-divided form, as is shown by experiments in fine screening to reduce the copper contents. Almost all of the copper which will pass a 40-mesh wire screen, will also pass a 200-mesh. This would indicate that the coarser screen removes the fine crystals that have dropped from the cathodes and that the remainder is in the form of a chemical cement.

The principle of all magnetic separators is simple. An electro-magnet, when energized by a current passing through its coils, attracts magnetic substances to one or both of its poles. This is the first step in the separation. The second is to cause the magnetic material to drop off from the pole, separate from the non-magnetic material from which it was removed. The simplest, but most impracticable, method of doing this is to lift away the magnet, cut off the current and allow the attracted material to fall into a separate

receptacle. Magnetic separation has been, indeed, effected in practice, on a small scale, in precisely that manner, and it is a useful method for laboratory tests, but for commercial work it is too cumbersome and slow.

Hand sorting has the advantages of saving clean mineral from unnecessary crushing, therefore avoiding loss in slime; of separating the two minerals of equal, or nearly equal, specific gravities, like blende and siderite, or blende and pyrites; of saving in cost of plant. It is not likely to be any more expensive in direct cost than a cheap process of milling, like ore dressing; it is apt to be a good deal cheaper than some of the more expensive processes, like cyaniding. The cost of picking depends chiefly on the size of the pieces of ore and their specific gravity. It is obviously cheaper to pick out lumps of 2-in. size than $\frac{3}{4}$ -in. size, while lumps of a heavy mineral, like galena, weigh up faster for the same expenditure of labor than a light material, like quartz. It is apt to be uneconomical to pick over ore smaller than $\frac{1}{2}$ -in. size. Ore of 1-in. size can generally be picked to advantage. With labor at 30c. per hour the cost of picking galena ought not to exceed 60c. per ton, or 90c. per ton for blende, and it may be considerably less if the ore be favorable.

Cathode copper is exceedingly pure, usually about 99.93 per cent. copper, with hydrogen as the chief impurity. Objectionable cathode impurities are of two classes—those which depress the electrical conductivity and those which make the metal brittle. Arsenic and antimony represent the first class; tellurium and lead the second. Good cathode copper should show but a few thousandths of a per cent. of arsenic and antimony. Experiments have indicated that it takes but 0.0013 per cent. of arsenic or 0.0071 per cent. of antimony to lower the conductivity 1 per cent. Any conductivity troubles in electrolytic copper can almost invariably be traced the presence of undue amounts of one or both of these elements. Impurities of the brittle-making class are rarely met with, and if present are due to mechanical contamination of the cathode, either in the bath or in the subsequent furnace treatment. A third class of cathode impurity concerns the refiner, comprising silver and gold. Cathodes usually show from 0.1 to 1 oz. silver and a trace of gold. This seems to be due entirely to the mechanical fouling of the cathode by particles of anode slime. In fact, it is a question if most of the arsenic and antimony found in the cathodes does not have a similar origin. The slime is very finely divided and the continual circulation of the electrolyte necessary to prevent polarization maintains a slight turbidity. These particles are probably electrostatically attracted to the cathode.

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Contents

	PAGE
Editorials:	
The Amalgamated Report.....	1108
The Present Position of the Zinc Industry	1108
The Prevention of Coal Dust Explosions	1109
*The Metallurgy of Aluminum in 1906, Joseph W. Richards	1083
The Sulphide Corporation.....	1086
*Behavior of Carbon and Phosphorus in Steel..... Henry M. Howe	1087
Alaska United Gold Mining Company	1090
Copper Range Consolidated Company.. ..	1090
*The Imperial Air-Motor Holst.....	1091
Gypsum in Northwestern New Mexico.. ..	1091
Accident and Old-age Insurance.....	1091
*Revival of the South Crofty Tin Mines, Cornwall..... Edward Walker	1092
Rights of Crossing Electric Power Lines	1092
*The Calamine Dressing Works at Monteponi..... Ermino Ferraris	1094
Tungsten in Park County, Montana. Special Correspondence	1094
Collection of California Minerals at Los Angeles	1094
The Reform of the United States Mineral Land Law..... R. W. Raymond	1097
Iron Ore of Cleveland, England.....	1098
Oil and Gas in Southeastern Kansas... ..	1098
Vauation of Zinc Ore.....	1098
Copper Refining Practice.....	1098
Method of Analysis of Gold-Silver Bullion..... J. E. Clennell	1099
Imports and Exports of Metals in Germany	1109
Experiences with Austrians as Iron Miners	1101
*An Alternating-current Coal-mining Installation. T. W. Sprague and C. K. Stearns	1102
Improvements in the Schuylkill Coal Region..... Special Correspondence	1105
Colliery Notes.....	1106
Metallies	1107
Correspondence:	
The Eastern Mining Company, Philippine Islands..... A. J. Eveland	1110
The Taylor Hydraulic Air Compressor..... V. F.	1110
The Elmore Vacuum Process. A. Stantley Elmore	1111
The San Cayetano Mines, Ltd. W. Murdoch Wiley	1111
Saving Clippings..... John K. Prather	1111
Sampling Lake Superior Iron Ore. G. A. B.	1111
Richness of Cobalt Ores. Albert R. Ledoux	1111
New Publications.....	1112
Mine Timbering..... R. W. Raymond	1112
Personal	1113
Obituary, Societies and Technical Schools, Industrial, Trade Catalogs, Construction News.....	1114
Special Correspondence.....	1115
Mining News.....	1117
Markets, etc.....	1121

*Illustrated.

The Amalgamated Report

The report of the Amalgamated Copper Company for 1906, which has been published this week, is distinctive, like predecessors, for what it does not tell, rather than for what it does. The net income for 1907 was \$14,154,400, against \$9,161,537 in 1906. The net income in 1907 was equivalent to a little more than 9 per cent. on the \$153,887,900 outstanding capital stock of the company. On its face, this is not an entirely satisfactory showing, in view of the extraordinarily high price for copper which prevailed throughout 1906. However, it is to be remembered that the Amalgamated is simply a holding company, and that large surplus earnings, upon which it may draw, may be retained in the treasuries of its constituent companies. The peculiar feature of the Amalgamated is the general ignorance as to just what it owns. It is remarkable that so important a company should have continued so long to withhold from its stockholders information as to what is behind its stock.

The interesting statements in the report relate to the production of the company. The output of the Washoe and Great Falls works is given as 275,000,000 lb. in the calendar year 1906, of which the production of the Amalgamated companies was 224,000,000 lb., the remainder being derived from custom ores. The Amalgamated smelted the entire output of the North Butte company, and smelted the output of the Red Metal Company subsequent to July 1, besides which it obtained considerable supplies of ore from smaller companies.

It is interesting to note that the combined production of the Washoe and Great Falls works was just 30 per cent. of the total production of copper in the United States in 1906, while the production of the constituent companies of the Amalgamated Copper Company was a little less than 25 per cent. of the total. These figures are far in excess of those of any other copper producing company of the United States. The Washoe works is the largest single producer of copper in the United States; probably it is the largest in the world. The second place is held by the Great Falls works, and the third place by the Douglas works of the Copper Queen company, but between these two the difference is small.

In the report of the Amalgamated, it is remarked that "The position of the copper metal market during 1906 was highly satisfactory. The price of the metal rose from 18½c. in December, 1906, to 25¼c. in March, 1907." (Evidently these figures refer to the price for the metal on the basis of 30 days, delivered.) "At the close of the company's fiscal year (April 30, 1907) all refined copper that can be produced up to July 1 next by the various companies controlled by this company has been sold in advance." Consequently, the Amalgamated on its last sales realized nearly the maximum price, the maximum having been the average of 25¾c. (some small lots selling as high as 25¾c.) which was attained on March 11 last.

The Present Position of the Zinc Industry

During the last few years, especially during 1906, conditions have been developing in the zinc industry of the world, which are of supreme importance. This relates particularly to the enormous increase in the supply of ore offered to the smelters. New South Wales and Mexico, the former gradually and the latter suddenly, have developed into producers of zinc ore of the first magnitude. The production of zinc ore in New South Wales in 1906 amounted to 102,650 long tons, against 103,000 long tons in the previous year, but going behind the face of the returns, it appears that there was a considerable increase, because of the better grade of the ore produced in 1906, the estimated yield of spelter from the ore exported having been 33,427 tons in 1906 against 30,637 tons in 1905. American smelters received from Mexico 88,900 short tons of ore in 1906 against 32,164 in 1905, and practically none in 1904. Some Mexican ore also was exported to Europe. Besides these large new supplies, European smelters have been recently obtaining a good deal of ore from other new countries, such as Japan (where zinc-smelting works are now being erected) and Turkey; while in 1906, a considerable supply of calamine ore of high grade was for the first time received from Rhodesia, where there appears to be large deposits, which will afford a steadily increasing output.

This plethora of raw material has al-

ready had an important effect upon the world's market for spelter. For one thing, it has cut off all hope that the United States will soon become an exporter of spelter. On the contrary, it is to be feared that, more frequently than usual, the price of spelter in the United States will have to be reduced in order to prevent importations, in spite of the protective tariff of 1.5c. per lb. During the last three or four years the prices for spelter at London and New York have been showing an increasing disparity; at present there is a difference of about 0.8c. per lb. This is easily explained by the position of the European smelters, who in the abundance of their ore supply are able on the one hand to offer spelter at lower and lower prices, and on the other hand bid lower and lower prices to the miners for ore, preserving a large margin for smelting all the time. During 1906 the smelters' margin was so large that the business was unusually profitable. The natural result of this, together with the refusal of the smelters to accept certain supplies of ore, has been to lead several of the mining companies, together with other metallurgical companies, to go into the smelting business on their own account. At the present time there is something like an epidemic in the construction of new zinc-smelting works in Europe. In Silesia and the west of Germany it is reported that six large smelting works (one of which has recently gone into operation) are under construction; one or two new smelters are being built in France; a large works is under construction in Great Britain, and another one is contemplated. A new works was lately completed in Australia, making two now in that Commonwealth, and a works is to be built in Japan.

Some of the new works that are being erected in Germany occupy locations which give them much better facilities for the transportation of ore by canal and river from Rotterdam and Antwerp than any other works in Germany at present possess. Consequently, there is no doubt that some of these new works will capture a good deal of the business of smelting foreign ore. Naturally, the situation is viewed with a good deal of alarm by the existing concerns. The increased competition will doubtless reduce smelting prices to a normal level, and the hope of great profits from the new enterprises, based on existing conditions, probably will

fail of fulfilment for that reason. However, the effect on the American market will be obvious. With large supplies of cheap ore, and competition among the European smelters that materially reduces their margin for smelting, there is little likelihood that American smelters will have any opportunity to export spelter; in other words the conditions in Europe will tend to keep the London price steadily below the price in America. As regards the situation in Europe, looking toward the more distant future, the hope will be that the new works will produce no more than to satisfy the annual increase of the demand, while the old works will maintain their present production. This is the most optimistic view that can be taken. Anyway, the change in conditions is not likely to be sudden, inasmuch as only a small portion of the new smelting capacity will go into operation during 1907.

It may be remarked that the United States also will have a considerable increase in smelting capacity in 1907.

The Prevention of Coal-dust Explosions

One of the most difficult problems that now confronts coal-mine managers is the prevention of dust explosions, or of eliminating the possibility of fine coal dust entering as a factor in gas explosions. Various plans have been adopted, and although some systems have met with partial success, there are still many unfavorable conditions to be met.

The most general practice is to spray the roof, sides and floor of the different gangways and chambers, or to saturate the intake air with steam, which is a less satisfactory method. All of these plans have the same effect, causing the floor to swell, or the top rock to weaken and fall; furthermore, the timbers are soon rotted when spraying is used, and the consequent necessity of constantly renewing the roof timbers has a tendency to keep a continual movement upon the roof and sides, which intensifies the danger to the miners.

If watering the workings of a mine cannot be successfully followed, there remains nothing to suggest except that some plan should be adopted to prevent the initial accumulation of dust. This can partially be accomplished by keeping the cars as nearly dust-tight as possible. They

cannot be made completely dust-tight, because the fine dust is extremely penetrating; it is a fact that the fine dust from steam coal will find its way into a watch case. A small amount of watering in any mine is sure to prove beneficial, and especially is it advisable to wet the outgoing car of coal once or twice during transit. However, the plan of indiscriminate spraying, besides causing a hot, saturated atmosphere, uncomfortable to work in, is likely to cause a greater loss of life from roof-falls than would perhaps occur from explosions. Wet zones are effectual in mitigating an explosion, but can only be looked upon as a means for preventing the destruction of the entire colliery, and not as remedies to prevent local explosions.

Larder Lake

This district, in northern Ontario, is now attracting a good deal of attention as a rival of Cobalt. Highly optimistic reports have been published in the daily newspapers. As is always the case, the district is tremendously overestimated in the press reports, which result from the work of the boomers in their campaign to sell stock. There are, however, some prospects showing free gold in quartz, and it is possible that some of them may prove to be real mines when developed. So far, however, very little work has been done. Indeed, there has really been no chance. The discoveries were not made until late last summer, and at that time there were no supplies on the ground; moreover, there were no roads into the district, the only means of access being by canoe routes. Several parties got supplies in on the snow during the winter, built camps, and in May were just about to begin work. At Larder City a firm of enterprising merchants succeeded in obtaining a stock of general merchandise, and one of the hardware merchants of Cobalt has established a branch store. The coming summer will doubtless see tremendous activity in prospecting in the new district, and before the summer is over some reliable forecasts should be possible. Until that time, however, the new district should be regarded in a conservative way, and the offerings of the stock of companies should be considered in the light of the facts which are stated above.

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 Eastern Mining Company, Philippine Islands

I would like to call the attention of mining engineers and the public interested in mining, to the methods used by the agent of the Eastern Mining Company, a corporation organized at Manila, in the Philippines, to dispose of stock in the United States, in connection with which, my name, and that of H. D. McCaskey, formerly chief of the mining bureau of the Philippine islands, and now on the United States Geological Survey, is being used.

After three years' service with the Government of the Philippine islands as geologist of the mining bureau, I resigned to take the management of the Eastern Mining Company. I was convinced that the property was worthy of further development, and A. Heise, the president of the company, was sent to the United States to raise a larger amount of money than seemed to be available in Manila. His mission was to put before capitalists a business proposition, to raise funds from the sale of the capital stock which he was authorized to sell, and it was naturally presupposed that only legitimate business methods would be used.

On account of the distance, principally, and possibly through design, it is only recently that I have learned that there are being inserted in papers in the United States, large advertisements which are full of misleading statements regarding the property of the Eastern Mining Company. Some of these I quote as follows:

"Sixteen quartz claims, all demonstrated perfect title, with U. S. patent, and 39 placer claims of 800 acres, averaging 35c. per yard. . . . Over \$8,000,000 in sight on quartz claims. . . . \$100,000 have been spent in development work in the last five years. . . . A five-stamp mill actually at work, producing over \$3000 per month at the present time."

These assertions are gross exaggerations. The number of claims and the acreage is sufficiently accurate, but hardly a dollar's worth of work has been done on the placer ground, and it is wild imagination to place a value of 35c. a yard on the ground. There is not "\$8,000,000 in sight on the quartz claims." The figures in my report to the directors are \$100,000. The amount of money spent in development work has mysteriously increased fourfold.

There is no "five-stamp mill actually at

work on the property." A small (iron-frame, 800-lb. stamps) mill was installed about two years ago, and produced bullion to the total amount of about \$5000. It broke down repeatedly, and its final collapse took place long before the person responsible for the advertisements, left Manila for the United States; he was and is perfectly familiar with the fact that it has not been running for over six months, and did run only a few weeks at a time. There was no accuracy in the methods of operation, and all the operators were entirely ignorant of mining or milling, so that calculations of value per ton and the rate of extraction are founded on thin air.

The agent of the company who is responsible for such methods of selling stock was sent to the United States to raise funds by legitimate means, and it is entirely on his own responsibility that he has used such methods. The board of directors has voted its disapproval, and taken steps to end such proceedings, and I, personally, have severed my connection with the company. In order that the true conditions may be learned by anyone interested, I have published an abstract of my report on the property, in the *Far Eastern Review*, a semi-technical journal of good standing, here in Manila. It appeared in the number for May, 1907.

Beyond the figures in that report and the statement of general conditions there, I can assume no responsibility.

A. J. EVELAND.

Manila, P. I., April 1, 1907.

The Taylor Hydraulic Air Compressor

In the JOURNAL of May 4 we read an interesting article, headed "Compressed Air in Mining," by J. H. Hart, in reference to a falling-water compressor. We are much interested in the process that Mr. Hart mentions in his communication. Will you kindly advise us if what Mr. Hart advocates is practicable, and what depth of hole would be necessary to obtain an effective working pressure in the reservoir of 80 lb. or more per square inch, and could a greater pressure than that be obtained? If so, what depth of hole would be required, say, for 90 lb. effective pressure? We have a fall of 49 ft., with abundance of water, and we should like to put this process in practice if it is feasible.

