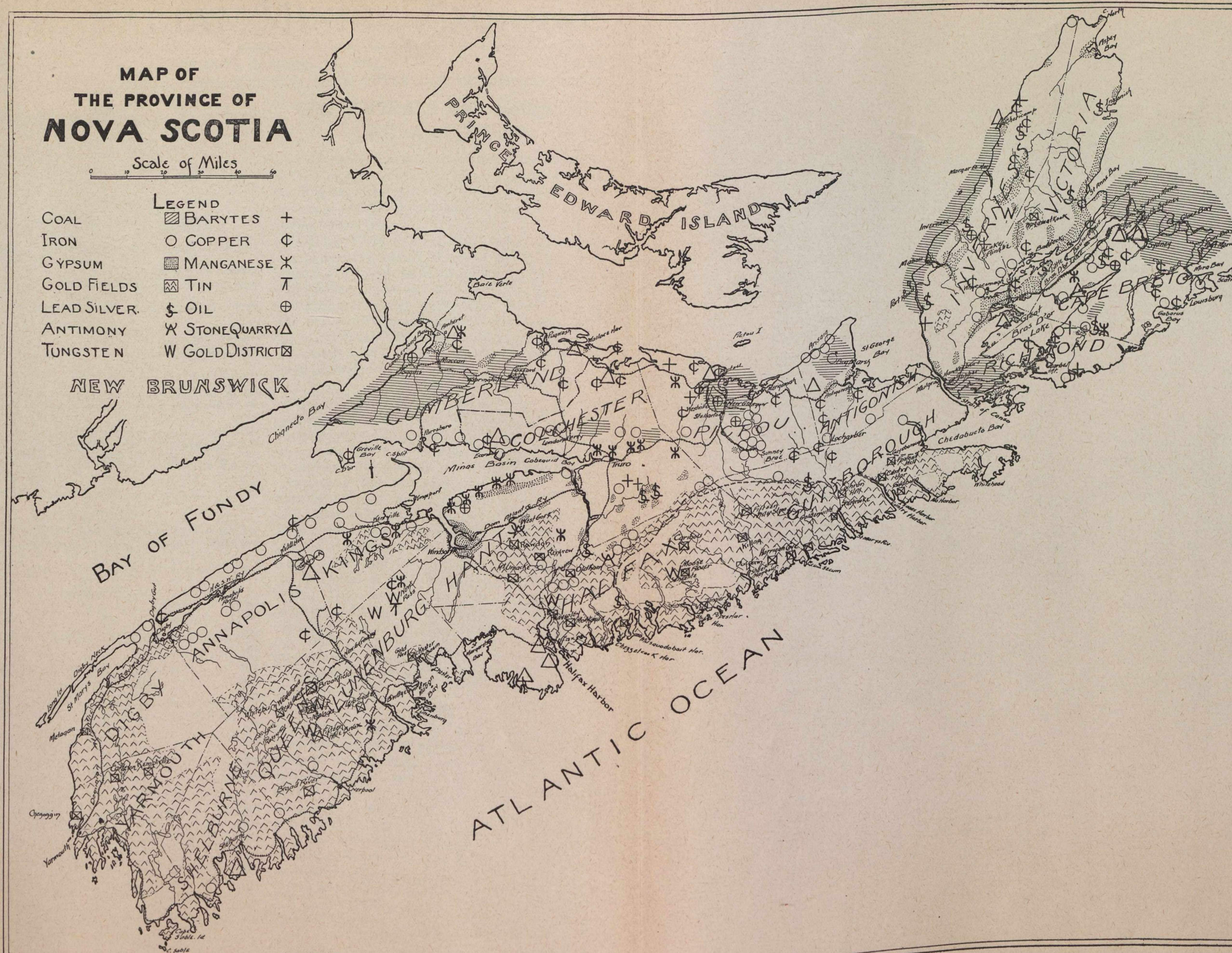

MAP OF
THE PROVINCE OF
NOVA SCOTIA
Scale of Miles
LEGEND
COAL
IRON
GYPSUM
GOLD FIELDS
LEAD SILVER
ANTIMONY
TUNGSTEN
BARYTES
COPPER
MANGANESE
TIN
OIL
STONE QUARRY
GOLD DISTRICT
NEW BRUNSWICK
PRINCE EDWARD ISLAND
BAY OF FUNDY
ATLANTIC OCEAN
CUMBERLAND
COLCHESTER
PICTOU
ANTIGONISH
GUYSBOROUGH
HALIFAX
HANTS
KINGS
ANNAPOLIS
LUNENBURG
QUEENS
DIGBY
YARMOUTH
SHELBURNE
INVERNESS
VICTORIA
CAPE BRETON
RICHMOND
Chignecto Bay
Minas Basin
Cobequid Bay
Truro
Halifax Harbor
Chedabucto Bay
St. Marys Bay
Digby Neck
Yarmouth
Sydney
Louisburg
St. Georges Bay
Baie Verte
Pictou I.
Bras D'or Lake

THE CANADIAN MINING JOURNAL

VOL. XXXIII. TORONTO, September 15, 1912. No. 18

The Canadian Mining Journal

With which is incorporated the
"CANADIAN MINING REVIEW"
Devoted to Mining, Metallurgy and Allied Industries in Canada.

Published fortnightly by the

MINES PUBLISHING CO., LIMITED

Head Office - Room 36, Canadian Birkbeck Building, 10 Adelaide Street East, Toronto.
Branch Office - - - - - - - 34B Board of Trade Building
London Office - - - Walter R. Skinner, 11-12 Clement's Lane London, E.C.
U. S. A. Office - Ward & Smith, 931 Tribune Building, New York

Editor
J. C. MURRAY. B.A., B.Sc.

Contributing Editor
H. MORTIMER-LAMB

SUBSCRIPTIONS--Payable in advance, $2.00 a year of 24 numbers, including postage in Canada. In all other countries, including postage, $3.00 a year.

Advertising copy should reach the Toronto Office by the 8th, for issues of the 15th of each month, and by the 23rd for the issues of the first of the following month. If proof is required, the copy should be sent so that the accepted proof will reach the Toronto Office by the above dates.

CIRCULATION.

"Entered as second-class matter April 23rd, 1908, at the post office at Buffalo, N.Y., under the Act of Congress of March 3rd 1879."

CONTENTS.

THE MINERALS AND MINES OF NOVA SCOTIA.

So diversified and so numerous are mineral deposits and mining operations in the Province of Nova Scotia that it is out of the question within reasonable limits to present a complete description of even a few of the leading enterprises,.

Realizing this fully, it was early determined that the only practicable method of attack was to publish a selected and timely series of articles dealing mainly with late developments. It is proposed, further, to rearrange, modify, and add to this material at a later date with a view to embodying it in pamphlet form. But before expatiating further on these plans it is appropriate to have a look over the mining field of Nova Scotia generally.

GOLD.

Since the year 1862 Nova Scotian gold mines and prospects have yielded about $20,000,000 in gold. The recorded production for the year 1862 is just about equal to that for 1911. This fact, if one studies closely the history of the industry, is susceptible of favourable explanation. But that explanation, to be complete, must embrace the several physical, commercial, and human factors that have combined to militate against the industry. Here we need not debate the question at length. It suffices to state our deliberate conviction that there is ample reward awaiting the unprejudiced and competent investor in the gold regions of Nova Scotia. There are yet large areas of unprospected territory; and to correct the abuse due to long tenure of unworked areas, an Act was passed last May providing for revoking leases or licenses of such areas. This gives much freer scope to the prospector, and, incidentally, indicates a spirit of progressiveness on the part of the Government.

COAL.

Coal mining has been for long and still is the most important branch of the mining industry. Before 1894, the annual sales of coal in the Province never exceeded 2,000,000 tons. In the year 1893, the Dominion Coal Company commenced operations. Since then, with the Nova Scotia Steel & Coal Company as a later heavy producer, the annual sales have gone up by leaps and bounds, until during this current year they promise to exceed 6,500,000 tons; while the gross production may approach 7,500,000 tons.

The Acadia Coal Company, the Inverness Railway and Coal Company, the Maritime Coal, Railway & Power Company, and several smaller concerns, contribute a large share of the total. All are carefully managed and excellently equipped.

Yet there is ample room in the coalfields of Nova Scotia for the investor, particularly for the European investor. Not a few tragedies have been enacted where the giddy promoter and his victim have been the chief actors, and where the property has been abandoned before its merit or demerit was demonstrated. Not a few holdings have been opened that show large promise. And Nova Scotia is so admirably situated, geographically, has such a number of accessible harbours, that her advantages in these respects are supreme.

The vast enterprises that have been established in will, we believe, be a revelation to our readers. The commercial conservation of coal has been carried to a higher point nowhere than in Nova Scotia. Better still, her manufacturers are competing successfully for a share of the trade that is created by the needs of the mining companies.

IRON AND STEEL.

The vast enterprises that have been established in Cape Breton and at New Glasgow by the Dominion Steel Corporation and the Nova Scotia Steel and Coal Company owe their growth in large measure to special conditions. In themselves they have contributed very largely indeed to the development of coal mining, and to the support of growing industrial communities. For the opening of iron ore deposits in the Province they have done more than is generally known, as witness the Torbrook mines of the Canadian Iron Corporation.

One of our leading articles is written by Mr. J. H. Plummer, the vigorous president of the Dominion Steel Corporation. Mr. Plummer, who is obviously no "free trader," states the case for the iron and steel industry in a manner at once convincing and moderate. We would be guilty of painting the lily were we to add to what that article contains. We commend it to our readers most heartily.

GYPSUM.

The potentialities of the gypsum trade of Nova Scotia are enormous. Only a fair beginning has been made. For instance, while this year there will be quarried between 350,000 tons and 400,000 tons, the great bulk of this will be shipped crude to the United States, whence much of it is shipped back to Canada manufactured. The number of manufacturing concerns in Nova Scotia is small, their capacity inconsiderable. The demand for the many commercial products is large and will grow. The supply of high-grade gypsum is, humanly speaking, almost inexhaustible. Here, also, is one of the neglected fields of the Province.

BRICK AND TILE.

Cheap fuel, the best of raw material, an extensive market, and easy transportation are the inducements offered to the brick manufacturer in Nova Scotia. The reports of Dr. Henrich Ries, published by the Ottawa Mines Branch, is amply commendatory. The range of material available is wide, covering practically every grade of clay and shale. Building brick, fire brick, drain tiles, roof tiles, and various kinds of pottery can be produced. China clay, also, has been found in quantity. With the industrial revival that is pending will come a strong demand for these commodities.

MISCELLANEOUS.

