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CIRCULATION.

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CONTENTS.

THE FUTURE OF MINING.

The philosophy of industrial economics is being applied to mining in increasing degree. The exhaustion of bonanza deposits and the gradual improvement of mining and metallurgical processes have brought into the category of profitable deposits many ore bodies that were not workable a few years ago. The same process of evolution is effective now and for all future time. It is wise to pause now and then for the purpose of observing just where we are and just how far we may take advantage of the progress of applied science.

The task of summing up the present status of the mining industry is not a slight one. The writer who attempts to indicate the future must be thoroughly informed as to the present. Also, he must be conversant to an extraordinary extent with the past. In the current bulletin of the Institution of Mining and Metallurgy, Mr. A. G. Charlton takes upon himself the duty of outlining the future from an economic standpoint. His paper calls for more than passing notice.

Most important factors in the expansion of mining are the increase of population, the impressive improvement in mining and metallurgical practice, and the immense growth of railroad construction. Of all parts of the British Empire, Canada has gained most pronouncedly in the last decade. In railroad construction she has taken vast strides. Her population has almost doubled. Her mineral production has been multiplied by three. And we now are on the eve of larger and stronger development.

Looking into the future effect of various natural agencies, Mr. Charlton believes that, with the opening of lower grade deposits, the cost of supplies, wage-rates, and salaries, may possibly suffer a general lowering. In this we cannot concur. The history of mining, closely interwoven with the evolution of larger and more efficient mechanical devices, teaches the lesson that cheap labour is not good labour. The general and inevitable tendency is for wages and salaries to go up. The cost of supplies is controlled by so many arbitrary circumstances that generalizations are unsafe.

A second effect, and this Mr. Charlton considers more probable, is that the supply of metals per capita may become gradually less. The price of commodities would thus fall. But we see no force in the conclusion that there would result a proportionate diminution in the number of openings available for mining and metallurgical engineers. In fact, since the price of metals would have risen, the inducements to search for good mining investments would be greater. Not until the available surface of the globe shall have been pros-

pected will Mr. Charlton's argument hold.

Five modern undertakings of world-wide significance are, in Mr. Charlton's opinion, to influence profoundly both the general channels of trade and the mining industry. These are:—The opening of the Panama Canal; the establishment of an "All-Red-Route" through Canada; the completion of the Cape to Cairo Railway; the opening of Asia Minor and Persia by the Euphrates Valley Railway; and the awakening of China to modern methods.

The opening of the Panama Canal and the completion of the Grand Trunk Pacific, not to mention the linking together of the loose ends of the Mackenzie and Mann lines, will be of most vital importance to Canada. Unlike South Africa and Rhodesia, Canada has been primarily an agricultural, pastoral, and lumbering country. Mining is only beginning to take its proper place. With efficient railroad service, mining will sooner or later become not only the chief source of freight and the indirect source of numerous collateral industries, but will on its own merits overshadow all other industries with the exception of agriculture.

Many industrial, economic, and professional phases are touched upon in the paper under discussion. These are too numerous to permit of mention here. It suffices to say that Mr. Charlton, in language that is clear and vigorous rather than elegant, clothes with fresh interest certain truths that are too often overlooked. But we must not omit an expression of approval as regards his strongly worded plea for an Imperial School of Mining and Metallurgical Economics. The suggestion that an Imperial Minister of Mines is needed "to keep the heart of Great Britain in touch with mining affairs all over the Empire" is quite impracticable. Long-distance administrative offices, as witness India, are not to be desired. Canada has had her own sad experience. In matters educational the case is quite different. We cannot have too much of the spirit of free-masonry in the mining profession.

The problem of instructing working-men has been adequately attacked only in one province in Canada, and that province is Nova Scotia. Mr. Charlton emphasizes the opinion that British working-men are under-educated and, hence, man for man not up to the productive standard of their American and German cousins. He advocates the training not only of the labourer, but also of the employer. One means to the desired end is the international collection, co-ordination, and diffusion of geological, mining, and economic data.

The point that most concerns us in Mr. Charlton's paper is one that we have often enough laid stress upon. Advancement can only come with mutual co-operation. Capital is not the main requisite. Professional enterprise, official and private interchange of information, and careful, technical control of investment are the foundations upon which mining will attain the healthiest and largest future.

CEMENT.

The direct and specific charges brought by Sir Sandford Fleming against the promoters of the cement merger must not be ignored. The person whom the public believes to have been the prime mover in the whole consolidation is Mr. Max Aitken. Mr. Aitken, a Canadian born, is now a member of the British Parliament. His attainments have been widely advertised. In England he represents the typical successful Canadian. Thus, if for no other reason than expediency, the charges must be investigated, and either substantiated or refuted. Of course, there are other and better reasons. As a nation we require a thorough re-vamping of our business ethics. If Sir Sandford's allegations are true, wholly or in part, then our British cousins have just cause to conclude that Canadians are supinely willing to put a premium upon larceny and dishonesty, provided only that the scale of operations be large enough.

Canadian newspapers, irrespective of political colour, are now loudly demanding a thorough investigation. We may here allude to the fact that the first adequate summing up of the cement situation appeared in Mr. J. J. Harpell's book, "Canadian National Economy," recently reviewed in these columns.

The Toronto Globe, May 25, comments editorially upon the proposed investigation and calls vigorously for immediate action. It quotes, by the way, an editorial from the Moncton Transcript. It is instructive to note that the Transcript has pirated, almost word for word, a paragraph from Mr. Harpell's book.

On the face of things there seems to be ample ground for investigation. It will be remembered that the Canadian Cement Company was organized, under Dominion charter, with power to issue $5,000,000 of 6 per cent. bonds, $10,500,000 of 7 per cent. cumulative preferred stock, and $13,500,000 common stock. With the assistance of the banks the promoters purchased outright a number of cement plants, a number sufficient to assure control of cement prices in Canada. According to Sir Sandford Fleming the amount disbursed in purchasing eleven plants and in expenses was $16,592,250 in stock, bonds, and cash. But the total securities received by the holding company aggregated $29,998,400. Thus there is the enormous balance of $13,406,150 to be accounted for by the promoters. Moreover, the physical assets of the company are worth probably not more than $10,000,000. The truth then appears to be that Canadian consumers will be called upon to provide dividends on nearly $30,000,000, on an original investment of one-third that sum.

Light is thrown upon the situation by the request of the promoters, who still hold large blocks of common stock, to the Dominion Government for the privilege of converting the 7 per cent. preferred stock into 5 per cent. debenture stock. Obviously by this conversion some $200,000 of annual dividends will be transferred from the holders of preferred to the hold-

ers of common. And this again may be but preliminary to a general unloading of common after it will have become temporarily enhanced in value.

The labour cost per barrel of cement manufactured in Canada is low, lower indeed than in many countries where selling prices are more reasonable. The Canadian consumer pays as much as $2.50 per barrel. It is interesting, but not consoling, for the Canadian consumer to know that he is paying for motor-cars, English elections, and other picturesque perquisites of the promoter.

* * * *

Sir Sandford Fleming's name is known and honoured throughout the British Empire. The tactless impudence of two of the Cement Company's officers in commenting publicly upon his allegations is inexcusable. Sir Sandford's word will be accepted by all until he is proved to be mistaken.

For the Dominion Government to ignore Sir Sandford's charges will be only less disastrous than for it to indulge in the not unfamiliar device of padding a special committee. The knife, and not the poultice, is necessary.

BATHS FOR MINERS.

The coal-miner suffers socially from the peculiar nature of his work. At the end of the shift he resembles a chimney-sweep. If circumstances force him to perform his ablutions in his narrow cottage, he carries dust and dirt into his home, vexing the soul of the housewife beyond measure. In settled districts he has to travel, begrimed and begriming, from the pit mouth to his house. All this is humiliating.

Dr. J. S. Haldane, in a recent number of The Times (London), writes with unusual saneness upon this subject. He expresses the belief that the question is not one of hygiene but of social decency and propriety. Dr. Haldane is a competent authority. It is his opinion that the desirability of providing wash-rooms for the coal-miner does not depend upon any point of health, but that it is entirely a matter of expediency. "The reasons that make changing and thorough washing at the end of a shift desirable are not directly connected with the health of miners, for there is nothing unhealthy about coal dust, and coal mining, with all its risks, is one of the most healthy and wholesome of occupations. The main reason is that a miner who returns home unwashed and in his pit clothes must necessarily bring into his house an amount of coal dust which is apt to soil everything and every person in the house. . . . Washing and changing at the pit-head would save endless discomfort, trouble, and dirt, and could be more quickly and conveniently done than at home. Why it has never become universal at collieries I am quite at a loss to understand."

In the course of his letter, Dr. Haldane speaks warmly of the manliness and intelligence of coal-miners as a class. His words apply equally in Canada. Here, as elsewhere, the coal-miner is usually a fine specimen of self-reliant manhood. Loyal to a degree, he is, perhaps, apt to be led away by the demagogue. But a right appeal to his better instincts rarely fails of response. He is entitled to the best and fairest treatment. It is certain that consideration in small matters, and it is a comparatively small matter to supply soap and running water, would do much to create sympathetic understanding between employer and employee. Some, but by no means all, Canadian collieries make provision in respect of washing. All coal-mining companies should be obliged by custom, if not by legislation, to consider in this respect the comfort of the worker.

A WISE APPOINTMENT.

The announcement that the services of Mr. E. Jacobs have been retained by the B. C. Department of Mines will meet with the warm approval of all Canadian mining men. For many years Mr. Jacobs has devoted himself unremittingly to the cause of clean mining journalism. As editor of the British Columbia Mining Review he did notably good work. As secretary of the Western Branch of the Canadian Mining Institute he has spared no effort to rouse and maintain interest. In these directions Mr. Jacob's efforts have been of inestimable value to British Columbia.

But it is as a general journalist that Mr. Jacobs has done most for the Province. He is the staff correspondent of the CANADIAN MINING JOURNAL. Letters and articles from his pen appear also in several of the best mining publications on both sides of the Atlantic. In the newspapers of British Columbia, notably the Nelson Daily News, there appear frequent contributions from his pen. His annual review of mining in British Columbia is singularly complete, accurate, and timely. In short, upon Mr. Jacobs the public relies for truthful and regular information as to the progress of mining in the Canadian west.

Mr. Jacobs' distinguishing characteristics as a journalist are fearlessness, exactness, and capacity for work. He has the entire confidence of the mining fraternity in British Columbia and elsewhere. His appointment to an official position will aid rather than minimize his usefulness. The Government of British Columbia has acted wisely and well in giving recognition to a man whose chief object is the good of the industry.

THE GEOLOGICAL SURVEY.

On another page will be found a statement of the proposed field work of the Geological Survey during the coming summer. Our readers will notice that the officers of the Survey are well distributed throughout all the mining provinces. The influence of economic considerations is particularly evident. For example, Dr Andrew Lawson, of the University of California, who some years ago spent considerable time in co-

ordinating the geology of the Lake of the Woods and Rainy River regions, is again to devote his energies to these districts. No better choice could have been made. We sincerely hope that Dr. Lawson's revision of the geology of this country will bear immediate fruit. Other specialists, not members of the regular staff, are Dr. Heinrich Ries, Dr. R. A. Daly, and Dr. A. F. Foerst.

It is gratifying to note that the most prominent geologists on the continent are glad to be associated with our Geological Survey. This fact is in itself a constructive compliment to this branch of the Federal Department of Mines.

Incidentally, we learn that Dr. Chas. D. Walcott, secretary of the Smithsonian Institute, has accepted an honorary position as collaborator in geology with special reference to the Cambrian of the Rockies. Thus Dr. Walcott's results will be officially available to the Survey.

On the whole, the Survey appears to be in a fit and vigorous position. Its labours bear more closely than ever upon the industry of mining, and its grip upon puolic interest is yearly becoming stronger. The establishment of reciprocity in brains between Canada and the United States is quite as important as tariff-tinkering.

OURSELVES.

Modesty is a virtue. Not often do we lose sight of this fact. Circumstances, over which we have occasion to feel pleased, have impelled us to forget for the nonce our inherent diffidence. This issue of the CANADIAN MINING JOURNAL is larger by eight pages than former numbers. The pressure upon our advertising pages has become so great as to necessitate four additional pages. As a consequence we have added four more to our reading matter. This, we hope, will be as gratifying to our readers as to ourselves.

Having divested ourselves for a moment of our garment of modest reticence, it may not be unseemly to say a few words about the JOURNAL as an advertising medium.

Unlike the so-called trade periodicals, the JOURNAL does not appeal solely to one class or profession. It is true that our steadiest support has come from subscribers and advertisers who are entirely or almost entirely identified with the mining industry. But in addition the JOURNAL'S list of subscribers and advertisers is widely inclusive of many diverse interests. Our subscribers are scattered over the wide world. Japan, Corea, Russia, Germany, Central and South America, all appear upon our mailing list. All the countries of Europe are represented. But, after Canada and the United States, Great Britain and the remainder of the British Empire receive the largest share of copies.

The Canadian market for mining machinery, supplies, and specialties, not to mention professional talent, is singularly active. The bulk of our readers are men who are in that market for some commodity that has to do with mining, whether it be machinery or brains. Hence we feel that, without boasting, we may claim to occupy a unique position in that the JOURNAL is the only periodical that can appeal adequately to the large number of persons whose business in life is to buy or sell the materials that are necessary to the operation of mines.

THE SPRINGHILL STRIKE.

After long years of violence, recrimination and futile waste, the Springhill strike is at last ended. Never in the history of mining in Canada has there been a more acrimonious struggle. The points of difference, and the nature of the dispute, changed with every passing year. But each year brought its own accretion of bitterness and hostility.

For twenty-two months about 1,200 men have been idle. This is but a fraction of the total loss throughout the past. But it is probably the largest single item.

Peace has been secured. We are glad to note that the U.M.W.A. has not won recognition, because the U.M.W.A. does not deserve recognition. The P.W.A. is a far healthier, and sounder organization, and is indigenous to Nova Scotia.

PORCUPINE.

In our advertising pages will be found announcement of a forthcoming book on Porcupine. As set forth there, the demand for back numbers of the CANADIAN MINING JOURNAL containing articles on Porcupine could not be met. Hence the publishers felt impelled to bring out an adequate edition of a book that would include most of the published articles, along with some new and appropriate material. Very fortunately, also, through the courtesy of the Ontario Bureau of Mines, it has been possible to secure the latest official geological map of the district. This excellent map is remarkably complete and accurate and is in itself an absolute necessity to the prospector and miner. It must be noted that the Bureau gives no official sanction to the material in the book. The map is copyrighted. As an act of courtesy the Bureau has permitted us to secure a number sufficient for the present book. But this implies nothing more than the mere fact that the map appears with our book.

The book is so arranged as to give the reader all the present available authoritative information that is required to guide him in learning about Porcupine. One or two general articles are included for the benefit of the untechnical reader. Late claim maps and a brief directory of companies are useful additions.

We sincerely hope that the volume will serve the purpose for which it is designed.

The Yukon navigation season has opened. The first steamer from Dawson for Iditarod was booked to sail on May 30.

Construction of 110 Koppers By-Product Regenerative Coke Ovens for the Algoma Steel Company at Sault Ste. Marie, Ontario, Canada.

By D. M. GRIFFITH.

On March 11th, 1911, the first coke was made in No. 1 battery of the 110 by-product coke ovens, which were constructed by H. Koppers, of Joliet, Illinois, for the Algoma Steel Company at Sault Ste. Marie, Ontario, Canada. Less than a year elapsed from the time excavation was started until the ovens were producing coke; and considering the extreme conditions under which this plant was built, such as severe weather, marshy ground, poor labour conditions, isolation of plant from base of supplies, working from temporary yard level, etc., remarkable progress was made in its construction.

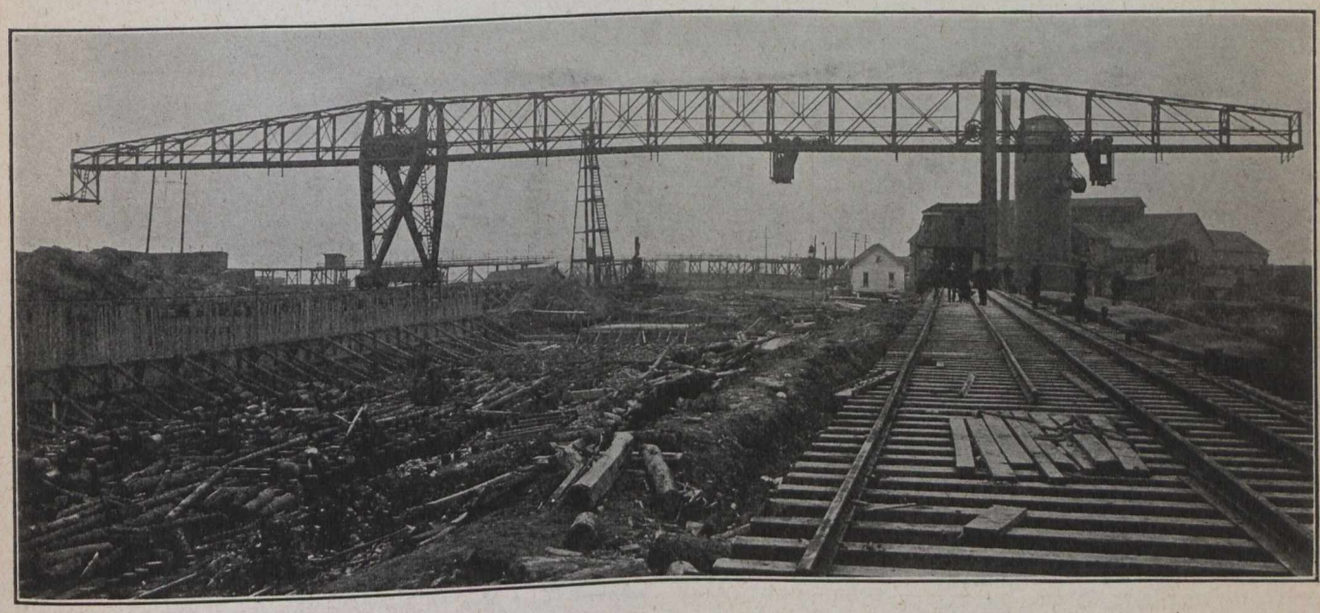


Fig. 1.—Part of the Piling Used for Carrying the Concrete Slab. Photograph taken April 5, or 15 Working Days after Excavation was Started.

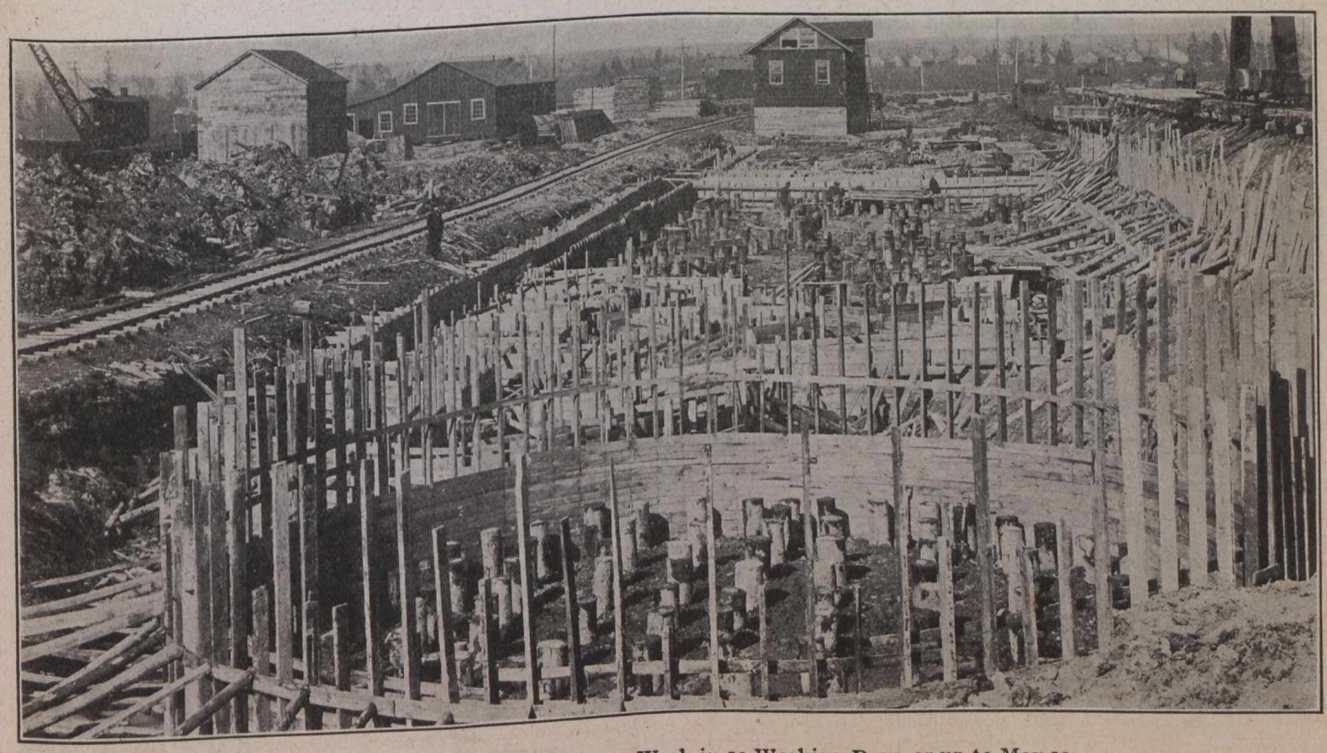
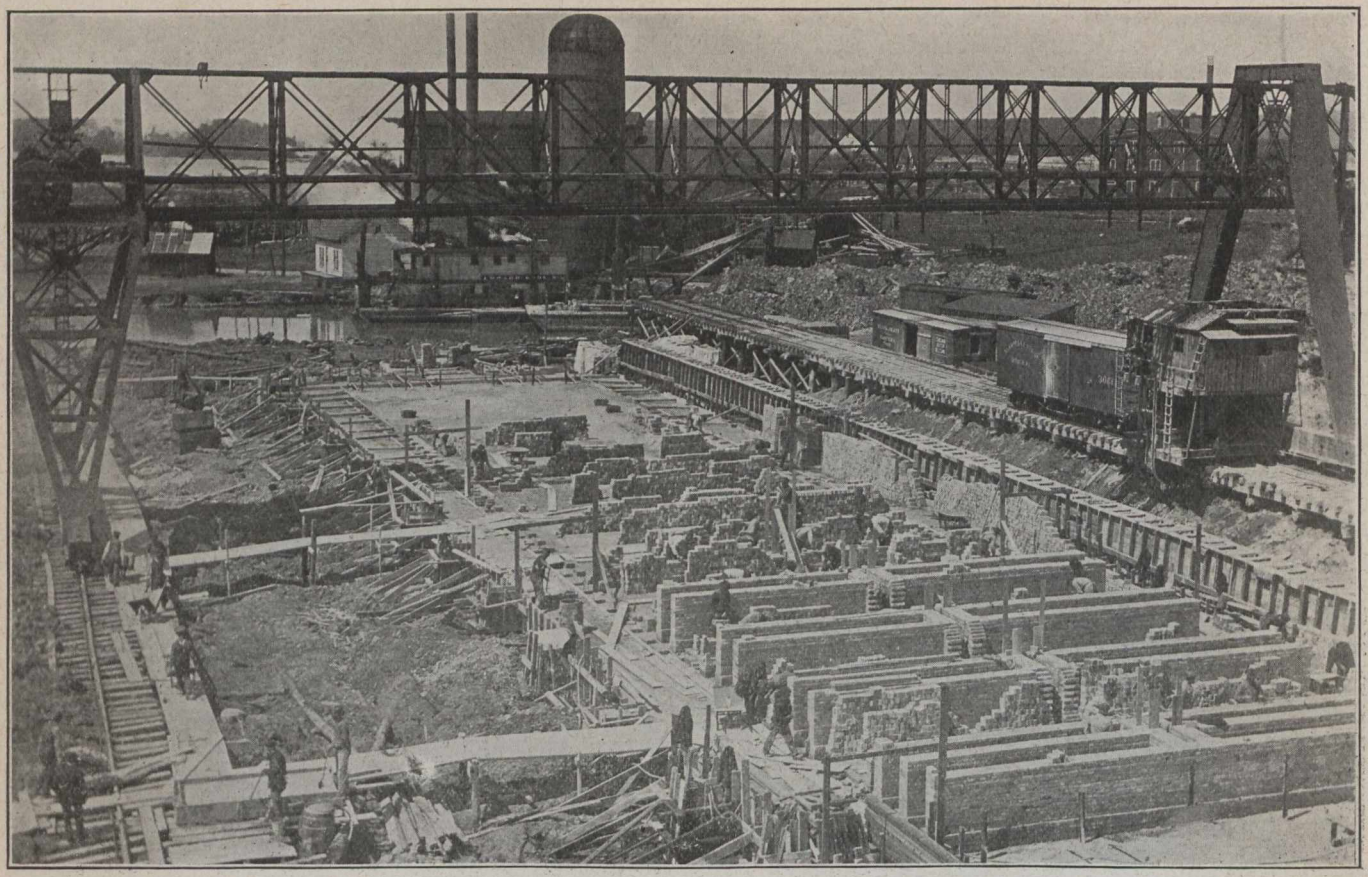


Fig. 2—Progress of Piling and Form Work in 19 Working Days, or up to May 19.