V. F.

Mexico, May 25, 1907.

[The system to which Mr. Hart referred

is in practical (and entirely successful) use at several places. Perhaps the most important installation is at the Victoria mine, in the Lake Superior district, Mich., which was described by D. E. Woodbridge in an elaborate article in the JOURNAL of January 19, 1907. The pressure of air obtainable is independent of the fall of water that is naturally available, the air in the reservoir being under the pressure of the column of water between the latter and the tail-race, i.e., the level at which the water finally flows away. The pressure of air obtainable can thus be readily computed. If increased pressure be required, it is only necessary to sink the air tank deeper, which is a mere matter of shaft sinking. The natural fall and rate of flow determine the rate at which the air is compressed. The process works most efficiently with a large volume of water at moderate head. Under such conditions about 4 cu.ft. of water are required to entrain 1 cu.ft. of air. At Magog, Quebec, a flow of 4292 cu.ft. of water per minute, with a natural fall of 22 ft., and a total depth of shaft of 150 ft. below the normal head of water, compresses 1148 cu.ft. of air per minute and delivers it at a pressure of 53.3 lb. The mechanical efficiency of this installation is nearly 71 per cent., i.e., that proportion of the total energy of the falling water is delivered in the compressed air. This is a high figure, even in comparison with what might be expected from a compound compressor of the best construction driven by a turbine.

At the Victoria mine, in Michigan, a fall of about 70 ft. is utilized. The air is stored in a reservoir excavated at a depth of 300 ft. The pressure obtained is 116 pounds.

Designs and equipment for the Taylor air-compressing system may be obtained from the Taylor Air Compressing Company, Montreal, Canada.—EDITOR.]

The Elmore Vacuum Process

I note with interest your editorial remarks (p. 917 of your issue of May 11, 1907) upon the article I had the pleasure of communicating regarding the Elmore Vacuum Process of concentration.

Your desire to have data as to working costs of this process is a very natural one, and I hope at an early date to supply you with the fullest details on this all important point.

In this connection, however, it is good evidence of satisfaction on all points (in-

cluding working costs) that after some months of working of one unit it has been decided in several instances to increase the number of our machines—in one case as you will have noted from my article, the installation is now being increased from one to 19 units.

Probably the following figures will be of interest as giving a very fair idea of working costs in America. Naturally the price of acid, oil and labor will vary at different mines: Oil, say 7 lb. per ton of ore treated at 1c., 7c.; acid (where required), 6 lb. per ton, at 1c., 6c.; labor (at \$2.50 per 8 hours), 11c.; total, 24c. This is on the basis of a plant of say 200 tons per 24 hours' capacity. To the above the cost of say 0.05 h.p. per ton has to be added, say 10 h.p. for a 200-ton plant.

At a working plant in this country the consumption of oil is at the rate of only 4 lb. per ton of ore treated, and the minute quantity of acid in the mine water used for milling is found amply sufficient.

There is one statement in your editorial which I am anxious to correct without delay, as otherwise wrong impressions may be created in the minds of your readers with regard to our original oil concentration process.

You write of "the failure of the original Elmore oil process." What I wish to emphasize is that that process was not a "failure" in any single instance. It is true that we were most unfortunate in the mines where it was put to work; but in every case the process accomplished all that we had claimed for it. The stoppage of the plants resulted from failure of the mines to produce payable ore or tailings as can be proved by letters from the mine managers in each case. In the case of one mine, however, the plant was never run continuously, as concentration was considered inadvisable before the plant started work, and all trials were promptly stopped. In another instance the value of the ore hauled from the mine was found in regular work to be about \$3 per ton, and as the mining costs were just over that figure it was not possible for any process to make a profit on treatment. Again, our old plant was installed to treat tailings from an existing water concentration mill, but when considerable quantities of the dump ore were put through the plant the grade went down, and the tailings were not worth treating.

I send you these particulars in order that the actual facts in connection with the old Elmore process may be known.

THE ORE CONCENTRATION COMPANY
(1905) LTD.

A. STANLEY ELMORE, Chairman.

London, May 24, 1907.

[Mr. Elmore evidently misconstrued our remarks. The failure of the original oil process, to which we referred, was due precisely to misfortunes (and we may add poor judgment) in its applications, as he states, although the process itself was in

many respects a beautiful one, as we said. We think that our remarks on the subject were sufficiently clear.—EDITOR.]

The San Cayetano Mines, Ltd.

I write to correct some inaccuracies in reference to the San Cayetano company and mines, which appeared in your Guanaquato correspondence in the ENGINEERING AND MINING JOURNAL of May 18 last.

First—The name of the company which has been organized to take over the San Cayetano properties is "San Cayetano Mines, Ltd.," not the "San Cayetano Tunnel Mines Company," as stated by your correspondent.

Second — The Mineral Development Company has absolutely no connection with the San Cayetano Mines, Ltd., or the properties. This error is probably attributable to the fact that the writer was formerly president and is now vice-president of the Mineral Development Company.

W. MURDOCH WILEY.

New York, May 23, 1907.

Saving Clippings

I have just read the article in the ENGINEERING AND MINING JOURNAL of April 20 last, by G. B. Levings, on a system for saving clippings, which is practically the same as I have used for some time. However, I find it better to put only the headings and numbers on the envelopes, and to use an index book where I have room to write the subjects together with what other notes I want. It is easier to refer to the index than to the backs of the envelopes, and there is not so much handling. Besides the articles of interest I also find it of value to clip pictures of machinery both from the mining journals and catalogs and file them in the same way. JOHN K. PRATHER.

Cananea, Mexico, May 25, 1907.

Sampling Lake Superior Iron Ore

I am anxious to know if mechanical sampling has ever been tried on the Lake Superior iron ore, and if so, what sampler has been used?

G. A. B.

Iron River, Mich., May 16, 1907.

[So far as we are aware, mechanical sampling has not been tried in practice on the Lake Superior iron ores. The subject was discussed in a paper by Edward A. Separk, entitled "Some Aspects of the Analyzing and Grading of Iron Ores on the Gogebic Range,"* which is printed in the proceedings of the Lake Superior Mining Institute, Vol. X.]

The use of steel elevator casings has largely increased and nearly every large plant throughout the country is adopting the use of them, in place of the old style wooden casings.

Richness of Cobalt Ores*

BY ALBERT R. LEDOUX†

I have been asked by several members of the Institute what is the grade of Cobalt ores, as determined by my sampling works in Jersey City. Since January, 1905, we have handled at our works 366 carload lots of this ore, and 52 other lots—less than carloads—including what we call nuggets, the nuggets either coming separately consigned or as part of a carload. I do not feel at liberty to state the assays of any particular lots of nuggets, as there have been some delicate questions concerning the value of some of these bonanza shipments. These nuggets, as you are aware, are not pure silver, but run anywhere from 700 parts to 870 parts of silver in the thousand. There are more or less gangue and other minerals associated with the silver, and the metallic silver itself, visibly free from gangue, runs about 950 fine.

Leaving out of consideration the nuggets and native silver, and including only the lots of regular ore, a review of 394 lots sampled, shows that the highest lot ran 7402 oz. of silver to the ton, the next in order being 6909, 6413, 6163 and 5948 oz. per ton.

PROPORTION OF SILVER IN 394 LOTS OF COBALT ORE.

	Per Ct
Over..... 6000 oz.	4 lots (say) 1.0
Between... 5000 oz. and 6000 oz.	3 lots (say) 0.75
Between... 4000 oz. and 5000 oz.	12 lots (say) 3.0
Between... 3000 oz. and 4000 oz.	17 lots (say) 4.25
Between... 2000 oz. and 3000 oz.	39 lots (say) 10.0
Between... 1000 oz. and 2000 oz.	72 lots (say) 18.25
Between... 900 oz. and 1000 oz.	11 lots (say) 2.75
Between... 800 oz. and 900 oz.	7 lots (say) 1.75
Between... 700 oz. and 800 oz.	12 lots (say) 3.0
Between... 600 oz. and 700 oz.	21 lots (say) 5.25
Between... 500 oz. and 600 oz.	10 lots (say) 2.5
Between... 400 oz. and 500 oz.	13 lots (say) 3.25
Between... 300 oz. and 400 oz.	20 lots (say) 5.0
Between... 200 oz. and 300 oz.	44 lots (say) 11.25
Between... 100 oz. and 200 oz.	66 lots (say) 17.0
Less than.. 100 oz.	43 lots (say) 11.0

While the greater part of shipments of cobalt have come to New York, some have gone abroad and many have gone to Copper Cliff.

It seems to me that this is a remarkable showing for a camp so young as Cobalt, the first car having reached our sampling works about the first of February, 1905.

Silver, of course, in point of value is the more important element. The highest percentage of cobalt found in any one shipment is 11.96 per cent., the average being 5.99 per cent. The highest assay for nickel in any car is 12.49 per cent., the average being 3.66 per cent. The highest percentage of arsenic is 59.32 per cent., the average, 27.12 per cent. Mixed with the nuggets are other minerals; sulphides, arsenides, etc., and the gangue matter.

*From advance sheets of the Jour. Can. Min. Inst., Vol. X, Toronto meeting, 1907.

†Mining engineer, 99 John street, New York.

New Publications

TIN DEPOSITS OF THE WORLD. By Sydney Fawns. Pp. 304; illustrated. 6x9 in.; cloth, \$5.50. London, 1907: *The Mining Journal*.

This is the second edition of a work which has won considerable esteem, as is manifest from the fact that a new edition has been required only about a year after the appearance of the first. In the new edition the book has been considerably simplified, a chapter on tin smelting having been added, while all the material has been brought as far as possible up to date. In the latter particular the author is entitled to appreciative congratulation, inasmuch as the information which he presents, including comprehensive statistics of production and commercial movements, is caused to cover the year 1906. The date of his preface—April, 1907—and the date of publication—May, 1907—are documentary evidences of sharp work, while the completeness of the latter is evidence that the author is one who has followed his subject *con amore*.

Having reviewed the first edition in the *JOURNAL*, it is unnecessary to speak at length as to the second edition. The book contains most of the information that anyone needs to know on the subject of tin, and if the abstracts, digests, etc., which necessarily compose its major part, are not always chosen with the nicest discrimination, the student will find that the many and minute references to the original publications are a strongly redeeming feature. Indeed, the author is so generally particular in that respect that it is regrettable to note that in one case, at least, he overlooks to give the reference to a rather extensive quotation. Such criticism as is to be made of the book pertains to the above mentioned lack of discrimination. There is one kind of compilation in which the author carefully filters all his material and presents only the clear filtrate. There is another kind in which the author presents everything as a kind of edited note-book. In some of its parts especially Mr. Fawns' work is of the latter type. However, this is no carping criticism, but simply is by way of explanation, because the author avows as his chief aim the collection of the scattered literature of tin mining. As such an intelligent collection his book cannot fail to be of much practical value to all who are interested in tin mining. We have found it to be a constantly useful work of reference.

THE DESIGN OF WALLS, BINS AND GRAIN ELEVATORS. By Milo S. Ketchum, professor of civil engineering, University of Colorado. Pp. xiv + 394; illustrated. 6½x9 in.; cloth, \$4. New York, 1907: The Engineering News Publishing Company.

Contents: The Design of Retaining Walls. Rankine's Theory. Coulomb's Theory. Design of Masonry Retaining

Walls. Reinforced Concrete Retaining Walls. Experiments on Retaining Walls. Examples. Cost. Design of Coal Bins, Ore Bins, etc. Types. Stresses in Bins. Experiments on Pressures on Bin Walls. Design of Bins. Examples and Details of Bins. Cost. Methods of Handling Materials. Design of Grain Bins and Elevators. Types. Stresses. Experiments on the Pressure of Grain in Deep Bins. Design of Such Bins. Examples. Cost.

This book will be welcomed by the constructing engineer as the first authoritative and elaborate contribution to technical literature on the perplexing subject of the design and construction of coal and ore bins. In the storage, particularly the overhead storage, of large amounts of material, which is called for increasingly in modern practice, the construction of these bins forms a large item in the structural cost of a works. Some of the conditions to be observed in their design are decidedly peculiar, and while various engineers have evolved rules of their own, there have been few well established and generally known rules to go by. Probably in many cases, perhaps the majority, bin structures have been built superfluously strong, like the general constructions of the engineers, masons and carpenters of old. Consequently it is particularly gratifying to have this systematic analysis of the stresses due to granular materials together with a discussion of the principles of design and the details of the structures which are to contain them. The portion of the book which relates to coal and ore bins is the largest, and this will make it appeal especially to mining and metallurgical engineers. They will find the admirable study of retaining walls to be scarcely less useful.

Professor Ketchum is well known as the author of "The Design of Steel Mill Buildings," which won high appreciation because of its eminently practical character. His present work is one of the same order, and will take a high place.

Mine Timbering *

By R. W. RAYMOND

It is somewhat surprising that American technical literature contains so little on the subject of mine-timbering. The explanation may, perhaps, be found in the circumstance that our mining engineers have hitherto had, on the whole, an abundant supply of timber. Perhaps it would be more accurate to say that our American methods were adopted when such a supply was available, and continued after they had become financially unprofitable. Certainly nothing could be more wasteful than the "Comstock" system of square-set timbering, introduced when the virgin

forest around the mines furnished an apparently unlimited amount of heavy timber. And while this system "held out to burn" (as it literally did in many disastrous and prolonged mine conflagrations), its practitioners did not care to study the safer and more economical methods developed in practice under the stress of less favorable conditions. But the Comstock system has broken down by its own weight; and our mining engineers are everywhere studying how to save timber instead of squandering it.

The first step in such a study is to ascertain exactly what is the practice which needs to be improved; and this book, while it contains valuable suggestions, not a few, of improvement and reform, is largely a picture of American practice as it exists. It is another of those compilations, issued by the *ENGINEERING AND MINING JOURNAL*, which have proved so convenient to the readers of technical contributions to that periodical, and to *THE MINERAL INDUSTRY*. But besides the material thus collected for permanent use from these sources, it contains papers from other quarters, notably one by Bernard Macdonald, published originally by the Canadian Mining Institute, and one by Norman W. Parlee, published by the Canadian Society of Civil Engineers. These two, together with the monograph of Wilbur E. Sanders, from Vol. VIII (1899) of *THE MINERAL INDUSTRY*, are, perhaps, the most valuable, as they are the most detailed and elaborate, of the chapters of the book; and they warrant the special mention of their authors on the title-page. But the book contains many other articles of interest and value, as may be inferred from the following list of its contents:

"Mine-Timbering," by Wilbur E. Sanders; "Mine Timbering by the Square-Set System at Rossland, B. C.," by Bernard Macdonald; "Methods of Mining and Timbering in Large Ore-Bodies in British Columbia and Michigan," by Norman W. Parlee; "Mine Timbering in Section 16 of the Lake Superior Mining Company, Michigan," by C. St. G. Campbell; "The Framing of Rectangular Shaft Sets," by Wilbur E. Sanders; "Square-Set Practice at Bingham, Utah," by Louis S. Cates; "Square-Set Timbering at Bingham, Utah," by Claude T. Rice; "Mine Timbering at Lake Superior," by W. R. Crane; "Timber and Timbering in the Cœur d'Alene," by J. H. Batcheller; "Timbering at the Chillagoe Mines, Queensland," by T. J. Greenway; "Timbering in Tasmania," by Mark Ireland.

It will be noted that, although this list includes no account of European practice, it covers a wide range of conditions in this country, and in others similarly situated, and represents both old and new methods. Incidentally, it contains many practical descriptions and suggestions of constructive details, which are pertinent and valuable, whatever be the general system adopted.

*"Mine Timbering." By Wilbur E. Sanders, Norman W. Parlee, Bernard Macdonald and others: New York and London: Hill Publishing Company. Pp. 180; illustrated. Price, \$2.

Personal

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

C. W. Purington has left St. Petersburg, Russia, for East Siberia.

C. W. Pritchett has returned to Denver from a professional trip to Mexico.

Newton Booth Knox was married to Miss Elizabeth Blossom, April 10, in Yokohama, Japan.

S. F. Parrish has removed from Los Angeles to Tonopah, Nevada, where he has opened an office.

Edgar C. Moxham, mining engineer, of New York, is visiting Colorado and Wyoming on professional business.

H. Vincent Wallace, of Nogales, Ariz., has left for New Mexico to examine copper properties in Otero county.

Leonard Lehlbach, manager of the Lepanto Mining Company, sailed from Manila last month for San Francisco.