Of the score of other mineral products—manganese, copper, tin, antimony, tungsten, etc., etc., space will not permit us to say more than that they have by no means received the attention they deserve. Only sporadic or ill-advised attempts have been made to develop many of these deposits. Others, partly developed, are promising. Several are on the high road to success.

GENERAL.

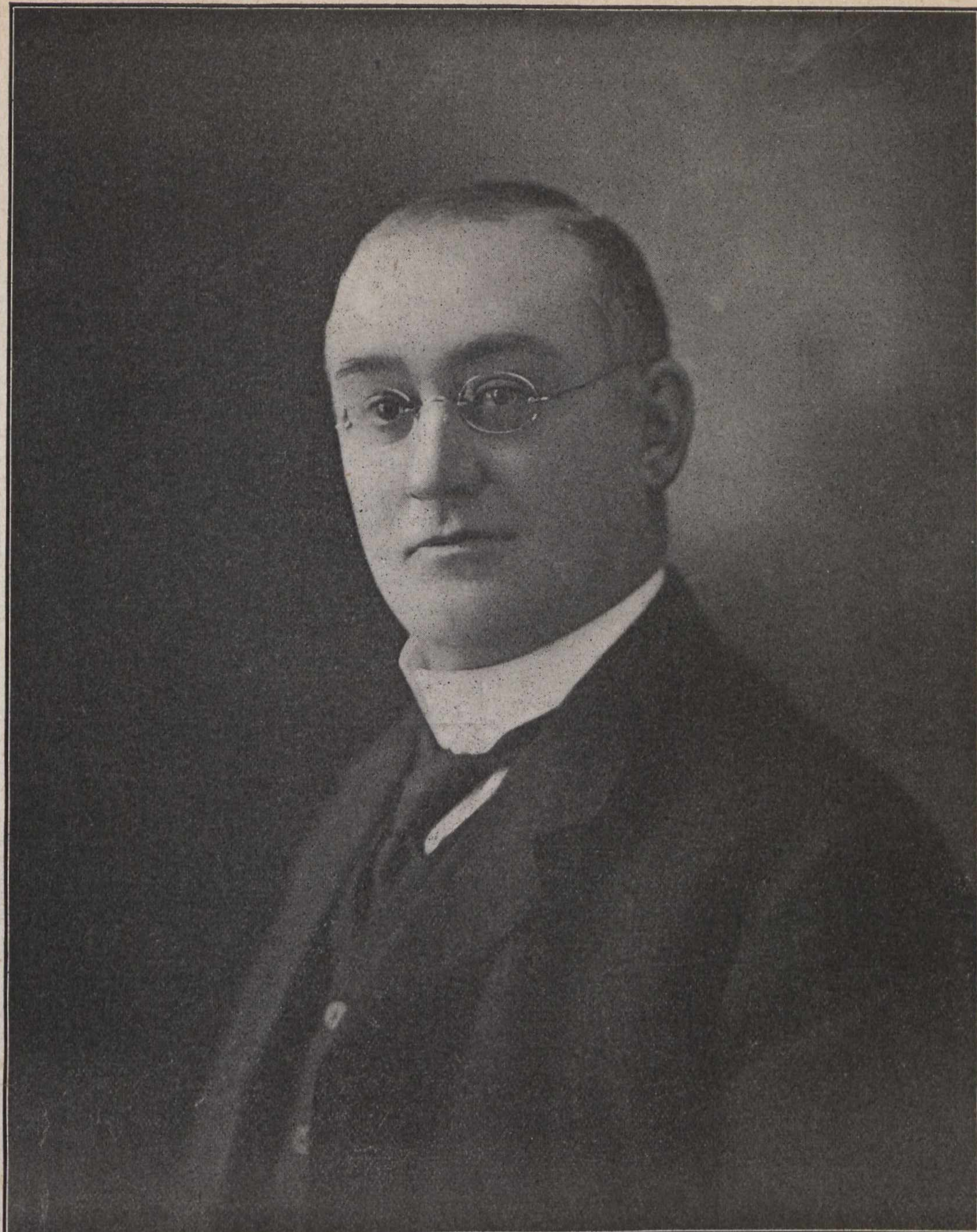
Properly to appreciate the general conditions that surround the mining industry in Nova Scotia, a personal visit is absolutely necessary. Most Canadian mining men are almost as lamentably ignorant of the Province's resources as is the foreigner. That Nova Scotia ranks first among the Provinces of the Dominion as a producer of coal, of iron and steel, and of gypsum, will be news to many Canadians. Incidentally, also, Nova Scotia easily takes the lead in her output of such minor articles of commerce as college presidents and politicians. These are mostly exported.

And, by the same token, one of the best assets of the Province is the ordinary mining population, a class that has been depleted sadly by migration, but that is still numerous enough to be of major importance. The Nova Scotian miner, properly handled, has the good qualities both of Cousin Jack and of the western hustler. Of course, he has his own shortcomings. The attractions of the river-drive or of the haying season often prove too much for him. But this can be overcome if the mine offers sure employment.

Hardly any country provides such facilities for the technical education of workmen and of mining students. The Technical College at Halifax, and numerous special day and night schools at various centres give practically free instruction in all that appertains, not alone to mining, but to all the common trades. Hence Nova Scotia is creating a supply of trained men to meet her own needs—men who have first-hand knowledge of the country. This fact redounds to the credit of the Provincial Government. Largely instrumental in the organization of the system has been Mr. F. H. Sexton, on whom more than on anyone else has fallen the burden.

. . . .

For this Special Nova Scotia Edition the amount of available material has been embarrassingly plentiful. Despite the fact that all our current news and ordinary departments have been displaced, it has been quite impossible to cover the ground as fully as we might have desired. Many subjects, particularly that of gypsum quarrying, have been, perforce, omitted. Fortunately



HON. G. H. MURRAY,
Premier of Nova Scotia

a very full description of the gypsum industry was published in these columns on December 15, 1911, and January 1, 1912. Other necessary omissions were numerous. Several gold mines and collieries, and not a few other mining enterprises we have had to neglect. Moreover, we have been unable to touch upon transportation and water powers, both topics of the utmost interest. While these will be fully dealt with in future issues, we still regret that the exigencies of space do not permit of their inclusion here.

. . . .

It has been our object, first, to accentuate the fact that the larger mining and metallurgical concerns of Nova Scotia represent the highest phase of technical efficiency. The articles on the practice at the Dominion Steel Company's open-hearth furnaces, and at the steel works of the Nova Scotia Steel and Coal Company, are ample evidence of this. If more evidence be needed, we have but to refer the reader to the descriptions of the power equipment and the new tipple at the plant of the Acadia Coal Company.

Our second object has been to impress our readers with the variety of the Province's mineral resources. There will be found in the following pages, articles on gold, manganese, coal, iron, china-clay, firebrick, barite. This list, to have been thoroughly inclusive, would have been twice or thrice as long. However, the lesson is there.

. . . .

As stated above, our readers will have an opportunity next spring, to read a thoroughly comprehensive redaction of this issue, published in pamphlet form. In this pamphlet all our involuntary sins of omission will be remedied.

THANKS.

Our requests for articles from those engaged in mining in Nova Scotia met with a singularly prompt and full response. The amount of material available, indeed, became overwhelming, and too much of it must be held over for future issues.

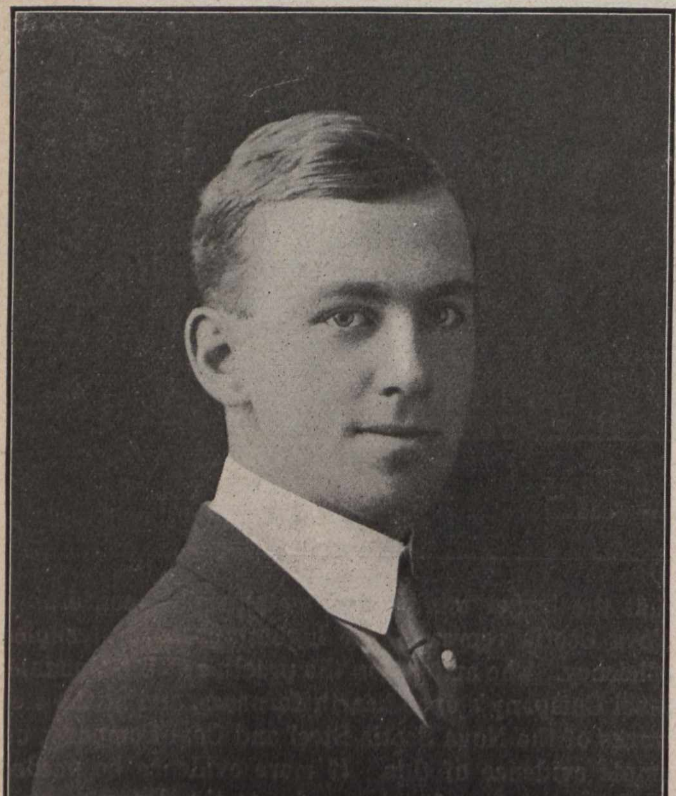
Our especial thanks are due to many individuals. To Mr. F. H. Sexton, much of the credit for the whole issue is due. Without his assistance it would have been difficult, indeed, to have succeeded. We are particularly grateful, also, to Mr. J. H. Plummer, the president of the Dominion Steel Corporation, for his remarkably vital paper on the iron and steel situation; and to the president and officers of the Nova Scotia Steel and Coal Company for their unfailing courtesy and kindness.

Most of all, however, our thanks are due to the Provincial Government. The co-operation of the Provincial Department of Mines has rendered this edition possible.

NOTES.

Our next Special Issue, to appear on October 15, or November 1, will deal with Cobalt, Gowganda, Elk Lake, and South Lorrain.

Circumstances and the unwarranted modesty of the persons concerned conspired to prevent us from obtaining portraits of the Hon. Mr. Armstrong, Commissioner of Mines; Mr. H. Donkin, Deputy Commissioner, and Mr. E. R. Faribault, whose name has long been one to conjure with in Nova Scotian mining circles.



H. B. PICKINGS,
Assistant Inspector of Mines

F. H. SEXTON,
Director of Technical Education

IRON AND STEEL IN NOVA SCOTIA

*Written for The Canadian Mining Journal, by J. H. Plummer.

I.

That the manufacture of iron and steel is a fundamental industry, and that these commodities are among the earliest which any country that has suitable natural resources should seek to produce, is universally accepted, and to this was due the general support given by both sides in Parliament to the granting of bounties in aid of the industry.

In Canada we have the natural resources and during the past ten years, at any rate, have nothing to be ashamed of in the progress we have made to supply our own basic materials, but we are as yet occupying only a small part of the field open to us.

II.