Fig, 3—Oven Foundations and Chimney Flues to Stack, with Brick Work on Regenerator Walls under way.

On account of the marshy ground at the site chosen for the coke plant, it was necessary to support all of the foundations upon piling. The total number of piles required was about 6,020.

To divert the course of a creek which wound around through the coke plant site, two concrete retaining walls were constructed. One of these walls was made of sufficient size to support the track for the shear-leg of the travelling coal bridge. This creek now extends the entire length of the coke plant, and empties into the slip just beyond the stack end of battery No. 1.

The slip was extended about a half mile, so that

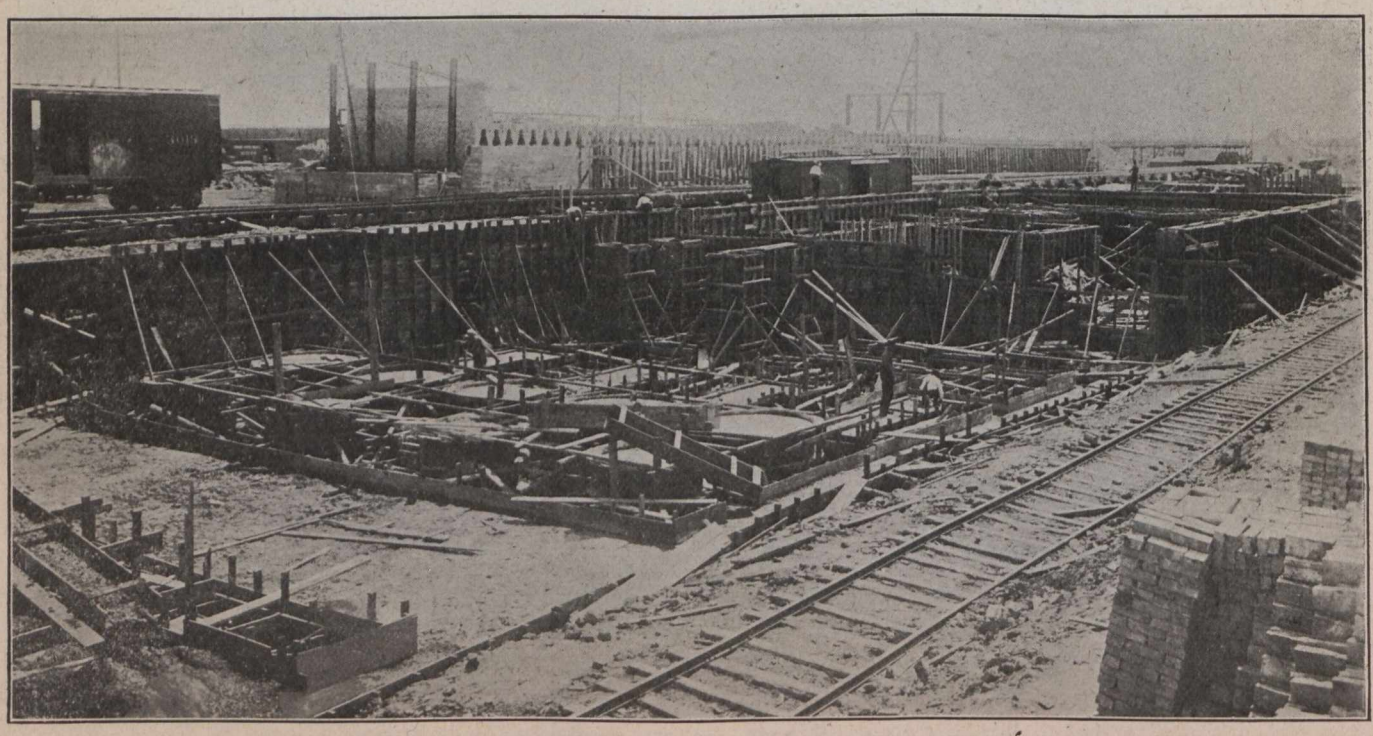


Fig: 4.—Showing the large Amount of Concrete and Form Work completed in 37 Working Days Following the view in Fig. 2.

coal could be delivered direct to the coke plant by boat. This channel is 90 feet wide and is of sufficient depth to take care of boats with a carrying capacity of 12,000 tons of coal.

conveyed, by electrically operated coal transfer cars, to either the coal storage pile or to the coal hoppers.

The coal is taken from this hopper by a belt, to the coal breaker and crusher building, where it is

Fig. 5.—Showing by Height of the Locomotive the Large Amount of Form Work needed to give a Yard Level 16 Feet above Top of Piles.

Fig. 6.—Progress Made up to October 6, 1910.

In connection with this slip, and extending its entire length, has been constructed a very substantial timber dock. This dock supports the track on which the coal unloaders travel. also a coal transfer trestle, by means of which the coal from the boat unloaders is broken up and the iron particles removed by a magnetic separator. The coal is then crushed and conveyed by a belt to mixing bins, from which point it is conveyed by another belt to the 2,000-ton coal storage bin. By means of hand operated gates, which are lo-

cated in the bottom of the coal storage bin, the coal charging car receives the coal from the bin for charging direct into the top of the ovens.

In fig. 1, which is shown on this page, can be seen a part of the piling which is used for carrying the concrete slab, upon which the oven and stack foundations

5, 1910, which was just fifteen working days after the excavation work was started.

Fig. 2 shows the progress made in the construction work on No. 1 battery up to May 7, 1910. In 27 working days, the form work for the voids and chimney flues was completed, and the 3-foot thick concrete

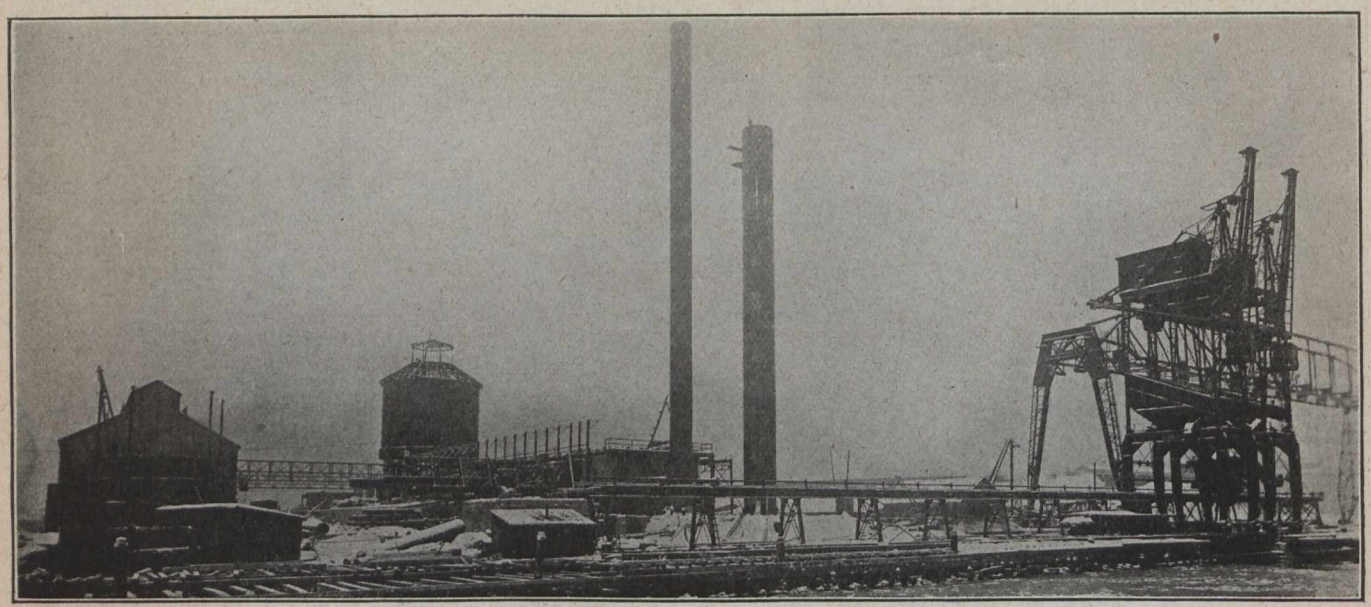


Fig. 7.—View taken December 7, 1910. showing Slip, Coal Unloaders, Coal Transfer Trestle and Storage Bin, By-Product Building and Battery No. 1, with Stack and Gas Holder.

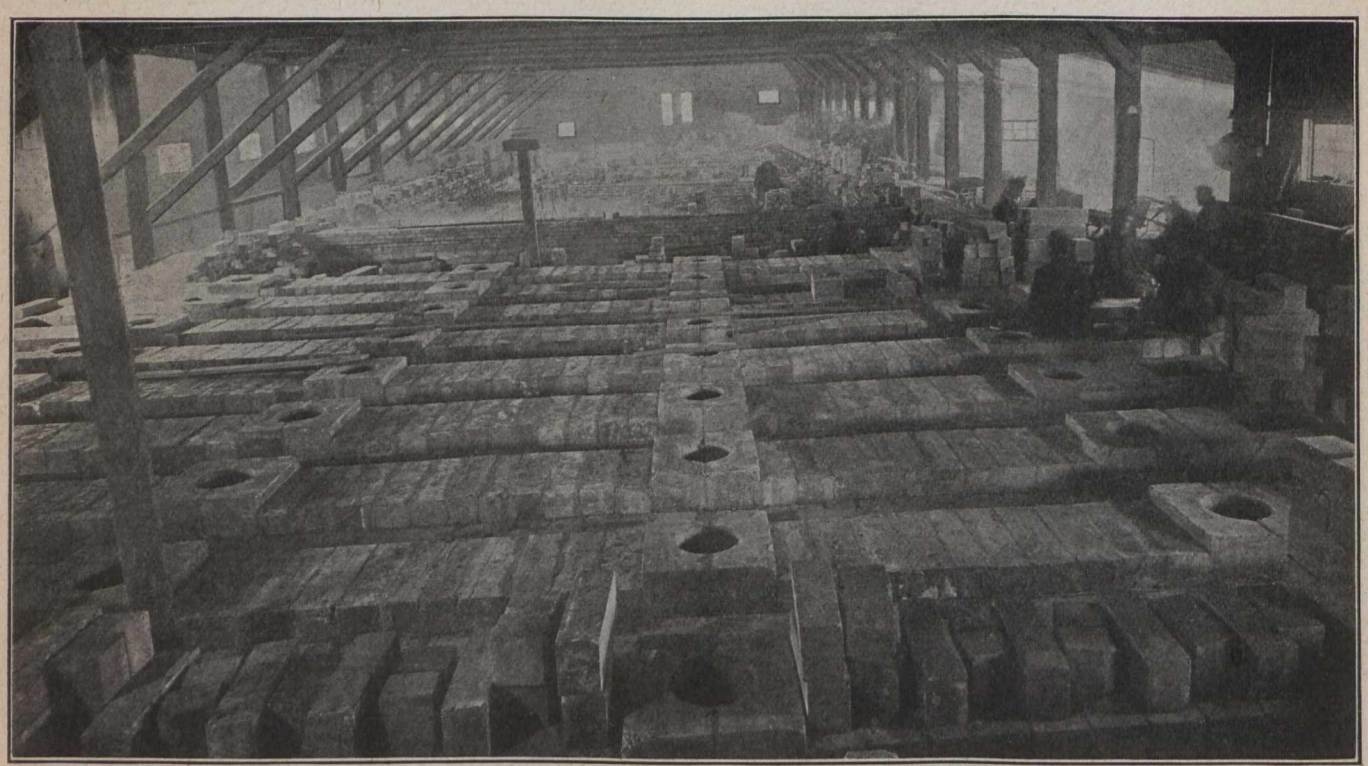


Fig. 8—Temporary Building over Battery No. 2. Brickwork for This Battery Nearly Completed.

are supported. These piles vary in length from 30 feet to 60 feet, and are spaced about 2 feet 9 inches, centre to centre. The steel travelling bridge, in the background, is used for distributing the concrete for the oven and by-product building foundations and the creek retaining walls. This picture was taken on April

slab, which rests on the piles, was laid. Also, the concrete foundations for the entire first battery were up to an elevation of 11 feet above the top of the piles. This left a height of about 5 feet more of concrete to be put in, to bring the oven foundations up to the proper level for the starting of the brickwork.

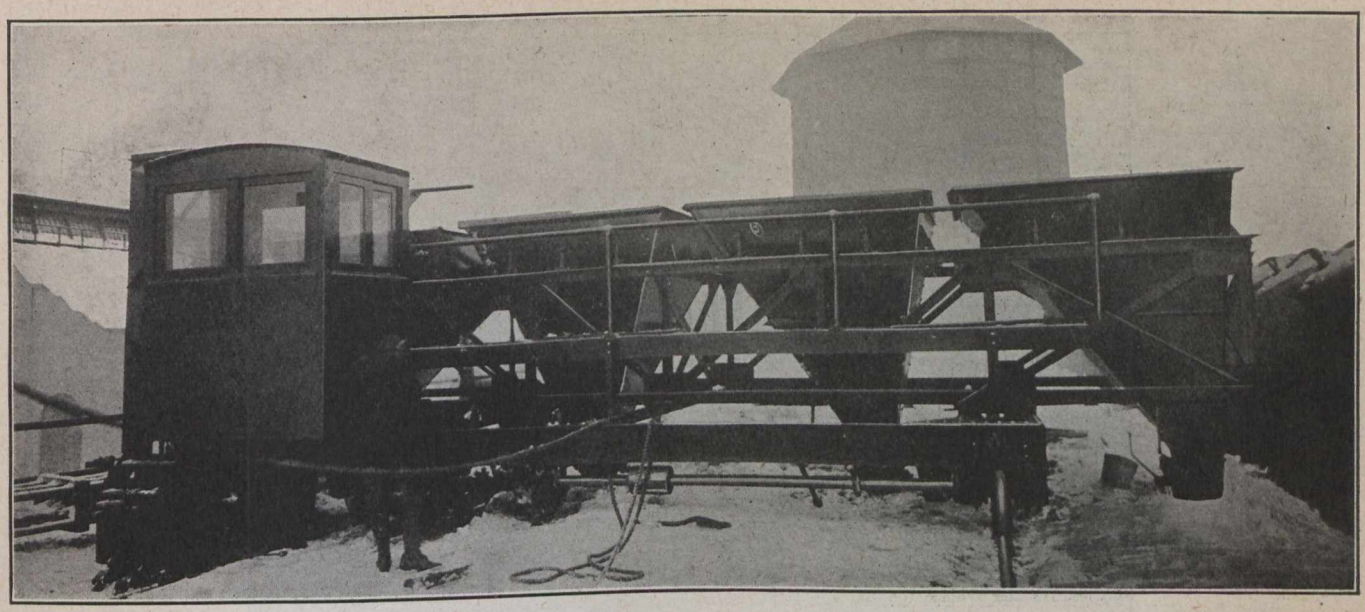


Fig. 9—Electrically Operated Four Hopper Coal Charging Larry.

On April 26th, excavation work was begun for the by-product building and gas holder. In fig. 3, can be seen the progress made in piling and form work, up to May 19th. In nineteen working days all of the excavating and piling for the foundations for the by-product apparatus, building walls, and gas holder was finished, as well as considerable form work for gas holder and building walls.

Fig. 4 shows the progress made in the construction work on the ovens, up to June 8th. This picture was taken just one month later than that shown in fig. 2, and it will be noted that the oven foundations have been finished, and the chimney flues to stack have been constructed and lined with brick; and a good start has been made on the brickwork of the regenerator walls. In the background can be seen the progress which has been made on the slip, up to this date. The channel has been dredged for a distance of about one-third of a mile, and has reached a point a little beyond the centre line of ovens.

In fig. 5 can be seen the excavation and piling for the creek retaining walls, between which will flow the creek, whose course was diverted.

Fig. 6 shows the progress made on by-product building form work and foundations up to July 2nd. It can be seen that a large amount of concrete and form

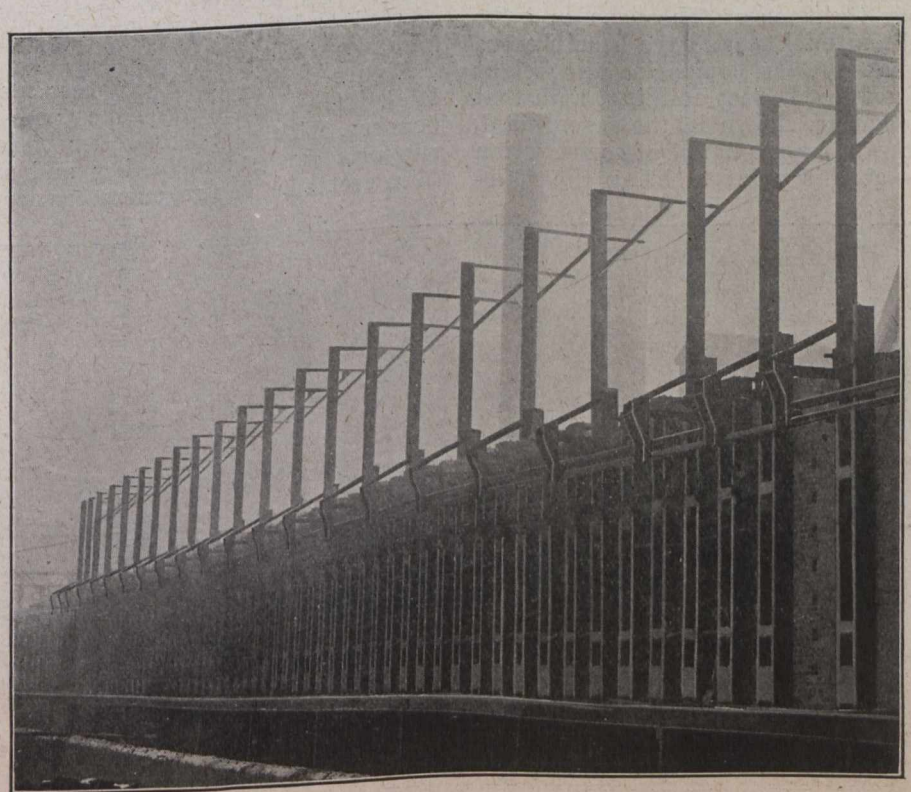


Fig. 10—Progress on Battery No. 2 up to March 1, 1911

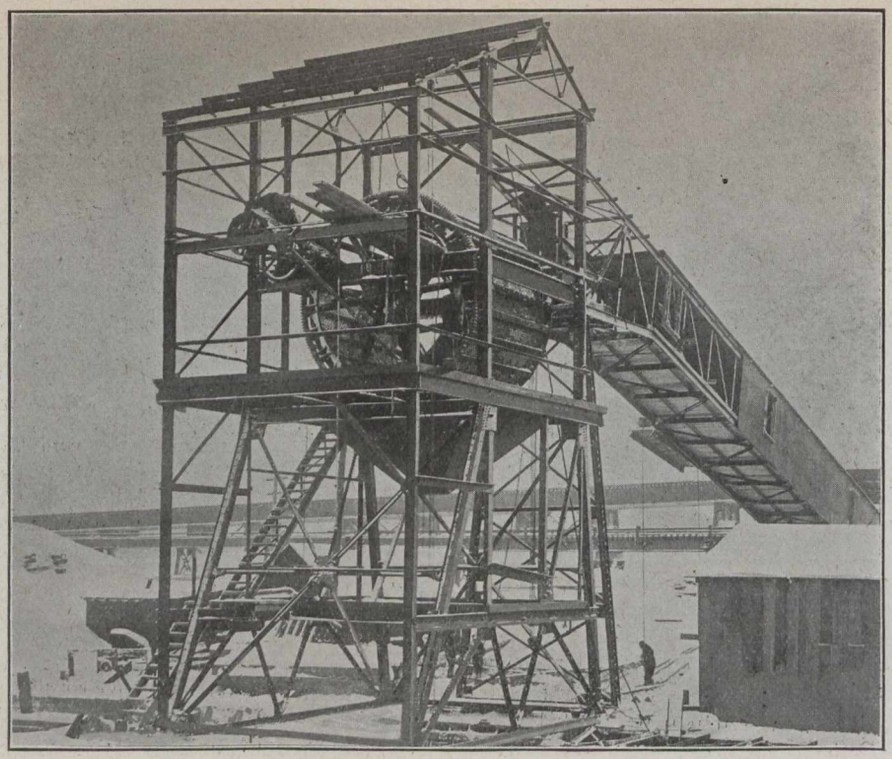


Fig. 11

work has been completed during the interval of 37 working days, which elapsed between the taking of the photographs, shown in figures 3 and 6.