Arthur W. Jenks will make Portland, Oregon, his future headquarters, where he has opened an office at 242 Washington street.

James P. Colp, late of Los Angeles, is now superintendent of the White Cross Gold Mining Company, at Leastalk, California.

Col. T. G. Bush, president of the Shelby Iron Company, accompanied by his wife, left on June 1 for an extensive foreign trip.

Horace L. Chapman, of Columbus, O., is acting president of the Sunday Creek Coal Company, in place of John H. Winder, resigned.

A. A. Hassan, mining geologist, New York, is in Toronto, Canada. His purpose is to study the mineral deposits of Ontario and Quebec.

Gordon Grant has lately been appointed inspector of construction on the National Transcontinental Railway (Grand Trunk Pacific).

John M. Roan has resigned as manager of the mines of the Sunday Creek Coal Company, and will accept a position with the Cumberland Syndicate.

W. W. Allen has completed his year of service with the Caucasus Copper Company, Ltd., in Russian Caucasia, and is on his way to the United States.

J. Parke Channing, mining engineer, of New York, has gone West on professional business. He is not expected to return until about the end of August.

Francis C. Lincoln, mining engineer and geologist, New York, has left for Alaska on professional business. He will return to New York about August 15.

J. Bishop Tingle, late of the Johns Hopkins University, has been appointed professor of chemistry and mineralogy at McMaster University, Toronto.

M. P. Boag, of the Risdon Iron Works, is erecting a stamp mill and concentrating machinery on the property of the Eastern Gold Bug Mining Company, Masbate, P. I.

Hood McKay, recently with the Lykens Valley Coal Company, has been appointed superintendent of the Lehigh Valley Coal and Navigation Company's mines at Lansford.

J. W. H. Hamilton, of Hamilton & Hansel, New York, is on a business trip to Vancouver and British Columbia. He will probably be absent the greater part of the summer.

W. E. Defty has resigned as consulting engineer to the Mina Juarez company, Sonora, Mexico, and has no further connection with the company in any capacity whatever.

Frank R. Fisher has been appointed general superintendent of the Illinois Collieries Company. He has been connected with the Consolidated Coal Company and other Illinois mines.

J. W. Astley, formerly general superintendent for the Le Roi Mining Company at Rossland, B. C., has recovered his health and will return to British Columbia about the end of May.

O. E. LeRoy has resigned from the Geological Survey of Canada. It is understood he has accepted a position with a mining company operating in the Cobalt district, northern Ontario.

John H. Winder has resigned his position as president of the Sunday Creek Coal Company, of Ohio, to take charge of the coal properties of the Cumberland Syndicate in West Virginia.

C. W. Merrill, superintendent of the cyanide mills of the Homestake Mining Company, of Lead, S. D., has been a recent visitor in New York. He returned west about the middle of this week.

R. R. Hedley, of Nelson, B. C., has been appointed by the Canadian Government to collect data for British Columbia and the West, for a special report on the mining and metallurgical industries.

W. H. Wiley, who reached Whitehorse from California early in May, is examining a number of mineral claims in Whitehorse copper camp bonded during the winter for a Pennsylvania syndicate.

Otto H. Schultz, for thirteen years assistant treasurer and auditor with the Alabama Consolidated Coal and Iron Company and companies absorbed by that company, has tendered his resignation.

Hon. Adam Beck, of the Ontario Hydro-Electric Power commission, has gone to Europe in the interests of the project, to make a thorough examination into electrical methods in Switzerland and elsewhere.

Charles A. Herbert, for some time past chief engineer of the Chicago, Wilmington & Vermillion Coal Company, has been ap-

pointed general superintendent of the company's mines in place of Robert H. Zoller, resigned.

W. W. Leach, of the Geological Survey of Canada, has gone north to resume the work of delimiting the coal and copper areas in the Telkwa Valley section of Skeena mining division, northern British Columbia.

George H. Collins, for 11 years actively connected with mining in the Boundary district of British Columbia, has removed to Vancouver with the object of interesting himself in British Columbia or Alaska coast mines.

W. J. Elmendorf, of Spokane, Wash., manager for a syndicate which last winter purchased the Arctic Chief and Best Chance copper claims in southern Yukon, is at Whitehorse directing development work on these properties.

Morris W. Bush, assistant to the president of the Alabama Consolidated Coal and Iron Company, who has been with the Alabama Consolidated and the companies absorbed, for seven years, has resigned to take service with another corporation in Alabama about June 1.

William Auman, lately superintendent of the Susquehanna Coal Company, has been appointed superintendent of the Lykens Valley and Summit Branch coal companies. D. D. Randall, late engineer, has been appointed superintendent for the Susquehanna company.

Byron N. White, of Spokane, Wash., has resumed mining operations on his Pueblo and Carlisle copper properties near Whitehorse, Yukon Territory. During the winter 700 or 800 tons of ore were shipped to the Tye Copper Company's smelter on Vancouver island, B. C.

D. D. Cairnes, of the Geological Survey of Canada, reached Vancouver, British Columbia, about the middle of May *en route* from Ottawa to Whitehorse, Yukon Territory. He will work north of Whitehorse, particularly in the vicinity of the coal measures in that locality.

Harold C. E. Spence has returned to Steeple Rock, New Mexico, where he will assume the management of the properties in which the chief owners are Wernher, Beit & Co., of London, and Compagnie Francaise de Mines d'Or et de l'Afrique du Sud, of Paris—Mr. Spence himself having acquired the interests of the Exploration Company while in Europe recently.

Dr. Albert P. Low, director of the Geological Survey of Canada, has been appointed deputy minister of mines, in the Department of Mines, which is now being organized under the new law. He will, for the present, remain in charge of the Geological Survey. The title of Dr. Eugene Haanel, Dominion superintendent of mines, will be hereafter director of the mines branch of the department.

Obituary

Eugene B. Willard, Jr., was killed on May 21 by an explosion at the No. 1 Eliza furnace of the Jones & Laughlin Steel Company, Pittsburg. He had been connected with the iron and steel industry during his entire active life, and had been assistant to the general superintendent of the Eliza furnaces since July, 1906.

Orrin W. Potter, for many years prominent in the iron and steel industry of the West, died at his residence in Chicago on May 17. He was born at Rochester, New York, in 1836, and early became identified with the rolling-mill industry of Chicago. It was at the North Chicago works under Mr. Potter's superintendence, that the first bessemer steel rail was rolled in the United States. In 1871 Mr. Potter became president of the North Chicago Rolling Mill Company, and later chairman of the board of directors, and of the executive committee of the Illinois Steel Company. He was heavily interested in a number of important commercial and industrial enterprises.

W. C. Perry, president of the Central Coal and Coke Company, of Kansas City, died in a street car at the Country Club station, near that city, May 27. Mr. Perry had been at the club, where he played golf. He had been in poor health for some time past. Mr. Perry went to Kansas City in 1899 from Fort Scott, Kan. He was United States district attorney for Kansas in Mr. Cleveland's second term. Since he became president of the Central Coal and Coke Company, which is one of the largest coal-mining companies of the Southwest, Mr. Perry was very active in the development of the business in his charge. Also he had other mining interests in Mexico and elsewhere. He was one of the leading citizens of Kansas City, and an excellent type of the Western business man.

Societies and Technical Schools

Columbia University—Graduating exercises of the class of 1907 will be held in the Havemeyer building, on the campus, New York, on Monday, June 10. The chief address will be delivered by Stuyvesant Fish, of the class of '71; his subject will be: "Some Phases of the American Railroad Problem."

Colorado State School of Mines—The thirty-third annual commencement took place, May 24, in Guggenheim hall at Golden, in the presence of a large audience, and 35 graduates received their diplomas. The principal speaker of the occasion was Frank E. Shepard, president of the Denver Engineering Works Company, and the presiding officer was Dr. Alderson, president of the school.

Industrial

The Western Electric Company has completed its new plant at No. 230 Lee street, Atlanta, Georgia.

The Riverside Iron Works, Denver, Colo., has been incorporated with a capital of \$150,000 by A. G. Sutherland, Robert J. Sutherland, A. G. Sutherland, Jr., and Paul G. O'Brien.

The Edison Illuminating Company, Detroit, Mich., has installed in its Beecher avenue sub-station, a 25-ton electric Northern crane, manufactured by the Northern Engineering Works, Detroit.

The Wood Drill Works, Paterson, N. J., are planning a large addition to the present plant. This is made necessary by the remarkable growth of the business; the works being at present six months behind on orders.

The Canada Corundum Company, Ltd., on May 21 removed its main office to the works at Craigmont, Ont. Hereafter no office will be maintained in Toronto. The removal has been found necessary for the more efficient handling of the company's business.

G. U. G. Holman has been appointed manager of the electrical department of the Boston branch of the H. W. Johns-Manville Company. After graduating from the Massachusetts Institute of Technology Mr. Holman was for several years with the Thomson-Houston and General Electric companies.

Trade Catalogs

Receipt is acknowledged of the following trade catalogs and circulars:

Buffalo Steam Pump Company, Buffalo, N. Y. Buffalo Mine Pump. Pp. 4, illustrated, paper, 3½x6 in. 1907.

Cyclone Drill Company, Orrville, Ohio. Hollow Rod and Cable Drills. Pp. 96, illustrated, paper, 6x9 in. 1907.

Link-Belt Company, Chicago, Ill. Revised Price List of Sprocket Wheels. Pp. 15, illustrated, paper, 6x9 in.; April 1, 1907.

Allentown Rolling Mills, Allentown, Pa. Bulletins Nos. 13 and 14. The Aldrich Electric Pump. Pp. 8, illustrated, paper, 6x9 in. 1907.

Ingersoll-Rand Company, 11 Broadway, New York. Booklet 20A. The Temple-Ingersoll Electric-Air Rock-Drill. Pp. 18, illustrated, paper, 3¼x5½ in. 1907.

Robins Conveying Belt Company, 13-21 Park Row building, New York. Bulletin No. 44. A Well Ordered Shipping Department. Pp. 4, illustrated, paper, 4x9 in. 1907.

Construction News

Greenwood, B. C.—The Dominion Copper Company, Ltd., has bought for its Sunset mine, near Greenwood, Boundary district of British Columbia, a Rand 10-drill compound air compressor. A 50-h.p. electric hoist has also been purchased for this mine.

Irondale, Puget Sound, Wash.—The charcoal iron furnace at Irondale, near Port Townsend, has been renovated, 60 men having been employed in reconstruction and the installation of new plant and machinery. It is planned to resume operations, after a shut-down of several years, early in July. The greater portion of the ore to be smelted will come, as before, from Texada island, B. C., from a deposit running about 50 per cent. magnetite. Bog iron will again be obtained from Skagit county, Wash. Jas. A. Moore, of Seattle, is at the head of the enterprise.

Dawson, Yukon—Large quantities of materials are being brought in by the Guggenheim mining companies for use in connection with their water supply system for hydraulicking and dredge-mining operations in the Canadian Yukon. About 1,000,000 ft. of timber for dredge construction purposes has been purchased in British Columbia and one-fourth of this quantity is now in transit between Skagway and the head of navigation on the Yukon river. About 100 large pipes, approximately 70 ft. in length by 4 ft. diameter, have been shipped from the Fraser river (B. C.) terminus of one of the transcontinental railways for Skagway. The pipes were manufactured in Pennsylvania and are probably the largest ever taken into the Yukon.

Rossland, British Columbia—It is understood that the management of the Le Roi mine intends substituting electricity for steam as motive power for its two air compressors, which have a combined capacity of 8000 cu.ft. of free air per min. at sea level. This plant has proved an economical one, using steam, for a test extended over a period of 30 days under ordinary working conditions showed a coal consumption of 1.9 lb. per h.p. per hour, and that air was compressed to 95 lb. per sq.in. at a cost (exclusive of interest and depreciation charges) of \$1.59 per each 100,000 cu.ft. of free air compressed. It is believed that electric power will be still more economical, now that the West Kootenay Power and Light Company has abundant generating capacity at its Bonnington Falls station for all demands likely to be made on it. Should Le Roi Company use electricity for its air compressors, its winding engines—one of 1000- and another of 500-h.p. capacity—will probably be run by compressed air, using steam to reheat the air.

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

May 29—At the first meeting of the creditors of the bankrupt Squaw Creek Mining Company of Gazelle, Siskiyou county, F. A. Wright, of Gazelle, was appointed trustee. The liabilities are \$60,000 and the assets about \$6000.

The case of Sutter county against Johnson, involving the validity of the Caminetti act permitting hydraulic miners to build dams on all streams of this State, has been transferred by the Supreme Court to the July term, and the San Francisco calendar, where it will be heard by the Supreme judges in bank on account of the great importance of the decision of all mining interests of the State.

A complaint has been filed on behalf of the Rawhide Gold Mining Company, alleging that the Dutch Mining and Milling Company had drifted from a shaft on the Dutch mine, at Quartz Mountain, Tolumne county, into territory pertaining to the App mine, which belongs to the Rawhide company, and extracted over 20,000 tons of gold-bearing quartz. The complaint, which is sworn to by W. A. Nevills, states that this stealing of ore had been going on for three years, and places the damage at \$150,000. Plaintiff asks judgment for \$150,000 and costs of suit, and that defendant be perpetually enjoined from entering upon or trespassing upon the property of the Rawhide company.

William Mitchell, an old-time Placer county miner, has begun a suit in the Superior court for the recovery of his mine, which passed out of his hands under a contract, which has not been carried out. Mitchell, who is a man of advanced years, made a contract with Herman Estorff, whereby the latter was to take the mine and pay Mitchell \$25 per month and 25 per cent. of the gross yield of the mine. In event of sale, Mitchell was to receive \$10,000 as his share. Estorff carried out the provisions of the contract, and subsequently formed a company known as the Blue Gravel Mining Company, and deeded the property to the company. Estorff died, and the original contract was carried out for a time, and then the payments to Mitchell ceased.

The Trinity Sugar Pine Company is not to be disturbed in its holding of about 2000 acres of land entered upon before the local Land Office as mineral land, and which has since been developed as timber property. This decision has just been handed down in the charges preferred by Special Agent Prior against George Lambert, William Lambert and William Prat-

tie, who on the day on which they proved up their claims, transferred the property to G. L. Hoxie, the president of the Trinity Sugar Pine Lumber Company. This case has been before the Land Office for five years, and was the outcome of the several persons taking up land as mineral which on further development was shown to be more valuable for timber than mineral, and which land was held by persons who incorporated the Trinity company. The men who entered upon the land spent considerable money doing development work about what is known as "Murphy's Mine."

The decision concludes that "after carefully considering the evidence in this case, we believe that the lands embraced in the above-described entry are not such as could be classed as mineral lands, and that while the circumstances surrounding the making and disposal of this entry seem suspicious, still the preponderance of the evidence in this case does not conclusively prove to our minds that the entry was made in and for the benefit of George L. Hoxie."

The mines of Amalie and Piute districts in Kern county are trying to bring influence to bear to have the United States Geological Survey map out and describe these districts.

The terminus of the Tonopah & Tidewater Railroad will shortly be established at Zeburski, Inyo county, California, two miles north of the old borax works. The line is wholly completed to that point excepting a little work in the big cut, which has been the cause of the great delay. It is intended to do all of the freighting from there to Greenwater until the permanency of the district is assured, and after the main line has been completed to Beatty to connect with the Brock system on the north. The nearest point is at the Lilla C. mine, 12 miles, while it is 28 to Zeburski.

G. J. Moore and others, who own considerable mining ground on the south fork of Smith river, Humboldt county, are about putting in a flume for diverting the stream so as to get at the river bed. It is the intention of the company to construct a flume 12 ft. wide and 4 ft. high by which the waters of the stream will be carried a distance of 600 ft. across a bend, thus enabling the working of the bars there, which are believed to be rich.

Modoc county is coming to the front as a mining section, as well as in stock-raising and farming. The new mining district on the east side of Goose lake, is producing gold in considerable quantity,

and machinery is to be introduced for extensive operations.

The Alto mine, near Knights Ferry, Stanislaus county, recently re-christened the California-Calaveras, is shortly to have a mill of 100 stamps, to be later increased to 200 stamps. The ledge matter between the walls runs from 80 to 120 ft. in width, and while the property has been in the past productive, large reduction works are necessary to make it profitable. The company by purchasing the old Spanish grant and securing a bond on the Ed. Flowers holdings of 15,000 acres, is in absolute control of 37,000 acres.

The matter of the mining strikes at Grass Valley is not yet settled, the mine operators and miners having failed to come together so far, though the mines are still in operation. At Angels, Calaveras county, the mines are still closed down with little present chance of a settlement of the wage question. About 250 of the miners left the town last week for the newer camps of Nevada. Up in Amador county there is an impression that the miners are about to inaugurate a general strike.