So far as present knowledge of our resources goes, there are three districts in Canada where this industry may be naturally developed. In the Maritime Provinces we have ample coal, of which, among the raw materials used, the largest tonnage is needed. We have sources open to us for the cheap supply of ore by water; and there are good prospects of ore deposits being developed within the Provinces. The larger plants have besides the great advantage of water transportation for the finished products.

In Ontario there is much iron ore, coal in the United States within reach at a reasonable cost, and an excellent market. The raw materials cannot be assembled as cheaply as in Nova Scotia, but there are some counterbalancing advantages in the way of distribution.

In the west, British Columbia has resources which must lead to the development in good time of its iron and steel industries. What there may be in the vast country lying between Ontario and British Columbia it is too early to say.

At present Nova Scotia is the chief centre of the industry, with Ontario following closely in her wake, and it is of Nova Scotia that I have been asked to write.

III.

To do justice to the claim of any industry in this province, one must look back at earlier days. When Confederation was first proposed, a large number of her people were strongly hostile, and it cannot be denied that at first the province did not gain by the change. Before Confederation her trade was mostly in the hands of her own merchants, and Halifax held a strong position as a distributing centre. She levied her own duties, on such articles as under the local conditions were best suited to bear the burden, and she had the whole world to look to for such supplies as she could not or did not herself produce.

After Confederation her trade fell largely into western hands, and she became a customer of the other provinces for most of her needs; flour and other foodstuffs, clothing, boots and shoes, and other things. Her industries were largely undeveloped; she sent little to the west, but men and money; she bought a good deal. She had great possibilities in agriculture, in coal and in fisheries, but in none of these got much benefit from western trade in these earlier days.

Then came the industrial awakening. The stimulation of the manufacture of iron and steel by bounties, the incidental but most important help to the coal industry which this in itself gave, and the development of coal mining by the opening of the markets up the St. Lawrence as the effect of the duty on coal, all combined to give to the Province her first serious benefit under Confederation. I am, of course, speaking of material benefits only; it would be a grave injustice to her people to suggest that they do not value the benefits of another sort which they are proud to share with all Canadians. But citizenship in a great Dominion and the wider national life and outlook which it gives, however greatly to be valued, do not in themselves provide homes or food and clothing for wives and children. Before the coming of the industrial development the young men and women of the province found new homes abroad to an alarming extent, and New England absorbed her citizens by hundreds of thousands.

The growth of such centres as the Sydneys, New Glasgow, Amherst, etc., and the less marked but very important industrial growth elsewhere in the province, have greatly modified all this, and have had an important effect on the life of the province, its prosperity and its public revenues.

The recent census made it clear that, but for the growth of the industrial centres, the population of Nova Scotia as a whole would have shown a decrease, and that there was an actual decrease of the farming population.

Prince Edward Island, which is practically without industries, also shows a decrease. I cannot speak from personal knowledge of the Island, but I am told that her young men are drifting away, that the proportion of unmarried women is increasing, and that it is becoming more difficult to find labour for her farms.

The striking point in this, which applies in some degree to Nova Scotia as well, is that this shrinkage of population has been accompanied by the growth of large and excellent markets at their doors for all that they raise. I am told that the farmers are prosperous, and that the conditions of the whole Island have improved as the industrial centres in Nova Scotia have grown.

There is nothing new in this; Ontario, Quebec, the New England States and other districts have had the same experience. It seems to show that true prosperity, and room and scope for a growing population must be lacking where there are no industries. Men are not all alike, and only a certain percentage in any community take to farming or other work on the land. Many prefer industrial pursuits because of the wider opportunities they give, because of the steady work, the higher wages, the shorter hours, and, most of all, the town or city life with which they are usually identified. Such men will seek new fields of work elsewhere if they do not find these opportunities at home, and their own community can ill afford to lose them.

The duty of Parliament to deal fairly with the claims of the different provinces, with due consideration for their differing needs, will not be gainsaid. No Nova Scotian grudges the unstinted pouring out of money in aid of immigration, of railways, of canals, and of other things for the development of the West. But this province, and to some extent the Maritime Provinces generally, must look chiefly to the development of their industries for their share of the national growth. If, then, it be admitted that this basic industry is one which should be fostered; if the facts I have outlined

*President of the Dominion Steel Corporation.

be considered, and if the several interests of the provinces are to receive justice in the framing of our fiscal policy, I think the claim of Nova Scotia to full consideration for these primary industries of iron, steel and coal, in which she leads, cannot be overlooked.

IV.

As regards the actual condition of the iron and steel trade in Nova Scotia, I should say that from one point of view it is very promising. At all points large extensions are being made to existing plants, and larger production has been reached, or is within sight. These extensions have been entered on in reliance on the willingness of Canadians, of Government and Parliament, to continue a policy of reasonable protection for Canadian enterprise.

From another point of view the condition of affairs is not good. The depression in the iron and steel trade in the United States last year brought Canadian prices to a low level, the effects of which are still felt, and earnings have been poor. The tariff conditions affecting the trade are in many respects unsatisfactory. Its difficulties in that regard have been respectfully laid before the Government; there are low duties on articles which should be made in Canada, such as the larger sizes of structural steel; in other cases, where the duties are in themselves adequate, exemptions make a large portion of the market duty free. The tariff on wire rods, wire and similar products, might have been framed expressly to divert a large part of this important and growing tonnage into foreign hands. There is an annual sum of four or five million dollars paid to foreign workmen in this line alone which should be paid to Canadian workmen. If Canadian makers had this business it would do little more than operate fully plants already in existence, and one is only calling attention to the obvious in saying that full operation is the key to lower costs, to which in this as in other lines we look for ultimate independence of tariffs. I cannot refrain from saying that to give large bounties to establish the making of iron and steel, and with their lapse so to deal with the tariff as to deprive the makers of a large part of their market, is a most inept and wasteful policy.

V.

Free trade would doubtless command the support of most business men if things were equal industrially all the world over, but they are not. No country ever tried to establish its industries and maintain free trade at the same time; certainly not England, or the United States, or Germany, and the more that the competition which the industries in a new country must meet comes from countries where industries are fully developed and specialized, the more need there is of protection at home until conditions have been more equalized.

We hear a great deal about opposition to the tariff among the American people, and we are often told that the public we serve will follow in their train. But we ask, with confidence, for fair play, and fair play demands that the course of the industrial development in both countries, and its relative stage in each at present, should be fully considered. In the United States there has been protection, literally for generations, to an extent far beyond anything dreamt of in Canada; protection so effective, so far as iron and steel are concerned, that in these lines they now lead the world.

The resentment of the American people is not, it seems to me, directed against duties reasonably necessary to protect their industries, but against excessive duties which impose an undue and unnecessary burden on the consumers. So far as I can judge, most Americans, whatever their politics may be, are firm supporters of such protection as is necessary for the prosperity of their industrial workers, which necessarily includes prosperity for those who employ them. If in dealing with the Canadian tariff this spirit prevails, neither the manufacturers nor their employees will have anything to complain of.

VI.

The production of iron and steel in Canada in a large way began only ten years ago, and while we have had foreign experience to guide us, there is not a branch of the industry in which we have not had to meet our own special difficulties, and work out our own salvation. We have had to organize our staffs, to train our workmen, to deal with ore, coal, limestone, etc., previously untried, to develop efficient means of transportation, and to master our own special problems, and, in most of these matters there is little help to be had from others' experience. We have had to buy—and pay for—our own, and we have still much to learn.

We have, however, made great progress, and this brings me to a point which troubles many reasonable people. They ask such questions as this: "You should by this time be able to make steel at about the same cost as the United States manufacturers; why cannot you secure the market?" Now, one might have to admit that there might be a difficulty even under reasonably equal conditions, but the conditions are not equal.

To take one obvious point first, manufacturers in the United States supply a home market ten or twelve times as large as ours in the mere number of buyers, and relatively much larger still in volume, with some part of our own market and of other foreign markets in addition; they manufacture in large quantities, and are able to specialize. All this gives them a great advantage. They could add to their ordinary production a tonnage which would supply us fully, and yet be but a trifling increase of their large output. They can sell it here, if they choose, at its nominal cost or even below it, and still get some advantage out of the business. They could not live on such prices as they usually get in Canada, if the same prices governed their home sales, and the Canadian plants could not hope to succeed if American export prices—below living rates—had to be accepted as a permanent condition. That we escaped without disaster from the serious market conditions last year was due chiefly to the fact that, although so large a part of the trade was attacked, and in many cases secured by United States manufacturers, the tariff and the dumping duties prevented slaughter sales and so secured a portion of the market for Canadian manufacturers.

Passing by other considerations such as the effect of the preferential tariff, and of competition from the Continent; from Belgium, for instance, where the average wages were found a year or so ago to be 85 cents per day, as compared with $2.08 per day at Sydney; I will go on to a second point, not quite so obvious, which is involved in our geographical conditions.

In that portion of the United States which lies near our borders, from the Atlantic to the Middle West, and within easy reach of Canada, in many cases right on the lakes which join the two countries, there are a very large number of iron and steel plants. There is scarcely a business centre in Canada east of Winnipeg which cannot be reached at comparatively low cost for transportation from some of these plants, and this appears to be further helped when times are bad by favourable rates of carriage of goods intended for export.

In Canada, on the other hand, the volume of trade compared to that of the United States is still small, and as plants on a large scale are essential to cheap production, there can as yet be very few of them to supply the home market. It follows that there are many places which these plants can reach only at considerable cost for transportation. Compared with the nearest source of supply in the United States, the home industries are in such cases under a disadvantage, and the duty which United States manufacturers pay is often counterbalanced in whole or in part by the extra freight charges which the Canadian products have to bear. This is a natural condition of which Canadians if they are to manufacture iron and steel, must make the best until more plants are built. A little consideration of the long east and west stretch of country which Canadian manufacturers serve, and of the limit within which such a sum as $2.50 per ton (the duty on pig iron and steel billets) would carry these products by rail, will show how seriously this question of transportation affects the value of the duty as a protection to the industry.

VII.

I hasten to admit that in all this an excellent argument for free trade can be found, and that the conditions justify such questions as this: Why should be not let the foreign manufacturers supply us, since they can and do send us goods at prices at which it does not pay Canadians, in their present stage of development, to make and deliver them?

One answer is that under such conditions we should have no manufacturing industries in Canada, and should never get into a position where we can meet foreign manufacturers on more equal terms; also that we do not wish to be a purely agricultural country, with the limited scope which that condition would offer to our sons, and with no outlet for such of our people as cannot find or do not wish for work on the land. I believe this to be the firm desire of the majority of Canadians; that they wish to see Canada grow along all the lines of national life; agriculture as the mainstay, but balanced and complemented by industries of all kinds natural to the country.