Fig. 7 shows the amount of construction work that has been done on the ovens and by-product building, up to August 13th. The regenerator walls have been finished; the oven wall brickwork has reached a height of about 4 feet above the floor of the ovens, and the concrete pinions and end buck-stays have been erected at each end of the battery. In comparing the height of the form work of the by-product building, with that of the standard locomotive, shown in the foreground, one can readily see that a large amount of construction work was necessary at this point to bring the foundations to their proper elevation, so that the finished yard level would be 16 feet above top of piles.

Fig. 8 shows the progress made up to October 6, 1910. The brickwork has been completed for battery No. 1. In the foreground is shown a part of the form work and concrete for battery No. 2. The steel roof trusses and columns for the by-product building are erected, and work has been started on the purline and building walls.

Figure 9 shows the progress made up to Nov. 16, 1910. The buckstays, coke and pusher side steel benches, with cast iron cover plates, steel stack, and supports for gas collecting and suction mains have been erected. The regenerators are filled with checker

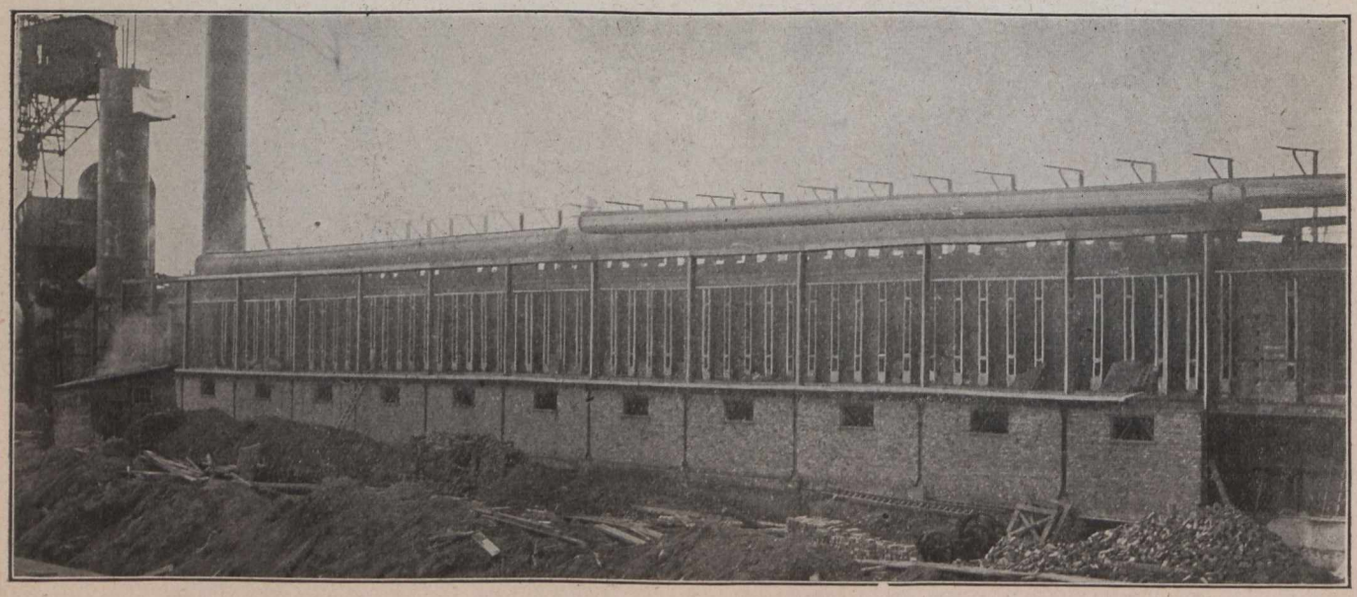
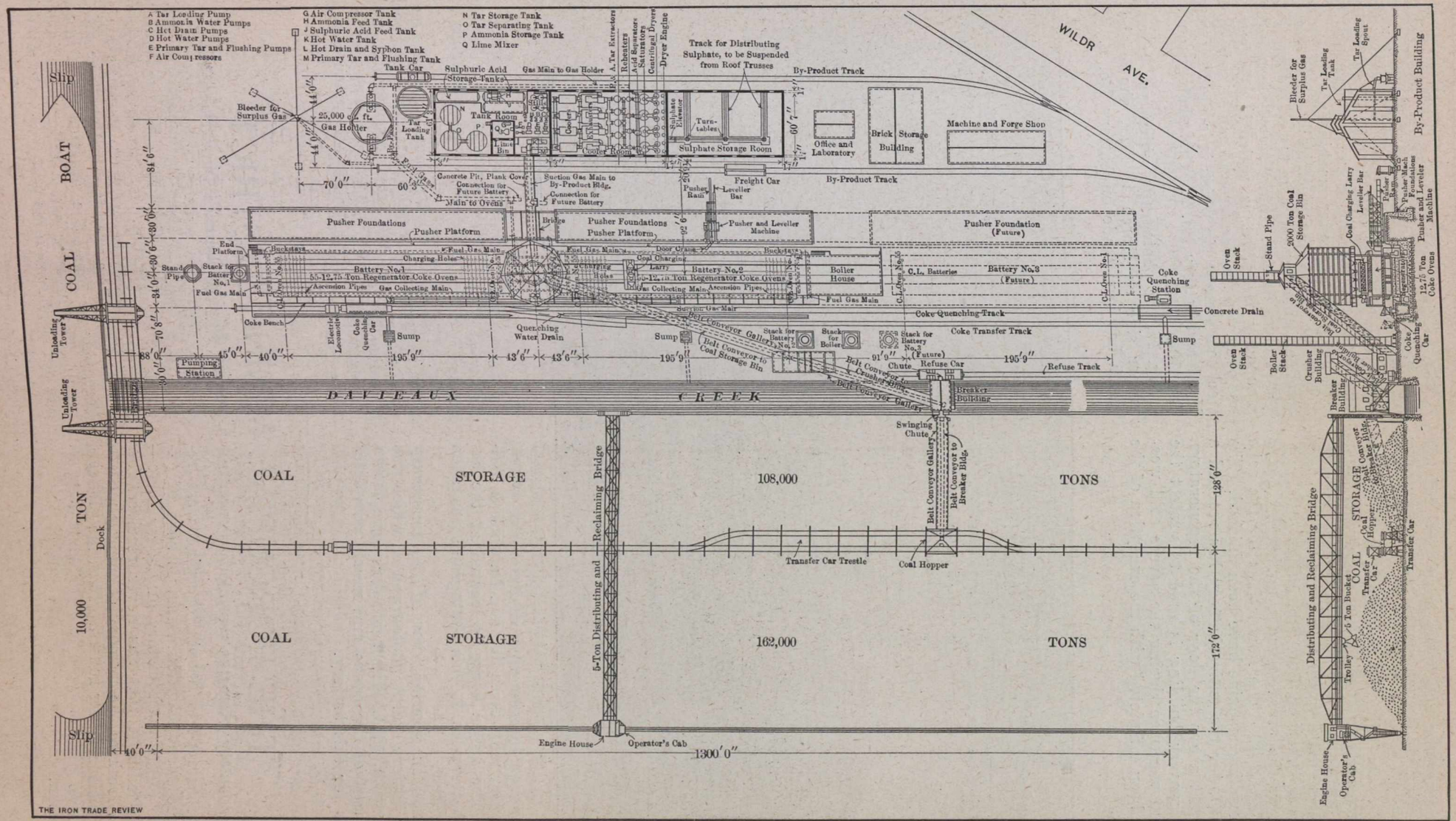


Fig. 12



General Arrangement of Koppers By-Product Coke Ovens at the plant of the Algoma Steel Company, Sault Ste. Marie, Ontario.

brick, the regenerator end walls have been bricked in; and the brick walls underneath the benches have been completed.

Fig. 10 shows the slip, coal unloaders, coal transfer trestle, dock, travelling coal bridge, standpipe, pump house, stack for battery No. 1, coal storage bin, by-product building, battery No. 1, and gas holder. This photograph was taken on Dec. 7th, 1910.

Fig. 11 shows the progress made on battery No. 2 up to Dec. 15th, 1910. The foundations for the coke pusher and levelling machine have been finished. The oven brickwork for the entire battery has reached a height of 8 feet above the floor of the regenerators. The large temporary building is used to protect the brickwork and workmen during the severe cold weather, and has been completed with the exception of the side sheeting.

Fig. 14 shows the progress made on a part of the coal handling machinery up to Jan. 6, 1911. The steel framing for the breaker and crusher building, and the conveyors from the coal hopper to breaker building, have been erected and work has been started on the erection of the breaker machinery.

Fig. 15 shows the electrically operated 4-hopper steel coal charging larry on top of battery No. 1. This car receives its coal from the coal storage bin and has a capacity of 12.75 tons, which is sufficient to charge one oven. In the background can be seen the 2,000-ton steel coal storage bin which is located between battery No. 1 and battery No. 2. This photograph was taken Jan. 10th, 1911.

Fig. 16, the photograph which was taken from the pusher side on March 1, 1911, shows the progress which has been made on battery No. 2. The brick-

Fig. 12 shows an interior view of the boiler house, which is equipped with three 300 h.p. Babcock & Wilcox boilers. The boiler house is located at the extreme end of battery No. 2. This photograph was taken on Dec. 28th, 1910.

Fig. 13 shows an interior view of the temporary building over battery No. 2, photograph of which was taken on Jan. 16th, 1911. The brickwork here shown is above the roof of the ovens and nearly completes the brickwork for this battery.

work, including the regenerator end walls and the checker brick has been finished, and the buckstays and structural work on coke and pusher benches have been erected.

Fig. 17 is a general arrangement of the entire coke plant, showing the present installation of two batteries of 55 ovens each; and provision made for a future installation of one battery of 55 ovens.

Battery No. 2 will be ready to make coke by April 24th.

THE PORCUPINE MINING DISTRICT

Introductory Remarks reprinted from text of Canadian Mining Journal's New Publication.

The first press reports about Porcupine were received with the silent skepticism that is born of experience. The unfortunate history of Larder Lake—a district, incidentally, that has never received fair play—was too fresh in the memory of mining men to permit of enthusiasm being roused. Thus the pioneers of the Porcupine district were left for some time in splendid isolation.

While this was wholesome morally, it was not encouraging. The nomadic prospector depends upon the public to pay his shot. He has no desire to operate—he merely wishes to discover, to make his "stake," and to have done with it. In Cobalt he did this. In Porcupine he found the situation much more complicated. The investor had a bitter taste in his mouth and did not intend to be guilty of certain indiscretions

that marked the birth-throes of Cobalt. Nevertheless, a number of ready sales took place. Companies and syndicates were organized post-haste, and the promoters did not suffer. But in the greater number of cases the investor held aloof. The consequence has been that the majority of Porcupine flotations have been engineered with a view to taking in immediate profits. This phase is remunerative to the individual, but most costly and unbusinesslike so far as Porcupine is concerned.

Cobalt, when it was discovered, met with a very cold reception from mining men. As soon, however, as actual shipments of ore were made, recognition came with surprising rapidity. Then followed a period during which those whose judgment had been at fault sought to vindicate themselves by throwing cold water on the camp. But Cobalt, despite all captious critics, made good.

Cobalt brought into play much more prospecting and mining talent than could well be taken care of. Hence it was natural that many individuals should seek new fields. New fields were sought and were found. Porcupine was the first fruit.

In its first position Porcupine was between the deep sea of popular incertitude and the devil of promoters' bombast. As to the real character of the ore bodies there was room for scientific discussion. But the atmosphere is now clear, at least geologically. The prompt and effective work of the Ontario Bureau of Mines was of inestimable value to the camp. The advent of substantial foreign interests is to be credited to the Bureau's timely activity.

So vigorous was the early prosecution of mining in Porcupine that the Ontario Government decided to build to the camp a branch line of the Temiskaming and Northern Ontario Railway. This line will be finished during the coming summer. Naturally it will mean much to the district. Only those who worked their way over the summer trail last year can realize how severely Porcupine operators were handicapped by the lack of transportation facilities. The fact that teams were hired for as much as $25 per day gives some idea of the situation. But by far the worst obstacle was the bad mail and telegraph service. The exigent terms imposed upon buyers made it almost impossible to investigate mining claims sufficiently. It can readily be imagined that a delay of one or two weeks in transmitting a letter from Porcupine to Toronto, Montreal, or New York might imply the difference between success and failure in putting through a mining deal. In any case, the general tendency would be to come to a decision that was unwarranted by existing conditions. Now, however, since Porcupine will have all the advantages of modern communication, it is entirely possible to investigate fully any claim. This will temper the tone of promotion.

* * * * *

Ontario has had a very bad name in gold mining. The contributing factors in this bad name are too numerous to mention. But the prime fact is that the gold mines of the province have never been worked on their own merits. There has been far too much booming and promoting, and far too little ready money and common-sense. The Lake of the Woods region, for instance, had much to recommend it. Probably to-day money could be made out of several of the properties that have been labelled failures. But the district has lost favour in the eyes of prospectors and operators. This is true of more than one gold-mining section of Ontario.

Except for the Yukon excitement, no such widespread interest has ever been stirred up in Canada by the discovery of gold. Quite apart from any direct profits that may accrue to operators in Porcupine, the advertisement to Canada generally and to Northern Ontario specifically, is of enormous value. Following so closely upon the exploitation of Cobalt, the opening up of Porcupine has kept Northern Ontario continuously in the lime-light. It has strengthened decidedly the belief that there are yet many prizes to be won in the hinterland of Ontario and the adjoining area in Quebec. An illustration of this is afforded by the large amount of staking that just now is being done on the territory surrounding Keekeek Lake, Pontiac County, Quebec. Humanly speaking, it is improbable that attention would have been paid to this remote spot for some time to come had it not been for Porcupine.

Study of the mining situation, in Ontario, brings the conviction that only the fringe of the northern mineral belt has been touched. The summer of 1911 will see more prospecting done than ever before. Succeeding seasons will bring more men and more money to the country. It is absolutely within the range of probabilities that other Porcupines will be discovered. If Porcupine lives up to its promise, then Ontario will have received an unprecedented commercial impetus. Moreover, the wave of development will spread through to Quebec. Farming will follow hard upon the heels of mining. Thousands of square miles of arable land will be thrown open to the farmer and a permanent population will be established.

Considering the large number of bona fide investments that have been made in Porcupine, it behoves mining men to do what in them lies to disseminate right information and to discountenance the wild tales that emanate from all irresponsible sources. In whatever way Porcupine may develop, it now seems that in a few mines money will actually be made. But many more may prove profitable if initial sales and promotions are handled decently. In other words, sane exploitation will give the camp a maximum chance; frenzied speculation will shorten the life of individual mines and will injure the camp permanently.

* * * * *

The demand for back numbers of the CANADIAN MINING JOURNAL containing articles on Porcupine has exhausted all available supplies. As that demand shows no signs of abating the publishers of the JOURNAL decided to issue in pamphlet form several of these articles along with other material. The geological map that goes with this book was secured through special arrangement with the Ontario Bureau of Mines. The map has been copyrighted by the Bureau. It is to be noted that the Bureau assumes no responsibility, direct or indirect, for the matter contained in this book. The publishers, however, wish to express their warm sense of gratitude to the Bureau for the courtesy extended.

It is hoped that the information contained in the succeeding pages will prove a useful guide to professional men and investors.

PROGRESS IN MEXICAN MINING AND METALLURGICAL METHODS DURING THE CENTURY OF INDEPENDENCE

(Continued from last issue.)

The proper proportion of common salt is then added to the torta and thoroughly mixed with the pulp (repaso) by the action of 24 horses, held on lines by the "tortero," round whom they circle, while he himself continually changes his position, so that all parts of the torta are eventually reached. Before 1793 this work was done by hand. The next operation consists in the admixture of "magistral," an impure sulphate of copper obtained by the calcination of copper pyrites containing variable quantities of iron. Lastly, the torta is incorporated, that is, mercury is spread over its surface in a fine spray produced by filtration through porous cloth. After each addition of ingredients, and afterwards every other day, a repaso is given. In from 20 to 30 days, according to the size of the torta and the weather, the chemical action is complete, and the torta is said to be "rendida." The silver and gold has combined with the mercury to fluid amalgam, from which the pulp is washed by a liberal addition of water and stirring in large cylindrical vats. It is now only necessary to filter the excess of mercury off the solid amalgam, distill the latter in the manner described before for the gold amalgam, and melt. The product is very pure. Its fineness is determined in the mint and expressed in thousandths of the gross weight. Impurities are deducted and it should be noted that if gold is present in less proportion than three one-thousandths, it is not only not paid for, but even deducted from the silver as an impurity. Small wonder that Mexican pesos of this period from the gold bearing districts, are subjected, at a good profit, to parting in London and Paris.

The patio process is a purely empirical one and requires great practice on the part of those who carry it out. It would lead us too far were we to attempt a detailed description of all the operations in connection with it, or to mention the various vicissitudes to which a torta may become subject, and the means for diagnosing and correcting them. The only guide for the "azoguero" is that afforded by frequent tentaduras. From time to time improvements, based upon chance discoveries, have been introduced and local modifications, demanded by peculiarities of the ore, have been made, but the history of the process is free from the often absurd nostrums frequently used during the earlier times of Californian panamalgamation. Altogether, Medina's discovery was an admirable one and much more perfect than the mining methods in use at the beginning of the 19th century, which have been described above, for no other process until the advent of cyaniding has been able to oust it.

We have tried to produce an impressionist picture in broad traits of the methods employed in Mexican mining and metallurgy at the beginning of the century, in the years immediately preceding the outbreak of the revolution which ultimately liberated the country from the oppression under which it had been ground for more than two centuries and a half. It was the most productive period of Mexican mining with which the general prosperity of the whole country had naturally kept pace.

Then came the revolution, and with it almost complete stagnation of the industry. Guanajuato, a rich city of 100,000 inhabitants, had most to suffer from the depredations of the contending parties, and besides other material losses, had to face the almost complete destruction of its principal industry. The population dwindled down to barely 14,000; work in the mines became paralyzed on account of the impossibility of procuring workers, and the necessary fodder for the great number of animals required in the operations. Unwatering of the mines had to be abandoned and in many mines the water rose to the level of the bocamina. In others, which were not wholly submerged, exploitation was confined to the scrapings of the upper workings for the ore which had been overlooked in more prosperous times. The production fell to one-quarter of what it was in the years immediately preceding the revolution. While in the great Valenciana mine the extraction in 1808 had a value of $1,523,000, it dwindled down in 1823 to only $36,200. In one word, mining was at its lowest possible ebb, and what was even worse, the spirit of enterprise had been crushed and the means for recovering the lost position were utterly wanting.

The first relief from this apparently hopeless condition of affairs came from a quarter to which at the present day we hardly give sufficient credit for the timely help which it afforded, even if it was actuated by motives of self interest.

The country, after having shaken off the Spanish dominion, was now open to the whole world, and English capital was the first to appreciate the opportunity for engaging in profitable mining undertakings in Mexico. One company acquired the Real del Monte properties in Pachuca from the Count of Regla. Others took in "avio," the most important mines in Guanajuato, as well as in other parts of the country. Through ignorance and inexplicable negligence on the part of the local representatives their operations were huge financial failures, and after spending large sums in endeavours to retrieve their fortunes, they had to retire from the field with enormous losses to the share holders. While we cannot commend these companies for intelligent management, or for signal improvements in the method of working, it is undeniable that by bringing large sums of money into the impoverished country, which were mostly expended in the unwatering of the mines, they gave the first impulse towards a renewal of interest in mining, collected the scattered mining population, and in other ways prepared the road over which the original owners afterwards travelled towards prosperity.

On the whole, while mining in the years following, again became highly profitable, no improvements of importance took place for a long time. Among the older members of our Institute there are still many who have been eye-witnesses to the crude methods in vogue before the period of Mexican independence as they have been described above. However, gradually proper chemical methods for determining the nature and richness of ores took the place of the former tentadura;

dynamite was substituted for black powder; rock drills came into use and the raw cowhide with its concomitants was more and more relegated to the background. (2) This progress is due in great part, to the intelligence, adaptability and perseverance of the national engineers who received an admirable training in the mining schools. But they had to contend against powerful enemies: First, the fact that the country was far removed from machinery producing centres and that the means of transport were insufficient and the conditions for industrial independence, namely cheap fuel and iron, were as yet lacking. Then deep-rooted habits of indolence and improvidence of the labouring classes had to be overcome, and we all know that time is a necessary condition to effect reforms in this respect. And finally, there was the egotistical attitude of the monied classes towards mining. The old spirit of their fathers had departed and the capital was diverted from the mining industry to be invested in undertakings which offered results without the necessity of personal application.

We repeat, the progress made up to the end of the last century was slow, and Mexico stood in danger of being surpassed, notwithstanding its enormous mineral wealth, by other nations either more enterprising or more favourably situated with regard to fuel.

Then the situation suddenly changed. The discovery was made that in the numerous streams descending from the central tableland towards both coasts, an enormous source of power was contained which could be converted into electric energy and conveyed, without great loss, to the important centres of industry.(3)

You are acquainted with the stupendous undertaking in the valley of Necaxa, at least in its effect on life in this capital. But its bearing on the development of the mining industry can hardly be realized by those not directly connected with it. The wonderful activity displayed in such mining centres as Pachuca, El Oro, Guanajuato, and others, would be impossible, or at any rate greatly handicapped, if coal had still to be used for the production of motive power. Not to mention the total insufficiency of the power to be derived from the work of mules and horses. All the animals at work in the Guanajuato mines and mills during its most prosperous period could, during a whole month, not supply the energy required for the work of a single day. It may therefore be truly said that the advent of electricity marks a most important epoch in the history of mining and that Mexico in consequence of its unusually favourable hydrographical conditions has derived more benefit from the application of this agent, which but yesterday was scarcely known, than any other country. Instead of suffering from scarcity of fuel we have suddenly attained the position of possessing unusually cheap mechanical power.

Another discovery which gave an immense impulse to Mexican mining was the method of extraction of the precious metals from their ores by means of weak solutions of potassium cyanide. There has been much controversy over the question as to who was the real discoverer of the principle underlying this operation. We shall not enter into it here. Uncontrovertible, however, is the fact that since the introduction of the process by the McArthur-Forrest interests, millions of tons of ore, which formerly had to be considered as of no value, can be treated profitably, in consequence of which the economic conditions of the mining industry have been radically changed and much foreign capital has been attracted.