Few of the large mines of the county have been paying any big dividends for some time, and any disturbance of the labor conditions is apt to bring on a general shut-down. Recently the miners of Amador made a demand on the mine owners for a recognition of the union, but no direct reply has been made.

Salt Lake City

May 26—The Honerine Mining Company recently levied an assessment of 20c. a share. The minority shareholders have raised a protest and are taking steps to learn more about the company's affairs.

Suit has been instituted in the Federal court by W. W. Adams, a farmer, against the Utah Copper Company to recover damages to the amount of \$5000 caused by the pollution of Bingham creek by tailings from the concentrating mill at Coperton. Water from the stream is used for irrigation on the Adams ranch.

The Ute Copper Company has been formed to develop and operate the old Winnemuc mine in Bingham, which was an important producer of lead-silver ore in the early days of mining in Utah. The officers and incorporators are: Thomas Weir, president; John Weir, Jr., vice-president; J. M. Burt, secretary and treasurer; these, with Henry Catrow, of Salt Lake, and N. J. Catrow, of Miamisburg, O., are directors. The new company will

own about 225 acres of ground. For the present the property will be developed through a tunnel belonging to the Bingham Butte Mining Company.

The strike at the lead-silver smelters of the United States Smelting, Refining and Mining Company, which lasted for a little more than a week, has been settled by the company granting a slight increase in wages. During the trouble a workman who had remained loyal to the company was shot by a strikee.

The Morton Trust Company, of New York, has filed four answers to suits brought against it by the United States Government to cancel patents on certain coal lands acquired by the Utah Fuel Company and the Pleasant Valley Coal Company, on which the trust company holds first mortgage bonds. A denial that any of the land was illegally procured has been entered, also that the Federal court of Utah has jurisdiction in these cases.

A special meeting of shareholders of the Ohio Copper Company was called for May 30 at Lincoln, Neb., in order to authorize a \$600,000 bond issue. The proceeds are being used for the construction of a concentrating mill in Bingham, which will have a daily capacity of 2000 tons of ore.

The mine-owners of the Tintic mining district have granted carmen, trammers and muckers an increase in wages. The miners and other classes of skilled labor received a raise some time ago.

The capacity of the concentrating mill of the New Stockton Mining Company, at Stockton, Utah, has been increased to 100 tons a day and will be placed in commission within a week.

A movement is on foot to organize what will probably be known as the "Utah Society of Engineers." It is proposed to bring into the organization all mining, electrical, mechanical and civil engineers in Salt Lake and other Utah points.

Amended articles of the Iron Blossom Consolidated Mining Company have been filed. The number of shares is increased from 300,000 to 1,000,000. Jesse Knight, of Provo, is president.

The Newhouse Mines and Smelters Corporation, operating the Cactus mine in Beaver county, is taking steps to increase the capacity of the mill to 1200 tons a day, and it is expected that the new equipment will be installed by the end of June. The mine made a net profit in April of \$158,000, the mill having treated an average of 800 tons a day. President Samuel Newhouse says the initial dividend will be paid in July, and that the amount will be at least 20 per cent. of the capitalization.

Denver

May 31—It is probable that the Cripple Creek drainage tunnel will be constructed by a syndicate formed by several employees of the El Paso mine. Seven bids were submitted to the executive committee.

In the Teller County court, suit has been brought by the Doctor-Jackpot Consolidated Gold Mining Company, the Work Mining and Milling Company, and the Rose Maud Gold Mining Company to have 20 acres of ground, covering mineral territory disconnected from the townsite of Anaconda.

During the coming summer a corps of about 20 engineers of the United States Geological Survey will work in Colorado. One of the parties which are now preparing to leave Washington, consisting of seven men, will complete the Livermore quadrangle in the vicinity of Fort Collins and after doing so make topographical examinations in the southwestern portion of the State. A second party will survey a quadrangle in the Holy Cross forest reserve between Leadville and Aspen, while a third will be employed to bring the Colorado Springs quadrangle up to date, making a special survey of the Pike's Peak section.

The Federal grand jury, consisting of several prominent business men, is probing into the coal and timber land frauds, and within the past few days the Porter Coal Company and the Calumet Coal Company, of Durango, have been investigated, while it is understood that testimony is at present being taken in regard to lumber companies operating near Pogosa springs and in northern New Mexico.

The engineers who have been surveying for the extension of the Worland branch of the Burlington system to a connection with the Guernsey branch have completed the work, the line running about 8 miles east of Casper, Wyoming. When the line is built, the haul to Montana points for this system will be shortened more than 350 miles.

Recently the Laramie, Hahn's Peak & Pacific Railway Company completed the first 30 miles of its road. It has just purchased the first passenger equipment, which will run between Laramie and Centennial.

Secretary Pulver, of the State Federation of Labor, has sent a communication to Deputy State Labor Commissioner Swanson, drawing attention to the fact that boys under 12 years of age are being employed at some of the coal mines, 14 years being the age limit by the State law.

Active operations will soon commence at the sulphur mines of the Colorado Sulphur Company, near Creede, and if a sufficient supply of wood can be procured the mill and refinery will be run with double shift.

Trains on the Silverton Northern Railroad are again running part of the way and within a short time the track will be cleared to Animas Forks.

Last week the Sunnyside zinc plant at Eureka, 8 miles above Silverton, was destroyed by fire, the stamps and concentrating tables being saved. The Blake-Morscher electric separators were consumed.

The new mill of the Cañon City Mica Mills and Mining Company has been put in operation. The principal product will be mica flour.

The Colorado Gold Dredging Company is preparing for extensive operations in the Swan river valley, below Breckenridge, and will erect two modern dredging boats. At present five churn drills are at work prospecting the ground.

At Rock Springs, Wyoming, the Central Coal and Coke Company, which with the Union Pacific Coal Company has locked out its men for signing applications to become members of the United Mine Workers of America, has begun evicting the employees from the company houses, and the other company, it is understood, will take the same steps shortly. The mines are shut down indefinitely, which will reduce the output of the State about 4000 tons per day.

Toronto, Ont.

May 31—Some excitement has been created in Roblin, Manitoba, over the discovery of iron deposits within a few miles of that town. Claims have been staked by M. J. Galvin, Toronto, and Anthony Wagner, of Buffalo, N. Y., in the Boggy valley adjoining the line of the Canadian Northern Railway.

Transportation conditions at the Cobalt camp have been improved with the advance of the season and shipments for some time are expected to be heavy. Development work on a number of low-lying properties has been much interrupted by water. A good deal of machinery is now arriving and being installed, but the difficulty in obtaining anything like prompt delivery continues to be a serious drawback.

The rush up the Montreal river is still in progress. Last week fully 100 canoes per day left Latchford, carrying prospectors and mining men, and the total number who have gone into that region this spring is estimated at about 2000. Transportation will be facilitated this season by the placing of steamers on the route. They will be put on three navigable stretches of the river, separated by short portages.

Johannesburg

April 15—The returns for March show that the Transvaal produced 538,497 oz. fine gold, valued at £2,287,391, of which the Rand contributed 520,163 oz., valued at £2,909,510. The record output was that of last December, when 550,167 oz. were declared. It is likely that this will remain the high mark for some time to come. During March there were 8540 stamps at work in the Transvaal, of which 8190 were working on the Rand. Twelve of the leading producers recovered 12,000 oz. and over, the first on the list being the Simmer & Jack, which won 23,143 oz. fine gold in March. The Robinson was second with 22,259 oz.

Mining News from All Parts of the World

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

THE CURRENT HISTORY OF MINING

Arizona

YAVAPAI COUNTY

H. J. Beemer Company—A new strike is reported to have been made at the Storm Cloud mine, property of this company, 10 miles south of Prescott. A ledge was cut and opened for a distance of 20 ft., showing an average width of over 3 ft., and 20 per cent. copper, besides some gold and silver.

Mother Lode Copper Company—This company, operating in the Copper Basin mining district, has uncovered a shoot of ore at a depth of only 16 ft., the width has not yet been determined. An average of the assays is 12 per cent. copper and \$6 gold.

New England & Arizona Gold and Copper Company—This company operating in the Big Bull mining district, has opened a new body of ore, in its shaft at a depth of 225 ft.

California

AMADOR COUNTY

Fremont Consolidated Mining Company—At this mine, Drytown, Arthur Goodall, manager, another strike of rich ore has been made. It is "candle-box" ore.

BUTE COUNTY

Butte Dredging Company—This company has incorporated with a capital stock of \$50,000 with the following directors: H. D. Smith, W. S. Noyes, Bert Noyes, E. W. Stebbins and F. Cornwall.

CALAVERAS COUNTY

Blue Gravel—San Jose men have an option on this property and will soon commence work with Chris Anderson as superintendent.

EL DORADO COUNTY

El Dorado Water and Deep Gravel Mining Company—The El Dorado ditch and extensive water rights of this old company will be transferred this month to the Sierra Water Supply Company.

INYO COUNTY

Black Cañon—There is 4 ft. of good ore in the tunnel being run to intersect the foot of the winze.

Southern Belle Mines Company—The New Year shaft is being sunk with machine drills. Water contact will be met at 500 feet.

MONO COUNTY

Golden Eagle—J. B. Miller is about to begin work on this group at Millerville, between Masonic and Bodie. A good ledge has been found in one of the claims.

Hobo—This new camp is six miles east of Fletcher and one mile south of Summit station. High-grade free gold rock has been found there by two "hobos." There is plenty of wood and water.

Nevada-Masonic Mining and Milling Company—This company at Masonic will put on a considerable force of men. Geo. H. Jones, of Lindgrove, Iowa, is president.

Skookum—This section of the county 20 miles south of Bodie is attracting attention. On the Casa Diablo active work has been in progress three years; south of this is the Killiam property. The mineralized zone is a large one. The town of Skookum is near Antelope Springs, and 10 miles west of Hammel on the Nevada-California railroad.

NEVADA COUNTY

Idaho-Maryland Mining Company—Bray Wilkins, manager of this property, has gone East. More money is needed to unwater and retimber the old workings.

Kenosha Mine—Geo. W. Root has gone East to see about larger hoisting and pumping facilities.

Morning Star—There will be an early resumption of operations at this mine at Cherokee. Oakland, California, men have taken hold of it.

Pennsylvania Mining Company—The new big pumps of this company will increase the pumping capacity 1200 gal. per minute.

Union Blue Gravel—In this old property at North Bloomfield, J. H. O'Connor superintendent, a rich body of gravel has been struck.

ORANGE COUNTY

Southern California Coal Company—This company is opening by tunnels a newly discovered bed of coal.

PLACER COUNTY

Rawhide—This mine near Towle is to have a new tunnel 400 ft. lower than the old one. Miners are scarce or more men would be employed.

Tadpole Extension—In this mine, Todds Valley, a rich strike has been made.

Three Queens—From this mine near

Forest Hill, owned by Geo. Wingfield, of Goldfield, high-grade ore continues to be taken. Nuggets and specimen ore to the value of \$30,000 were brought to Auburn from the mine this week.

SAN BERNARDINO COUNTY

Avawatz Copper and Gold Mining Company—This company is now operating in the Avawatz range, and has been taking out ore for shipment to the Salt Lake smelter.

Big Five Mining Company—This company has acquired by purchase the old Gold Bronze mine at Vanderbilt.

Crackerjack Bonanza—This mine, Crackerjack district, has commenced shipping ore to the smelter at Roswell, N. M.

Golden Harvest Mining and Milling Company—This company has purchased the Golden Harvest mine at Yemo, four miles from Mannix station on the Salt Lake route.

Mountain Copper Company—The bunkers on the new railroad to the Hornet mine are nearly completed, and ore shipments to the Keswick smelter will soon begin.

SHASTA COUNTY

Stauffer Chemical Company—This San Francisco company has bonded from the Phoenix Securities Company, of New York, the Summit Consolidated, Graves Consolidated and North Mammoth Extension group in Little Backbone district west of Kennett.

SIERRA COUNTY

Homestake—Ben Haskell, of Forest, is planning to put up a cyanide plant on this mine on the Rock Creek section.

Nellie Bly—Oregon men are negotiating for this gravel mine on Oregon creek, three miles from Forest.

Sierra Buttes Mine—This old property, now owned by E. A. Hayes and associates of San Jose, is about to be started again for the summer.

Colorado

LAKE COUNTY—LEADVILLE

Actna—Iron ore of good grade has been opened at three levels in this property, Carbonate hill. An upraise is being carried to open a body of manganese ore. The shaft is now down 350 ft. and is in the quartzite.

Aurora Mining Company—This company, operating toward the head of Iowa

gulch on the divide between Iowa and Empire gulches, during the week took the Ready Cash into the combination. The main work is being carried on through the Chicago tunnel, which is now in 800 ft. and will be driven another 500 ft., the object being to develop the rich gold veins that extend vertically through the quartzite.

Badger Shaft—This property of the Triangle Mining Company, Adelaide park, has resumed work. A drift is being driven from the 820-ft. level to the south to catch the orebody from south Iron hill. The drift is in the lime-porphry contact.

Boulder Shaft—This shaft of the Little Evelyn Mining Company, South Evans gulch, has been sunk 38 ft. since it was unwatered and is now 420 ft. deep. The vein of ore found at the bottom of the shaft continues; it is probable that the shaft will be sunk 50 ft. deeper.

Buckeye—Two months ago a body of ore was opened in this property, Fryer hill, but it only proved a pocket. The lessees started another drift more to the east and after driving a little over 100 ft. caught the carbonate orebody in place. The ore channel has been opened up for nearly 5 ft. and shows a body 4 ft. wide. The strike proves the continuity of the Fryer hill oreshoots to the north and extending into Big Evans gulch.

Cosmopolitan Tunnel—The owners are driving on the tunnel, Birdseye, following a small streak of ore that runs 8 per cent. copper and 1½ oz. gold per ton. In the same section other properties have resumed work for the season. At Big English gulch the Eagle shaft is being sunk deeper to catch the ore shoot that was opened last fall in the Copper Belle shaft.

Fitzhugh—The body of ore in this property, East Fryer hill, is widening and is shipping 35 tons daily. The ore comes from the 450-ft. level. From the same level the Jimmie Lee, adjoining property, is being worked, and last Saturday a splendid body of ore was opened, some of it running high in silver; from this ore channel 25 tons of silicious ore is being shipped daily.

Forepaugh—Two sets of lessees went to work on this property, Fryer hill, during the week, at the upper and lower levels. From the former silicious ore is being shipped and from the latter sulphides. The American, adjoining the Forepaugh, is hoisting 20 tons daily of sulphides.

Helena—Two new boilers have been installed at this property, Iowa gulch, and the shaft will be sunk another lift. At the 500-ft. level a good body of sulphide has been opened.

Iron Silver Mining Company—Arrangements have been made with the United States Smelting Company and a zinc smelter at Coffeyville, Kan., to take 1000 tons of zinc per month from the Tuscon. The

company could easily ship 250 tons of iron daily, but the smelters have restricted the output to 75 tons daily.

Murphy Shaft—Considerable iron is being shipped from this mine, Rock hill, with an occasional car of high-grade lead carbonates. The lessees on the Crown Point are shipping steadily an excellent grade of oxidized iron. Shipments from all of the properties on the hill are being curtailed on account of the bad condition of the roads.

Indian Territory CHOCTAW NATION

Le Bosquet Mining Company—This company which operates mines south of Alderson, is building a track to connect with the Choctaw Electric railroad which line takes the coal to Krebs on the Missouri, Kansas & Texas road.

Oil at Morris—Several new oil wells have been struck recently at Morris and the town is thronged with oil men. The oil is of the same quality as Muskogee oil.

Missouri

ZINC-LEAD DISTRICT

Glass Lead and Zinc Company—A tract of 160 acres of the Big Stick Mining Company belonging to Geo. H. Davis, of Joplin, located in Center Creek valley north of Webb City, has been sold to this company. The new owners are developing the land. Mr. Davis, prospected the land by drilling and found ore in the sheet formation in 13 consecutive holes. The company intends this summer to erect two large concentrating plants and will sublease a part of the land on which other mills may be erected.

Pitchfork Mining Company—Senator Benjamin R. Tillman, of South Carolina, has become interested in the Joplin district. A short time ago Burt W. Lyon acting for Senator Tillman secured a lease on the Ideal Mining Company's lease south of Joplin, and the Pitchfork Mining Company was immediately formed. Last week drilling was begun and at a depth of 25 ft. the drill encountered a body of zinc ore. The hole was continued with the hope of finding a deeper run of ore.