This raises one of the chief issues between protection and free trade, into which I do not wish to enter, but there is another answer of a very practical kind. If we were relying on foreigners alone for our goods we should not get them at low prices. It is because goods are being made in Canada that goods brought in are offered at low prices; but for that fact United States manufacturers would only have to meet European competition in our markets, and the chances are that under ordinary conditions they would exact higher prices in Canada than at home.

It is scarcely necessary to bring forward any argument to support this point, but the case of barbed wire may be mentioned as an illustration. The earlier duties and prices for this article were doubtless unduly high, but in the years immediately preceding the removal of the duty, when a large number of mills were making the article in Canada, competition was strong and prices fair.

In 1896 the Toronto wholesale price was $2.85 per 100 lbs. In 1897 it went as low as $2.20. On January 1st, 1898, barbed wire became free. The American mills thereupon inaugurated a policy of competition at ruinous prices that drove the Canadian mills out of business and secured for themselves absolute control of the market. The effect may be seen from the price; they made it $1.80 in 1898, after that, when the home industry had been killed, it advanced until in December, 1899, it reached $3.60.

Since then nearly the whole of the barbed wire used in Canada has come from the United States, and their manufacturers have fixed the price. Of late there has been keen competition among the American manufacturers and it is entirely due to this condition, whose permanence would be contrary to experience, that the price has been easier. It is quite fair to say, and in keeping with our general experience, that if instead of making barbed wire free a duty of moderate amount had been left, Canadian farmers would, on the whole, have had much cheaper fencing.

Another case that may be mentioned is that of anthracite coal. The duty on this was removed some years ago, because it is not produced in Canada, but the Canadian consumer did not receive the slighest benefit from the reduction. There can be no home competition and the anthracite producers, working together, keep the price at the high level which they themselves fix.

VIII.

The needs of the industry in Nova Scotia are the same as elsewhere; a reasonable revision of the tariff. I have referred hitherto to American competition, but the industry has also to face the preferential duties on British goods, which are in a great degree the controlling factors in Canadian prices. These duties are very low; measured in the ordinary way they represent about 10 per cent. on pig iron, 7 per cent. on billets, and 15 to 20 per cent. on other articles. The average tariff on dutiable articles is about 26 per cent., so that as compared with other things the duties on iron and steel are moderate. Our chief troubles, however, arise from lack of any principle in the fixing of the duties, and from exemptions.

We have in the general tariff, for example, $7.00 per ton on small rolled sections, but only $3.00 on the larger sizes where the tonnage is heavy and the market most important.

Again, the largest users of small sections are the manufacturers of agricultural implements, who are exempt from duty on most of the materials they use. There are similar exemptions in other lines.

The billets from which wire rods are made are subject to duty; the wire rods themselves, in the sizes most commonly used, are free. Wire for fencing is free, the woven fence is subject to duty.

The wire from which barbed wire is made enters free, and barbed wire is free also, although experience has shown that the removal of the duty has not had a beneficial effect on the price paid by the consumers.

These, however, are merely illustrations. What we should have is a reasonable tariff, fairly apportioned, with a sweeping away of all exemptions save where Canadian manufacturers cannot supply the articles. It should not be so high as to shelter careless or ignorant methods, or obsolete and inefficient plant and machinery, but it should be high enough to compensate for the higher wages paid here as compared to Europe, and to help us to meet the special forms of competition from the United States which I have mentioned above.

With such a tariff a great growth may be confidently looked for, and it should be remembered that while there must be a profit for those whose capital and enterprise make the growth possible, the chief benefit is not to the employer, but to the employed. Even at present, when fire brick and many other things which should be made in Canada are still imported for use in the industry, over 80 per cent. of the cost of making iron and steel in Canada goes out in payment for Canadian labour.

There is ample tonnage to keep much larger plants in operation than we now have, there is enterprise enough to create these if the tariff conditions are made reasonable and are based on principle; there is capital to be had if the existing plants are able to make a proper showing in the way of earnings, and there is a plentiful supply of the raw materials.

Speaking of Nova Scotia in particular the development of the iron and steel business is of vital importance to the growth of coal mining in the province. The prosperity of the province, her ability to provide for educational and other social needs, to build roads and to carry on other public services, is bound up in the growing royalties from her coalfields, and to Nova Scotia, as to the Maritime Provinces as a whole, reasonable tariff conditions for iron and steel are of primary importance.

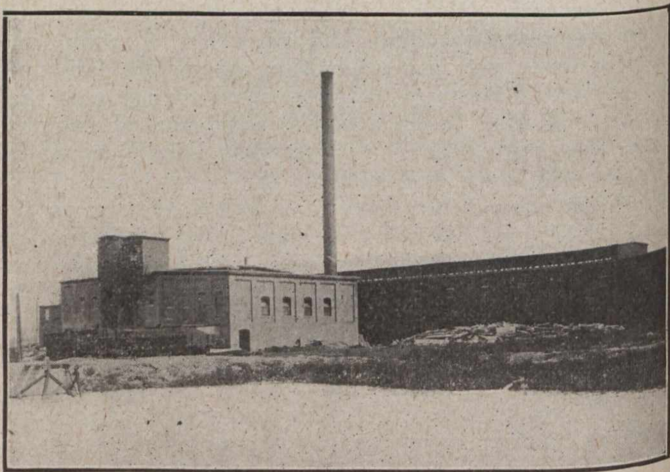
BASIC SLAG WORKS AT SYDNEY, N. S.

By C. R. Walker, Managing Director Cross Fertilizer Co., Sydney, N. S.

These works have been erected to deal with the basic slag produced as a by-product at the Bessemer furnaces of the Dominion Iron & Steel Company. Formerly this basic slag was so much waste material. Considerable expense was entailed in getting rid of it; but now it is being utilized as a fertilizer, adding materially to the yield of crops to which it is applied and improving old worn-out pasture to a wonderful extent. The works cover an area of over six acres.

All slag produced at the steel works is not of value from an agricultural point of view. Only basic slag containing phosphoric acid in a soluble state can be used for fertilizing purposes. This basic slag is obtained in the elimination of the phosphorus from the iron during its conversion into steel. At the Bessemer furnaces the slag is poured into cars having removable sides. These cars hold from ten to fifteen tons of slag which solidifies after a short time, and they are then run by private railway to the slag works. The sides of the car are removed and a crane is hitched on to the block of slag which is deposited quite close to the grinding mills. These blocks of slag are then broken by a drop ball weighing 3,000 lbs. falling from a height of thirty feet. By this means it is reduced to pieces not more than seven pounds in weight, after which it is loaded into bogey cars holding about 1,500 pounds and run into a hoist and elevated to a large hopper holding one hundred tons.

The slag is mechanically tipped into this hopper from which it is fed by a traveling conveyor to a couple of ball mills. The mills are loaded with a charge of 3,500 pounds of steel balls, each five inches in diameter, and are driven by steam at the rate of twenty-five revolutions per minute. The slag undergoes pounding in the ball mills which reduces it to a rough powder all of which will pass a seive having twelve mesh to the inch . From the ball mills the slag is conveyed to a tube or finishing mill. The tube mill is a steel cylinder, thirty feet in length, containing ten tons of steel balls of assorted sizes ranging from three-quarters to two inches in diameter. The slag passes in at one end of the mill, which is driven at the rate of thirty revolutions per minute and the pounding of the steel balls completes the process of grinding. The finished product finally passes from the tube mill ground so fine that 90 per cent. will pass a 100-mesh sieve, that is a sieve having 10,000 holes to the square inch. From the tube mill the ground slag is taken by an overhead conveyor to the warehouse where it is bagged and weighed automatically and stored until required by the farmers for application to their land in the autumn or spring. The mills have a capacity of 10 tons per hour, and, working day and night, can easily turn out 1,000 tons per week.



Works of Cross Fertilizer Co. Sydney, N. S.

As slag is not in consumption all the year round, very large storage capacity is required and the Cross Fertilizer Co., Limited, the proprietors of the basic slag works, has had to erect a warehouse 365 feet long by 150 feet wide, capable of holding 12,000 tons of the finished product. A railway runs through the entire length of the warehouse and, when necessary, 2,000 tons can be loaded into railway cars in 24 hours. The mills are driven by a 500-h.p. engine supplied by Fullerton, Hodgart & Barclay, Ltd., of Paisley, Scotland, to which steam is furnished by two Lancashire boilers by Penman & Co., of Glasgow, Scotland. The entire cost of buildings and plant amounted to $250,000.

THE DOMINION COAL COMPANY, LIMITED.

(Written for The Canadian Mining Journal, by F. W. Gray.)

The operations of the Dominion Coal Company were fully described in a series of articles which appeared in this journal in 1908, and since that time the progress of the company has been closely followed in the correspondence column of the Journal. A detailed account of the Coal Company's great industry would therefore be out of place, and the following account of the status of the enterprise is intended to be nothing more than a brief summary.

Since the incorporation of the Dominion Coal Company in 1893 it has passed through many vicissitudes, but these have been concerned chiefly with changes of financial control and management, and are of more interest to the frequenters of 'Change than to the readers of a technical periodical. The record of the industry itself has been one of consistent and steady growth. There have been hindrances from accidents and labour troubles, from which no mining company can hope to be entirely free, but there are not many companies engaged in the more or less speculative occupation of mining coal that are able to show so consistent a record of development as the Dominion Coal Company.

The amalgamated collieries of which the Dominion Coal Company became the possessor nineteen years ago were eight in number, six of them being in the Glace Bay Basin. The other two collieries were situated in the Morien Basin and at Old Victoria. These two last-named mines were closed down, and the energies of the company were concentrated on four collieries in the Glace Bay field, namely, Old Bridgeport, Caledonia, and Reserve collieries on the Phalen seam, and International Colliery on the Harbour Seam. In 1893, therefore, the Coal Company had four collieries at work on two seams, with an output capacity of 800,000 tons per annum. In 1912 the company had sixteen collieries, operating on seven seams, with an output capacity of 4,500,000 tons. The progress of the company is even greater than would appear from the foregoing statement, for the reason that the original four collieries operating in 1893 have been almost entirely remodelled, and it is well within the mark to state that, with the possible exception of International Colliery, every one of the company's mines has been developed and equipped in the period since incorporation.

Every record of outputs in the Coal Company's history has been easily distanced during 1912. For the seven months ending 31st July, the Glace Bay Mines of the Company produced 2,530,000 tons, comparing with 2,300,000 tons in the first seven months of 1908, the best previous year. Averaged over the seven months, the output so far this year, has been over 361,000 tons per month, a very consistent performance, all things considered. In July the output was 410,000 tons, this being the first occasion that the collieries have produced over 400,000 tons in any one month. It is probable that the August output will exceed 420,000 tons.