Mexico was somewhat slow in adopting this method, possibly on account of the fact that as at first practised, it was more applicable to gold than to silver ores. (4).

In our description of the process we can be much more concise than we were in that of the earlier methods, if for no other reason than that Rayas in 1808 is immeasurably farther from us than, for instance, Pachuca in 1911. Any of the modern reduction works there can be readily visited by those desiring some knowledge of this newest branch of metallurgy of the precious metals. Such a visit will afford convincing evidence of the great importance of this method of ore treatment and will show that, while Mexico entered on the field long after other countries, once the start was made, it has not only kept pace with them but, certainly as regards the treatment of silver ores, is ahead of most.

Briefly, the process is carried out as follows: as in any other wet method of extraction, the ore is finely triturated in stamps, chilean mills and tubemills, cyanide solutions being added from the beginning. The separation of sands from slimes, which a few years ago was considered indispensable to successful cyanide practice, has been superseded in all modern plants of this country by the "all sliming" method in which the sand is all ground as fine as possible or rather as fine as necessary, to obtain the best economic results. The pulp, consisting of finely ground ore and cyanide solution, is then agitated by means of mechanical stirrers or by compressed air, the latter now being made the rule in Pachuca. When the cyanide has completed its chemical action on the gold and silver of the ore, these substances are found in solution as double salts with sodium cyanides. This solution must now be separated from the worthless tailings by means of vacuum or of pressure filters of various construction, of which new forms are almost daily brought out. The clear filtered solutions are then brought into contact with zinc shavings or zinc dust, on which the precious metals are precipitated at the expense of the zinc.

The solutions after having been brought to their original strength by the addition of fresh sodium cyanide, enter again in circulation by being returned to the grinding apparatus. The black precipitate obtained by the operation, consisting chiefly of gold, silver, finely divided zinc, lime, alumina and other impurities, is then washed in filterpresses, dried, melted with suitable fluxes, and finally cast into bars of about 30 kilos, which are exported The product is not of the same purity as that from the patio process, rarely being above 950 fine, but, on the other hand the extraction is above 90 per cent. of the silver and 98 per cent. of the gold, and the process requires only as many days as formerly weeks, and the cost is less than one-fourth.

A description of the mechanical details of the appliances used in the cyanide process would fill volumes and not be pertinent to the purpose of this paper, which is to draw attention to the great and beneficent change in methods since the time when Mexico obtained its independence, especially during the last 30 years, when continued peace and tranquility made it possible to devote all the available energy to the development of the industry.

It must be noted that since the introduction of cyaniding all efforts have been directed towards improvements on mechanical lines, in which certainly wonderful progress has been made. Our knowledge of its

chemistry has, however, not advanced at the same rate and is still very much as it was when McArthur-Forrest first advocated and practised the principle involved, with the important exception, however, that it was found that in the treatment of silver ores, the extremely weak solutions used on gold have hardly any effect, but have to be considerably strengthened, a fact which was not known at that time. Before this was known successful treatment of silver ores by cyanide was considered impracticable.

Various other chemicals in combination with cyanide have been proposed and tried, as they were supposed to accelerate or intensify the action, but the largest number of them have no effect, or are only of use with certain classes of ore. Mention should, however, be made of Clancy's proposal to add to the straight cyanide solution calcium cyanamide, an alkaline sulphocyanide and an alkaline iodide, and passing a low voltage current through the agitated pulp. The process has not as yet been fully tried on our Mexican ores, refractory on account of containing part of the silver in combination with manganese. If successful on these, many ores not amenable to straight cyanide treatment could be profitably worked in this manner. According to the experiments of the inventor even in ordinary ores a saving of cyanide is obtained as the solutions are regenerated at the expense of a less costly substance, and a trifling expenditure of electrical power. If the claims made for this process are substantiated by results on a working scale, new prospects for the industry will doubtless be opened.

We approach the end of our task, which was to indicate in broad lines the difference between the methods is use at the beginning of the century of independence and those now practised. Some of the manifest faults of our sketch are due to the disproportion between the space at our disposal and the great mass of material which imperatively seemed to demand consideration. This caused a constant conflict between the desire for completeness and the necessity for brevity, which perforce made the work fragmentary. We have dwelt more minutely on the early part of the period under consideration than on more recent occurrences. The knowledge of these early times is rapidly being obliterated and in none of the splendid and valuable treatises on old Mexican mining history is it presented in a connected form, being generally overlaid by a wealth of statistics and detail, which to the non-technical reader is not calculated to increase clearness.

We are safe in concluding with the statement that, especially during the period of peace and security of the last 30 years, the progress has been enormous and in expressing the hope and conviction that under a continuance of these conditions the industry will gain in importance at the rate justified by the large mineral wealth of the country.

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(1) The old system of tentaduras as a guide in the patio process was gradually replaced by assays of the amalgam, proposed in 1875 or 1876 by Manuel Maria Contreras, M.E. The art of making correct tentaduras has well nigh been lost among the younger generation of engineers.

(2) Many mines may at present be said to be in a state of transition from old to new methods and in others these exist side by side as, for instance, when electrically moved cars are filled by peons carrying the ore and waste from great distances.

(3) As early as 1870, the opinion that the industrial future of the Republic depended upon the utilization of its great water power was advocated by mining and civil engineers in the daily press and various pamphlets. At that time, however, the long-distance transmission of electrical energy was hardly sufficiently developed for practical application.

(4) In 1894 the Arthur-Forrest Company installed a movable plant for the treatment of tailings in the State of Sonora, which they shifted from one point to another. This was followed by stationary plants in Guanajuato, El Oro, Pachuca, and other mining centres. In Pachuca the new plants followed each other rapidly. The last mill which has been reformed is that of Purisima Grande, where centuries ago the system of Bartolome de Medina had originated and where it was practised until very recently.

GEOLOGICAL SURVEY OF CANADA

Proposed Field Work, 1911.

[Editor's Note—The following list includes several specialists from the United States, whose names, marked with an asterisk, are familiar to most of our readers. See editorial.]

D. D. Cairnes.—International geological boundary line between Yukon River and Porcupine River. Co-operation work with the Division of Alaskan Mineral Resources of the United States Geological Survey. A section is needed to the Arctic Ocean and it can be most economically done while the boundary line parties are in the field and have trails opened up. The U. S. G. S. will look after the line from the Porcupine to the Arctic.

R. G. McConnell will continue work in the Portland Canal district and investigate the placer gold on Nace River.

G. Mallock will examine the anthracite district at the headwaters of the Skeena River.

C. H. Clapp will continue his geological investigation of Vancouver Island, with special reference to the Nanaimo sheet.

C. Camsell will examine the peridotite of Tulameen, in which the Survey has found diamonds, and study the new mineral district of Steamboat and others near Yale, B.C.

L. Reinecke will conclude his study of the Beaverdell mining district.

J. Drysdale will make a detailed geological investigation of Franklin Camp, North Fork of the Kettle River.

O. E. LeRoy will be engaged in reconnaissance work in several districts in the Kootenay, and will make a detailed examination of the Nelson district.

S. J. Schofield will continue the geological mapping of East Kootenay.

*R. A. Daly will take charge of work on a geological section across the Canadian Pacific Railway in British Columbia. He will commence this year about Kamloops.

J. A. Allen will continue his work on this section west of Ice River.

*C. D. Walcott as collaborator in geology with special reference to the Cambrian of the Rockies will

work in the neighbourhood of the C.P.R. about Field and Ice River.

W. W. Leach will work on the coal basins along the Crow's Nest Railway.

D. B. Dowling will continue his investigations on the coal basins in the vicinity of the G.T.P., Yellowhead Pass.

*A. G. Lawson, assisted by R. A. Wallace and J. D. Trueman, will revise the geology of the Lake of the Woods and Rainy River.

W. H. Collins will continue the geological investigations of the country north of the Sudbury district.

W. Johnston will continue his work in the Lake Simcoe district.

F. B. Taylor will continue his work on the surface geology of western Ontario.

C. Stauffer will conclude his study of the Devonian rocks of southwestern Ontario.

*A. F. Foerst will study the Palæosoic rocks of Manitoulin Island.

M. Wilson will continue his explorations in northwestern Quebec.

J. O'Neill will study the geology of the Monteregian Hills, Quebec.

J. Stansfield will make detailed studies of several of the mines north of the Ottawa River.

R. Harvey will continue Mr. Dresser's work in the Eastern Townships, Quebec.

J. Goldthwait will continue his investigation of the raised beaches in Quebec and the Maritime Provinces.

P. E. Raymond will study the geology of Quebec city and environs.

G. A. Young will examine the oil gas and gypsum district near Moncton, N.B.

W. A. Bell will study the Joggins and other sections on the Bay of Fundy.

E. R. Faribault will continue his mapping of the gold-bearing rocks of Nova Scotia.

*H. Ries and J. Keele will study the clays of New Brunswick, Quebec and the Northwest provinces.

Topographical.

R. H. Chapman and K. Chipman will continue the mapping of Vancouver Island.

S. J. McLean will triangulate the Kootenay-Columbia Valley, as a preliminary for its topographic mapping.

W. H. Boyd will map the Blairmore-Coleman coal district.

A. C. Sheppard will finish the Slocan district.

W. Lawson will make a topographical map of the Moncton, N.B., area.

THE AMALGAMATION OF GOLD IN BANKET ORE

Paper read before the Chemical, Metallurgical and Mining Society of South Africa

By W. R. Dowling, M.I.M.M. (Vice-President).

Amalgamation being the most important source of gold recovery on the Witwatersrand gold-field, recent developments and present varied opinions upon this subject make the time opportune for a general discussion and review of the situation.

The author does not propose to discuss the manipulative details of the method of amalgamation: such knowledge is assumed, and the general features and present tendencies of the process with the influencing factors only are dealt with. The decreasing grade of the ore due to the fact that the reduction in working costs has brought into the paying zone ore formerly not payable, and the large scale of operations to-day, necessitates the simplification and reduction of plant and operations to the minimum. The enormous tonnages of ore milled make each item of equipment and its operation cost a great deal in the aggregate and the fact that the interest on some particular non-essential item of expenditure does not amount to much per ton crushed is beside the mark, as in many cases the capital may not be available, or, if available, could possibly be employed more profitably otherwise.

As will be shown, the relative importance of the amalgamation recovery and the methods by which it was carried out have been considerably modified by various factors from time to time in the metallurgical history of the Witwatersrand. In the early days the main source of gold recovery was by amalgamation with a small amount of concentration and subsequent chlorination. The ore was crushed relatively fine by stamps, the screens mostly in use being 800 to 1,000 holes per square inch, and the discharge was set high to aid fine crushing and inside amalgamation. To obtain the maximum recovery it was considered necessary to catch the gold at the earliest possible moment after its release from the ore by crushing. To this end amalgamated copper plates were set inside the mortar boxes, which were made large and roomy and recessed at the back to protect the copper plates. Mercury was fed into the box periodically, and lip and splash plates received the outflow of pulp. Following these plates was the large apron plate, the latter being the only plate in use in most mills to-day. It was usual to cut the apron plate into two or more lengths, and arrange these in steps, mercury wells being placed at each step for the purpose of mixing the pulp and recovering possible floating particles. A large proportion of gold remained in the mortar-box as amalgam on the inside plates and around the dies, and was periodically cleaned up. Some of the gold discharged through the battery screen had already been wetted by mercury, and was also in the form of amalgam, and was caught on the outside plates. At the present time amalgamation tends more and more to be performed by the passage of pulp over a single plain inclined stationary plate, and the above devices of the early millman are likely to be followed into oblivion by the mercury trap, in view of the most efficient mercury trap which the tube-mill circuit affords. Cyanide was the favourite chemical employed for dressing plates, and was liberally used. It might be mentioned in passing that in some mills, many years after the introduction of the cyanide process, cyanide was still in use. The large mortar boxes necessarily reduced the crushing capacity of the stamps, and it was due to the introduction of narrow straight-backed boxes for the purpose of increasing crushing efficiency that inside plates became impracticable. The mercury feed to the mortar boxes, however, continued much later, it being argued by the exponents of this practice that since a particle of am-

algam was larger and heavier than its enclosed gold particle, it was more readily caught. Inside amalgamation and mercury feed to the mortar boxes increased the mercury consumption, and made it impossible to obtain a reliable sample of the ore crushed.

Concentration by means of blanket strakes, buddles, Frue vanners, and other means was practised, and some amalgamable gold was recovered, as well as, no doubt, some rusty gold from the oxidized ore. Evidence of the amalgamable gold reaching the concentration plants is the amalgam recovery made on the small plates attached to the Frue vanners then running, and also on some shaking secondary plates installed at the Ferreira mine.

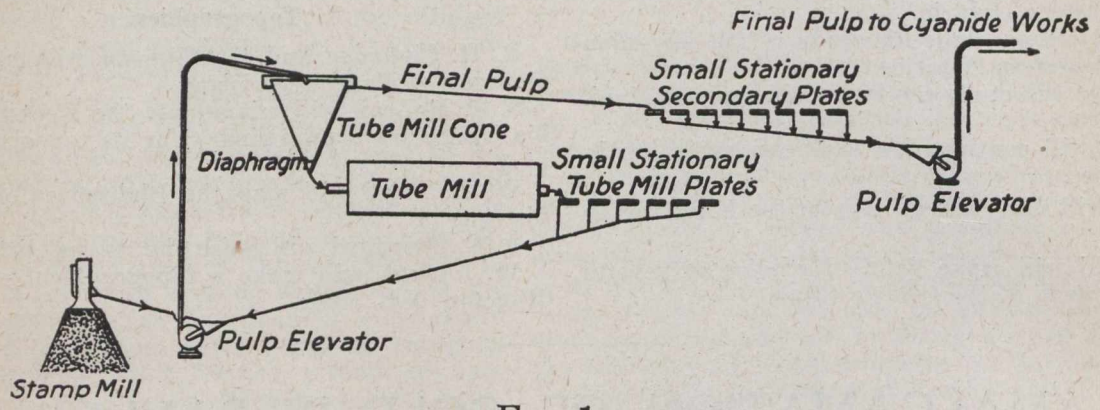


FIG. 1.

A

Information is very meagre and unreliable as to the percentage of recovery by the means outlined above. The assayer in the early days was not considered a necessary official on the mine, the pan in the hands of the mine-captain or millman being thought the more reliable means of determining the value of the ore. In December, 1894, however, J. S. Curtis sets the recovery at over 60 per cent. where a 900-mesh screen was used. It appears, then, that the percentage recovery of the early days on an oxidized and rich ore, by the various amalgamation methods then in use, was not much less than is obtained by the present fine crushing from low-grade pyritic ore by the ordinary straight mill plate and shaking tube-mill plates, as used in most reduction works to-day.

This had its influence on the crushing of the ore and amalgamation recovery, since, with a view to the production of as little slime as possible, the tendency was to crush coarser, thus decreasing the amalgam recovery, although the total recovery of the gold contents of the ore was considerably improved.

When the treatment of slime was successfully introduced by our past presidents, J. R. Williams and Charles Butters, in 1894, an entirely new view of ore treatment was rendered possible. The production of slime being no longer detrimental to the subsequent treatment by cyanide but the reverse, the ore was now crushed finer, thus again increasing the recovery by amalgamation. The recovery by the latter process was further improved by the use of lime in the mill service water, used to accelerate the settlement of the slime, as it was found that the agglomeration of the particles into larger aggregates enabled these to come into contact with the amalgamated surfaces and yield an appreciable proportion of their gold contents.

The increased recovery of gold obtainable by finer crushing and the removal of the main objections to this procedure by improvements in sand and slime treatment were generally recognized before the war (1899 to 1902). During this period, when local advance was debarred, progress in fine crushing was made in Australia by the introduction of tube-mills. The introduction of tube-mills for finer crushing in the Transvaal by J. R. Williams in 1904 raised the re-

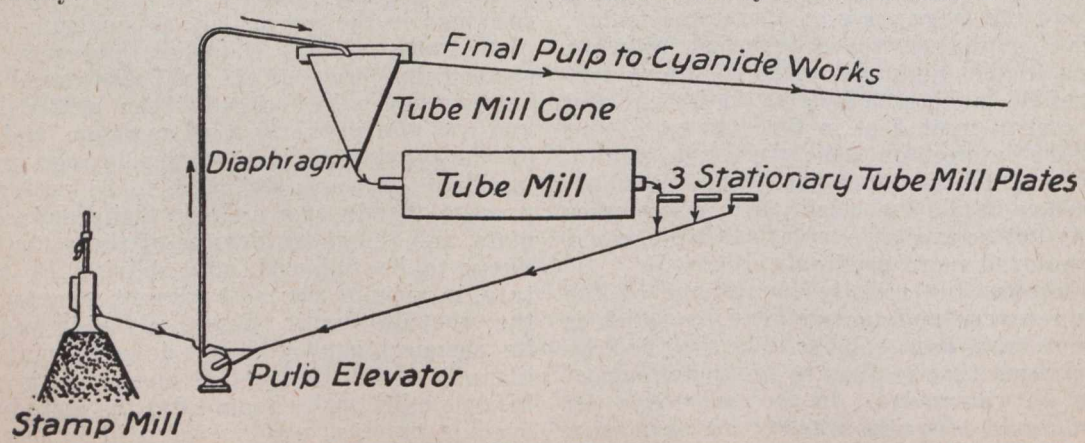


FIG. 2.

B

A most important change in the methods of gold recovery was brought about by the introduction of the cyanide process early in 1890. The cyanide process in the first instance was only applied to leachable sand. covery of gold by amalgamation to 65-70 per cent. of the contents of the ore, of which some 10 to 15 per cent. was by means of the tube-mill plates. The amalgamation recovery varied somewhat on different

mines according to the re-crushing plant erected, screening used, tonnage crushed, and value and nature of the ore.

Coming nearer to the present time, it is found that the increased use of tube-mills for re-crushing enables so coarse a screen to be used in the stamp-mill that amalgamation of battery pulp becomes an impossibility owing to the scouring action of the coarse pulp upon the mill plates. This necessarily leads to the removal of the plates from the stamp-mill in such cases, and a consideration of the following possible alternatives represented graphically in the corresponding diagrams:—

(A). Amalgamation of the tube mill pulp by one set of plates, and the overflow final pulp by another set, as at the Randfontein Central and Knight Central.

till crushed or abraded fine enough to overflow the classifiers.

With efficient tube-mill classification, all but the finest gold released by the stamps is brought into the tube-mill circuit and recovered on the plates, together with that released by crushing in the tube-mills. This being the case, the problem narrows itself down to determining whether it is necessary or advisable to amalgamate the final pulp, leaving the crushing plant as an overflow of the tube-mill classifiers. The considerations which enter into this problem are the extra capital outlay and buildings, the capital locked up as amalgam as setting to the plates, the increased area of amalgamated surface to guard, the consumption of mercury, the labour of dressing, and the additional elevation of pulp necessitated by

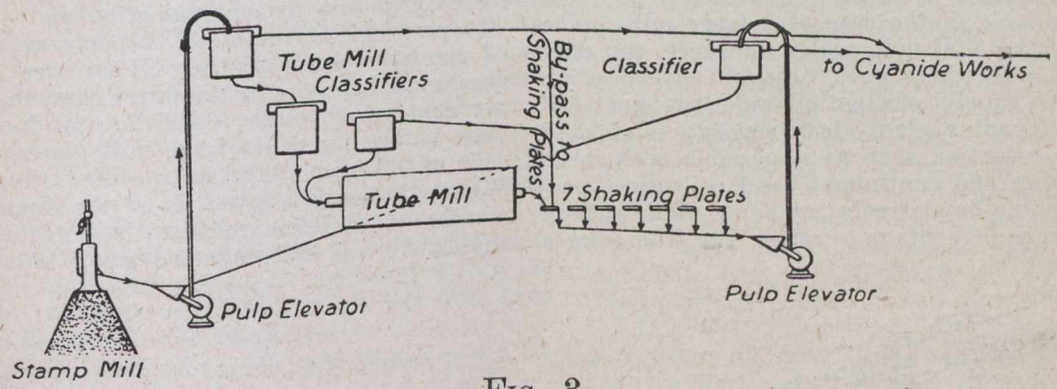


FIG. 3.

C

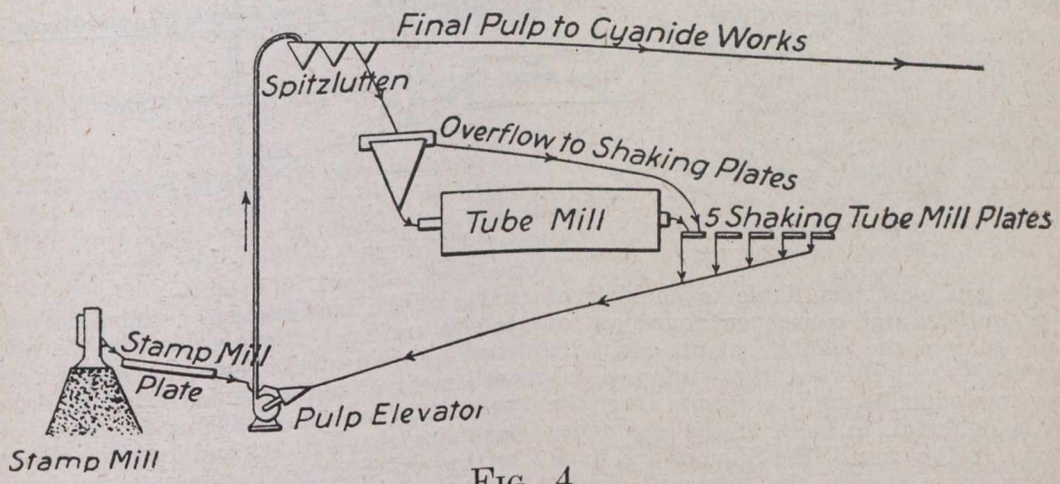


FIG. 4.

D

(B). Amalgamation of the tube-mill pulp only, as at the Simmer and Jack, Simmer Deep-Jupiter, and the various South Randfontein mills.

(C). Amalgamation of the mixed pulp after regrinding of the coarse portion by tube-mills, as at recently erected plants.

After the failure of various efforts to eliminate tube-mill plates, it may now be accepted that there is general agreement amongst metallurgists as to the advisability of amalgamating the tube-mill pulp, since otherwise considerable concentration of coarse gold by the classification of both stamp and tube-mill pulp takes place in the tube-mill circuit. Tube-mill pulp has only to be examined for metallic iron from the wear of shoes and dies and from other sources to illustrate how heavy particles will persist in the circuit its fall during this amalgamation process. Even if mercury traps are used at the foot of amalgamated plates outside the tube-mill circuit for the pulp overflowing the tube-mill classifiers, it is possible for fairly coarse mercury and amalgam to escape to the cyanide plant.