Montana

BUTTE DISTRICT

Coalition—The ore output is increasing gradually, the present record being about 1800 tons a day. Of the total, 1500 tons is raised through the company's own shafts. The remainder comes from the Nipper, the Red Penn and another vein, the contents of which are sent to the surface through the Parrot and Pennsylvania. The company, in conjunction with the Butte & Boston, is equipping the new shaft on the Tramway with a hoisting engine good for 3500 ft. and adding another

compartment to the shaft, making it three. The Boston & Montana Company is raising out 300 ft. of ground directly under the bottom and is driving toward the perpendicular from the 1400-ft. level of the Leonard with a view of raising another 100 ft. It is predicted that by Jan. 1, 1908, Coalition will be in shape to mine not less than 2500 tons of ore a day. Its Corra mine is not looking well. Its output is now about 150 tons a day.

Davis Daly—Work has been resumed in the crosscut going south of the 1800-ft. station of the Original. Up to May 27 the vein struck a few weeks ago had been crosscut 45 ft. and contained about 4 ft. of commercial ore. Development is going ahead in all of the other shafts of the company.

North Butte—Ore production of this company aggregates between 1300 and 1400 tons per day. The face of the crosscut driving north of the 1600-ft. level of the Jessie to intersect the Berlin vein advanced 168 ft. during April. The Berlin vein is still about 300 ft. from the face of the crosscut.

MISSOULA COUNTY

Missoula, Montana—The Cape Nome Copper Mining Company, operating copper-silver properties east of Missoula, is contemplating the erection of a 50- or 100-ton concentrating plant within the next few months. H. T. Wilkinson, Missoula, Mont., is secretary and treasurer.

Nevada

ESMERALDA COUNTY—GOLDFIELD

Combination Extension—The main shaft has now reached a depth of 320 ft., and the men are working in three shifts. The country rock has considerably changed lately. The mine is well equipped for quick sinking.

Florence—The Mohawk-Florence Leasing Company, which is operating a block on this property, has opened a vein 6 ft. in width, showing free gold, and yielding high assay returns. About 20 tons of high-grade shipping ore is being raised daily. The shaft is equipped with a hoisting plant and a 80-h.p. compressor.

Frances Mohawk—The shaft is now 420 ft. in depth and the crosscut from the 300-ft. level is in 65 ft. from the shaft. Preparations are being made to start a crosscut at the 400-ft. level and to resume shaft sinking to the 500-ft. level.

Jumbo Extension—The Mohawk-Jumbo Leasing Company, which is operating a lease on this property, has cut a rich vein 6 ft. in width at the 415-ft. level. No shipments of the ore will be made until the vein is developed so as to yield a steady output.

Sovereign—The shaft has reached a depth of 185 ft. and is progressing at the rate of 3 ft. per day. The water trouble formerly experienced has been overcome

by the pumps. The shaft is still in the orebody, which, while of low grade, is of great width.

NYE COUNTY—BULLFROG

Belle—The vein in the 150-ft. level is over 2 ft. wide. None of the ore is of shipping grade; but the assays are encouraging. The shaft will be carried down to the 300-ft. level before any extensive drifting is undertaken.

Gold Reef—The tunnel in this mine, which is situated in the Mayflower section of the field, is in ore-bearing rock, and it is believed that the vein will be cut within the next few days.

Mogul—The shaft has cut a vein at a depth of 30 ft. Numerous assays show it to be of milling grade. Drifting will not be commenced until the 100-ft. level is reached.

Oasis—The shaft has reached a depth of 75 ft. and is in ore all the way from the surface. The ore assays well, especially near the bottom of the shaft, where free gold is showing. The vein has been prospected for over 2500 ft. on the surface and is gold-bearing all that distance. The working force has been increased.

Plutus—Development operations in this mine are being actively carried on under the supervision of F. W. Nash. Rich ore, which resembles the Tramp ore, is showing in several parts of the workings.

NYE COUNTY—MANHATTAN

April Fool—The Frank Davis Leasing Company has opened a bonanza in this well known mine. The quartz is so rich that it is sacked and stored away as soon as it is broken down. Cabinet specimens of wire and crystal gold are frequently picked up after a shot has been fired. This find has greatly stimulated the development work in the adjoining mines.

Crescent-Eureka—A strike has been made in the main shaft at a depth of 60 ft. The ledge is over 10 ft. in width and carries free gold from wall to wall. Assays run from \$500 per ton into very high figures.

Silver Pick—Active development work is being done on this property, with the view of picking up the rich vein which is being developed in the Independence Consolidated adjoining.

Thanksgiving—This company has secured a hoisting plant from Goldfield for the development of the recent rich find. A large force of men has been engaged to erect the plant.

NYE COUNTY—TONOPAH

Ore Shipments—Shipments over the Tonopah Railroad for the week ending May 23, were: Tonopah Company, 550 tons; Belmont, 400; Tonopah Extension, 220; Montana-Tonopah, 145; Jim Butler, 41; Midway, 40; total from Tonopah,

1396 tons. From Goldfield shipments were 984 tons, making a total of 2380 tons. In addition the Tonopah company sent 3450 tons to its mill.

Oregon

BAKER COUNTY

Cornucopia Camp—The Queen of the West, under the management of Robert Glen, has begun to drift for ore. In the upper tunnel is a good showing of ore.

Last Chance—This mine, lying to the south of the Queen of the West, and parallel to it, has a ledge from 3 to 14 ft. wide. The property is a part of the Searles group, and is about 40 miles from Baker City.

Butler & Platts Company—H. S. Sims, of Arizona, has formed a partnership with Butler & Platts, in Baker City, and is interesting himself in the Baker copper belt.

Cox Property—An exhibit of high-grade copper ore from the Goose Creek Camp, 25 miles east of Baker City, aroused great interest in this camp. The ore was taken from the Cox property, now being operated by the Eagle Mountain Copper Mining Company under the direction of William Henry Harris, of Indiana.

Don Juan Mine—To satisfy debts this property in the Green Horn Camp, has been sold at public auction to Guy L. Lindsay, including five claims, mill site, ten-stamp mill, engine and boilers.

Lockwood Group—George W. Boggs has returned from Weiser, Idaho, where he secured a bond on the Lockwood Group of claims in the Seven Devils copper-mining country bordering on the Kleinschmidt road, near the Peacock mine.

Ronbaugh Group—David Ronbaugh, one of the owners of the group of five claims on Snake river known as the Ronbaugh Group, has sold his half interest for \$2500 in cash.

South Dakota

CUSTER COUNTY

New York Mica—Most of the new machinery for this mine has arrived. It includes four new tubular boilers and electric engine of 250 horse-power.

Saginaw—This company has purchased the Phyllis and Solon groups of claims, adjoining its own ground, about 9 miles northwest of Custer. Ten claims are included in the two groups.

LAWRENCE COUNTY

Branch Mint—A strike of good ore is reported on this property in the Galena district. Manager Handin is expected home from the East in a few days.

Homestake—The fire in this mine has been extinguished and the unwatering has been begun. The stamp mills have been put in operation again, 600 out of the

1000 stamps being now in use. These are at work on surface ore; but as soon as the water has been lowered to the 400-ft. level ore will be taken from that point, where there are large accumulations already broken in the stopes, which is of better grade than the surface ore that is now being worked. After that the work of unwatering will proceed slowly, inasmuch as a large part of the hoisting capacity will be employed in supplying the mills, but it is expected that the mine will be entirely unwatered in the course of three or four months.

Homestake South Extension—Drifting and sinking are both in progress. It is not expected, however, to open up much ore until the 300-ft. level is reached. The shaft is now about 175 ft. deep. Electric machinery, consisting of a hoist and air compressor, and other machinery will be put in next month to replace the steam plant now in use.

Dakota—This company holds its annual meeting on the 18th of June, and it is probable that nothing in the way of a Bald Mountain merger will be accomplished before that time.

PENNINGTON COUNTY

Auburn—The new 75-ton concentrating plant has been started and two drills are operating in the tunnel. The mill stands 300 ft. from the mouth of the tunnel and the ore will be carried from that place to the bin by means of a cable tramway.

Texas

JEFFERSON COUNTY

The Baltimore *Manufacturers' Record* says that a discovery of extensive sulphur and salt deposits not far from Beaumont is reported to have been made by Patillo Higgins, of Houston, who has organized the Beaumont Native Salt and Sulphur Company to develop the minerals. It is stated that the company has purchased 1200 acres of land between Beaumont and Pine Island. They are said to cover an area of about 400 acres, the sulphur being from 10 to 11 ft. below the surface and the salt about 15 ft. It is understood that the company has contracted for the necessary mining machinery and has arranged for transportation facilities. Wharves will be constructed on the Neches river, it is stated, to which the product will be carried by rail and shipped thence by barges to Port Arthur and Sabine for export.

MAVERICK COUNTY

Lamar Coal Company—This company has been for some time past working on a tract of 7500 acres of coal land near Eagle Pass. The seam is 7 ft. thick, and the coal is of good quality. A shaft is being sunk and the company expects to ship coal by July.

Olmos Coal Company—This company has acquired 3500 acres of land near Eagle Pass, where there is already a small mine

in operation on a 6-ft. seam of bituminous coal. Two more openings are to be made. L. M. Lamar, Sabinas, Mexico, is the chief stockholder.

Utah

BEAVER COUNTY

Frisco Contact—A drift from the 600-ft. level of the shaft has encountered ore of a milling grade. The mine was recently equipped with an 80-h.p. hoist and a six-drill compressor.

Revenue—The compressor plant installed at this property several months ago is in operation. Some extensive bodies of mill ore have been developed in this mine. L. G. Burton, of Salt Lake, is manager.

Utah Amalgamated Copper—High-grade sulphide ore has been encountered in the tunnel through which this mine has been developed. One assay showed as high as 800 oz. silver, 40 per cent. lead and 4 per cent. copper. Dr. C. Watkins and associates, Boston, own a controlling interest.

IRON COUNTY

Jennie—The mill on this property, Gold Springs, is treating about 40 tons of ore per day. C. A. Short, of Gold Springs, is manager.

SALT LAKE COUNTY

Bingham Mary—The initial car of ore from this property in Bingham will be in the market within a week.

Castro-Grecian Mining—This company, composed entirely of Greeks, is preparing to develop a property in Bingham situated near the ground of the United States Mining Company. Dr. P. Kassmikos, of Salt Lake, is president.

Markham Gulch Mill—This plant is in operation and is treating low-grade ore from the Utah Apex mine.

SUMMIT COUNTY

Daly West—This company has resumed operations in its Quincy mine; ore is again being marketed.

Park City Ore Shipments last week amounted to 3,681,760 lb., as follows: Daly Judge, 1,120,000; Silver King, 1,119,760; Daly West, 1,100,000; Ontario, 342,000 pounds.

Scottish Chief—Work has been temporarily suspended at this property.

Washington

FERRY COUNTY

Advance Mining Company—A 7-ft. vein has been intersected by the adit, 860 ft. in from the portal, at a depth of about 400 ft.

Colorado—The company in the San Poil district, is resuming operations on the adit level, where the vein had been cut about 200 ft. from the portal when work was suspended.

Central Mining Company—A new tunnel is in 240 ft. on the Umatilla mine, San Poil district which is intended to drain the shaft and explore the vein on the 100-ft. level. Jasper King, of Keller, is the local manager.

Copper Key—A large body of iron sulphide ore has been intersected in a cross-cut from the raise, above the No. 2 tunnel level.

Gwin—A blind lead, 10 ft. in width, has been intersected in the tunnel, over 200 ft. from the portal, at about 200 ft. deeper than the bottom of the shaft.

Gold Seal—An Iowa company has taken over this mine, on Bridge creek, and is hiring men to begin operations. S. L. Boyer, formerly of Republic, is manager.

Lone Star and Washington—The British Columbia Copper Company, now owning this mine, is opening it up in new places.

Lucille Dreyfus—The troubles relative to the fraudulent issue of stock by Eugene Kressley, the former secretary of the company, have been settled, and the mine, near Danville, is being prepared for the resumption of operations.

Nonparcil—Two shifts are driving a new tunnel.

Oversight—A pumping plant has been installed, and the Pin Money shaft is being drained, to resume sinking.

Stray Dog—The first carload of ore shipped by the new management, to the Everett Smelter, netted over \$80 per ton.

Winnipeg—The compressor plant has been completed, and power drills will be in operation in a day or two.

OKANOGAN COUNTY

Apache—The tunnel has intersected the vein, crossing about 3 ft. of ore.

Copper World Extension—The vein on the 200-ft. level improves with development. The company is planning to build a tramway from the mine to Sinlahekin valley.

Pinnacle—The lower tunnel, which enters Palmer mountain near its western base, has cut a vein of iron sulphide ore 8 ft. wide.

Security—Work on this property has been resumed after a long period of idleness.

Grant Consolidated Copper—Articles of incorporation have been filed, the present directors being Geo. A. McLeod, J. A. McLean and John Brown. The capital is \$1,650,000. The company has purchased the Double Standard, American Girl, Colon, Chalcopryite and 10 other claims on Copper mountain, near Chesaw.

Old Germany—The tunnel was driven 246 ft. to the vein, which has since been followed into the hill over 100 ft.

Canada

ONTARIO—ALGOMA DISTRICT

Superior Copper Company—This company, which has expended several hundred thousand dollars in developing the Superior Copper mine, will build a large concentrating plant at Sault Ste. Marie, Ont., just west of the plant of the Lake Superior Corporation and will also construct a railroad 5 miles in length to connect the mine with the Algoma Central railway. The plant will have a capacity of 400 tons per day.

ONTARIO—COBALT DISTRICT

Shipments of Cobalt ore for the week ending May 25 were as follows: Buffalo, 82,770 lb.; Coniagas, 146,000; Nipissing, 247,640; O'Brien, 126,220; Trethewey, 222,400; Cobalt Central, 40,000; Townsite, 6000; total, 871,090 lb.

Duchess—On this property located near the Timiskaming mine, Cobalt, seven veins in all have been discovered. Upward of 1000 ft. of stripping has been done.

McKinley-Darragh—The new Nipissing vein, Cobalt, was struck on May 29 and large quantities of ore are being taken out.

Nipissing—A new vein found on the property, Cobalt, is said to exceed in value anything so far discovered there except vein No. 49. It varies from 4 to 12 in. in width. A 600-lb. nugget taken from it is said to show 70 per cent. silver.

Penn Cobalt Silver Company—An important find is reported on the location of this company, Cobalt, in the 10th concession of Lorraine township, on the shore of Moose lake. An opening in the cliff extends back about 35 ft. and is about 26 ft. wide, the walls appearing to be a continuous body of vein matter. Samples show silver content as high as 268 oz. to the ton.

Progress—An 8-in. calcite vein, the ore from which assays about 56 oz. to the ton, has been struck in the course of drifting from the main shaft at 72 ft. Three other veins have been discovered on the property, Cobalt, and about 500 ft. of stripping has been done.

Silver Queen—On May 25 a 4-in. vein of high-grade ore was struck in cross-cutting at the 75-ft. level.

ONTARIO—MANITOU LAKE DISTRICT

Detola Development Company—John Burns, in charge of operations for the company, is arranging for the erection of camp buildings. A contract has been let for sinking the shaft 100 ft. deeper.

Laurentian Gold Mine—The drifting carried on at the 200-ft. level shows that the zone of rich schist, which at 85 ft. was between 35 and 40 ft. long, is enlarging with depth. Fine samples of gold have been discovered on three properties lying northeast of the Laurentian.

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, June 5—The coal trade in the East shows nothing new or of special interest. Demand for steam coal continues good, and the continued cold and stormy weather has made the call for domestic fuel an unusually prolonged one.

In the West much the same conditions prevail as were noted last week. Transportation is generally good, and mines are working freely. The Lake trade alone is rather slow.

Pittsburg coal operators are threatened by a strike. The miners have taken exception to the use of the Pate coal dump, which is used on the tipples to facilitate the screening of coal. The miners allege that the dump, which is operated by steam, has a tendency to break the lump coal. As they are paid on the basis of 1¼-in. screened coal, the miners believe they are losing much of their work. An attempt to arbitrate the matter did not succeed. The question remains unsettled whether the coal is broken up in the handling, but the operators took the stand that the burden of the proof now lies with the miners to prove their contention. The operators offered to demonstrate that the coal did not suffer from the new method and the coal miners failed to meet the arbitrators. Hence, it is with some hesitation that the miners announced they would strike for the abolition of the dump or an increase in pay per ton of coal screened. The latest news is that an arbitration has been agreed upon.

COAL-TRAFFIC NOTES

Shipments of coal and coke originating on the Pennsylvania Railroad Company's lines east of Pittsburg for the year to May 25 were as follows, in short tons:

	1906.	1907.	Changes.
Anthracite.....	1,596,353	2,227,785	I. 631,432
Bituminous.....	12,844,600	14,934,866	I. 2,090,266
Coke.....	5,134,928	5,602,513	I. 467,585
Total.....	19,575,881	22,765,164	I. 3,189,283

The total increase this year to date has been 16.3 per cent.