The Dominion Coal Company owns areas in each of the four basins into which the Sydney coalfield is geologically divided. Mines Nos. 1 to 10 are operating in the Glace Bay field, mines Nos. 12 to 16 are situated in the Lingan-Victoria field, and mines Nos. 21 and 22 are working in the Morien field. Between No. 21 colliery and No. 16 colliery is an intervening distance of over ten miles, as the crow flies. No collieries have as yet been opened on the areas in the Point Aconi district, adjoining the areas of the Nova Scotia Steel & Coal Company, but these will come in due time. When this takes place, the Coal Company's operations will embrace a district reaching thirty miles in length, and running inland seven miles, covering indeed the whole of the coal-bearing measures from the eastern outcrop of the Morien Basin to the termination of the coal-measures by Cape Dauphin on the west. The areas controlled by the Dominion Coal Company cover the most desirable portion of the Sydney coalfield, and in comparison the outlying areas not owned by the Dominion Coal Company are small in extent, and contain seams of distinctly inferior quality.

The Glace Bay collieries are linked together by the Sydney & Louisbury Railway, which has at its two extremities the two best shipping ports in the Island of Cape Breton. Louisburg is an ice-free port, and is largely used in the winter during the period that Sydney Harbour is closed. The two ports are so situated as to enable coal to be shipped all the year round, with but little interruption. During the drift-ice season a succession of north-east winds will block the entrance to Sydney Harbour, but the same wind will clear the fairway of Louisburg Harbour, and vice-versa a south-east gale will block Louisburg and clear Sydney Harbour. Drift ice is the only serious hindrance to navigation in Cape Breton waters during the winter. The harbour-ice is very easily broken up, and presents no insuperable difficulties. Except on very exceptional occasions, therefore, the Dominion Coal Company is in a position to ship coal into vessels the whole year round. The main line of the Sydney & Louisburg Railway is 40 miles long, and its various branches and sidings cover an additional 70 miles. The railway has an excellent roadbed, an absolute necessity when it is considered that between 400,000 and 450,000 tons of coal and freight per month are shipped over this line.

New Loading Pier, Sydney Harbour.

On Sydney Harbour the Coal Company has at the present time three shipping piers. One of these piers is now getting old, and will probably be shortly dismantled. A new pier is in course of construction, and will be completed for operation by the end of the year. This pier will accommodate the largest freighters at present afloat.

For the 1913 season the company will have in Sydney two modern loading piers, capable of berthing three large steamers at one time, and of handling up to 40,000 tons of coal every twenty-four hours. The largest coal carriers afloat will shortly fly the Black Diamond flag, as the "Glace Bay," and the "Bridgeport," each of 11,000 tons dead weight capacity, are expected in Sydney during September and October of this year. These vessels are specially constructed for speedy loading and discharging of coal, having large unobstructed holds, into which the coal can pour without any necessity for trimming. In addition to the 11,000 tonners the company has on long-term charter a number of freighters such as the "Kamouraska," the "Helvetia," the "Wabana," "Lingan," etc., all designed for the coal-carrying trade. These vessels will average about 8,000 tons deadweight capacity.

At Louisburg the company has a shipping pier, equipped with special storage pockets and appliances for the loading of slack coal.

The company has very completely equipped discharging plants at Hochelaga and Windmill Point near Montreal, and owns valuable wharf and terminal property at Three Rivers and Quebec. At St. John, N.B., there is a discharging plant, to which large additions will shortly be made. The company also owns some of the most valuable property on the water front at Halifax, and it is expected that a modern discharging plant will be erected there in the near future.

The geographical exigencies of the Dominion Coal Company's market have made them almost as much a transportation company as a mining company. From the foregoing statements it will be seen that the company controls its own railway, freighting and passenger steamers, and discharging plants, which are placed at points enabling the company to supply coal to the whole of Canada from the Maritime Provinces to the Great Lakes.

The mining practice of the company has kept pace with its growth in other directions. Less than ten years ago naked lights were used in the greater portion of the company's mines. To-day, naked lights are not used, except in the very early stages of mine development. With the exception of one colliery, where gas is not met at all, the collieries use a safety lamp which is securely fastened by a magnetic lock that can only be opened by a powerful magnet on the surface. Re-lighters are used underground, by which an extinguished lamp can be relit with absolute safety without the necessity to open the lamp.

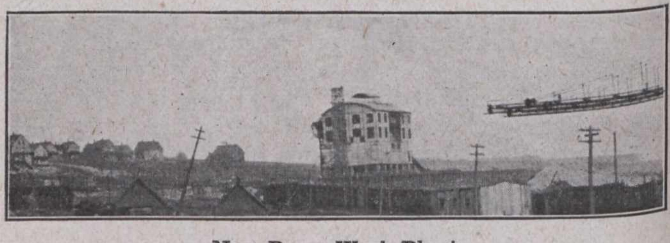
The blasting of the coal is under the closest supervision, and wherever it is considered that danger exists, only high-grade explosives are used, fired by a detonator and battery. In dusty places the coal face is regularly sprinkled, and the long ranges of air pipes underground conveying compressed air to the mining machines and engines, can be turned into water mains at short notice.

The company has paid considerable attention to fire protection. Each colliery has a trained volunteer fire brigade, and wherever possible, a system of water hydrants. Each brigade is equipped with sufficient hose, and at some of the collieries small chemical fire engines are provided. Many hundreds of hand chemical extinguishers are distributed throughout the colliery buildings and other departments of the company's operations, and in the underground workings of the mines.

For more adequate protection against underground fires, and as provision against the effects of a mine explosion, the company has provided a rescue station near No. 2 colliery, equipped with 35 sets of Draeger apparatus, motor-driven oxygen refill pump, two "Pulmotors," stretchers, electric hand lamps and first aid appliances. A number of live canaries are also kept here. If the necessity should ever arise, these would be used to test the life sustaining quality of the mine air after an explosion of fire. In addition to the equipment at the Central station, sufficient sets of apparatus are distributed at the outlying collieries. A new sub-station has recently been opened to serve the Lingan collieries, equipped with ten apparatus, refill pump, "Pulmotor," and other necessary accessories. At the central station a smoke chamber is provided in which the teams practice weight-lifting and other strenuous exercise in thick smoke and high temperature. The work of training men has now been in constant progress for the past four years, and the company has now a large body of trained men on whom they could rely for good service with the Draeger apparatus. A smoke-chamber will also be provided for the Lingan sub-station, and practising will be carried on at both points. The Springhill Mines of the company have been provided with an equipment similar to that of the Lingan station, and a rescue station is in course of construction at that place.

So far, no occasion for the use of the Draeger equipment has arisen at any of the mines of the company, but should the necessity unfortunately arise, the company will not be open to the reproach that it did not make proper provision.

By the beginning of November the company will have in operation a Baum coal-washer, capable of dealing with 120 tons of slack coal per hour.



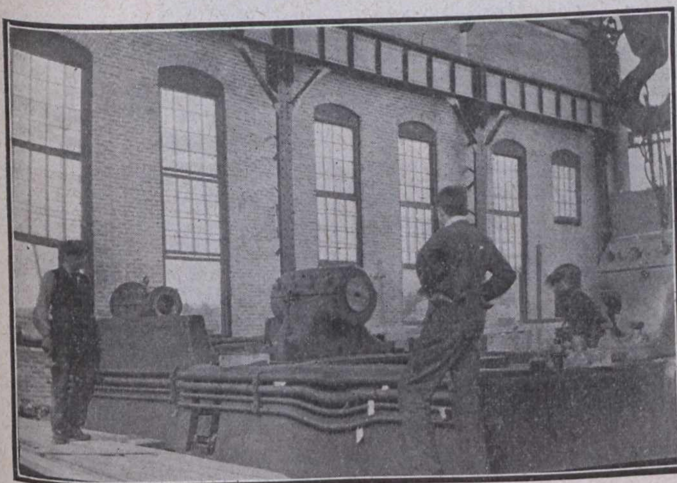
New Baum Wash Plant.

This is the first Baum washer to be erected in America, but in Europe, where a large number are in operation, the Baum washer is regarded as one of the best types. In addition to the washery proper, storage pockets to hold 6,000 tons of washed product, will be provided. The wash-plant buildings are all substantially constructed of concrete, brick and steel, and the installation of the plant has entailed a very large expenditure.

The Dominion Coal Company is fortunate in possessing coal seams so clean that the product of the mine needs little or no preparation, but whatever may be the nature of the impurities in a coal-seam, they tend to concentrate in the "minings" and the slack coal. By treating the slack coal in the new washer the company will obtain a clean, dry, lustrous product which should be in great demand. There will be no waste. Nothing but the impurities in the slack will be allowed to escape. The fine "slurry" or "schlamm" will be retained and used to fire boilers. The plant will be operated by electric power, and will use only a comparatively small amount of water in the washing process.

The company has effected great economies in the generating and transmission of power. So far as it is possible no fuel is used to raise power except slack coal and the refuse from the picking belts, and as will be seen later, the company is endeavouring to effect further economies in the utilization of refuse fuels and slack coal.

The greatest change around the collieries in recent years has been the gradual introduction of electric power in place of steam, and the tendency is now to eliminate all steam around the newer collieries, except for the purpose of heating buildings. About four years ago the company installed a central electric power generating station at No. 2 colliery, consisting of three 500 kilowat units, to which was added two years ago a 1,000 kilowat exhaust steam turbo-generator. There is now in course of construction another and larger generating station at Waterford Lake, situated a few miles to the rear of the new collieries at Lingan.