On reference to the sketches, it will be noted that alternatives (A) and (C) have two elevations of the total pulp, plus the tube-mill pulp, whereas (B) has only one elevation of the total pulp, plus the tube-mill pulp. Alternative (B) therefore does not involve any extra charge for re-elevation, and remains the same as in the usual present-day practice, as represented in sketch (D). Unless increased recovery counterbalances these disadvantages, it is preferable to omit this additional operation. The use of very coarse

battery screening naturally reduces the amount of metallic gold set free in the stamp-mill, and where the bulk of the crushing is done by the tube mills, the quantity of very fine gold which might reach and overflow the tube-mill cones is correspondingly reduced, as such gold is retained on the tube-mill plates before the elevation of the tube-mill pulp. Even where the coarseness of crushing in the stamp-mill does not preclude the use of plates there, their elimination, when conditions permit, is followed by the various advantages above mentioned, and the rendering available as immediate profit the gold on such plates, which would otherwise not be realized until the end of the life of the mine. Plates thus taken out of the stamp-mill may carry from £50 to £300 worth of gold per plate, according to their condition, and in the aggregate this may render some £20,000 worth of gold immediately available in the case of a large mill. The elimination of the final pulp plates, however, can only be considered safe where good tube-mill classification obtains, and an equally efficient cyanide treatment follows. In the cyanide plant clean separation of sand from slime is essential, such as is possible with large diaphragm cones and continuous sand collection, producing on the one hand freely leachable sand, and on the other a large percentage of slime free from coarse sand. With tube-mill classifiers liable to choking of small underflow outlets and consequent overflow of coarse sand and gold to the cyanide plant, and with slimy semi-permeable sand charges, the wisdom of allowing any fine amalgamable gold to escape from the crushing plant is doubtful, in spite of the economies above mentioned. In the case of the Simmer and Jack mill, where there are plates in the tube-mill circuit only, though the cyanide residues remain normal, the amalgam recovery dropped from 64 per cent. to 55 per cent. on a 6¾dwt. ore, owing to the fact that the fine sand and slime overflowing the classifiers are not amalgamated at all. If necessary, and as shown later in the case of the Simmer Deep plant, finer crushing and larger relative tube-mill cone area could be employed to increase the percentage of gold recovery by amalgamation. Whilst the collected sand is slightly enriched by some very fine free gold, there is no difficulty in dissolving this and obtaining a complete recovery. The popular theory that only 85 per cent. of this gold is recovered by cyaniding, instead of 100 per cent. by amalgamation, has not so far been borne out either in the laboratory by residue assays or regular panning of residues. Any fine metallic gold overflowing the tube-mill cones is necessarily smaller and more easily dissolved than the average of partly-encased particles in sand which are dissolved by cyanide. The amount of fine metallic gold overflowing the tube-mill cones is much affected by the number and area of the latter. Where a large ratio of tube-mills to stamps exists, much gold, more often than not, cannot be detected in the final pulp by panning or in the sand before treatment. This is the case at the Simmer Deep plant, where, before the removal of the stamp-mill plates, the total plates in operation numbered 82, equivalent to 5,276 square feet, of amalgamating area, and the amalgamation recovery was 56.8 per cent. of the ore value. After the removal of all the stamp-mill plates and the reduction of those in the tube-mill circuit to 30 stationary plates, presenting an area of 1,700 square feet, the amalgamation recovery was 57.7 per cent., and the value of sand and slime before and after treatment has not increased. The total extraction by amalgamation and cyaniding was 93.4 per cent. before and 93.5 per cent. after removal of the stamp-mill plates. There was slightly finer crushing of the ore in the latter case, there being 77.6 per cent. of -90-mesh (0.006 in.) product in the final pulp before removal of the mill plates, and 81.0 per cent. of -90 mesh (0.006 in.) product after the removal. Where the ratio is lower, as at the Simmer and Jack, a trace of very fine gold can be detected by panning the final pulp and collected sand, though the assay value of the sand residue remains normal. The slime is also enriched, though this may be offset by better washing, due to the lower percentage of moisture on settlement of well-classified slime, containing a higher percentage of fine (-200 mesh) sand. For instance, assuming that 1.5 dwt and 1.8 dwt, slimes are treated, settling to 42.5 and 35 per cent. moisture respectively, by two 4:1 washes in both cases, of which the first wash only is precipitated down to 0.01 dwt. per ton of solution. With 0.08 dwt. undissolved gold in the first residue and 0.10 dwt. in the second, the total extraction will be 90.4 per cent. (0.144 dwt. total residue) from the 1.5 dwt. slime, and 92.2 per cent. (0.14 dwt. total residue) from the 1.8 dwt. slime. Where Butters' or other vacuum filters are used, the value of the original slime should be immaterial, as, providing the dissolving of the gold is satisfactory, the residue should contain little more than the trivial amount encased. It is to be hoped that detailed results and working costs of the recent work in this direction at the Crown mines will before long be laid before our society.

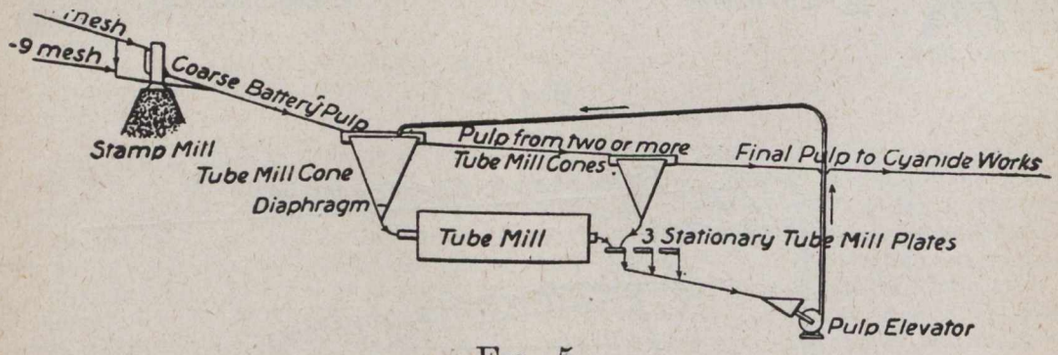


FIG. 5.

The author is indebted to F. A. G. Maxwell for much information on regular work at the Randfontein mines, where plates are eliminated from the stamp-mill, and hopes that he will bring forward his results as a discussion to this paper. In the meantime, it may

be said that during 1908, in the four 100-stamp sections of the South Randfontein, when there were amalgamated plates both in the stamp-mill and the tube-mill circuit, the average amalgamation recovery was 54.46 per cent., and the total recovery 92.06 per cent., whereas in 1910, when there were plates in the tube-mill circuit only, the amalgamation recovery was 48.60 per cent. and the total recovery 92.94 per cent.

As mentioned in a note lately presented by the author to this society, it has generally been considered necessary for the satisfactory amalgamation of the large volumes of thick tube-mill pulp that the plates should shake. Tracing back the history of this belief to the pioneer work done by J. R. Williams on the Glen Deep in 1904, it seems that in order to prevent the banking of sand on the stationary plates installed with 10 per cent. grade, it was found necessary to mount the plates on shaking vanner frames. Not only has the shake been subsequently adopted by all the mines without question, but the number of plates has gradually increased from the two originally installed to five and even six later. When the Knights Deep had five tube-mills, equivalent in cubic capacity of shell to 3.91 standard tube-mills of 22 feet x 5½ feet, sixteen shaking plates 10½ feet x 4¾ feet were in operation. As there was no convenient space for more plates when another tube-mill was erected, it was decided to make the sixteen plates serve. The number has now been reduced to fourteen. The ratios are:—

For 3.91 tube mills 16 plates=4.09 plates per tube-mill.

For 4.91 tube-mills 16 plates=3.26 plates per tube-mill.

For 4.91 tube-mills 14 plates=2.55 plates per tube-mill.

The amalgamation recovery was just as efficient with the smaller ratio as with the larger.

In the course of the experiment mentioned in my note, and after having thoroughly tested the stationary five plates system, initiated originally by F. A. G. Maxwell at Randfontein, it was decided on W. A. Caldecotts' suggestion to perform the whole amalgamation of the tube-mill pulp on two stationary plates per tube-mill. The Simmer East plant has three 22 feet x 5½ feet tube-mills. The pulp of each mill has been regularly run over two plates only since December 19th, 1910. The dressings have been at six hour intervals and the scrape taken six inches lower than formerly. The daily scrapes have been normal, yielding the amalgam called for. The two plates of one of the mills were steamed at the beginning of the run and again at the end of a month's run to determine whether the yield from this source was affected in any way. The previous practice in this plant was to steam one-third of the total plates each month so that each plate ran for three months before steaming. It was found that one month's run of the two plates yielded more amalgam when multiplied by three, than the average of the three months of five shaking plates previous to starting the non-shaking experiments. However, to be on the safe side, it was assumed that the plates would not accumulate steam amalgam at the same rate during the second and third months, and it was decided to multiply by only two and a half. This calculation gave a figure for steam amalgam just about equal to the average of the three months of five shaking plates. Adding this to the daily scrape and other sources the recovery is fairly arrived at, and works out at 21.54 per cent. of the screen value and 34.17 per cent. of the tailing value, compared with 21.80 per cent. and 34.04 per cent. of the previous five-shaking-plate period.

To ensure successful and economical work the ratio of water to solid should be reduced to the minimum, as not only does this decrease the velocity of the stream over the plate, but the cost for re-elevation is also less. The volume of pulp of 400 tons of sand per tube-mill plus 480 tons of water, allows about 10,000 cubic feet of pulp per 24 hours for each of the two plates, or about the same as passes over the plate of a five-stamp battery with a 9-ton duty per stamp, and a 6.5 to 1 ratio of water to ore in the screen pulp. The tube-mill circuit is the only part of the crushing plant where a thick amalgamable pulp is available without the installation and operation of special classifiers for the purpose. Distribution of the stream across the full width of the plate is also of considerable importance, and may be obtained by using the usual box at the head of the plate perforated with about ¾-inch holes along the bottom of the side facing down the plate. These holes should be of such capacity that the pulp attains some head in the box. In the event of any of the holes becoming temporarily choked, a further row of holes an inch or two higher up the front side of the box will serve to carry over the stream, and still maintain a fairly good distribution. The fall given to the stationary plates is 18 per cent. This is the fall arrived at by Mr. Maxwell and since adopted here. With the fall of 18 per cent. it is found that the minimum percentage of water in the sand is 55 per cent., and it appears that should it be desired to reduce the fall, the moisture would have to be increased, fall and water ratio being convertible terms within limits. The point to be reached in water ratio and fall is that just short of banking of the sand on the plate. Even with a low water ratio the rush of pulp over two plates appears to the eye to be too great, but this is not really so. As long as the velocity of the pulp stream is such that particles in suspension may come into contact with the plate and not be carried on mechanically without touching the plate, the gold will be caught. It might be considered that pulp carrying only 55 per cent. of moisture is too thick to allow the gold to sink through and reach the plate. As, however, amalgamation has been proved efficient with this ratio, this does not appear to be the case. In this connection, it might be mentioned that in pan amalgamation the pulp is kept very thick, although in plate amalgamation a fluid pulp was heretofore considered necessary for good recovery. On a stationary plate there appears a tendency for the gold to amalgamate further down the plate than when shaking; there is hence a liability for the scraping to yield less amalgam and the steaming more with stationary plates as compared with shaking plates. In connection with the satisfactory results obtained in the operation of the two stationary plate method, much credit is due to the practical skill and progressive attitude of Mr. A. J. Herald, the Knights Deep mill foreman, and to his assistant, Mr. Peter Wilson.

The removal of plates from the stamp-mill has had the good result of introducing on these fields the separate plate-house. The Homestake mine and the Waihi set the example many years ago, but the Witwatersrand has been very slow in following the lead and accepting the suggestion made before this society in 1903 by H. R. S. Wilkes. The arguments advanced by some millmen that a plate attached to each battery makes for good recovery due to better distribution of the pulp by the stamps over the width of the plate,

and that even vibration assists lack confirmation. It appears to the writer that this method is just one of the many practices taken over from other countries without investigation. Tube-mill plates have now been running long enough to prove that most efficient amalgamation can be performed with a pulp sub-divided from a launder and distributed over the width of the plate from a box pierced with holes. Tube-mill pulp carries heavier particles and contains less water than mill pulp, and is therefore a more difficult pulp to distribute. The advantages of a separate plate-house are increased running time, since stamps need not be stopped for plate dressing, and greater attention to the crushing machinery by the attendants, thus increasing the crushing capacity. Again, better amalgamation should be obtained by the greater attention to the work by specially chosen and trained men. The whole operation is confined to a smaller area and lends itself by closer supervision so that the risk of loss by pilfering may be reduced to a minimum. In connection with the matter of conveying pulp the author considers that sufficient importance is not attached to launders. All launders should be as smooth as possible and free from obstruction at the joints. Of all material used for the lining of launders there does not seem to be anything better than cement. This provides an ideal surface presenting least resistance to the flow of the pulp and affording very little lodgment for amalgam and still less for gold in unamalgamated pulp. On those mines here where separate plate-houses or combined plate and cyanide extractor houses have been built, the arrangements have not gone far enough or else too far. The erection of zinc-lathes, elevator pumps and tube mills in the same building as the plates and the extractor boxes means the introduction of gangs of men and natives for repairs, other than those engaged on the gold recovery work. If this machinery is placed in the same building because the launders may carry gold, then the whole tube-mill plant, including circuit launders and elevators, should be included. The best plan is to include in the building only such machinery as is actually connected with recovery work, so as to limit the men entering the building to those directly engaged in the work. The accumulation of amalgam in the tube-mill launders should be reduced to a minimum and the launders should be closed to protect what does collect. Prior to the introduction of tube-milling amalgam was to be found in the launders to the cyanide plant, and some found its way as coarse particles to the concentrate vats, entailing loss in the residue. Where efficient tube-mill classifiers are installed no amalgam is found to-day reaching the cyanide plant except in an impalpably fine condition, since heavy particles of amalgam pass into and are retained in the tube-mill circuit. There is always a loss of mercury in amalgamation mainly by abrasion, and where this enters the tube-mill amalgamation of the gold liberated by crushing takes place. Where this amalgam does not reach the plates it is found in the launders between the discharge of the tube-mills and the plates. Such impalpably fine mercury or amalgam as enters the cyanide plant dissolves in the same way as gold, and like dissolved lead salts, is either wholly or partially precipitated by soluble sulphides in the working solution, or later in the metallic form by zinc shavings in the boxes.

Where plates are eliminated from the stamp-mill the water ratio may be considerably reduced. The clearing of a long plate set at a fall of 9 per cent. or 10 per cent. by avoidance of any banking of sand from the pulp has been the factor determining the water ratio in the past, and this requires six to seven parts by weight of water to one of solid using average battery screening. It has been found that in the absence of mill plates the ratio may be reduced to 4.5 without serious ill effects provided the mill launders have sufficient grade to carry pulp of this consistency. A coarse screen with less water will give the same result in duty and grading as a finer screen and more water, water and screening being convertible terms within limits. The reduction of water has considerable influence on the cost of pulp elevation and of running water pumps, the reduction of weight from 6.5 to 4.5 of water to 1 of solid being equivalent to about 27 per cent. The saving in power in a large plant is material when working on the reduced ratio, and there is likewise a smaller load on the classifiers and slime collectors. There would, however, be no saving in the consumption of water as much the same volumes are exposed to loss by evaporation, seepage in dams, and moisture in residues.

Although there is no rule for the area of amalgamating plates there is no doubt that the number and area of plates in common use is unnecessarily large and when these are placed in a separate plate-house the total area may be materially reduced. The author is of opinion that much of the amalgam found at the lower end of long battery plates is largely worked down by amalgamators wishing to present a uniform bright surface all over the plate. The old practice was to install plates about 15 feet long x 5 feet wide per battery of 5 stamps, which equals 15 square feet per stamp. Where, say, one standard large tube-mill for 30 stamps is erected, and assuming that the tube-mill is equivalent to 30 stamps, five plates of 11 feet x 5 feet would probably be erected. The combined plate area is then:—

30 stamps=6 plates 15 feet x 5 feet=450 square feet=15 square feet per stamp.

1 tube-mill=30 stamps—5 plates 11 feet x 5 feet=275 square feet=9 square feet per stamp.

Total for 60 stamps units—725 square feet=12 square feet per stamp unit.

At the Randfontein Central the total plates erected amount to 9.6 square feet per stamp unit but it is now proposed to use only 4.8 square feet per stamp unit, and there is little doubt that the latter area will be quite sufficient. In the Simmer and Jack re-arrangement the plate area is about 2 square feet per stamp unit. With the high stamp duties of recent years the same plate area is doing nearly double the work it used to do in the past, and is capable of doing a great deal more. Conversely, in regard to the usual 10 per cent. fall, where this is increased more crushed material with smaller water ratio may be amalgamated with equally good results. H. W. McFarren in his recent interesting little book says the fall of plates varies from 1½ to 3 inches per foot, and should not be less than 2 inches or 2½ inches. A fall of 2 inches per foot is equivalent to 16.7 per cent., and 2½ inches to 20.8 per cent., whilst the average is 18.75 per cent. Among the advantages due to reduced area of plate are reduced cost of installation and operation, and especially a reduced cost of mercury, the consumption of mercury being in proportion to the area of plate. In the Simmer and Jack plant the consumption of mercury has been reduced to one-sixth of the former figure. Where a large area is exposed in amalgamation a proportionate amount of gold is taken up to set the plates, and is not available for realization until the end of the life of the mine. The gold held

by well-set plates may be taken at 1 ounce per square foot of plate. A 200 stamp-mill having 40 plates 15 feet x 5 feet will thus absorb 3,000 ounces of gold worth £12,000. The future points to the reduction of plate area to the point where only the gold too coarse for cyaniding will be caught by amalgamation. This point has probably been reached in the Simmer and Jack plant, which has now only 18 stationary plates in the tube-mill circuit in place of the former 64 battery plates and 30 shaking tube-mill plates. It will be noted that the Simmer East with plates in the stamp-mill have retained two stationary plates per tube-mill, whereas the Simmer and Jack and the Simmer Deep-Jupiter joint plants without plates in the stamp-mill have each retained three plates per tube-mill. The additional plate in the last two cases is a measure of safety to deal with the richer pulp and to have not less than two plates per tube-mill in action during dressing operations. Diagram (E) shows a proposed arrangement of crushing and amalgamating with three stationary plates only per tube-mill and no plates in the stamp-mill, and with safety cones for the common streams of pulp overflowing the tube-mill classifiers.

The author trusts that the foregoing account of some considerations affecting the methods of gold recovery responsible for some £20,000,000 per annum, two-thirds of the Rand's total output, may be of interest to members, including those who have visited the plants where the changes described have been effected, and he trusts during the course of his reply to the discussion to furnish future comparative details of future results.

In conclusion, the author wishes to thank Mr. G. A. Chalkley, the manager of the Knights Deep, and Mr. C. D. Leslie, the superintending engineer of the Consolidated Goldfields of South Africa, for access to information of the various mines of the group, and for permission to read this paper before the Society.

COAL-DUST EXPLOSIONS

(Abstract of Miners' Circular No. 3, U. S. Bureau of Mines.)

By George S. Rice.

It was after a series of great disasters that the Federal Government took up the inquiry into the causes of such explosions and established the testing station at Pittsburg, Pa., which is now part of the Bureau of Mines. The very first work was to prove to mine operators and miners that coal dust would explode even if no gas were mixed in the air with it. The dust was placed in a great tube 100 feet long and 6 feet in diameter, that had a cannon embedded in one end. This cannon was loaded with black powder, as a drill hole would be, tamped with clay, and discharged. In every instance when pure dry bituminous dust was used there was a dust explosion. Each succeeding experiment went further to show how very dangerous coal dust may be.

Fire damp carries its own warning — the "cap" in the safety lamp—but coal dust, though visible, does not attract attention unless present in large quantities. Fire damp rarely spreads through wide areas in a mine, and except in notable and very exceptional cases is controllable by means of the ventilating currents.

If by mischance a large body of fire damp is ignited, the force of the explosion is terrific, but the effect is localized unless dry coal dust is present, or unless (as rarely happens) the explosible mixture of air and gas extends through a large part of the mine. But dust accumulates everywhere in a mine that is dry, and the blast from the ignition and combustion of coal dust may traverse miles of rooms and entries and even wreck structures at the entrance of the mine.

Gas (methane) commonly enters mine workings by numerous small blowers or feeders from the coal seam, the roof, or the floor. In most mines the quantities that enter are so small that if the ventilating current is sufficient and is properly controlled, the gas is diluted by the air and carried harmlessly away. Only some of the mines in foreign countries and a few of those in the anthracite region of this country are subject to great bursts of gas into the workings. When such occur they must be met by special methods.

As will be explained later, even small quantities of dry coal dust, easily overlooked, may be responsible for an explosion in a mine that in other respects may be considered a model mine. A chain is no stronger than its weakest link. Hence a mine in which every precaution is taken except one may be subject to a fearful disaster like that of Courrieres, France, in which nearly 1,100 men lost their lives.

Only a few years ago many persons believed that coal dust would not explode unless there was some gas (methane) in the air with it, but those who have seen the tests of the past two years in the explosives gallery of the Bureau of Mines station at Pittsburg can have no doubt that a cloud of bituminous coal dust can explode when no methane or other inflammable gas is present.

Explosions in bituminous mines happen more often during late fall and winter than during late spring and summer because the mines get dry in winter. Cold air holds less moisture than warm air. The natural warmth of a mine raises the temperature of the air that enters cold in winter. As this air gets warmer it can absorb more water; it therefore dries the walls, roof, floor, and any dust present by taking up the moisture and carrying it out of the mine.

The aim of this circular is to present the facts about coal dust in brief form and simple language, with a view to explaining to all engaged in coal mining—miner and operator alike—the dangers of coal dust and the means of lessening the risk of terrible explosions.

Origin, Distribution, and Properties of Coal Dust. How Coal Dust is made at the Face.

It is almost impossible to prevent dust being made in the working places of coal mines, for most coals break to pieces easily. The dust thus formed is apt to be dry because coal seams generally carry little water.

Even if some water soaks down from above and appears in the workings, it gathers here and there in hollows, or "swamps," and, as a rule, the larger part of a mine that is not sprinkled, or made wet in some other way, is dry during fall and winter.

Dust is made at the face in undercutting the coal, either by hand or with machines. Breaking down the coal after it is undercut makes more dust. If the coal is shot down, dust is made by the shattering action of the blast. In breaking lumps with sledges or picks, and even in shovelling up the coal, some dust is made. If the coal is "shot off the solid," it is badly broken, and much fine, dangerous dust is produced.

Methods of Lessening Dust at the Face.

Since coal is easily broken the making of dust at the face can not be stopped altogether. It is clear, however, that there are several ways of lessening the amount of fine coal and dust. The coal should always be undercut or sheared. If it can not be wedged down and blasting is needed, each shot hole should be placed in the right spot and should contain only enough explosive to do the work. Care should be taken in breaking lumps.