New York

ANTHRACITE

June 5—In the anthracite-coal market the demand for small sizes has become very sharp, and can be met with difficulty by the producers. The demand for all other sizes is also very good. The car supply while not adequate is improving slowly.

On June 1 prices advanced 10c. per ton on all sizes and quotations are: broken, \$4.45; egg, stove and chestnut, \$4.70. Quotations on small sizes are merely nominal, being about as follows: pea, \$3.10; buckwheat, \$2.60; rice, \$1.95; barley, \$1.60. All f.o.b. New York harbor.

BITUMINOUS

The Atlantic Seaboard soft-coal trade shows improvement, there being greater demand and somewhat higher prices. This condition has been developed to a great extent by the continuous shortage of transportation facilities on land and water. Vessels are being chartered from two to three weeks in advance "to arrive" in order to secure them. Additional factors are the adverse weather recently experienced and the considerable number of vessels formerly in the coal trade which have taken outside freights.

Trade in the far East is calling for considerable quantities of coal which producers are not able to ship in the volume demanded and accumulations are piling up in shippers' hands. Eastern consumers are paying winter ocean rates to secure vessels.

Trade along the Sound is showing a disposition to take on large quantities of coal, and this tendency is increasing as anthracite prices go up each month. Sound barge rates continue high. New York harbor trade shows signs of improving, there being a steady demand for higher grades of coal. Good grades of steam coal are now selling around \$2.70@2.75 per ton f.o.b. New York harbor ports.

Transportation from mines to tide is fairly up to schedule and more regular. Car supply is up to demand generally.

In the Coastwise trade vessels continue to be scarce and in great demand and this condition is apparently growing more severe. Current rates are as follows: Philadelphia to Boston, Salem and Portland, \$1.05@1.10; Providence, New Bedford and the Sound, \$1; Lynn and Bangor, \$1.30; Portsmouth, Gardiner and Saco, \$1.15. Bath, \$1.10; with towages where usual.

Chicago

June 3—The coal market is in strong condition, generally, for the beginning of summer. Both steam and domestic coals have sold well in the last week, the activity in domestic grades being chiefly due to cool weather. There is no great accumulation of any coal on tracks, and prices

are fairly firm, while sales are good for nearly all coals. Anthracite sales in the last week of May were comparatively heavy, the discount for the month proving attractive. Buying was well distributed, both city and country sales being increased.

In Western coals, screenings are increasing in strength and prepared sizes are weakening, though slowly. Lump and egg from Illinois and Indiana mines sell for \$1.80@2.55; run-of-mine for \$1.60@2.25, and screenings for \$1.45@1.75. Brazil block brings \$2.65.

Eastern coals are generally in good condition. Smokeless holds up to \$3.35 for run-of-mine, the list price; Hocking is reported selling well at \$3.15; Youghiogeny is apparently hard to get, and sells at \$3.20 for ¾-in.; Pittsburg No. 8 also is scarce, bringing the same as Youghiogeny. The absence of demurrage coal is a gratifying feature of the market.

Indianapolis

June 3—The chief—and unusual—feature of the coal-mining industry in this State is the steady and continuous demand for domestic use coal. Never before were furnaces and heaters kept running from October until June. Of course, this demand has not been heavy, but the operators and shippers say it has been steady and not only from the cities, but from the country towns as well. The operators say that coal is going forward also for the stocking up for another season, consequently, the mines are now being operated to their fair capacity.

The joint conference of the executive boards of the Indiana Operators' Association and the United Mine Workers was held in Terre Haute, May 31 and June 1. After two days' consideration of a number of disputes which could not be settled by the local committees, nor the State officials of the two organizations, the joint conference adjourned without agreement, and without date for another conference. Ordinarily, the situation might be considered strained, but both sides say the disputes will yet be settled. In all cases the grievances were presented by the men.

The Brotherhood of Coal-Hoisting Engineers has served notice on a number of operators that they must cease to employ non-licensed engineers if they wish to avoid trouble.

The Indiana Railroad Commission has been notified that the Vandalia Railroad

has ceased adding a switching charge on coal consigned to Indianapolis, from the southern Indiana coalfields. Hitherto the Vandalia has made a switching charge of 7c. a ton on Indiana coal delivered off its own tracks in Indianapolis.

The new Indiana State law, taking effect June 1, provides that in ordering empty cars all coal operators must make such orders in writing to the railroad companies on all cars to be loaded within the State. Written orders must be filed with the local agent in order to keep a complete record and the time such cars are furnished by the railroad company. Orders can no longer be taken over the telephone, telegraph or orally as heretofore.

Hartshorne, Ind. Ter.

May 30—Work for the mines along the Rock Island promises to be very good the coming summer; the railroad as well as the coal dealers are storing large quantities of coal. At present there are plenty of cars to run all the mines full time, the only thing that is holding back an increased tonnage being the scarcity of miners.

Pittsburg

June 4—A strike of coal miners that threatened to tie up the entire Pittsburg district was scheduled for yesterday, but was averted. The trouble was due to dissatisfaction over the installation of the Pate dump at a number of the mines. The miners contend that the shaking of the coal means a decrease in earnings and is a violation of the agreement. A conference was held on Friday after the strike order had been issued and it was agreed to submit the question to arbitration. The mines will continue in operation pending the result.

The demand continues good and prices are firm and unchanged on a basis of \$1.20 a ton for mine-run coal at mine. For the first time in the recollection of the oldest river coal operator a "June rise" came without any coal of any consequence to go out. The rivers have been navigable almost constantly since the opening of the year and the coal has been sent to the lower ports as rapidly as it was loaded. A heavy shipment was made a week ago and this week there was scarcely enough ready to make two fairly good tows.

Connellsville Coke—There is no material change in the coke market and prices for prompt shipment remain low. Spot furnace coke has sold as low as \$2 a ton but quotations this week for June range from \$2.15 to \$2.25 and for last half \$2.50 seems to be the minimum. Foundry coke for prompt delivery remains around \$3. The *Courier* in its summary for the week gives the production in both fields of the Connellsville region at 421,278 tons and the shipments

aggregated 12,217 cars distributed as follows: To Pittsburg, 4,892 cars; to points west of Connellsville, 6,596 cars; to points east of Connellsville, 729 cars.

Foreign Coal Trade

Exports of coal and coke from the United States for the four months ending April 30, are reported as below by the Bureau of Statistics of the Department of Commerce and Labor:

	1906.	1907.	Changes.
Anthracite.....	493,721	687,539	I. 193,818
Bituminous.....	2,116,607	2,542,393	I. 426,386
Total coal.....	2,609,728	3,229,932	I. 620,204
Coke.....	245,792	285,985	I. 40,193
Total.....	2,855,520	3,515,917	I. 660,397

These figures do not include coal bunkered, or sold to steamships engaged in foreign trade. The coke exported went chiefly to Mexico and eastern Canada; the distribution of the coal was as follows:

	1906.	1907.	Changes.
Canada.....	1,773,497	2,197,356	I. 423,859
Mexico.....	357,090	398,768	I. 41,678
Cuba.....	248,326	287,488	I. 39,162
Other W. Indies.....	125,351	166,383	I. 41,032
Europe.....	30,852	22,728	D. 8,124
Other countries.....	74,612	157,209	I. 82,597
Total.....	2,609,728	3,229,932	I. 620,204

The exports to Europe were chiefly to Italy; those to other countries, to South America. The exports to Canada—68 per cent. of the total in 1907—were, in detail, as follows:

	1906.	1907.	Changes.
Anthracite.....	478,361	673,119	I. 194,758
Bituminous.....	1,295,136	1,524,237	I. 229,101
Total.....	1,773,497	2,197,356	I. 423,859

There was a considerable increase this year, in both anthracite and bituminous coals.

Imports of coal and coke into the United States for the four months ending April 30, were as follows:

	1906.	1907.	Changes.
Great Britain.....	60,665	20,004	D. 40,661
Canada.....	573,232	463,352	D. 109,880
Japan.....	5,972	54,899	I. 48,927
Australia.....	69,205	115,654	I. 46,449
Other countries.....	4,100	503	D. 3,597
Total coal.....	713,174	654,412	D. 58,762
Coke.....	36,825	54,342	I. 17,517
Total.....	749,999	708,754	D. 41,245

Some Nova Scotia coal comes to New England ports, but the bulk of the imports of coal is on the Pacific coast. The coke is chiefly from British Columbia, though a little comes from Germany.

Sydney, Cape Breton

May 31—The backward season and the delay in the opening of navigation is having a disastrous effect upon the Nova Scotia coal trade. Sydney harbor continues blocked with ice, the fleets of both the Dominion Coal Company and the Nova Scotia Steel and Coal Company being tied up. These companies control the greater portion of the Cape Breton output and the supply of the St. Lawrence river trade. The delay will prevent the anti-

ciations of a record output from being realized, as it will be impossible to make up the shortage during the season. The Dominion Coal Company is about 200,000 tons behind last year in its shipments to date. The inability of vessels to make a clearance has rendered it necessary to curtail the output at the mines, owing to a want of further storage facilities. It will be necessary to readjust contracts made previous to the new year for summer delivery, reducing the orders by about 7 per cent.

Iron Trade Review

New York, June 5—There is still a good deal of buying of pig iron and the market is active. The present business, however, is chiefly in bessemer and basic iron, the foundry demand being less in evidence.

In finished material the prevailing activity is chiefly in structural material, for which a good demand is reported. A large part of this is for buildings in the East.

Reports have been current that the United States Steel Corporation is negotiating with W. P. Snyder & Co. for the purchase of their extensive furnace interests in the Mahoning and Shenango valleys. Such an addition would help the Steel Corporation on its weak side.

Iron and Steel Exports—Exports of iron and steel, including machinery, from the United States for April, and the four months ended April 30, are valued as below by the Bureau of Statistics of the Department of Commerce and Labor:

	1906.	1907.	Changes.
April.....	\$14,933,495	\$17,684,863	I. \$2,751,368
Four months....	54,953,041	62,371,457	I. 7,418,416

The total increase for the four months was 13.5 per cent. The leading items of export for the four months were, in long tons:

	1906.	1907.	Changes.
Pig iron.....	27,850	28,346	I. 496
Billets, ingots & blooms	89,199	39,593	D. 49,606
Bars.....	27,251	30,187	I. 2,936
Rails.....	115,941	112,724	D. 3,217
Sheets and plates.....	32,183	45,279	I. 13,096
Structural steel.....	33,425	43,990	I. 10,565
Wire.....	54,856	52,881	D. 1,965
Nails and spikes.....	23,276	19,392	D. 3,884

Decreases are shown in nails, in wire, in rails, and in billets, ingots and blooms; the latter loss was the only large one.

Iron and Steel Imports—Imports of iron and steel, including machinery, in the United States for April and the four months ending April 30 are valued by the Bureau of Statistics as follows:

	1906.	1907.	Changes.
April.....	\$2,547,199	\$3,723,176	I. \$1,175,977
Four months....	9,875,981	13,742,284	I. 3,866,303

The increase for the four months was 39.1 per cent. The chief items of the iron and steel imports for the four months were, in long tons:

	1906.	1907.	Changes.
Pig iron.....	95,079	215,983	I. 120,904
Scrap.....	7,959	5,461	D. 2,498
Ingots, blooms, etc.....	6,739	5,427	D. 1,312
Bars.....	10,959	9,601	D. 1,358
Wire-rods.....	5,886	5,666	D. 220
Tin-plates.....	14,807	19,117	I. 4,310

There were large proportional increases in pig iron and in tin-plates.

Iron Ore Movement—Exports and imports of iron ore in the United States for the four months ended April 30 are reported as follows, in long tons:

	1906.	1907.	Changes.
Exports.....	17,546	1,752 D.	15,794
Imports.....	358,427	402,501 I.	44,074

Most of the exports were to Canada. Imports were from Cuba, Spain and Algeria.

Imports of manganese ore for the four months ended April 30 were 62,515 tons in 1906, and 59,345 tons in 1907; a decrease of 3170 tons this year. Most of the ore this year was from India and Brazil.

Baltimore

June 4—Imports of spiegeleisen for the week were 1250 tons; of ferromanganese, 3514 tons. Receipts of iron ore were 5350 tons from Cuba and 4800 tons from Spain; a total of 10,150 tons for the week

Chicago

June 3—Sales of pig iron have not been heavy in the last week, but signs indicate continued strength. The scarcity of iron is generally commented on as one of the causes of the lull. Among melters the feeling seems to be that it is a good plan to buy as little as is needed, in the hope that things will be easier in a little while. Sellers of iron assert that the market is bound to grow stronger with furnaces generally well sold up and much tonnage yet unplaced.

The local demand is chiefly for small lots on quick delivery conditions. Sales for the third and fourth quarters are not for large amounts, though fair in number. Northern furnaces have little quick-delivery iron to sell at any price; Southern obtains on such sales premiums of 50c. to \$1 over quotations for the fourth quarter. For fourth-quarter delivery quotations are as follows: Lake Superior charcoal, \$27.50; Northern foundry No. 2, \$24.50@25; Southern foundry No. 2, \$21@21.50 Birmingham, or \$25.35@25.85 Chicago.

Coke is easy, with no oversupply. Con- nellsville 72-hour brings \$5.85 per ton.

Cleveland

June 4—The chief object of interest in the local situation during the week just passed has been the strike of 2000 machinists in the city shops. The strikers walked out on June 3 in all shops where the nine-hour schedule would not be granted. It is expected that 2500 will be out before the week is out. The strike is to be deplored at this time as every one of the plants is swamped with orders for quick delivery. Efforts will be made to bring the strikers back, but they declare that they will not go back on any other terms than those demanded.

The iron-ore market has been active

during the week at steady prices. A number of large cargoes was received which build up stocks on the docks. Lake rates remain firm. Local foundries are fairly well supplied with pig iron. Prices remain as follows for last half delivery; No. 1 Foundry \$24.50; No. 2 \$24; No. 3 \$23.50; bessemer \$23.90; No. 2 Southern \$24.35; gray forge \$22.50.

Scrap dealers report a big demand for old materials and prices have jumped around during the week with pronounced gains in old iron and steel rails.

Philadelphia

June 5—The large amount of business that has been done during the past two or three weeks by engineering plants and foundries accounts for the reviving interest in pig for next year's delivery which is at present stirring the market. The furnaces in this territory are not in the market for this year's business, but whatever capacity is unsold will be reserved for the accommodation of regular customers and such outsiders as it may be possible to accommodate. Some additional business has been done with Virginia and Alabama furnaces. Local supplies of English and Scotch iron are practically non-existent. The demonstrated inability of furnace people to take care of summer or early fall needs has led to some additional business in foreign material. Quotations on basic for third quarter are \$24; low phosphorus, \$28; forge, \$22.50; No. 2 foundry, \$24.50.

Steel Billets—Consumers believe the mills are getting into shape where they can deliver strictly according to agreement. There is less feverishness as to obtaining supplies for future delivery. While new orders are fewer options to take larger quantities on old contracts are being used. A fair quotation is \$33 for rolling billets.

Bars—Capacity continues to be oversold. The tone of the market is strong, particularly for steel bars. Retail distribution from city and country stores is very satisfactory.

Sheets—The feature of the week is a more urgent demand for small lots for quickest possible delivery. Mills are not anxious for the business and offer no inducements.

Pipes and Tubes—A slight advance has been made to cover higher freight rates on merchant pipe. The tube situation is worse as regards deliveries. The larger consumers in our territory are pretty well covered by contracts.

Plates—The mills are gaining a little in point of making early deliveries. This easing up is only temporary.

Structural Material—Deliveries on old contracts are being hastened. Quite a good business has been done this week in small work for office buildings and city work.

Steel Rails—An interesting feature of the market is the rush of small orders for late summer delivery.

Scrap—The steel scrap scarcity is more pronounced. In other kinds a moderate business is being done.

Pittsburg

June 4—The iron and steel markets have been decidedly quiet for over a week, new business being extremely light and only for prompt shipment. For the first time since the opening of the year there appears to be a feeling of unrest in the trade. General conditions, however, do not warrant any alarm for the rest of the year, when the tonnage booked is considered. When there was a slight murmur of probable cancellations yesterday it was promptly hushed. Prices, except for some lines of finished material, are much higher than a year ago. Bessemer pig iron is \$7 a ton, and No. 2 foundry \$9 a ton, higher than on June 1, 1906. Bessemer billets are \$4 a ton higher and steel bars, \$2; iron bars, \$5, and plates, \$2.