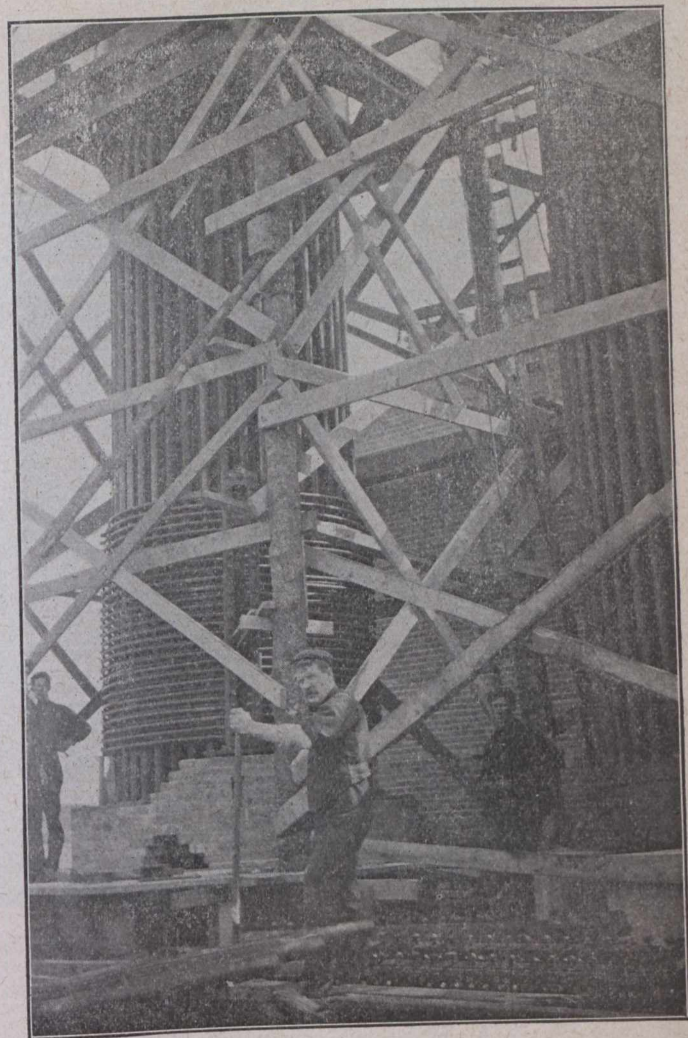
Interior Waterford Lake Power House.

The new station will contain two 2,000 kilowat units, having a momentary overload capacity of 4,000 kilowats. Turbine driven generators are to be used, taking live steam.

The boiler-plant is worthy of special mention. It consists of three Bettington boilers, the first of their kind to be erected on this side of the Atlantic. The boiler consists essentially of a vertical fire brick lined chamber surrounded by a circle of vertically arranged water-tubes, on the outside of which superheater tubes are coiled spirally..

The fuel is reduced to dust by a pulverizer, and is injected into the fire-chamber by a blowing fan, being consumed in a vertical flame 20 feet in length. All the combustible matter in the fuel is said to be consumed and the residue is an irreducible vitreous slag. The fire-brick walls of the combustion chamber are fused together by the intense heat, and the waste of the walls is renewed by the deposition of the liquid slag. It is stated the combustion-chamber walls require no renewal, but are automatically kept at the same thickness by the deposition of the liquid slag. The bulk of the slag, of course, falls down into the ash-pit below, and compared with the ashes from an ordinary hand-fired boiler, the quantity is small. It is claimed these boilers will give an efficiency not given by any other boiler on the market, and the company hopes to effect a considerable economy, not only from the increased efficiency, but from the utilization of inferior fuel.

The power generated at the Waterford Lake plant will pass into the main transmission line, in electrical connection with the No. 2 plant, and will feed all the



Bellington Boilers Under Construction, Showing Vertical Tubes and Superheaters.

collieries from No. 21 colliery at one extreme to No. 16 colliery at the other, and sufficient current will be generated to provide for projected new collieries in the Lingan district.

At No. 14 colliery a permanent electric hoist was put into operation at the beginning of August, so that the entire equipment of this colliery is electrically operated, including air compressors, coal hoist, ventilating fan, bankhead machinery, screening plant and underground pumps. When completed Nos. 15 and 16 collieries will be similarly equipped, and the only steam used will be for heating purposes in the winter.

Nos. 21 and 22 collieries will also be electrically operated, the transmission line having been run from No. 2 colliery, distance between five and six miles. The electrically driven air-compressors and hoist are both on the ground.

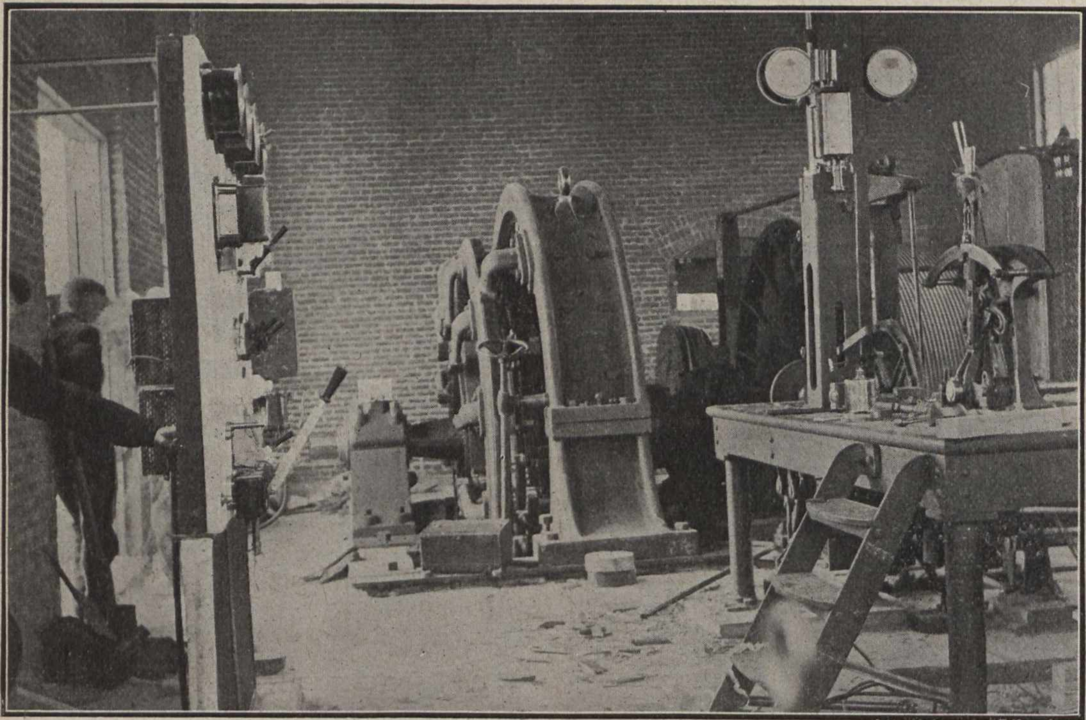
When the electrical equipment now being installed is completed, the Coal Company will have five large collieries entirely operated by electric power, in addition to which the bulk of the screening machinery, pumps, and ventilating fans at the older collieries has for some time past been electrically driven.

So far as the underground use of electricity is concerned the company has confined itself to motor-driven pumps and haulages, placed in steel and concrete lined houses, and they have not introduced electricity at the coal face, nor used trolley haulages such as are often met with in the coalfields of the United States.

The population directly and indirectly dependent on the Dominion Coal Company's operations is very large, and it is a significant fact that practically the entire increase of population in Nova Scotia, as shown by the last census, is accounted for by the increase in the population of Cape Breton. In Cape Breton Island the workpeople of the Dominion Coal Company number between 8,000 and 9,000, of which number some 6,000 persons are employed in and about the mines, the remainder being employees of the railway and auxiliary departments.

As most of the Company's collieries have been placed in clearings of the original forest, the problem of housing the workmen has been a most serious one, and has necessitated an expenditure of large dimensions. The company owns about 2,100 single dwellings of varying grades, six large workmen's hotels, and a number of boarding houses and shacks. The miners' cottages containing four rooms rent at between $6 and $7 per month. The houses now being built at the Lingan collieries have four rooms and a kitchen, with a verandah in front. Each house has a good-sized plot of surrounding ground sufficient for garden use. The company rents to the workmen houses at from $7 to $8 per month, for which private landlords in the vicinity obtain from $10 to $15 monthly.

The Dominion Coal Company Employees Benefit Society was incorporated in July, 1910. being a consolidation of the Miners' relief societies which have existed in one form or another at the Cape Breton collieries for some thirty years past. This society now numbers over 10,000 members—the Springhill employees being included—and is making good progress. The relief paid covers both sickness and accident, in fact any disability not arising from improper or immoral conduct. The indemnity paid is $6 per week for 26 weeks, then $3.50 per week for a further 26 weeks, followed by $2.00 per week for two years. A widow receives $8.00 per month for five years, and $3.00 per month for each child up to the age of fourteen years.



Siemens Bros. Electric Coal Hoist, No. 14 Colliery.

[Editor's Note:—Mr. F. W. Gray, the author of the above article, is our Nova Scotia correspondent. Of his frequent contributions to these columns this is one of the best.]

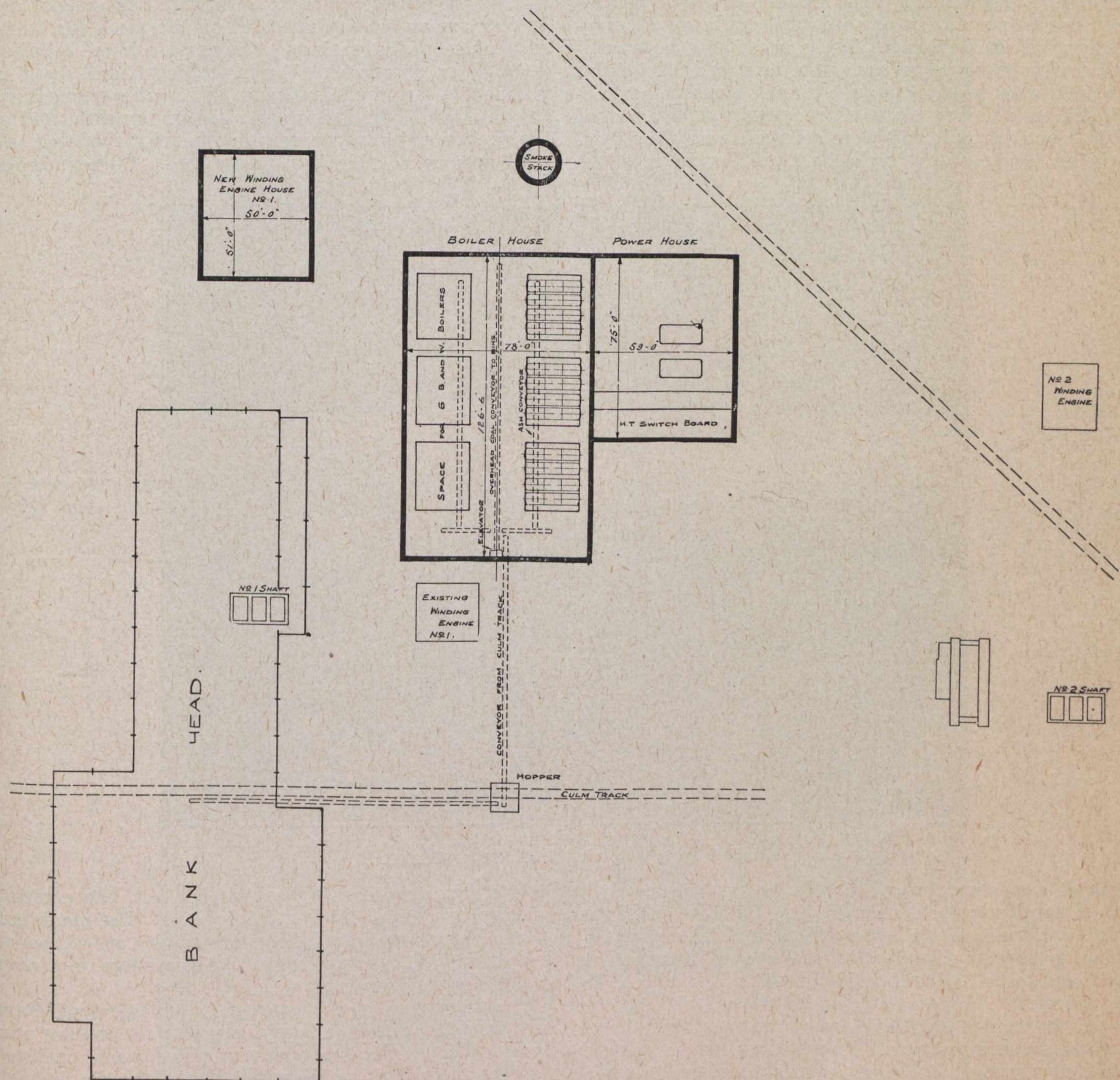
A MODERN POWER PLANT

Written for the Canadian Mining Journal by T. Forster Courthope.