All fine coal, cuttings, or "bug dust" should be loaded into cars and sent out of the working places before shots are fired. There are two reasons why this should be done: (1) To keep the coal dust from being ignited by a shot; (2) to prevent the fine coal and dust being blown into the gob (from which they can not be removed) and becoming dangerous there.

In Germany a method of mining coal by forcing water under high pressure into the face through drill holes has been tried recently. This method serves to saturate the coal with water, as well as to break it down, and is said to greatly lessen the amount of dry dust made at the face. Although it is best suited to long-wall mining, the method can, perhaps, be used in wide rooms in some coal seams.

How Coal Dust is Scattered Along Entries.

Coal dust is scattered along haulage roads in several ways. Many cars have open joints or loose-fitting gates, and fine coal sifts through the openings. Larger pieces of coal are shaken off the cars by jolts in running over the mine tracks or by bumps in switching and making up trips. These lumps fall on the roads and are ground to pieces.

The air passing over the cars moves very fast because the cars reduce the space through which it has to pass. Dust lying on the cars is picked up by the current and scattered along the entries; much of the dust falls to the floor, but some of the finest and lightest collects on timbers and on projections from the ribs and roof. The latter is the most dangerous kind of dust, for unless it is dampened any shock may throw clouds of it into the air, where it may be ignited by a flame or an electric arc.

Methods of Lessening Dust in Entries.

The use of tight cars without gates will keep much fine coal from dropping along roads. Such cars are used in most coal mines in Europe and also in a few mines in this country, notably in Alabama. To keep lumps from falling off, coal should not be piled higher than the sides of the cars. If the cars are tight and properly loaded much of the dust that now gathers along the haulage roads will be done away with.

A good way to keep air currents from brushing fine dust from the tops of loads is to put strong sprays of water at the entrances to partings or sidings, so that the dust will be washed into the body of the car. This method is used in some mines in Wales.

Combustion and Explosion.

When a piece of coal burns, the carbon and the other burnable substances in the coal unite with the oxygen of the air to form gases and water vapor. This union is called combustion. It is accompanied by flame and heat, and the resulting hot gases and vapor tend instantly to take up many times the space filled by the piece of coal and the oxygen needed to burn it.

A small piece of coal burns quicker than a large piece, and if a piece of coal of some kinds is small enough it will burn in a flash. If many particles of such coal are suspended in the air, as in a dust cloud, so that each particle has some oxygen near it, the burning of one particle may fire others and the flame may spread through the dust cloud in an instant. If this happens, the hot gases and vapor from the burning dust cloud suddenly take up more room and press outward in all directions; in other words, the mixture of coal dust and air explodes.

Coal Dust in Explosions.

The fact that dry pure dust from bituminous coal, lignite, or asphalt explodes when ignited in the air has been proved beyond doubt by the tests at Pittsburg. Opinions differ as to the exact way in which the flame of the explosion spreads. Some persons think that gases given off by the particles of dust ignite and burn; others think that each bit of coal dust burns completely.

Dry coal dust in air will explode whether any inflammable gas is present or not; but the presence of a very small proportion, less than 1 per cent., of methane helps greatly to start an explosion. Fire damp, a mixture of air and 5.5 to 11 per cent. of methane, explodes with great violence when ignited. But although a fire-damp explosion may be violent, it is probable that such an explosion never extends all through a mine unless the flame is supported by burning coal dust. Certainly, the strength of most great mine explosions has been derived from coal dust and not from gas.

The shock to the air from an explosion travels ahead of the flame itself, so it has happened that miners caught by an explosion have felt the shock in time to throw themselves down or into some opening before the flame swept by. This shock, or advance wave, of an explosion stirs up much dust, but generally all of this dust is not consumed in the flame, because there is not enough oxygen present. So some of the dust is only charred or coked, and part of this while in a hot or half-pasty condition sticks to the ribs and roof, or to props and caps.

Quantity of Dust Needed to Spread an Explosion.

In certain tests at the mining experiment station at Pittsburg the bituminous coal dust used was so fine that it passed through a 200-mesh sieve (one with 200 openings in the length of an inch), and floated easily on a strong air current. This dust spread an explosion when there was only 0.32 ounce of it suspended in each cubic foot of air, or 1 pound in 500 cubic feet of air.

It can be shown that to burn completely 0.12 ounce of the dust used at Pittsburg will take all the oxygen in a cubic foot of air; to burn a pound of it will take all the oxygen in 133 cubic feet of air.

Fine Coal and Coal Dust.

Experiments made by the Bureau of Mines indicate that fine dust will ignite and spread an explosion more readily than coarse dust. But if the flame and shock are strong, coal of certain kinds in pieces fine enough to pass through a 20-mesh screen (one with

20 openings to the inch) helps to spread an explosion, even though there is no finer dust mixed with it. For this reason all bits of coal that pass through a 20-mesh screen may be called dust, and such particles of bituminous or lignitic coals must be considered dangerous in a mine, if they are dry, abundant, and not mixed with large quantities of rock or shale dust, which does not burn.

Differences in Coal Dust.

Tests at the Pittsburg station have shown that there are great differences among the dusts of different kinds of coal. Some ignite and spread an explosion much more easily than others. For example, in none of the tests by the Bureau of Mines has anthracite dust been made to spread an explosion. It is possible that under some conditions anthracite dust may ignite when suspended in the air, but there seems to be little danger of this under ordinary mining conditions. Moreover, in the long history of the Pennsylvania anthracite mines, some of which are very gaseous, there have never been any explosions so widespread as some that have taken place in bituminous coal mines.

Bituminous coal and lignite contain much larger proportions of volatile matter (matter that becomes gaseous on heating) than anthracite, and the larger proportions of volatile matter in these coals probably have much to do with the greater explosibility of their dusts. But some semibituminous coals, like those of the New River and Pocahontas fields in West Virginia, contain a smaller proportion of volatile matter than bituminous coals and yet give dusts that make intense explosions when strongly heated. So it seems that something besides the fineness of the dust or the composition of the coal fixes the ease with which the dust will spread an explosion. This other feature appears to be the structure of the coal; that is, the way in which the coal is bound together. Experiments being made at Pittsburg bear out this view. It is found that dusts which have about the same composition do not ignite with the same ease, and the resulting explosions do not have the same strength.

Effect of Stone Dust.

It has been proved by experiments at Pittsburg and in Europe that if stone dust, clay, sand, or any other material that will not burn is mixed with coal dust, it keeps the coal dust from igniting easily. The more there is of such material in the mixture, the more difficult it is to set fire to the coal dust; and when the mixture contains more unburnable dust than coal dust, there seems to be little or no danger of the coal dust spreading an explosion. But the unburnable material must be fine and it must be well mixed with the coal dust to have its full effect. If the material is coarse or in lumps, like pieces of rock, and the dry coal dust is scattered around or over these lumps, or if, when there is much shale or clay dust on the floor, the pure dry coal dust has gathered on the ribs, timbers, or roof, any disturbance of the mine air may stir up enough coal dust to feed and extend an explosion.

Explosiveness of Dusts.

As already stated, experiments at Pittsburg and elsewhere have shown that a mixture of air and the dust or bituminous coal or lignite may be explosive, even though the air contains no inflammable gas other than that from the dust. The records of mine explosions confirm the results of these experiments, for there have been explosions in shallow mines in Iowa in which gas (methane) has never been found. Moreover, an explosion, once started in a dry, dusty mine, may travel through miles of entries and headings, even when there is not a trace of inflammable gas in the mine air. It is true, however, that the presence of even a small percentage of such gas greatly increases the chance of a dust explosion.

There have been many instances of explosions of coal dust in and about coal bins when the dust was raised into the air and set on fire. Similar explosions have happened in coal-crushing rooms. During the past year (1910) there were explosions of this kind at a plant in St. Louis, Mo., and at a cement plant in Colorado. In the latter explosion nine men were burned so badly by the flaming dust that they died.

It must not be thought that coal dust is the only kind of dust that will explode when no inflammable gas is present at the moment of explosion. Dusts of other substances containing carbon will do the same thing. Among such substances are flour, starch, and sugar. Many flour mills have been blown to pieces by dust explosions. The destruction of the big flour mills at Minneapolis in 1878 is a terrible example of ruin and loss of life caused by exploding flour dust.

Causes of Coal Dust Explosions.

air may be ignited and start an explosion in a coal

The more common means by which coal dust in the mine are as follows: The flame from a shot or the accidental ignition of an explosive in the open; an explosion of a small body of fire damp; and, more rarely, an electric arc of glowing wire or even the flame of an open lamp.

Shots or Blasts.

The long flame from a shot of black powder has been the commonest cause of coal-dust explosions in mines in this country. Blown-out shots have started many, and it is a common belief that the flame of black powder must come from a blown-out shot to start a dust explosion. This belief is not supported by the facts, for explosions have started from shots that were not blown out, nor even overcharged. It is certain, also, that if the air at the face contains even a small percentage of gas (methane), the flame from even a properly placed and charged shot of black powder may start a dust explosion. The danger is greatest when several shots in the same working place are fired at the same time. The dust made by a shot, and any gas distilled from the coal by the heat, may be set on fire by the flame of the next shot.

Dynamite is fully as dangerous as black powder. It is quicker than powder, but gives a long hot flame, and many explosions have been traced to its use. Miners have been known to put two explosives, like black powder and dynamite, in the same hole. Such a combination is more dangerous than either explosive used alone. If the quicker-burning explosive is placed at the outer end of the charge it may blow out the stemming; if it is placed at the bottom of the hole it may blow the slower explosive while still burning into the dust raised by the shot.

Danger from Tamping with Coal Dust.

The chance of a shot of some long-flame explosive like black powder or dynamite starting a dust explosion is fearfully increased if the shot is tamped with coal dust or fine coal. Sometimes miners wet the dust or machine cuttings used for stemming in the belief that they can thus keep it from being ignited. There is little ground for this belief. If the shot is blown out, its heat instantly drives off the water, and then sets fire to the cuttings. Experiments at Pittsburg have shown that if coal-dust stemming is wet it gives a flame only a little shorter than if dry. When 2.5 pounds of black powder and 2.6 pounds of coal-dust

stemming were used in a cannon the flame with dry stemming was 64 feet long and with wet stemming 50 feet long. With heavier charges the flames would probably have been longer.

Sometimes miners use pieces of coal of nut size for stemming in the belief that they lessen the danger in this way. It is clear, however, that ramming or tamping such pieces will crush them, and that the shot will break the pieces still finer and perhaps ignite them.

Fire Damp.

Explosions of fire damp have ranged next to the use of long-flame explosives as a cause of dust explosions. Methane is given off more or less from nearly all coals, although most coal mines in the United States do not make enough methane to be called gaseous. A great many of them make a little methane, but so little that the return air currents carry under 0.5 per cent., a quantity too small to be detected with a good safety lamp. But if a mine is dry and dusty, and long-flame explosives like black powder are used, the presence of a small percentage of methane greatly increases the chance of an extensive dust explosion. Moreover, in those mines in which methane comes from the coal seam, the percentage in the mine air is usually larger at the working faces; and it is "at the face" that many explosions start.

If methane comes from the floor or from the roof, it is likely to collect in the gob, or where there have been falls of roof, or in places where the air currents do not circulate. In a well-ventilated mine any body of fire damp is likely to be small, and if it is ignited there is little chance of the explosion spreading far unless dry coal dust is at hand. Therefore, if a mine makes any methane at all, great care should be taken to keep down the coal dust in all the workings.

Electric Arcs and Glowing Wires.

That an electric arc or a glowing wire could ignite coal dust in the air was not thought possible a few years ago, but since then several mine explosions have been laid to these causes. Of course, it must take a combination of unusual conditions to start an explosion in this way, but such a combination may happen now and then. All that is necessary is to have an arc from a grounding or an overcharged hot wire surrounded by a thick cloud of inflammable dust. If a trip of cars runs away on a dusty road and breaks the trolley or feed wires, the wrecking of the trip stirs up the air and raises dust, and if this dust is easily set on fire, the forming of an arc by the broken wires may start a flame. Laboratory experiments at Pittsburg have shown that a small white hot live wire can set fire to a cloud of dust.

Many people have believed that an open flame could not ignite floating coal dust unless a shock, as from a blown-out shot, accompanied the flame. Yet floating coal dust has caught fire about bins and dusty tipples. Usually there has been little damage done because the dust was not confined, but a bad explosion in the coal-grinding room of a cement plant in New Jersey is believed to have started from the flame of an open lamp. In mines, because the space is confined in rooms and entries, there is much greater chance of the burning dust causing an explosive wave. This possibility was shown in a recent coal-mine explosion that started near the mouth of a dusty drift. This drift was an intake, so the air could not have contained any gas. A trip of cars jumped the track and knocked out some timbers, thus making a dense dust cloud that was probably fired by the flame of a trip-rider's lamp. The explosion travelled a long distance into the mine and gained strength as it travelled.

An incipient dust explosion, started by the flame of an open lamp, was seen at a mine in Yorkshire, England. The dust that ignited was raised by a passing trip of cars. The flame followed the trip some distance and then ran back.

MOISTURE IN MINE AIR.

Moisture Needed to Render Coal Dust Inert.

Experiments at the Pittsburg station and the examination of coal mines after explosions have indicated that if the coal dust in any part of a mine is so damp that every sample of it that may be gathered sticks together when pressed in the hand, there is little or no danger of a dust explosion starting in that part of the mine. To be so damp as this, the dust must hold moisture to the extent of at least one-third its own weight. The added moisture tends to keep the dust from taking fire in two ways: (1) The moist dust must be dried before it will flame, and the drying takes heat, so more heat or a larger flame is needed to ignite wet dust than dry dust; (2) moistened dust settles to the floor and packs there or sticks to the walls and roof. In case of a shock to the mine air no dust cloud can form to spread a flame.

Mine Air in Summer and in Winter.

As has been stated, coal seams are generally dry. Even in the wet mines water comes in only at certain points. Such water may be considered as more or less accidental, and in most mines not artificially moistened the working places and roads are dry except in summer time.

All mining men have noticed that in summer the intake airways of mines become moist and even wet. They have noticed, too, that as the summer advances this moisture creeps in farther, until finally in most mines the dampness extends through all the workings. On the other hand, they have seen that when colder weather comes in the fall the intake airways begin to dry up, and after a while the roadways that have been damp or wet get dusty unless they are sprinkled or watered in some way.

Another fact that has been widely noticed is the relation between explosions and the time of the year. In summer the bituminous and lignite mines in this country are practically free from terrible explosions; these begin when cold weather comes. The records of State mine inspectors show that there is ground for believing that dust explosions in coal mines have been much more common in winter than in summer. Dust explosions may happen in the summer once in a while, and in districts where the air is dry, as in the Rocky Mountain coal fields, there is nearly as much likelihood of their happening in summer as in winter, unless special measures are taken to keep the dust in such condition that it will not spread a flame.

Mines are drier in winter than in summer because the outside air in winter is colder than the mine and can hold little water. When this cold air enters the mine it takes heat from the mine walls. As it gets warmer it can hold more water, and it takes this water from the floor, roof, ribs, and dust and thus dries the mine. In summer the outside air is warmer than the mine and its water-holding power is high. On entering the mine the air is cooled, it can hold less moisture, and some of the moisture is left as drops of water on the walls and roof, or makes the floor wet.

Relative Humidity.

When air contains all the water in the form of vapor it can hold it is said to be saturated. Water vapor can not be seen, but air that is saturated with water vapor can carry more water as fog or mist.

Relative humidity means the quantity of water vapor in the air compared with the quantity the air would hold if saturated, and this relation is expressed as a percentage. When the air at any place is saturated with water vapor the relative humidity is 100 per cent.; when the air is half saturated the relative humidity is 50 per cent.

The amount of water vapor needed to saturate air depends chiefly on temperature. Warm air can carry much more water than cold air. Tables showing the quantity of water vapor needed to saturate air at different temperatures, called psychrometric (or dew point) tables, are given in Weather Bulletin 235, published by the United States Weather Bureau, Washington, D.C.

Moisture Carried by Ventilating Currents.

To get an idea of the way which the change from winter to summer affects mine air, assume that in winter the temperature outside a mine is 0 deg. F. and the relative humidity is 70 per cent. By reckoning from the figures given in dew-point tables, it can be shown that under these conditions each 100,000 cubic feet of air carries into the mine a little over half a gallon of water. Therefore, an intake of 100,000 cubic feet of air per minute would carry into the mine about 750 gallons of water a day. In summer, with a temperature of 80 deg. F. and a relative humidity of 70 per cent. outside the mine, a current of 100,000 cubic feet per minute would carry into the mine 13.1 gallons of water per minute, or 19,000 gallons every 24 hours—that is, 23 times as much as under the assumed winter conditions.

The average temperature of most coal mines in this country is between 55 deg. and 70 deg. F., except near the intakes. The winter temperature of a mine differs only a few degrees from the summer temperature, because the temperature of the ground changes very little and the intake air takes the temperature of the walls of the mine.

A peculiar fact, noted by the mining engineers of the Bureau of Mines and by others, is that the relative humidity of the main return air current of the mine is nearly always over 90 per cent., no matter what the relative humidity of the outside air may be. The average relative humidity in the returns of coal mines, as shown by many measurements made under the direction of this bureau, is 90.5 per cent. A lower relative humidity in the returns is found in those Rocky Mountain regions where the air outside the mines is dry nearly all the time.

Prevention of Coal-Dust Explosions.

The chance of a coal-dust explosion can be much reduced by care in using explosives. It can be reduced still more by using what are known as permissible explosives—explosives that have passed certain tests by the Bureau of Mines. If these explosives are always used under the conditions prescribed by the bureau, there is little danger of their igniting dust.

The pressure of a small or large body of methane, the inflammation of which is an important cause in starting dust explosions, can be prevented by thorough ventilation. Many mine operators are satisfied if they send large volumes of air into a mine. At some mines more air enters than is really needed, but not enough reaches the working places to sweep the face or to keep the gob free from inflammable gas.

Leaky stoppings, overcasts, and doors are responsible for the loss of air. A bad error in most coal mines in this country is the use of a single ventilating door in places where double or triple doors would prevent part of the loss of the ventilating current.

It is evident that although the making of dust in coal mines can not be stopped, there are ways of keeping down the quantity of dust. It is also clear that although any bituminous coal or lignite mine that is dry is liable to have a dust explosion, the chances of such an explosion can be greatly lessened. To entirely prevent dust explosions is more difficult, but they can be prevented by carrying out measures to keep the dust from igniting and to keep it in such condition that it can not spread an explosion.

Methods of Keeping Coal Dust from Being Dangerous

There are two ways of keeping coal dust from being dangerous. One is to wet it; the other is to mix or cover it with rock or shale dust, clay, or sand. If the coal dust is wet enough it will not ignite; if there is enough unburnable dust mixed with it, a flame will not spread.

Applying Shale Dust.

The stone-dust treatment for coal dust has been tested at some foreign experiment stations, and is now being systematically tried at the Altofts Colliery in England. The dust, finely crushed shale, is thrown on the ribs and timbers of the passageways and scattered in a thick layer on the floor. It is renewed from time to time, whenever coal dust begins to show on top of it. In addition, quantities of the rock dust are placed on narrow boards fastened to the posts of the timber sets, or on horizontal planks over the roadways, or on easily overturned swinging shelves made of boards or canvas. The dust is distributed in this way that it may be thrown into the air in a thick cloud by the shock of an explosion and thus smother the flame. This method of using shale dust is called the "shale-dust curtain."

Many foreign experts think the application of rock or shale dust a good method to use in those mines in which the roof may be injured by wetting.

A fine example of how well rock dust may be distributed by natural means is to be seen in the northern Illinois longwall field, where the bits of shale that constantly fall from the roof and the pack walls keep the coal dust covered up. Explosions have never happened in this longwall district, though mining has been going on there for over 40 years.

The rock-dust method of making coal dust harmless promises to be of value in the Rocky Mountain coal fields where water is scarce. Certain mine operators in Colorado and New Mexico, following suggestions made by the mining engineers of the Bureau of Mines, are now experimenting with adobe dust and sand as a substitute for rock dust or wetting.

Wetting the Coal Dust.

The first-mentioned method of rendering coal dust harmless, that of moistening or wetting it, has been tested at the Pittsburg station, and used in many mines in Pennsylvania, West Virginia, and Alabama. It has proved thoroughly successful when properly carried out. A number of ways of wetting down the dust have been tried. These are by the use of water cars, hose and nozzle, fixed nozzles for sprinkling or spraying water, steam jets, and combinations of steam jets and water sprays.

Another method, the application of a salt that absorbs moisture from the air (calcium chloride), is being tried in a number of mines in West Virginia, and promises to be of value under special conditions.

Dust can be wet down and kept moist by the systematic use of any one of these methods. The great trouble at many mines, including some in which there have been dust explosions, has been that the method adopted was not thoroughly carried out.

Water Cars.