In merchant pipe and plates the mills seem to be more congested than in any other line. An independent pipe interest reluctantly accepted a large order for pipe for California, deliveries to be made within four months, the buyer paying a premium of \$4 a ton over the established price. This contract practically puts the concern out of the market for the remainder of the year. The National Tube Company is still taking on some new business, but is not guaranteeing delivery. A number of inquiries for steel cars have been received, and if the contracts are closed it will be impossible for the plate mills to get out the tonnage necessary to complete them before next year. The pressure on the sheet mills has fallen off and deliveries are being promised before Oct. 1. For prompt shipment, premiums of about \$2 a ton are paid. Demand for tin plate is not as heavy, and the leading producer is not taking on any business for last quarter delivery.

The wage question is now up and until the scales have been arranged for the year beginning July 1 it is not likely that much new business will be booked at current prices. The representatives of the Amalgamated Association of Iron, Steel and Tin Workers and the Western Bar Iron Association are meeting today in Toledo, O. A conference with the Republic Iron and Steel Company has been arranged for June 10. The conference with the American Sheet and Tin Plate Company likely will be held on Tuesday, June 18. A disagreement is certain to result unless the workers' representatives withdraw their demands for an advance. They have already received increases in wages this year under the existing scale amounting to 6 per cent., despite the stiff advance in the price of tin.

Pig Iron—The only sale of pig iron of

any consequence this week was 650 tons of malleable bessemer for prompt shipment at \$24.25@24.75. Valley furnaces. Small lots of bessemer iron brought \$24.50@25, and a few small sales of No. 2 foundry were made at \$25.50@26, Valley furnaces. There is a heavy demand for prompt bessemer iron, but there is none to be had. The Carnegie Steel Company, which was running short of iron on account of the idleness of Furnace C of the Edgar Thomson group for repairs, will be in better shape this week, as one of the new Carrie furnaces was blown in last night. Repairs to the idle furnace will be completed next week, when it will again be a producer at the rate of 600 tons daily.

Steel—The supply of crude steel shows some improvement, and bessemer billets are quoted at \$31, Pittsburg. Open-hearth billets cannot be had, and are quoted nominally at about \$33. Plates remain at 1.70c., and merchant steel bars at 1.60c.

Sheets—The mills are catching up on deliveries, as there is no new business being placed. Black sheets are strong at 2.60c., and galvanized at 3.75c. for No. 28 gage.

Ferro-Manganese—There has been a decline in ferro, which it is believed will be only temporary. One lot for prompt shipment sold at \$66, and for last quarter a sale was made at \$65 per ton.

Cartagena, Spain

May 18—Messrs. Barrington & Holt report shipments of iron ore for the week: Great Britain, 13,750 tons. The market continues active and prices are firm. During the past fortnight tonnage has been somewhat scarce for prompt loading and for this reason the stocks of iron ore on the wharves and at the railway stations have increased.

Quotations for iron ores are: Ordinary 50 per cent. ore, 9s. 9d.@10s. 3d.; low phosphorus, 10s. 9d.; specular ore, 55 per cent., 12s. 6d., all f.o.b. shipping port. For manganiferous ore, same terms, quotations for No. 3—12 per cent. manganese, and 35 iron—are 14s. 6d. No higher grades on the market.

Pyrites—Iron pyrites, basis 40 per cent. iron and 43 sulphur, is quoted 11s. 9d. per ton, f.o.b. shipping port.

Dusseldorf, Germany

May 15—Imports of iron and steel, and of machinery, into Germany for the three months ended March 31 were, in metric tons:

	1906.	1907.	Changes
Iron and steel.....	95,501	145,905	I. 50,404
Machinery.....	23,902	14,860	D. 9,042
Total.....	119,403	160,765	I. 41,362

Exports for the three months were as follows, in metric tons:

	1906.	1907.	Changes.
Iron and steel.....	992,862	814,094	D. 178,768
Machinery.....	78,298	75,659	D. 2,639
Total.....	1,071,160	889,753	D. 181,407

Imports of iron ore for the three months were 1,465,358 tons, and exports were 1,017,486 tons; showing net imports of 447,872 tons. Imports of slag and slag products were 146,989 tons; exports being 8982 tons.

London

April 15—Exports of iron and steel, and of machinery, from Great Britain for the four months ended April 30 are valued by the Board of Trade returns as follows:

	1906.	1907.	Changes
Iron and Steel..	£12,151,182	£15,461,711	I. £3,310,529
Machinery.....	8,346,398	9,626,688	I. 1,280,290
New Ships.....	1,816,130	3,032,801	I. 1,216,671
Total.....	£22,313,710	£28,121,200	I. £5,807,490

The total increase was 26 per cent. The leading items of the iron and steel exports were, in long tons:

	1906.	1907.	Changes.
Pig iron.....	400,041	670,340	I. 270,299
Wrought iron.....	60,813	72,299	I. 11,486
Rails.....	133,760	141,562	I. 7,802
Plates.....	77,508	121,457	I. 43,949
Sheets.....	149,998	167,825	I. 17,827
Steel shapes, etc.....	57,615	79,920	I. 22,305
Tin-plates.....	123,151	137,208	I. 14,057

The total quantities of iron and steel were 1,333,359 long tons in 1906, and 1,742,789 tons in 1907; an increase of 409,430 tons. Exports of pig iron to the United States in 1907 were 231,948 tons, an increase of 161,319 tons over 1906; of tin-plates, 22,210 tons, an increase of 7151 tons.

Imports of iron and steel and of machinery into Great Britain for the four months were valued as follows:

	1906.	1907.	Changes.
Iron and steel...	£3,216,219	£2,126,984	D. £1,089,235
Machinery.....	1,669,072	1,767,894	I. 98,822
Total.....	£4,885,291	£3,894,878	D. £ 990,413

The total decrease was 20.2 per cent. The chief items of the imports were, in long tons:

	1906.	1907.	Changes.
Pig iron.....	24,248	24,245	D. 3
Wrought iron.....	45,058	20,323	D. 24,735
Steel billets, etc.....	213,419	92,837	D. 120,582
Bars and shapes.....	22,237	3,936	D. 18,301
Structural steel.....	56,371	28,192	D. 28,179

The total quantities of iron and steel were 495,034 tons in 1906, and 269,475 tons in 1907; a decrease of 225,559 tons this year.

Imports of iron ores into Great Britain for the four months were, in long tons:

	1906.	1907.	Changes.
Manganiferous ores.	135,514	128,509	D. 7,005
Iron ores.....	2,570,561	2,542,953	D. 27,608
Total.....	2,706,075	2,671,462	D. 34,613

Of the ores imported this year 92,333 tons of manganiferous and 1,983,373 tons of iron ores came from Spain.

Johannesburg

April 29—The problem of the unemployed grows worse every day. For a long time many of the unfortunates have been living in a camp near Johannesburg, sustained from a donation of £500, given by a Rand philanthropist. This fund will not last forever, and the men are begin-

ning to get restless. To provide employment the Government has started relief work, offering the men 2s. per day and rations, for road building. The aristocrats of labor have indignantly refused such a humiliating proposition, which they declare is an insult. They consider that their services are worth at least 10s. per day, if not more.

As a protest, and to sufficiently impress the Government, mass meetings are being held, and a great march of the unemployed on Pretoria is being organized, to interview the acting prime minister.

The price of coal on the Rand has been brought down to such a low point by fierce competition, that scarcely any of the companies are making a decent profit. There seems to be a movement on foot for the different companies to come to an agreement as to price, so that in future the price of coal on the gold mines will probably be somewhat higher.

There is a considerable difference in the grades of coal being supplied to the gold mines. Some of it is rather inferior stuff, while the coal from other collieries is of excellent quality. Hand sorting is adopted on those mines where slate is prevalent.

The cost of coal per ton crushed on the gold mines has been greatly reduced in the past few years. On some mines it is now as low as 9d. while on other mines where the conditions are unfavorable, the cost per ton crushed is nearly 60 cents.

The Boer government is continuously maintaining that there are any number of Kafirs waiting to work in the mines. The conditions are exceptional. The terrible scourge of locusts that has swept over South Africa this year is still with us, and many of the crops of the Kafirs and the white farmers have been ruined. The black men are forced to come to the mines for work. But they will only sign on for a few months.

There have been many ghastly mining swindles and failures on the Transvaal of late, but it is satisfactory to note the success of some of the new ventures. The Robert's Victor diamond mine is doing very well, and expects to pay regular dividends before long. This mine is in the Orange River Colony, about 49 miles from Kimberley. Another success seems to be the Voorspoed diamond mine, also in the Orange River Colony about 20 miles west of Kroonstad. The prospects of this proposition are encouraging.

On the other hand, Lion Hill diamond mine, which was such a favorite counter on the stock exchange a few weeks ago has fallen in the public estimation. The shares mounted from £1 to nearly £20. Today they are being offered at £2 15s. per share, but there are no buyers. Then again we have Barberton Coppers, which are still being heavily gambled in. A report by a distinguished geologist shows that no mine is yet proved and that the prospects for copper are by no means favorable.

All these syndicates show that every effort is being made to explore and prospect the country. As far as the base metals are concerned the results have been disappointing. There are any number of copper syndicates and glowing reports, but after all this activity there does not seem to be a copper mine worth mentioning.

Metal Market

NEW YORK, June 5.

Gold and Silver Exports and Imports

At all United States Ports in April and year

Metal.	Exports.	Imports.	Excess.
Gold:			
Apr. 1907..	\$2,201,659	\$ 4,928,490	Imp. \$2,726,831
" 1906..	2,485,552	14,941,583	Imp. 12,456,031
Year 1907..	7,904,963	16,575,105	Imp. 8,670,142
" 1906..	22,632,174	25,257,670	Imp. 2,625,496
Silver:			
Apr. 1907..	4,862,998	3,921,484	Exp. 941,514
" 1906..	4,213,687	2,833,859	" 1,379,828
Year 1907..	19,532,994	15,307,010	" 4,225,984
" 1906..	23,379,295	15,510,857	" 7,868,438

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 June 1 and years from Jan 1.

Period.	Gold.		Silver.	
	Exports.	Imports.	Exports.	Imports.
Week.....	\$ 2,813,838	\$ 40,535	\$ 1,089,432	\$ 23,025
1907.....	4,696,534	5,570,127	16,148,138	742,298
1906.....	5,465,121	44,120,908	26,959,640	883,979
1905.....	32,990,546	5,169,142	13,493,018	1,654,482

Exports of gold for the week were chiefly to Paris; of silver to London. Imports, both gold and silver, were from the West Indies and Central America.

The shipment of \$5,400,000 gold to Paris this week looks as if it might be the beginning of a considerable movement. Paris has been accumulating gold lately, with a view to possible requirements later.

The joint statement of all the banks in the New York Clearing House for the week ending June 5, shows loans \$1,139,931,000, an increase of \$13,541,600; deposits, \$1,128,194,600, an increase of \$15,554,100 as compared with the previous week. Reserve accounts show:

	1906.	1907.
Specie.....	\$183,105,600	\$221,928,000
Legal tenders.....	82,898,200	72,903,100
Total cash.....	\$266,003,800	\$294,831,100
Surplus.....	\$ 6,816,025	\$ 12,782,480

The surplus over legal requirements shows a decrease of \$2,906,425, as compared with the previous week this year.

Specie holdings of the leading banks of the world, June 1, are reported as below, in dollars:

	Gold.	Silver.	Total.
Ass'd New York.....			\$221,928,000
England.....	\$176,185,550		176,185,550
France.....	529,324,285	\$197,765,995	727,090,280
Germany.....	184,650,000	61,550,000	246,200,000
Spain.....	77,495,000	127,640,000	205,135,000
Netherlands.....	26,649,000	27,996,000	54,645,000
Belgium.....	16,270,000	8,135,000	24,405,000
Italy.....	161,535,000	24,737,000	186,272,000
Russia.....	580,355,000	31,475,000	611,830,000
Aust.-Hungary.....	228,220,000	63,660,000	291,880,000
Sweden.....	20,725,000		20,725,000

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.

Shipments of silver from London to the East are reported by Messrs. Pixley & Abell, as follows, for the year to May 23:

	1906.	1907.	Changes.
India.....	£ 7,279,713	£5,082,034	D. £ 2,197,679
China.....	.....	.....	.....
Straits.....	1,750	426,062	I. 424,312
Total.....	£ 7,281,463	£5,508,096	D. £ 1,773,367

Imports for the week were £4000 from Brazil, and £91,000 from New York; £95,000 in all. Exports were £76,000, all to India.

Indian exchange has been stronger, and all the Council bills offered in London were taken at an average of 16.06d. per rupee. There has also been some buying of silver in London on Indian account.

The Treasury Department estimate of the money in the United States on June 1 is as follows:

	In Treasury.	In Circul'n.
Gold coin (inc. bullion in Treasury).....	\$ 242,206,764	\$ 695,680,258
Gold certificates.....	50,614,460	630,635,409
Silver dollars.....	4,355,588	82,083,942
Silver certificates.....	3,274,748	470,459,252
Subsidiary silver.....	9,052,491	121,726,527
Treasury notes of 1890..	11,220	6,066,780
U. S. notes.....	3,580,823	343,100,193
Nat. Bank notes.....	11,910,342	590,030,208
Total.....	\$327,006,436	\$2,939,782,569

Population of the United States, June 4, 1907, estimated at 85,956,000; circulation per capita, \$34.20. For redemption of outstanding certificates an exact equivalent in amount of the appropriate kinds of money is held in the treasury, and is not included in the account of money held as assets of the Government. This statement of money held in the treasury as assets of the Government does not include deposits of public money in national-bank depositaries to the credit of the treasurer of the United States, amounting to \$172,831,241. The total in circulation showed increases of \$7,176,544 over May 1, and \$196,101,449 over June 1 last year.

Prices of Foreign Coins

	Bid.	Asked.
Mexican dollars.....	\$0.52	\$0.54
Peruvian soles and Chilean.....	0.47	0.50
Victoria sovereigns.....	4.85	4.87
Twenty francs.....	3.85	3.89
Spanish 25 pesetas.....	4.78½	4.80

SILVER AND STERLING EXCHANGE.

May-June.	Sterling Exchange.	Silver.		June.	Sterling Exchange.	Silver.	
		New York, Cents.	London, Pence.			New York, Cents.	London, Pence.
30	.....	.....	31	3	4.8675	67½	31
31	4.8675	67½	30½	4	4.8675	67½	31
1	4.8675	67½	31½	5	4.8675	67½	31

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

Other Metals

May-June.	Copper.			Tin.	Lead.	Spelter.	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	London, £ per ton.	Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
30	.....	.....	101	.....	.....	.....	.....
	24½	23	.....	.....	.....	6.35	6.20
31	@25	@23½	101½	42½	6.00	@6.45	@6.30
	24½	23	.....	.....	.....	6.35	6.20
1	@25	@23½	.....	42	6.00	@6.45	@6.30
	24½	23	.....	.....	.....	6.40	6.25
3	@25	@23½	98½	41½	5.75	@6.45	@6.30
	24½	23	.....	.....	.....	6.40	6.25
4	@25	@23½	98½	41	5.75	@6.45	@6.30
	24½	23	.....	.....	.....	6.45	6.30
5	@25	@23½	99½	41½	5.75	6.45	6.30

London quotations are per long ton (2240 lb.) standard copper, which is now the equivalent of the former g.m.b.s. The New York quotations for electrolytic copper are for cakes, ingots or wirebars, and represent the bulk of the transactions as made with consumers, basis, New York, cash. The price of cathodes is 0.125c. below that of electrolytic. The lead prices are those quoted by the American Smelting and Refining Company for near-by shipments of desilverized lead in 50-ton lots, or larger. The quotations on spelter are for ordinary western brands; special brands command a premium.

Copper—The market remains without essential change. Last Friday and Saturday there was some perfunctory demand for immediate shipment, which resulted in a number of sales, but the demand then subsided and since then dullness has been the rule again. Domestic consumers are still conspicuous by their absence. The situation in the home market is still suffering from the deadlock, the causes for which are well recognized. There have been various rumors as to the policy of the largest selling interest, which has been holding out of the market, but these have not been founded on any authoritative information, and the position continues unchanged. It is interesting to note that, owing to the continued disparity between the prices of electrolytic and casting, certain refiners have given up making the latter and now are converting all their product into electrolytic. At the close the market is nominal at 24¼@25c. for Lake, 23@23½c. for electrolytic, and 22½@23¾c. for casting.

Standard copper in London has been very erratic, showing the element of uncertainty hanging over the market. There has, however, been a distinct tendency to discount lower prices evidenced by selling of the three months' option, which resulted in the backwardation of £4. The close is steady at £99 1s. 3d. for spot, and £95 1s. 3d. for three months'. For refined and manufactured sorts we quote: English tough, £104; best selected, £108; strong sheets, £115.

Statistics for the second half of May show an increase of 100 tons.