In the following description of the Acadia Coal Company's power plant, together with a general outline of the machinery for which it was put down, no attempt is made to treat the matter exhaustively, but at the same time no detail is omitted which might prove interesting to the reader.

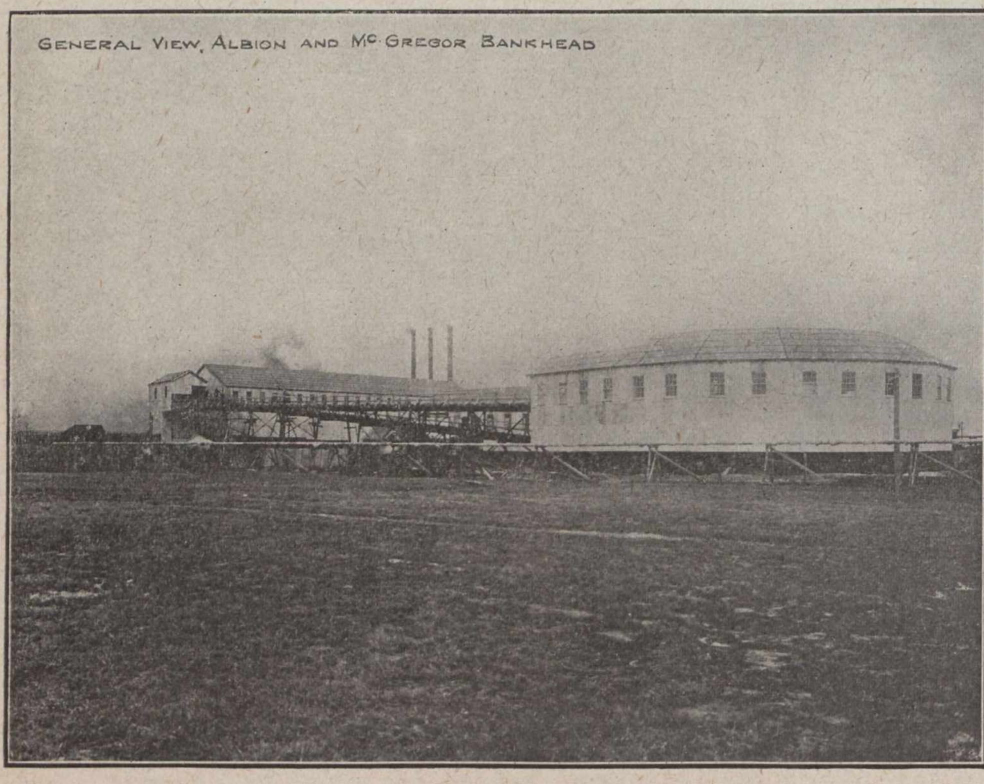
The company's power station is situated about 1¼ miles southwest of the town of New Glasgow, Nova Scotia, and is in close proximity to the East River. It is almost an ideal place for a power station, being within easy access to a plentiful supply of water. The Allan Nos. 1 and 2 shafts are in close proximity to the power house and preparations are being made at the former to deal with a large quantity of coal. Of the bank arrangements something will be said later. The company also own what are known as the Albion, Vale, and Acadia mines, all of which are worked by means of stopes. The Allan and Albion mines are, up to the present, the only ones where electrical developments have taken place, and it is proposed to confine this article to these.

The turbine sets, of which there are two, are placed in a very substantial, well lighted, and roomy brick building of ample proportions, space being left at the west end for an additional 3,000 k.w. set when occasion demands. The high tension switchboard at the east end is situated about eight feet above the level of the main floor, access to the front of the board being by



General Plan

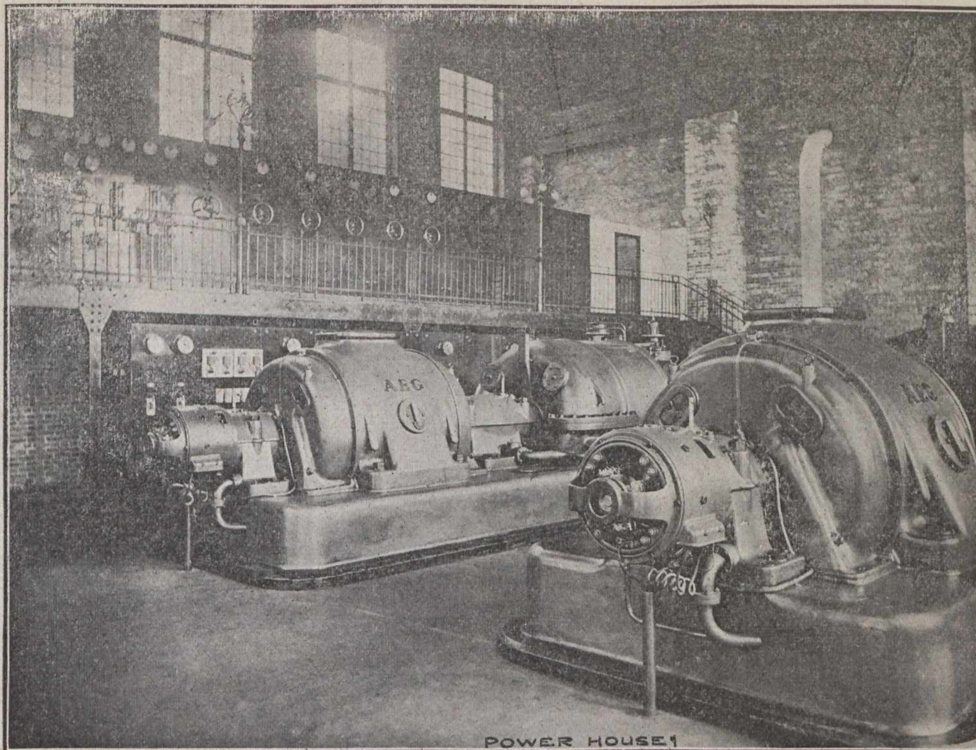
means of a gallery running the full width of the building, with a suitable stairway on the left side. The low tension switchboard is placed on the main floor immediately in front of the high tension gallery. A traveling crane capable of handling the heaviest pieces, is placed across the building and capable of traversing the full length. Immediately adjoining, and on the south side of the power house, is placed the boiler house in which are installed six 450 h.p. Babcock & Wilcox boilers, these boilers are placed next to the division wall separating the boiler house from the power house. Opposite the existing position of the boilers there is sufficient space for an additional six boilers when the plant is increased. Now that a verbal sketch of the plant has been drawn we will go on to describe it in detail, commencing at the turbines. These are of the now well-known Curtiss type and may be described as impulse turbines with pressure stages, these stages being subdivided in velocity stops as required. They are of 1,500 k.w. each unit and were constructed by the Allegemeine Electriciate Gesellschaft, of Berlin, rated to the banks of the East River and are about 310 yards from the condensors. Their capacity is about 5,000 gallons per minute, against a head of 42 feet. Metallic starting resistances are used on these motors owing to the exposed position of the pump house. The liquid starting type are unsuitable on account of the severity of the winter frosts. In connection with the condensor the usual auto-atmospheric valves are fitted to the exhaust pipes allowing the exhaust to escape to atmosphere, in the event of a condensor failure. The generators are also by the A. E. G., and have as previously stated, a capacity of 1,500 k.w. each at cos. p. 8, 3,150 volts, 344 amps. per phase, frequency 50. These generators are of substantial build and well designed. The exciter armatures are mounted on the same shaft and have no separate bearings. The exciter frame is bolted to a flange on the end bearing pedestal and fixed in position by an alignment ring. The cable connections to the switch boards are arranged underneath, and at the exciter end of the generators, heavily insulated and steel armoured cable being employed. Current is led



General View, Albion and McGregor Bankhead.