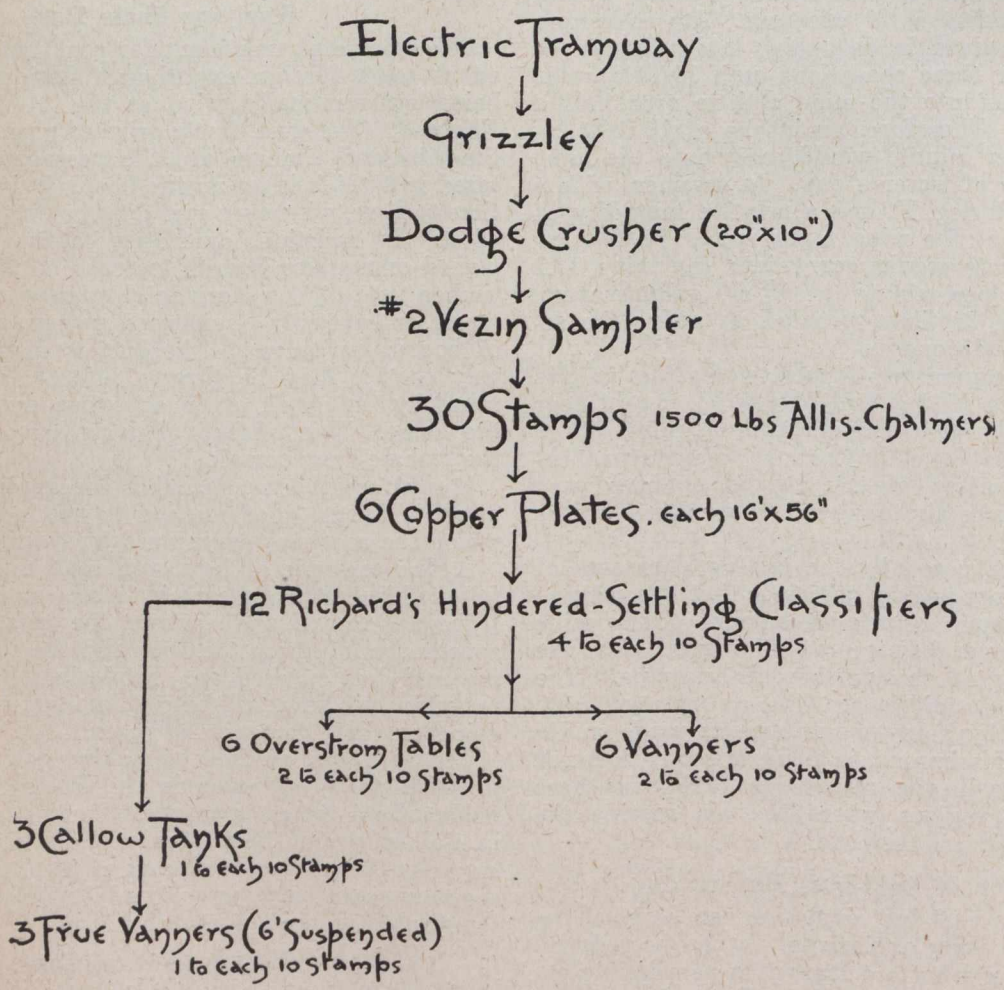
It is difficult to wet dry coal dust by throwing water on it. Perfectly dry coal dust will float a long time on water, and pouring water on such dust is like pouring water on a duck's back. Water dribbled on a dry road runs off and is lost in the loose rocks underneath the road or stands in little puddles till it drys up. For these reasons the use of water cars is not successful unless the roads are watered daily. Also, the sprinkling must be done by a force pump on the water car or by compressed air acting on the surface of the water in the car tank, so that the roof, timbers, and ribs can be wet as well as the floor. Pouring water from a bucket or dribbling it along the middle of the roadway from a valve in the tank is not a remedy and is of little value.

Hose and Nozzle.

Systematic washing down by hose and nozzle is an excellent way of laying dust. The water lines should be run along all the haulage ways up to the working faces and should have plenty of taps for attaching the hose. The washing down should be done often enough to keep the dust so damp that it will take up the next water thrown on it. To make fine dry coal dust so damp that it can be molded in the hand, 33 per cent. of water must be added; to make it muddy, at least 50 per cent. must be added. The mixture would therefore contain 25 and 35 per cent. respectively, of added moisture.

The hose and nozzle method of laying dust is particularly suited for watering a place previous to firing a shot—a precaution that is required in some European countries. The hose may be used to sprinkle the ribs and roof near the track and also the gob; provided, of course, that such sprinkling does not cause the roof to slack and fall nor the gob to take fire spontaneously, in which case the rock-dust method should be used.

(To be continued.)



FLOW SHEET, HOLLINGER MINING COMPANY'S MILL.

THE HOLLINGER MILL.

Before the fire at the Hollinger it was proposed to meet the whole requirements of the mill with 30 stamps. Since the fire has obliterated every trace of human activity the suggestion is to go on as before. But various influences, healthy influences, are at work. Therefore, it may well be believed that we shall see a 100-stamp-mill at work instead of a thirty.

Personal and General

Mr. J. E. McAllister was, on May 9, at Greenwood, B.C., presented with an address by the officials and other employees of the British Columbia Copper Company, on the occasion of his retirement from the position of general manager of the company. Accompanying the address was a valuable service of silver, presented to Mr. and Mrs. McAllister as a souvenir of their long residence in Greenwood (since 1903) and the esteem in which they are held. The same evening the citizens of Greenwood and vicinity tendered Mr. McAllister a complimentary valedictory banquet. It is understood that Mr. McAllister intends joining a firm of consulting engineers with headquarters in New York.

Mr. John B. Hobson, well known as having for years been actively engaged in placer gold hydraulic mining on a large scale near Quesnel Forks, Cariboo district, B.C., lately returned to British Columbia after having spent several weeks in California. He will shortly proceed to Quesnel Forks to there operate his Cresta Blanca hydraulic mine.

Mr. A. J. McMillan, liquidator of the Le Roi Mining Company, recently left Rossland, B.C., on a business trip to New York.

Mr. J. L. Parker, of Vancouver, B.C., lately paid another visit to Sheep Creek, Nelson mining division, going thence to southwestern Alberta.

Mr. A. H. Gracey has returned to British Columbia from a trip to Arizona. Lately he accompanied some other mining engineers to Camborne, Lardeau district of British Columbia, to assist them in their examination of the Eva and Oyster-Criterion gold properties. For several years Mr. Gracey was manager of the Eva mine and 10-stamp mill.

Mr. C. Hussey, business manager for Messrs. Finch & Campbell, of Spokane, Washington, U.S.A., has been spending a week or two at the Standard silver-lead mine, near Silverton, Slocan, in connection with the purchase of material and plant for an aerial tramway, water system, compressor plant, and concentrating mill for the Standard mine.

Mr. Ernest Levy, of Rossland, B.C., manager of the Le Roi No. 2, Limited, has gone on a trip to England.

Mr. F. Burbidge, of the Coeur d'Alene mining district, Idaho, U.S.A., has been on a brief visit to the Slocan district, examining mining property.

SPECIAL CORRESPONDENCE

NOVA SCOTIA.

Glace Bay—Dominion Coal Output.

The ice conditions during the last half of April were a great hindrance to shipping, and indications were that the drift ice might give trouble throughout May. Towards the end of April, however, there was a succession of westerly winds which drove the ice down the coast, and by the beginning of May the coast was clear. Shipping commenced at the International Piers in Sydney Harbour on the 4th of May, and during the first fortnight of May the Dominion Coal Company's daily output will have averaged over 14,000 tons. The output for the month should be about 330,000 tons.

The amount of coal stored at the mines during the winter was unusually large. At the mines over 300,000 tons was banked, and at the Steel works a stock of 120,000 tons was laid down. During the past winter the mines probably worked more regularly than they have ever done in the slack season. The old days of idle winters and feverish summers have about passed away, and the Glace Bay mines work as steadily the year round as any bituminous collieries in operation. There are few places where a miner can obtain steadier work the year round than at Glace Bay at the present time.

The foundations are being put in for a new electric water-hoisting engine to replace the present electric hoist at the International Water Shaft, which is the main drainage station for the Harbour Seam mines. The new hoist will be fitted with a Siemen's Ilgner fly-wheel equalizer, by which the stored-up energy of a rapidly revolving and heavy fly-wheel is utilized to equalize the fluctuating load of the hoist. This device is largely used in Germany and in European mines, and also in the United States, but there is probably not one yet installed in Canada.

The Dominion Coal Company's mines are now large users of electric power, the current from the main transmission line being used to drive the screening machinery, ventilating fans, pumps and auxiliary haulages underground, and for lighting the collieries. The first electrically-driven air-compressor in this part of the country is now being erected at No. 12 Colliery. So far none of the coal-hoisting engines have been electric, but it is more than probable that the near future will see one or more of these installed in Cape Breton. The shallow cover in the Glace Bay field affords an ideal opportunity for the transmission of electric current to underground pumps and haulages through the medium of boreholes.

Construction work has commenced on the new loading pier at Sydney, and the railway tracks are being laid. Work on the excavation of the foundations for the new wash-plant has also been started. The erection of the coal-handling plant at No. 2 Colliery will commence some time in May. The foundations are completed.

The Albion Mine Fire.

Mr. C. J. Coll's letter in your issue of May 1st demurs to references made in this correspondence on one or two occasions to the mine fire which took place at Stellarton in March, 1910, as "credit-claiming reports," and states that "there has been neither warrant nor occasion for the 'full meed of credit' given and so unctuously taken." Mr. Coll is mistaken in supposing that your correspondent or any other person in Cape Breton wishes to claim credit unduly. Reference to the correspondence will show that no attempt of this kind has been made, any more than to quote the official report of Mr. Thomas Blackwood, the Deputy Mine Inspector, as printed in the Nova Scotia Mines Report. Mr. Blackwood was one of the persons engaged in fighting this fire, and had every opportunity of forming a proper opinion of the usefulness of the rescue apparatus used, and it is Mr. Blackwood's report and not your correspondent's opinion that Mr. Coll objects to. Although he accompanied the trained men with the apparatus to Stellarton, your correspondent acting under instructions, did not go into the mine, and would not presume to give an opinion from hearsay only. No good could arise from attempting to answer Mr. Coll's letter in detail, and your correspondent can only refer your readers to the full text of Mr. Blackwood's report, at the same time disclaiming any unprofessional desire to claim undeserved credit for either the Cape Breton men or the apparatus which they used.

Mr. Coll believes that the uses of rescue apparatus or smoke helmets are strictly limited. So they are, and no person has urged this point more than your correspondent, but there are times when oxygen breathing apparatus has proved invaluable.

If Mr. Coll wishes to emphasize the folly of glorifying breathing apparatus to the exclusion of reasonable precautions, or of regarding it as a panacea for mine disasters and fires, and wishes to set forth the strictly limited uses of such apparatus, he will have the sympathy of all practical men. No multiplication of Rescue Stations or provision of modern apparatus will offset laxity or bad conditions of mining, and the use of breathing apparatus by untrained men is mere suicide. But when Mr. Coll says that the services of the Cape Breton men "were not required," many persons who know the circumstances under which these men worked in fighting the fire at the Albion mine will think that he is just a little unfair to them.

BRITISH COLUMBIA.

The spring season, which is more favourable to mining operations than the winter, is generally later in the mining districts of the Province than was expected it would be. Cold weather has retarded the melting of the snow, so that the commencement of hydraulicking in the placer-gold mining districts has been delayed two or three weeks, while in some parts where lode mining is the principal industry, hauling ore has had, of necessity, to await hardening of roads.

Much activity is noticeable in connection with newer camps, though still early for important work to be undertaken. Newspaper stories of Steamboat Mountain camp, for instance, suggest that many will go in to prospect in this new field. Again, many are preparing for an active season in the Portland Canal district, and others in country tributary to Skeena River. Development of coal lands on Graham Island, of the Queen Charlotte group, is promised; an increase in production of coal in Nicola Valley district is being prepared for; and coal mining operations in the vicinity of both Granite Creek (Tulameen) and Princeton (Similkameen) will be continued. Sheep Creek gold mines are likely to have done on them development on a larger scale than in the past, while the erection of new stamp mills, for the Mother Lode and Nugget mines, for which it has been announced that provision has been made, will enable a much larger recovery of gold to be made this year than in the past. In other parts of Nelson mining division than Sheep Creek—about Salmo, Ymir, and Nelson City, especially—the outlook is good for more mining and larger production than last year. In East Kootenay both lode and placer mining should be fairly active. Rossland and Boundary mines may be unfavourably affected by continued idleness at the Crow's Nest coal mines, if an agreement between operators and the miners' union be not soon made, and work be resumed at the several collieries, but there is still hope that some mutually acceptable understanding will be arrived at and long, protracted idleness be thereby avoided. Notwithstanding that there are some discouraging features in the situation, there is on the whole good reason to look for a continuance of operations on a scale that will result in last year's excellent record of progress being well maintained.

Slocan.—Melting snow has made wagon roads and trails too soft to allow of ore being hauled or packed to the railway or steamer shipping places, consequently few Slocan district mines shipped ore during the month of April. Similar conditions will largely prevail in May, so production will, from records of quantities of ore and concentrate received at the smeltery from the Slocan, appear to have been small. In several mines, though, development has been continued all through the winter, with generally satisfactory results. The most marked progress made has been in connection with three mines in Four-mile Creek camp, namely, the Standard, Van-Roi, and Hewitt-Lorna Doone group. Latterly further development at the Standard has been to some extent discontinued and the shipment of ore stopped, pending completion of an aerial tramway from the mine 7,900 feet down to the mill-site on Slocan Lake, immediately north of Silverton. The carrying capacity of this tramway will be about 20 tons an hour, with forty 850-pound buckets on the ropeway. Construction is being advanced, with towers in course of erection, and iron and steel materials arriving from the manufacturing works. Machinery for the Standard Silver Lead Mining Company's concentrating mill is also being received; meanwhile the necessary grading and log-cribbing has been done and framing the timbers for the mill building got well forward. The mill will have a crushing and grinding capacity of 200 tons a day, but for the time it will not be necessary to keep this part of the plant running continuously, since jigs and other concentrating machinery being installed are for treatment of only 100 tons per diem. Further, about 30 per cent. of the ore produced at the Standard mine is of first-class grade and is shipped crude to the smeltery, while second-class ore after having been crushed will be passed over a picking belt, so that all ore of a grade suitable for smelting without previous concentration will be sorted out before the remainder shall be fed to the mill. It is expected that the mill will be completed and in operation by October 1, while the water system for power purposes, and the aerial tramway, will both be in working order several weeks earlier. The Van-Roi Mining Company's mill, which, after delays extending over several months, caused by non-delivery of machinery, commenced concentration of ore about March 15. During the month of April the quantity of ore put through the mill was 3,273 dry tons, the product of which was about 190 tons of silver-lead and 230 tons of silver-zinc concentrate. The former product, which averages about 66 per cent. lead, is shipped to Trail, B.C., and the latter, averaging 44 per cent. zinc, to Bartlesville, Oklahoma, U.S.A. The importance of this mine is indicated by the following figures —during four calendar years, 1907-1910, the aggregate of payroll payments made in connection with the operation of the Van-Roi mine and mill (heretofore the company has operated the Wakefield mill under lease) was $300,843. Present development work in the mine is chiefly opening on No. 5 level extensions of the same shoots of ore as were worked on levels above. The largest of those shoots, though not yet stoped out, has yielded from stopes between Nos. 4 and 2 levels approximately 60,000 tons of ore. No. 5 has already opened several shoots of ore proved in higher levels to be large and of a good grade. Two veins are being opened, known as the Main and Beryl veins, respectively. The outlook for the mine, in which much development work has been done and large quantities of ore blocked out, is so favourable that a long and profitable run of the mill is confidently expected. The Wakefield mill is to be used to concentrate ore from the Hewitt-Lorna Doone mines, owned and operated by the Silverton Mines, Ltd. For several years the development of these mines had been in progress until now there is much ore available and easily accessible for extraction. The Wakefield mill plant is being overhauled, and to its equipment for production of lead and zinc concentrates is being added Elmore Vacuum Process plant, for treating the zinc middlings only. This mill will be running in June, and thereafter will, it is expected, add materially to the total of mineral production from the Four-mile section of Slocan district. Other mining properties tributary to Slocan Lake that are being worked are the Mollie Hughes and Sweetgrass, near New Denver; Buffalo, above Four-mile Creek; Eastmont and Enterprise, on Ten-mile Creek; Arlington, Ottawa, Meteor, Black Prince, and Hampton, on or about Springer Creek; and several others in various parts of the district.

Coast.—Reports are persistent to the effect that ore of good grade has been found in the Britannia mine, Howe Sound. Much development work has been done on this big property during recent years, but although large bodies of ore have been opened, the great bulk of the ore has been of such a grade that, with copper at a low price, there would have been little profit in extracting and smelting the ore. However, development work has been persistently continued, and the concentrating mill operated in a comparatively small way. For some time the expenditure on mine and mill totalled fully

$30,000 per month. Latterly the amount has not been so large, but if the reports above alluded to prove well founded, a return to the earlier scale of operations will be made. Texada Island mines are expected to maintain production this year on a fairly large scale. The Marble Bay mine has worked a shoot of bornite ore, containing also good value in gold and silver, down to a depth of about 1,200 feet. The Cornell mine, in the same vicinity, is being further developed by the Tyee Copper Company, and it is expected a considerable quantity of ore will be sent to the company's smeltery on Vancouver Island this year. Farther north, the Hidden Creek Copper Company's mine, on Observatory Inlet, is stated to be developing most encouragingly. Reports place the estimated quantity of ore found by underground prospecting, partly by extending the workings and partly by diamond-drilling, at a far larger total than when the property was taken under a working bond and option of purchase by the Granby Company, which, it is understood, will shortly make another payment on purchase account. Mr. James Cronin, formerly manager of the St. Eugene mine, East Kootenay, is among those returning to the Skeena district to do further exploration work on new properties situated in that part of the province. Both Portland Canal camp and Moresby Island of Queen Charlotte group, are expected to make an improved showing this year. Lode mining in Atlin district, some of which was done in 1910, will again have attention. The rich gold ore taken last year from narrow veins on the Northern Partnership group, gave such good returns that it is probable more work will be done on this property this year. Other lode claims in Atlin district will also be developed.

GENERAL MINING NEWS.

NOVA SCOTIA.

Halifax, N.S., May 28.—The long and bitterly-fought strike at the Springhill coal mines was ended yesterday afternoon, when the men adopted the report of the Settlement Committee. The points of agreement under which the strike is brought to an end, as adopted at the meeting of the miners in Springhill, are as follows:—

(1) The men to be taken back as soon as places can be found for them, the company saying it hopes to find employment in 45 days for a majority of the men.

(2) The schedules of the mechanics are to remain, with no reductions of the rates before the strike.

(3) The Longley Board's fine, that is, the docking system, is to govern.

(4) Coal cutters are to get ten per cent. less than the rate paid before the strike, fair consideration to be allowed to enable a man to earn an average wage where changing conditions in coal make that necessary. When the men went out J. R. Cowans, the former manager, announced a reduction of fifteen per cent.

(5) The usual clause that any employee may appeal to his employer against an alleged grievance, with an ultimate appeal to President Plummer.

The Longley Board of Conciliation refused to say that the United Mine Workers ought to be recognized; it refused to recommend an increase in wages or to compel the company to adopt a fixed schedule as to prices.

The men rejected the report of the Longley Board, and struck to enforce their demands for an increase in pay, and for the removal of what they said were grievances. They now return without the removal of any of the grievances, without recognition of the United Mine Workers, and at ten per cent. less wages for coal cutting.

Some 1,200 men have been idle for twenty-two months, and the loss to the miners is estimated at $500,000. The strike has been costly to the United Mine Workers. It is known that while President White did not force a settlement, his sentiment and that of the present United Mine Workers' executive was strongly in its favour. P

Sydney, N.S., May 16.—An interesting statement regarding the earnings of coal companies in Nova Scotia was made by General Manager Cantley, of "Scotia," at a reception on the company's new ore carrier.

Mr. Cantley said that much was written by persons entirely ignorant of the subject as to the "fabulous returns received by Nova Scotian coal mines, but when it was realized that the "Scotia" company made a profit of less than 25 cents per ton on all the coal it mined last year, it would be seen what little foundation there was in these assertions.

The Dominion Company made a somewhat higher profit, but there were many companies in the province which earned even less than this. For the amount of the capital and the risk involved, Mr. Cantley said he considered that Nova Scotian coal mines yielded the poorest return of any industry he knew of.

ONTARIO.

Cobalt.—The sale of the Cobalt Central properties at Cobalt, which was to have taken place to-day, has been postponed until June 17.

Cobalt.—A contract has been signed whereby the low grade ore of the Crown Reserve Mining Company will be treated in the mill of the Nova Scotia Cobalt at Peterson Lake. Arrangements, including the building of a long aerial tramway, will be commenced at once, and there will be no more time lost in making the bargain operative. The contract is on a flat rate per ton treated, with a certain extraction guaranteed. The bullion will be returned to the Crown Reserve for shipment.

At the Crown Reserve ready for immediate shipment is 350,000 tons of low grade on the dump, estimated by Mr. Cohen in the last annual report to be worth $250,000. This is being added to from development work very materially every day. In addition the lower levels of the Crown Reserve promise to furnish a very large percentage and tonnage of low grade ore, and either a mill of their own or a custom concentrator was urgently needed. By the new arrangements the assets in the big dump will be more quickly available than if the construction of a concentrator were attempted.

Cobalt, May 18.—The sixteenth mill to be erected in the district, that of the Cobalt Lake Mining Company, is progressing rapidly, and the management hopes to see the stamps dropping in August.

The first drills were set up to make the excavations on March 27; to-day all the foundations are in, and half of the framing has been done. The whole of the plant is either on the ground or in transit. The mill will be of 20 stamps, and will embody most of the features used in connection with water concentration in the Cobalt camp. A very large percentage of the extraction is expected to be made on the six jigs above the stamps.

Elk Lake.—A five-stamp mill, a compressor and a couple of boilers are now being installed at the Thelma Gold Mines, in Bryce Township, midway between Elk Lake and Earlton, on the T. & N. O. Dr. Bell, of McGill University, is now on the property, making examination. Montreal and French capital is largely interested in the enterprise.

Gowganda.—It is announced from Gowganda that both the Millerett and the Miller Lake-O'Brien will make several ship-

ments from the camp this summer in spite of the deplorable condition of the waggon road.

BRITISH COLUMBIA.

Nelson, May 16.—The Windermere Mining, Milling and Development Company, with offices at Moyie, has been incorporated for the purpose of pushing development work on the Estella property, under bond to them, and all other mineralized claims from the base of the mountain to the Estella mine.

Nelson.—Ymir is situated 18 miles south of the city of Nelson, and about seven and a half miles north of Salmo, the Sheep Creek distributing point, on the Salmon River, in the very heart of a great mining district which contains nearly all, if not all, the precious metals sought after. Wild Horse, Bear, Porcupine and Hidden Creeks flow from an easterly direction and empty into the Salmon at or quite close to the town of Ymir. These creeks range from 10 to 17 miles in length, with abundance of timber, and numerous branches. It is over these creeks the now famous Sheep Creek gold belt extends, and beyond the question of a doubt by those familiar with the various ores and formations of the district these same gold producers of to-day, now found on Sheep Creek, will within the next year or two be found on or quite near the summits of the creeks just mentioned, which the quartzite belt, with its mammoth quartz and other dykes, traverses, and which in another month will be free from snow and available for prospecting. It is quite possible some strikes will be made this summer, for rich ores used to be brought to town from the heads of these creeks in the early days, to which no attention was paid owing to the narrowness of the veins. In future more attention will be given these, as on Sheep Creek. These, with the veins already discovered in the vicinity and in the district at large, will sooner or later be made known abroad, the result of which can only be surmised.

YUKON.

Dawson, May 13.—The Yukon will be open for the season's navigation next Thursday, when a flotilla of six steamers and eight barges will start from Lake Lebarge for Dawson, Fairbanks and Iditarod, carrying 800 tons of freight.

Every steamer will be crowded with passengers rushing to the various camps, largely on the lower Yukon.

Many now at White Horse will walk across Lake Lebarge on the ice to catch the steamers.

The American boundary survey expedition, comprising 125 men and 150 horses, will catch the steamer Canadian at Yukon Crossing next week, come to Dawson, and transfer here to the steamer St. Michael, which will take them to the mouth of the Porcupine River, where they will transfer to the steamer Delta for Rampart House.