Exports of copper from New York for the week were 674 long tons. Our special correspondent reports exports for the week from Baltimore at 572 long tons

copper. The exports from Baltimore also included 41,005 lb. copper sulphate.

Copper Sheets—The base price of copper sheets is 32c. per pound.

Copper Wire—The base price of copper wire, No. 0000 to No. 8, is 27¼@27½c. per pound.

Tin—The increase in the visible supplies of 1900 tons as cabled from London resulted in a very sharp break early in the week, but at the lower level there has been a better demand and the market closes steady at 41¼.

The foreign market also sustained a sharp decline, but the close is steady at £187 for spot, and £184 for three months'.

It is stated that at the Banka sales in Holland last week about 600 tons of tin were bought for account of the United States Steel Corporation.

Shipments of tin from the Straits in May were 5130 tons, a decrease of 260 tons from May of last year.

Lead—The American Smelting and Refining Company reduced its price \$5 per ton on Monday, and the market is now quoted at 5.75c. New York.

The market in London shows continued strength, and closes firm at £20 for Spanish and £20 2s. 6d. for English lead.

Spelter—There has been a very good business doing, which has resulted in the absorption of whatever quantities were offered for near-by shipment, bringing about an advance at the close to 6.45 New York, and 6.30 St. Louis.

The weakness in the European market continues, and the close is cabled at £24 10s. for good ordinaries, and £24 15s. for specials.

The Bartlesville Zinc Company is erecting a six-block smelting works at Bartlesville, Indian Territory, which it is expected will be ready for operation next October.

Zinc Sheets—The base price is now \$8.60 per 100 lb. (less discount of 8 per cent.) f.o.b. cars at Lasalle and Peru, in 60-lb. case for gages No. 9 to 22, both inclusive; widths from 32 to 60 in., both inclusive; the lengths from 84 to 96 in., both inclusive. The freight rate to New York is 27.5c. per 100 pounds.

Antimony—The market has experienced a further decline and is weak. Reports of lower quotations come from abroad also. The market here is 18½c. for Cookson's; 16@16½c. for Hallett's; and 15½@16½c. for other 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.

Platinum—The market has declined and is in weak condition. Consumption remains normal, apparently not having been stimulated by falling prices. The latest

quotations are: Ordinary metal, \$27 per oz.; hard metal, \$29.50 per oz. Scrap is \$19@20, with light demand.

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.

Imports and Exports of Metals

Copper — Exports of copper from the United States for the four months ended April 30 are reported as below by the Bureau of Statistics of the Department of Commerce and Labor, in long tons, of 2240 lb. each:

	1906.	1907.	Changes.
Great Britain.....	6,815	6,081	D. 734
Belgium.....	712	409	D. 303
France.....	12,267	10,042	D. 2,225
Italy.....	2,369	2,824	I. 455
Germany and Holland...	34,609	28,612	D. 5,997
Russia.....	762	1,160	I. 398
Other Europe.....	3,896	3,208	D. 688
Canada.....	391	434	I. 43
China.....	800	..	D. 800
Other countries.....	45	74	I. 29
Total metal.....	62,666	52,844	D. 9,822
In ores and matte.....	2,528	1,483	D. 1,045
Total.....	65,194	54,327	D. 10,867

The total decrease was 16.7 per cent. The actual quantity of ore and matte exported this year was 25,907 tons, of which 22,705 tons went to Canada, 3022 tons to Mexico, and the balance to Germany and Great Britain.

Imports into the United States of copper and copper material for the four months ended April 30, with re-exports of foreign metal, are reported as follows; the figures give the contents of all material in long tons of fine copper:

	Metal.	In ore, etc.	Total.
Mexico.....	13,344	5,697	18,941
Canada.....	4,268	1,899	6,167
Great Britain.....	7,223	.....	7,223
Japan.....	957	.....	957
South America.....	.....	1,364	1,364
Other countries.....	7,329	608	7,937
Total imports.....	33,121	9,468	42,589
Re-exports.....	178	.....	178
Net imports.....	32,943	9,468	42,411
Net imports, 1906.....	24,830	7,975	32,805

The total increase in the net imports was 9606 tons, or 29.3 per cent. The actual tonnage of ores and matte imported from Mexico this year was 31,792 tons; from Canada and Newfoundland, 42,866 tons; from South America, 11,105 tons.

The exports and net imports compare as follows for the four months:

	1906.	1907.	Changes.
Exports.....	65,194	54,327	D. 10,867
Net imports.....	32,805	42,411	I. 9,606
Excess, exports.....	32,389	11,916	D. 20,473

This shows a decrease this year of 63.2 per cent. in the excess of exports.

Tin—Imports of tin into the United States for the four months ending April 30 were as follows, in long tons:

	1906.	1907.	Changes.
Straits.....	6,056	5,422	D. 634
Australia.....	366	304	D. 62
Great Britain.....	8,278	7,928	D. 350
Holland.....	162	532	I. 380
Other Europe.....	586	423	D. 163
Other countries.....	23	14	D. 9
Total.....	15,461	14,623	D. 838

There was a decrease of 5.4 per cent. in the imports of this year.

Lead—Imports of lead into the United States in all forms, with re-exports of imported metal, are reported as below for the four months ended April 30, in short tons, of 2000 lb. each:

	1906.	1907.	Changes.
Lead, metallic.....	3,161	6,914	I. 3,753
Lead in ores and base bullion.....	26,434	18,665	D. 7,769
Total imports.....	29,595	25,579	I. 4,016
Re-exports.....	16,956	8,171	D. 8,785
Net imports.....	12,639	17,408	I. 4,769

Of the imports this year 16,294 tons were from Mexico and 2227 tons from Canada. Exports of domestic lead were 83 tons in 1906 and 176 tons in 1907, an increase of 93 tons.

Spelter — Exports of spelter from the United States for the four months ended April 30 were 1718 short tons in 1906 and 250 tons in 1907, a decrease of 1468 tons. Exports of zinc dross were 4082 short tons in 1906 and 4363 tons in 1907, an increase of 281 tons. Exports of zinc ore were 10,270 long tons in 1906 and 8070 tons in 1907, a decrease of 2200 tons.

Imports of spelter for the four months were 1417 short tons in 1906 and 414 tons in 1907, a decrease of 1013 tons.

Antimony — Imports of antimony into the United States for the four months ended April 30 were as follows, in pounds:

	1906.	1907.	Changes.
Metal and regulus.....	2,656,999	3,671,297	I. 1,014,298
Antimony ore.....	538,985	913,693	I. 374,708

There was a large increase this year, both in metal and in ore.

Nickel—Imports of nickel ore and matte into the United States for the four months ended April 30 were 4246 tons in 1906, and 5200 tons, containing 6,590,579 lb. of metal, in 1907. The metal contents were not reported last year.

Exports of nickel, nickel oxide and nickel matte for the four months were 4,117,285 lb. in 1906, and 3,901,489 lb. in 1907; a decrease of 215,796 lb. this year.

Platinum—Imports of platinum into the United States for the four months ended April 30 were 3966 lb. in 1906, and 2817 lb. in 1907; a decrease of 1149 lb. this year.

Quicksilver — Exports of quicksilver from the United States for the four months ending April 30 were 233,641 lb. in 1906, and 183,562 lb. in 1907; a decrease of 50,079 lb. this year.

Aluminum—Exports of aluminum from the United States for the four months ended April 30 were valued at \$39,210 in 1906 and \$112,514 in 1907, an increase of \$73,304 this year.

Missouri Ore Market

Joplin, Mo., June 1—The highest price paid for zinc concentrates was \$51 per ton, on an assay basis of \$47 per ton for 60 per cent. zinc. One bin of ore, settled for at \$50 per ton, was sold on a base price of \$47.50. The base price on medium and under-grade concentrate was generally advanced, no offering under \$46 being reported. The average price was \$45.22, lowered on account of heavier silicate sales. The highest price for lead was \$83.50 per ton, medium grades bringing \$80@82, increasing the average to \$80.78 per ton.

Activity the first of the week gave place to a lessened demand toward the close, when it became apparent that the new mills recently started would offset the reduction in output occasioned by the inundation of the Badger mines on May 13. The output and shipment of the week was approximately balanced, and was practically at a stage normal to the inflow of water.

Following are the shipments of zinc and lead from the various camps of the district for the week ending June 1:

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville.	3,738,480	1,004,510	\$128,537
Joplin.....	2,076,580	393,030	65,756
Duerweg.....	1,048,920	307,940	37,125
Alba-Neck City.....	1,326,730	.....	32,505
Oronogo.....	839,940	65,990	21,735
Galena-Empire.....	696,390	94,660	19,703
Aurora.....	753,520	22,190	16,000
Prosperity.....	287,550	179,900	14,043
Granby.....	750,000	30,000	11,900
Spurgeon.....	273,340	43,870	6,155
Sherwood.....	119,810	7,500	3,115
Baxter Springs.....	109,820	.....	2,471
Carthage.....	65,510	.....	1,604
Carl Junction.....	44,660	10,400	1,465
Sarcozie.....	52,170	.....	1,199
Totals.....	12,183,420	2,159,990	\$362,713

22 weeks.....266,428,940 42,069,870 \$7,988,283
 Zinc value, the week, \$275,476; 22 weeks, \$6,266,673
 Lead value, the week, 87,237; 22 weeks, 1,721,610

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	.....	June.....	80.96	.....
July.....	43.25	.....	July.....	74.31	.....
August.....	43.56	.....	August.....	75.36	.....
September.	42.58	.....	September.	79.64	.....
October.....	41.55	.....	October.....	79.84	.....
November..	44.13	.....	November..	81.98	.....
December..	43.68	.....	December..	81.89	.....
Year.....	43.24	.....	Year.....	77.40	.....

Wisconsin Ore Market

Platteville, Wis., June 1—The interest shown by the ore buyers did not let up during the week, in consequence of which, there was no change in the price of zinc ore. All the 60 per cent. ore in the district was cleaned up, at \$47@48 per ton. One lot was reported sold at \$50. The lower grades brought high prices, as com-

pared with former years. The transactions reported bear out the prophecy made in a previous issue of the JOURNAL, and it now seems that even the most optimistic may be surprised during the coming summer. Every energy is being used to complete the plants, and before winter sets in the Wisconsin district should be shipping double what it is now. Inquiries from outside buyers show that the eyes of the smelters are on the district.

The smelter bins are well filled, but in spite of this fact buying continues by all the regular buyers. Lead price dropped off a little and all that was reported sold at \$81.50@82 per ton. Sulphur and dry-bone suffered no material change.

Shipments of the district were as follows, by camps, for the week ending June 1:

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville.....	595,130	.....	.....
Buncombe-Hazel Green..	682,900	.....	.....
Linden.....	463,560	.....	.....
Benton.....	400,070	.....	.....
Rewey.....	125,000	.....	.....
Livingston.....	105,000	.....	.....
Galena.....	83,500	.....	.....
Cuba City.....	66,000	86,740	.....
Highland.....	66,000	.....	.....
Harker.....	62,260	.....	.....

Total for week..... 2,649,420 86,740
 Year to June 1.....39,381,260 1,782,150 189,160

Taken as a whole, the zinc market is firmer at the present writing than it has been for several weeks. The rainy weather and continued car shortage has had a little to do with loading.

Chemicals

New York, June 5—Imports of heavy chemicals into the United States for the four months ended April 30 are reported as follows, in pounds:

	1906.	1907.	Changes.
Bleaching powder	39,878,144	40,334,928	I. 456,184
Potash salts.....	57,168,433	73,800,427	I. 16,632,014
Soda salts.....	7,082,587	8,015,934	I. 933,347

Exports of acetate of lime for the four months were 21,742,251 lb. in 1906, and 32,637,887 lb. in 1907; an increase of 10,895,636 lb. this year.

Copper Sulphate—The market continues strong, and quotations are unchanged at \$7.50 per 100 lb. for carload or larger lots; \$7.75 per 100 lb. for smaller parcels.

Exports of copper sulphate from the United States for the four months ended April 30 were 10,081,956 lb. in 1906, and 5,413,387 lb. in 1906; a decrease of 4,668,569 lb. The exports this year contained the equivalent of about 604 tons of fine copper.

Phosphates—Exports of phosphates from the United States for the four months ended April 30 were, in long tons:

	1906.	1907.	Changes.
Crude.....	346,532	314,155	D. 32,377
All other.....	8,113	10,668	I. 2,555
Total.....	354,645	324,823	D. 29,822

The chief exports this year were 102,030 tons to Germany; 47,396 to Great Britain; 52,780 to France; 27,242 to Italy.

Sulphur—Imports of sulphur and pyrites into the United States for the four months ended April 30 were, in long tons:

	1906.	1907.	Changes.
Sulphur.....	31,745	13,158	D. 18,587
Pyrites.....	171,093	202,109	I. 31,016

The decrease in brimstone imports was due to the displacement of Sicilian sulphur by the Louisiana product. Estimating sulphur contents of pyrites, the total imports of sulphur were 100,182 tons in 1906 and 94,001 tons in 1907; a decrease of 6001 tons.

Nitrate of Soda—Messrs Mortimer & Wisner, of New York, report the position of nitrate in the United States on June 1 as follows, in long tons:

	1906.	1907.	Changes.
Stocks, Jan. 1.....	13,100	13,050	D. 50
Imports, 5 mos.....	113,650	104,432	D. 9,218
Total supplies.....	126,750	117,482	D. 9,268
Deliveries, 5 mos.....	123,370	108,982	D. 14,388
Stocks, June 1.....	3,380	8,500	I. 5,120
Afloat for U. S.....	80,350	125,000	I. 44,650

The quantity afloat includes all cargoes due to arrive at United States ports before Sept. 15 next.

Mining Stocks

New York, June 5—The general market is still depressed and uncertain. The taking of a large amount of gold for shipment to France—indicating that foreign loans are being called in—had an unfavorable effect.

The curb market has been dull and weak. Sales have been small and buying orders little in evidence. It has been almost a dead week, in fact.

Boston

June 4—The mining-share market has been in the doldrums the past week and price changes, as a rule, have been unimportant. They showed a mending tendency for a while, but there is no stability to the market and buyers are lacking. Much depends upon the course of the metal market.

Amalgamated stiffened over \$3 during the week, touching \$87.12½, but in the meantime fell back to \$83.75 today. The annual report, issued Monday, had no effect on the stock. Calumet & Hecla has declared another \$20 dividend, making a total of \$103,350,000 distributed to date. The stock is off \$12 to \$798, ex-dividend. Quincy is off \$3 to \$112 on light trading. Another Boston director has been added to the Quincy board, making four in all.

Old Dominion fell \$3 to \$44. Of the 12,000 shares of new stock offered about two-thirds was taken by stockholders at par, \$50. Calumet & Arizona went off to \$150, ex-dividend, recovering to \$154. Copper Range has fluctuated within narrow limits and closes within a fraction of a week back at \$79. Franklin is off \$1.50 to \$13.50 and Isle Royale went off \$2 to \$14, recovering \$1.

Nipissing, Boston & Corbin and Helvetia have been the chief features for strength in the curb market.

Colorado Springs

June 7—The stock market is still dull and inactive, notwithstanding the mill and smelter returns for the month ending today show nearly \$1,250,000 output from the mines of the Cripple Creek district. The mines are producing and paying regular dividends, but the stocks seem to be gradually declining in price. The principal reason of this decline is that the investing public has grown tired of the manipulation of various stocks, both listed and unlisted.

STOCK QUOTATIONS

Table with columns for NEW YORK and BOSTON, listing various companies and their stock prices as of June 4.

N. Y. INDUSTRIAL

Table listing industrial companies in New York and their stock prices.

ST. LOUIS

Table listing companies in St. Louis and their stock prices.

BOSTON CURB

Table listing curb companies in Boston and their stock prices.

LONDON

Table listing companies in London and their stock prices.

Large table with columns for S. FRANCISCO, NEVADA, and GOLDFIELD STOCKS, listing various companies and their stock prices.

New Dividends

Table listing companies and their new dividends, including pay-able, rate, and amount.

Assessments

Table listing companies and their assessments, including delinquent and sale amounts.

Monthly Average Prices of Metals AVERAGE PRICE OF SILVER

Table showing monthly average prices of silver in New York and London from 1906 to 1907.

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

AVERAGE PRICES OF COPPER

Table showing average prices of copper in New York and London, categorized by Electrolytic and Lake.

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

AVERAGE PRICE OF TIN AT NEW YORK

Table showing average prices of tin in New York from 1906 to 1907.

Prices are in cents per pound.

AVERAGE PRICE OF LEAD

Table showing average prices of lead in New York and London from 1906 to 1907.

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

AVERAGE PRICE OF SPELTER

Table showing average prices of spelter in New York, St. Louis, and London from 1906 to 1907.

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