The first steamer from Dawson for Iditarod will sail May 30. It will be the packet Sarah. The Sarah will return immediately from Dikeman, bringing the first Iditarod gold and passengers this year for Seattle. It is due here on the return trip June 5.

The first steamer from Fairbanks this year will be the Schwarks, expected about the 24th.

A fleet of small boats with passengers for Dawson has passed Big Salmon.

The mails are now moving in canoes and launches.

MINING NEWS OF THE WORLD.

GERMANY.

Germany is endeavouring by every means at her command to create an oversea market for her coals. Germany is the only country on the Continent of Europe which can, and does, raise more coal than is required for her inland consumption. Charters for carrying German coal to French, Italian, Egyptian and even South American ports were at one time of rare occurrence; now they are almost familiar. German coal agents, backed by scientifically organized efforts, have succeeded in forcing coal into markets at one time held exclusively by British coal exporters. What she is doing can be best illustrated by the statement that no fewer than 58 vessels cleared from Rotterdam last month with cargoes of German coal for Mediterranean and other ports. A notable increase in Germany's coal export trade will undoubtedly be shown this year when the statistics are available. The labour disturbances in British coalfields have been a powerful factor in favour of Germany's efforts to find markets for her surplus coals.

GREAT BRITAIN.

At the House of Commons, May 1st, Mr. Masterman, M.P., Under-Secretary for Home Affairs, received a deputation from various societies of colliery examiners for the discussion of provisions in the Coal Mines Bill affecting the duties and status of firemen and deputies.

Among other matters the deputation asked that firemen and deputies should have an opportunity of appealing to some tribunal in cases of arbitrary dismissal; that the eyesight test should be of a practical character; that men now satisfactorily performing the work should not be prejudiced by the introduction of the examination system, and that in the provision that firemen and deputies should, where practicable, devote their whole time to those duties, the qualifying words "where practicable" should be struck out.

On this last point, Mr. Masterman asked if the adoption of the suggestion would not destroy the whole deputy system as it now existed in Northumberland.

Mr. Coulthead: That is so.

Mr. Masterman: The words "where practicable" were introduced to meet the case of Northumberland.

Mr. Williams and other members of the deputation contended against combining the duties with extraneous work.

Mr. Masterman said that if the amendment suggested was made they would have to rearrange the mines in Northumberland, and many deputies might be displaced. He suggested that the point was met by the provision that districts should not be too large. If there were other duties to perform the districts must be smaller accordingly. He promised, however, that the various suggestions made should be carefully considered.

SOUTH AFRICA.

Johannesburg.—At the end of December the reef-bearing area of the East Rand Proprietary was 3,417 claims, of which 266, or 7.8 per cent., had been exhausted. The company has submitted its calculations as to minerals underlying townships and bewaarplaatsen in the vicinity of its claims, but up to the present no notification has been received from the Union Government in connection with the matter. The total profit for the year figured at £1,269,935, out of which two dividends of 20 per cent. were paid amounting to £962,358. Profits tax absorbed £108,930, and the sum of £160,553 was appropriated for the redemption of capital expenditure. The total of the latter came to £864,932, the principal items being:—

Excess development and shaft-sinking	£430,683
Machinery, plant, building	314,070
Reduction plant	103,655

There were crushed 2,126,334 tons during the year of an average assay value of 7 dwts. per ton, yielding 691,860 ounces, equal to 6.5 dwts per ton. The value was £2,900,883, or 27s.

3.4d. per ton, while the cost of production was £1,651,527, or an average of 15s. 6.4d. per ton. The rate of profit was 11s. 9d. per ton. Compared with the previous year there was an increase of 1d. per ton in working cost. This contrasts with a rise of 2s.2d. shown by the other great Rand consolidation, the Crown Mines.

The ore reserves increased by 1¾ million tons, the payable aggregate being 10,274,000 tons, which is below the figure contemplated by Sir George Farrar in his speech of a year ago. Taking payable and unpayable ore together, the reserves increased by 2,578,516 tons. It is thus evident that the proportion of payable ore has diminished, the value of the entire quantity has dropped 1s. 3d. per ton. It is, of course, the payable ore that is the true criterion. The footage driven, risen and sunk was 110,084 feet. In this important particular the East Rand Proprietary leaves its rival, the Crown Mines, very far behind, the total of the Eckstein amalgamation being 58,750 feet. Whereas the Crown Mines opened up 2,366,000 tons, the East Rand exposd just over six million tons. It is worth noticing that the Crown Mines' reserves are just 1 dwt. higher than those of the Farrar organization, but this margin is likely to be lessened as the proportion of reserve in the western part of the Crown Mines is reduced. The actual value will be temporarily affected by development done in the water rights section of the Crown, exploited by arrangement with the Government. In the East Rand the total development is about 121 miles.

Johannesburg—The gold output for April of the mines on the Witwatersrand amounted to 638,421 ounces of fine gold, and from the outside districts 29,293 fine ounces, total 667,714 ounces, valued at £2,836,267, as against 676,065 ounces, valued at £2,871,740 in March. This is a decrease of 8,351 ounces, or £35,473, on the month. The daily average for April was 22,257 ounces, against 21,809 ounces for the previous month, and breaks the record of 21,815 ounces created last February.

UNITED STATES.

Bisbee, Ariz., May 15.—The much-talked-of merger of the Calumet & Arizona and the Superior & Pittsburg has at last been formally made, and hereafter these two great Bisbee properties will be one.

Miami, Ariz., May 17.—During April the Old Dominion of Globe concentrated 11,085 tons of ore, smelted 29,275 tons of charge (ore, flux, etc., mixed), and produced 2,515,000 pounds of copper.

Spokane, Wash, May 10.—Nine dividend-paying mines in Shoshone county, Idaho, in the heart of the Cœur d'Alene district, earned net profits amounting to $2,500,000 in 1910, or $500,000 more than in 1909, according to a statement compiled from official reports by John Dolan, county assessor, who also says that more than $5,000,000 was paid by the operating companies for extracting the ore, the major portion being for labour.

The gross earnings of the Bunker Hill & Sullivan mine, heading the list, amounted to $3,514,431, the Federal company's properties at Mace and Wardner each being near the $2,000,000 mark.

The chief dividend payers are the Bunker Hill & Sullivan, the Federal Company's properties at Wardner and Mace, the Hercules and the Hecla. The new producers are the Caledonia, with net profits of $165,597, the Stewart with $21,788, and the Success with $10,049. Bunker Hill and Sullivan heads the list with $971,263, or about $400,000 more than in 1909. The Hecla's profits are placed at $216,909; the Federal's Wardner property earned a net profit of $285,303, while the Mace property shows a gain of $493,439, as compared with 1909. The Morning mine, also owned by the Federal Company, lost $40,000, though it handled 333,900 tons of ore.

COMPANY NOTES

DOMINION STEEL-COAL COMPANY.

Abstract of President Plummer's Report.

Your directors have filled the vacancies caused on the board of the Steel Corporation by the appointment as directors of the Honorable R. Dandurand and of Sir William Mackenzie of Toronto.

Coal Earnings—In considering the statement of earnings your directors would remind you that the period covered by the report includes four months in which the strike existed, that even when ended it was many months before the disorganization which it caused ceased to be felt, and that an extra winter period—December, 1910, to March, 1911—is included, during which earnings are necessarily small. The net result, under these conditions, is in your directors' opinion reasonably satisfactory.

The Coal Company's plant is in very good condition, and your directors look for an increased production in the current financial year.

Dominion Iron & Steel Company.

Business of the year.—The expectations of your directors that the new coke ovens would be ready last autumn were not fulfilled, and the additions to the plant generally have been much delayed by various causes, among them difficulty in obtaining suitable labour. For the ten months just closed we have, therefore, only maintained the proportionate output of the previous year, the figures are as follows:

	Tons.
Pig iron	205,865
Steel ingots	250,462
Rails	109,534
Wire rods	68,602
Billets and blooms sold	28,040

In the new year beginning 1st April, 1911, the plant now in operation should produce 290,000 tons of pig iron, an increase of about 50,000 tons, with a corresponding increase in finished products.

The bounties on pig iron and steel ingots received during the year were $316,045.21, being $228,365.97 less than in the previous twelve months, and they ceased altogether on 31st December last. The bounty on wire rods for the ten months amounted to $459,817.50.

Property Extensions:—To increase the annual production of your plant, to which we must look for such a reduction of costs and increase in earnings as will compensate us for the lapsing of the bounties, and to meet the demands of our customers, your directors have authorized the erection of another blast furnace, which will make six in all. The erections will be gone on with as soon as possible.

The new work on hand at the date of our last meeting, or since arranged for, which should all be completed within 18 months, will increase the capacity of the plant from 250,000 tons per annum of finished steel to over 400,000 tons, and your directors have no reason to doubt that the effect of this increase in the lessening of costs and the enlargement of earnings will be satisfactory to the shareholders.

The Bounties.

Bounty on Wire Rods.—Under the proposed reciprocity trade agreement with the United States, wire rods will enter free into both countries, and the confident expectation of your directors that on the lapse of the bounty on wire rods a duty

would be imposed has therefore become impossible of fulfilment. Application was at once made to the Government for an extension of the bounty for a term, during which preparation could be made to market in other forms the material now sold as wire rods, but no reply has yet been given.

While they would not minimize the loss which the company must suffer if the bounty is not extended, your directors have every confidence that the effect will be ultimately overcome when the plant is completed.

Vacancies on the Board.

Vacancies on the board.—Your directors filled the vacancies on the board caused by the death of the Hon. L. J. Forget and Mr. H. F. Dimock, by the appointment thereto of Mr. E. R. Wood, of Toronto, and Mr. Mark Workman, of Montreal. At the annual meeting you will be asked to elect, in addition, the Hon. R. Dandurand, of Montreal, and Sir William Mackenzie, of Toronto, who have joined the board of the Dominion Steel Corporation, Limited.

LA ROSE IN APRIL.

During the month of April La Rose produced 289,895 ounces of silver of gross value of $155,548. Net profit for the month was $101,325, as compared with $95,878 after March.

For the first four months of the current year La Rose produced 1,200,931 ounces of silver of gross value of $630,386, and net of $424,279. This is at the rate of $1,275,000 per annum, or more than twice the amount required for the present 8 per cent., or 40 cents per share dividends on the 1,498,627 shares outstanding.

STEEL OFFICIALS.

The officials of the Dominion Steel Corporation have been elected as follows for the ensuing year:

Steel Corporation.

Mr. J. H. Plummer, president; Sir Wm. C. Van Horne, vice-president; Mr. C. S. Cameron, secretary and treasurer; Mr. W. A. Doig, assistant secretary and assistant treasurer; Executive Committee—The President, the Vice-President, Mr. Wm. McMaster, Mr. J. R. Wilson, Sir Henry M. Pellatt, Mr. Frederic Nicholls.

Dominion Coal Company.

Mr. J. H. Plummer, president; Mr. J. R. Wilson, vice-president; Mr. C. S. Cameron, secretary and treasurer; Mr. W. A. Doig, assistant secretary and assistant treasurer; Executive Committee—The President, the Vice-President, Sir Wm. Van Horne, Mr. Wm. McMaster, Hon. Robert Mackay, Mr. F. L. Wanklyn.

Dominion Iron & Steel Company.

Mr. J. H. Plummer, president; Mr. Wm. McMaster, Vice-President; Mr. C. S. Cameron, secretary and treasurer; Mr. W. A. Doig, assistant secretary and assistant treasurer; Executive Committee—The President, the Vice-President, Hon. Robert Mackay, Sir Wm. Van Horne, Mr. J. R. Wilson, Mr. Geo. Caverhill.

STATISTICS AND RETURNS

COBALT ORE SHIPMENTS.

Shipments from the Cobalt camp for the week ending May 12, in pounds:

Nipissing	130,380
La Rose	59,530
Temiskaming	58,760
Hudson Bay	64,360
McKinley-Darragh	62,340
Right of Way	60,200
Buffalo	54,850
Coniagas	64,710
Kerr Lake	60,034
Total	615,164

Following are the shipments from the Cobalt camp for the week ending May 19, and those from Jan. 1, 1911, to date:

	May 19. Ore in lbs.	Since Jan. 1. Ore in lbs.
Badger	.....	55,200
Bailey	.....	40,000
Barber	.....	6,000
Beaver	62,615	657,858
Buffalo	.....	1,061,830
Chambers-Ferland	62,900	511,800
City of Cobalt	.....	427,780
Cobalt Lake	61,420	1,749,270
Cobalt Townsite	.....	351,840
Colonial	.....	42,000
Coniagas	61,000	1,651,890
Crown Reserve	.....	946,960
Hargraves	.....	41,100
Hudson Bay	.....	310,480
Kerr Lake	60,082	1,141,980
King Edward	.....	40,000
La Rose	146,630	2,360,780
McKinley-Darragh	109,130	2,251,550
Nipissing	66,070	2,379,740
O'Brien	.....	543,770
Peterson Lake (Little Nip.)	.....	58,480
Provincial	.....	40,510
Right-of-Way	.....	378,460
Silver Cliff	.....	106,680
Standard Cobalt	.....	44,813
Temiskaming	64,910	775,302
Trethewey	.....	528,630
Wettlaufer	.....	117,232

The shipments for the week were 694,757 pounds, or 347 tons.

The shipments from Jan. 1 to May 19 were 18,621,885 lbs., or 9,310 tons.

Following are the shipments from the Cobalt camp for the week ending May 26, and those from January 1, 1911, to date:

	May 26. Ore in lbs.	Since Jan. 1. Ore in lbs.
Badger	.....	55,200
Bailey	.....	40,000
Barber	.....	6,000
Beaver	58,850	716,708
Buffalo	107,120	1,168,950
Chambers-Ferland	.....	511,800
City of Cobalt	66,000	493,780
Cobalt Lake	.....	1,749,270
Cobalt Townsite	80,880	432,720
Colonial	.....	42,000
Coniagas	.....	1,651,890
Crown Reserve	50,090	997,050
Hargraves	.....	41,100
Hudson Bay	64,370	374,850
Kerr Lake	60,000	1,201,980
King Edward	.....	40,000
La Rose	275,680	2,636,460
McKinley	246,340	2,497,890

Nipissing	205,640	2,585,380
O'Brien	.....	543,770
Peterson Lake (Little Nip.)	.....	58,430
Provincial	.....	40,510
Right of Way	73,320	451,788
Silver Cliff	.....	106,680
Standard	58,000	102,813
Temiskaming	.....	775,302
Trethewey	.....	528,630
Wettlaufer	.....	117,232

The shipments for the week were 1,146,290 pounds, or 573 tons.

The shipments from Jan. 1 to May 26 were 19,768,175 pounds, or 9,884 tons.

B. C. ORE SHIPMENTS.

The following are the returns of the ore production and movement for the past week, and for the year to date:

Boundary Shipments.

Granby	16,455	424,120
Mother Lode	6,972	121,305
Rawhide	5,115	68,646
Jack Pot	643	12,208
Athelstan	125	739
Napoleon	250	743
Lone Star	345	738
Other mines	.....	30,173
Total	29,905	658,672

Rossland Shipments.

Centre Star	3,770	73,849
Le Roi No. 2	796	10,048
Le Roi No. 2, milled	300	5,700
Nickel Plate	28	309
Other mines	.....	4,731
Total	4,894	94,637

Slocan-Kootenay Shipments.

Sullivan	983	13,229
St. Eugene, milled	420	12,636
Queen, milled	420	7,770
Richmond-Eureka	40	1,000
Granite-Poorman, milled	250	4,750
Nugget, milled	110	2,090
Wilcox, milled	75	1,425
Knob Hill	251	1,002
Van Roi, milled	800	5,849
Other mines	.....	5,999
Total	3,349	55,650

The total shipments for the week, including estimated milling, were 38,148 tons, and for the year to date, 808,959 tons.

Granby Smelter Receipts.

Grand Forks, B.C.

Granby	16,455	424,120

B. C. Copper Company's Receipts.

Greenwood, B.C.

Mother Lode	6,972	121,305
Rawhide	5,115	68,646
Jack Pot	643	12,208
Athelstan	125	739
Napoleon	250	743
Lone Star	345	738
Other mines	.....	406
Total	13,450	204,785

Consolidated Company's Receipts.

Trail, B.C.

Centre Star	3,770	73,849
Sullivan	983	13,229
Le Roi No. 2	796	10,048
Richmond-Eureka	40	1,000
St. Eugene	223	2,628
Nickel Plate	28	309
Knob Hill	251	1,002
Other mines	.....	42,005
Total	6,001	143,710

The total receipts at the smelters for the week, including concentrates, were 35,906 tons, and for the year to date, 772,615 tons.

LE ROI NO. 2.

Le Roi No. 2.—Josie mine report for April—Shipped 2,350 tons of ore and 154 tons of concentrates. The receipts from smelter are $33,857 (£6,981), being payment for 2,133 tons shipped, and $3,055 (£630), being payment for 108 tons concentrates shipped—in all $36,912 (£7,611). Estimated costs for corresponding period—Development, $10,000; ore production, $9,000; milling, $1,500. Total, $20,500 (£4,227). Other expenditure, $2,000. Holywell drift, 500 feet level—Advance, 83 feet, of which 64 feet averaged 1 ounce 7 dwts, gold and 3⅛ per cent. copper over 9 inches. Annie drift, 1,300 foot level—Advance, 126 feet.

TORONTO MARKETS.

May 27.—(Quotations from Canada Metal Co., Toronto).
Spelter, 5.50 cents per pound.
Lead, 3.65 cents per pound.
Antimony, 8 to 9 cents per pound.
Tin, 44 cents per pound.
Copper, casting, 12¾ cents pr pound.
Electrolytic, 12¾ cents per pound.
Ingot brass, 8 to 12 cents per pound.

May 27.—Pig Iron—(Quotations from Drummond, McCall Co., Toronto):—
Summerle No. 1, $22.50 (f.o.b. Toronto.)
Summerlee No. 2, $22.00 (f.o.b. Toronto.)
Midland No. 1, $19.00 (f.o.b. Toronto.)
Midland No. 2, $19.00 (f.o.b. Toronto).
Hamilton No. 1, $18.00 (f.o.b. Hamilton.)
Hamilton No. 2, $17.50 (f.o.b. Hamilton.)
Clarence, $19.00 (f.o.b. Toronto).
Cleveland, $19.00 (f.o.b. Toronto).

GENERAL MARKETS.

Coal, anthracite, $5.50 to $6.75.
Coal, bituminous, $3.50 to $4.50 for 1¼-inch lump.

Coke.

May 24—Connellsville Coke:—
Foundry coke, prompt, $1.90 to $2.00 per ton.
Furnace Coke, prompt, $1.50 to $1.55 per ton.

May 24—Tin, Straits, 44.40 cents.
Copper, Prime Lake, 12.37½ cents.
Electrolytic copper, 12.20 cents.
Copper wire, 13.75 cents.
Lead, 4.47½ cents.
Spelter, 5.50 cents.
Sheet zinc (f.o.b. smelter)), 7.25 cents.
Antimony (Cookson's), 9.50 cents.
Aluminium, 20.00 to 20.50 cents.
Nickel, 40.00 to 45.00 cents.
Platinum, ordinary, $42.50 per ounce.
Platinum, hard, $44.50 per ounce.
Bismuth, $2.00 to $2.10 per lb.
Quicksilver, $46.50 per 75-lb. flask.

SHARE MARKET.

(Courtesy of Warren, Gzowski & Co.)

Miscellaneous.

	May 27, 1911. Bid.	Ask.
Dominion Steel Corporation	.56⅜	.57
Nova Scotia Steel	.98¾	.99
Crow's Nest Pass	.....	.68
Granby	.33¾	.34
Consolidated Mining & Smelting	.35	.45
Amalgamated Asbestos	.09	.10
Black Lake Asbestos	.....	.15

Cobalt Stocks.

Bailey	.05	.15¼
Beaver Consolidated	.44	.44¼
Buffalo	2.00	2.30
Chambers-Ferland	.13	.13½
City of Cobalt	.16	.17
Cobalt Central	.03	.05
Cobalt Lake	.21¾	.22
Coniagas	6.75	7.00
Crown Reserve	3.18	3.25
Foster	.05⅛	.06
Gifford	.03	.05
Great Northern	.19	.19¼
Green Meehan	.03⅞	.04¼
Hargraves	.18	.18¾
Hudson Bay	85.00	105.00
Kerr Lake	6.00	6.75
La Rose	4.30	4.50
Little Nipissing	.04	.04½
McKinley	1.73	1.73½
Nancy Helen	.02¼	.04
Nipissing	10.55	10.65
Nova Scotia	.12½	.15
Ophir	.12	.14½
Otisse	.01¼	.02
Peterson Lake	.11	.11¼
Right of Way	.10	.13
Rochester	.05⅝	.06
Silver Leaf	.03¾	.04½
Silver Queen	.04	.08
Temiskaming	.70¼	.70½
Trethewey	.95	1.05
Wettlaufer	1.08	1.10

Porcupine Stocks.

Foley	1.44	1.47
Porc. Northern	.66	.68
Detroit and New Ontario	.50	.51
Rea	5.97	6.05
Apex	.16	.18
Porc. Canada	1.12	1.18
Porc. Central	.73	.75
Dobie	3.25	3.50
Dome Extension	.59	.60
Hollinger	12.76	12.90
Monita	.24	.25
Preston	.34	.34¾
Pearl Lake	.56	.60
Imperial	.15	.20
Porc. Tisdale	.10¾	.11½
Swastika	.63	.64
United	.05	.08
Vipond	.62½	.63¾
Standard	.18	.28

New York Curb.

Brit. Col. Copper	5⅛	5⅜
Butte Coalition	19	20
Chino Copper	..	24¾
Davis-Daly Copper	1⅜	1½
Ely Consolidated	7/16	½
Giroux Mining	6⅝	7
Goldfield Consolidated	5⅞	6
Greene-Canadian	7	7⅛
Harcuvar Copper	..	..
Inspiration Copper	9⅝	9¾
Miami Copper	20½	..
New Baltic Copper	7	7½
Nevada Con. Copper	19	19¼
Ohio Copper	1 9/16	1 11/16
Rawhide Coalition	.7	.8
Ray Central	1⅝	1 11/16
Ray Consolidated	..	..
Union Mines	7/16	½
Yukon Gold	3 15/16	4

Silver Prices.

	New York. cents.	London. pence.
May 9	53¼	24 9/16
" 10	53⅛	24½
" 11	53⅜	24⅝
" 12	53½	24 11/16
" 13	53½	24 11/16
" 15	53½	24 11/16
" 16	53½	24 11/16
" 17	53¼	24 9/16
" 18	53⅜	24⅝
" 19	53⅛	24½
" 20	53⅜	24⅝
" 22	53⅜	24⅝
" 23	53⅜	24⅝
" 24	53⅜	24⅝