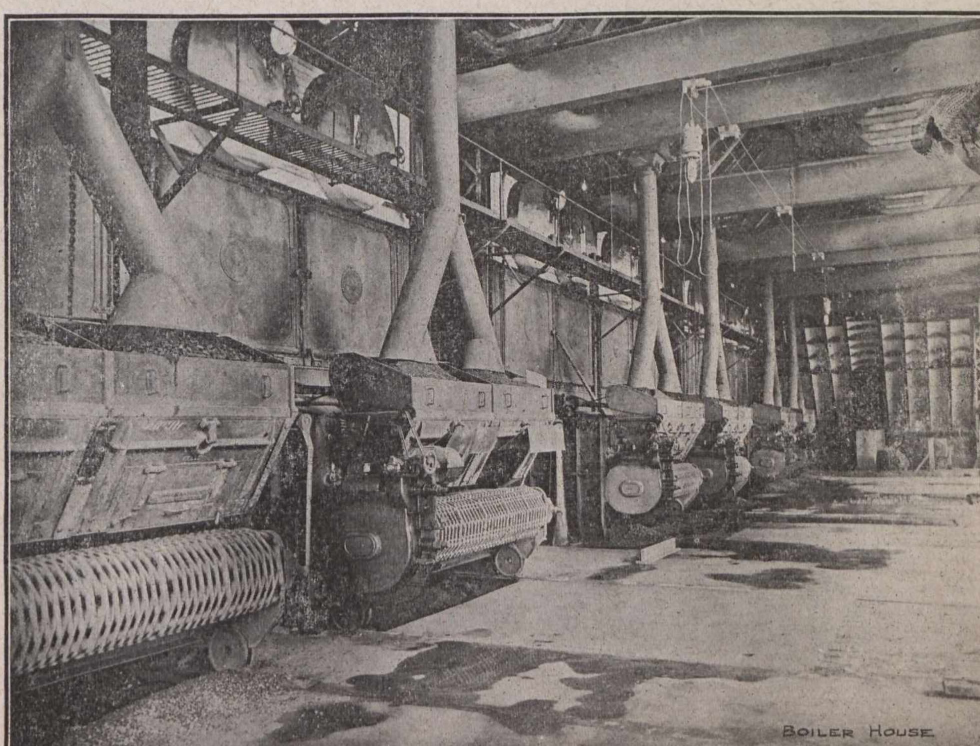
work at a steam pressure of 150 lbs. per square inch, with a total superheat temperature of 300° C., the revolutions per minute being 3,000. It is perhaps interesting to note that under test the steam consumption was found to be 14.4 and 14.78 lbs. per kilowatt hour. In the basement immediately under the turbines, are placed the condensers, these are of the usual cylindrical surface condensing type. The air pumps are placed sufficiently clear of the condensors to ensure accessibility. These pumps are of the reciprocating type, coupled direct to a 17.5 h.p. motor taking 27 amps. at 525 volts., and running at a speed of 236 revolutions per minute, they sustain comfortably a vacuum of 27 in. under full load. The centrifugal circulating pumps are direct coupled to an induction motor of 75 h.p., taking 77 amps. at 525 volts, and running at a speed of 975 revolutions per minute. These pumps are situated on to the collector rings by copper brushes, the exciting voltage varying according to the load. The maximum allowable voltage is 110, these low values are chosen to keep the voltage low through the slip rings, moreover it obviates the danger of racing.

The generators are of the entirely enclosed type. Fans are provided on the ends of the rotors for cooling purposes. They produce a pressure in the spaces enclosed by the stator end guards which forces the air through the air gap between the rotor and stator and also in a greater quantity through the air passages in the iron core. The air flowing through the machines can only travel in a predestined way and all parts of the generators, particularly the windings are uniformly traversed by the air currents. It is obvious that any impurities contained in the air would in time be deposited in the air ducts and passages of the generator, to avoid this, the air is drawn through an air filter. These air filters consist of a permeable material which is sewn together in the form of pockets which are stretched



Power House.

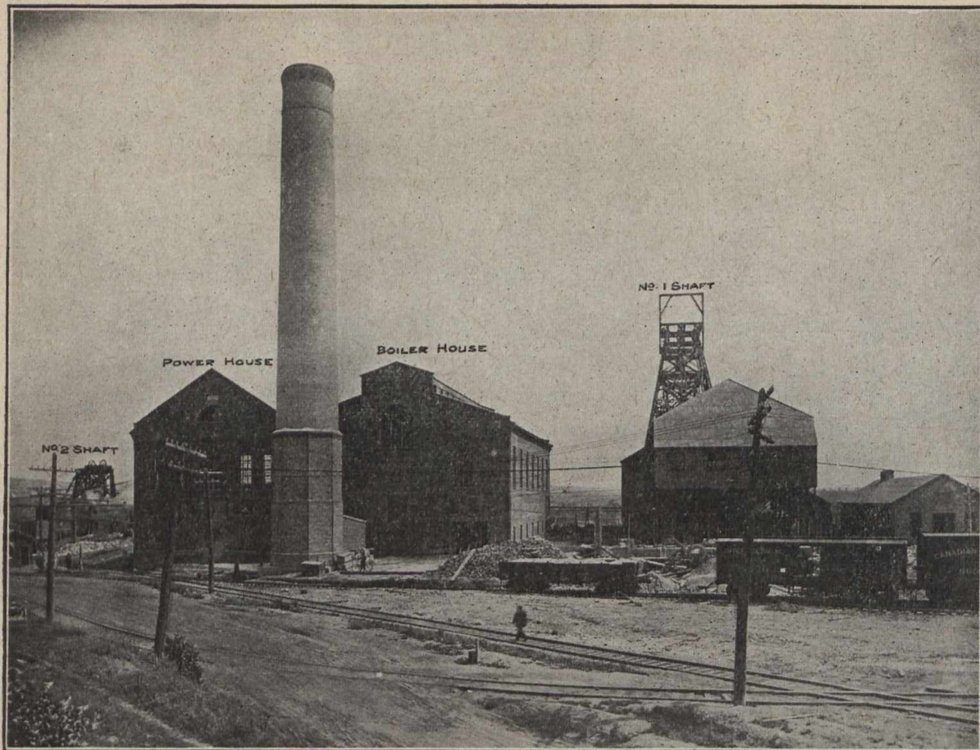
on a wooden framework, the whole being mounted on angle iron frames. The number of these frames are



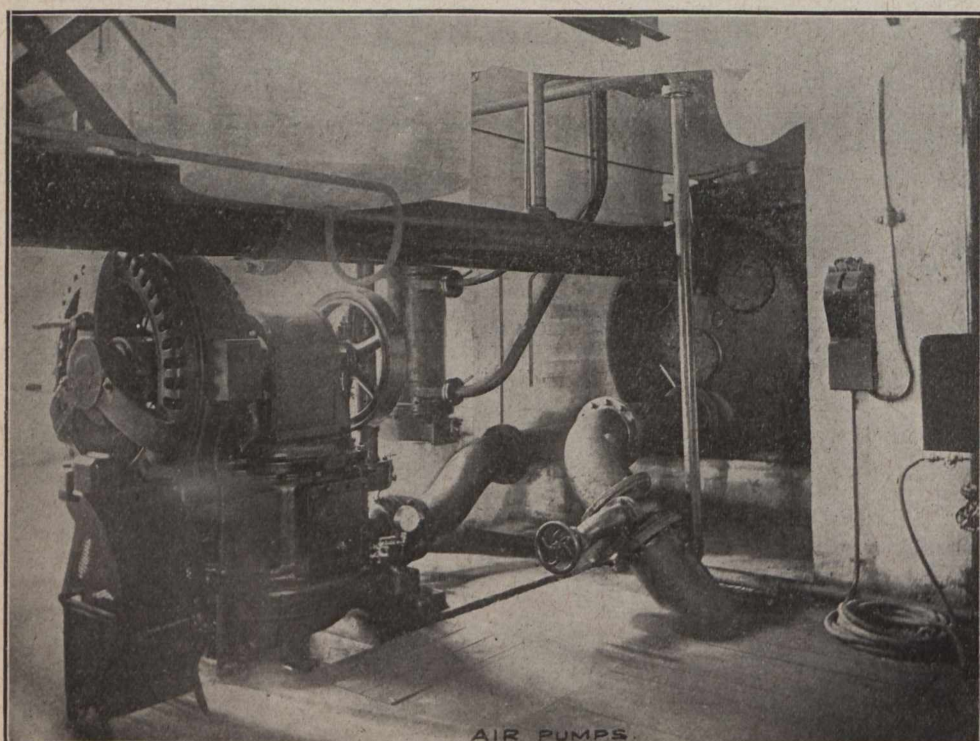
Boiler House.

varied to suit the required quantity of air, the regulation being arranged in such a manner that the pressure drops amount to a few tenths of an inch water gauge. This material is cleaned when required by means of a vacuum cleaner. From 1,000 to 7,000 cubic feet of air per minute is required for cooling purposes, the quantity being determined by the load on the machine. The induction side of the filters is distinctly shown on the photograph, the eduction duct being just visible above it.

The main switchboards are in black marble and consist of fifteen panels. The main distributing leads consist of round copper bars with concentric couplings, this makes a very real workmanlike job, and is very accessible. The current and potential transformers are placed immediately behind the H.T. panels, and are housed in concrete cells, the secondary leads from these transformers being lead to their respective instruments in small iron rectangular cases. The whole of these connections are arranged in a very systematic manner and strikes one with a feeling of almost overpowering orderliness! In front of the cells perviously mentioned are placed an additional group, these contain the main control switches, which are, of course, oil immersed. Each of the main switches is supplied with two maximum current release coils, and are set to automatically cut out the switch when a certain pre-arranged current passes through them. In connection with the tripping gear of these switches there is an arrangement so that

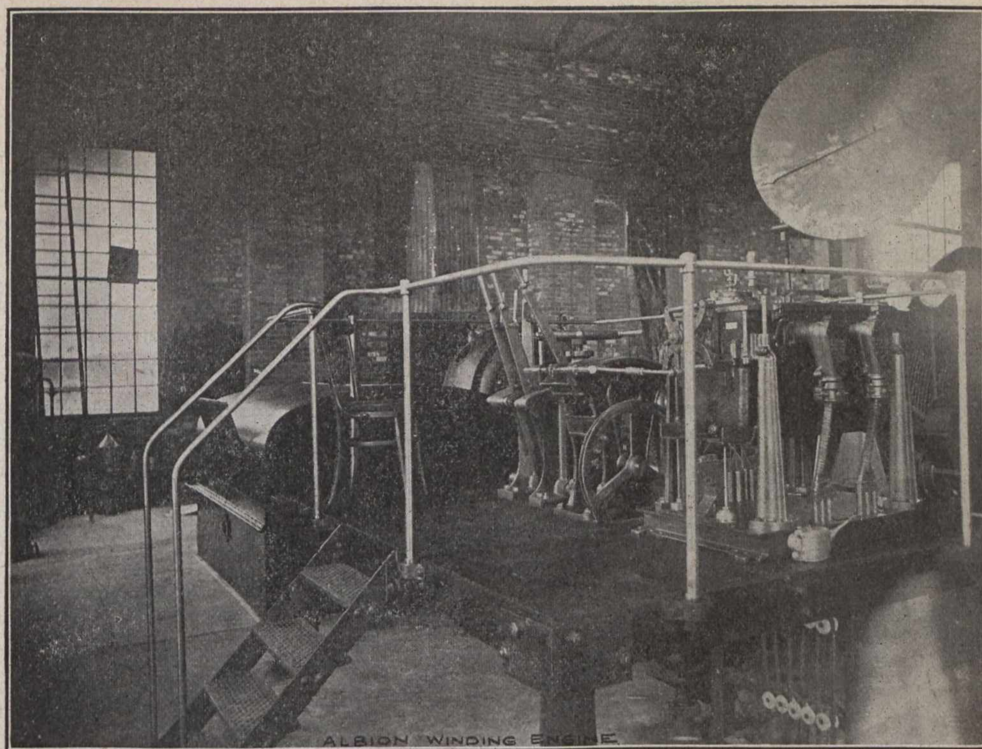


General View of Plant, Acadia Coal Co.



Air Pumps.

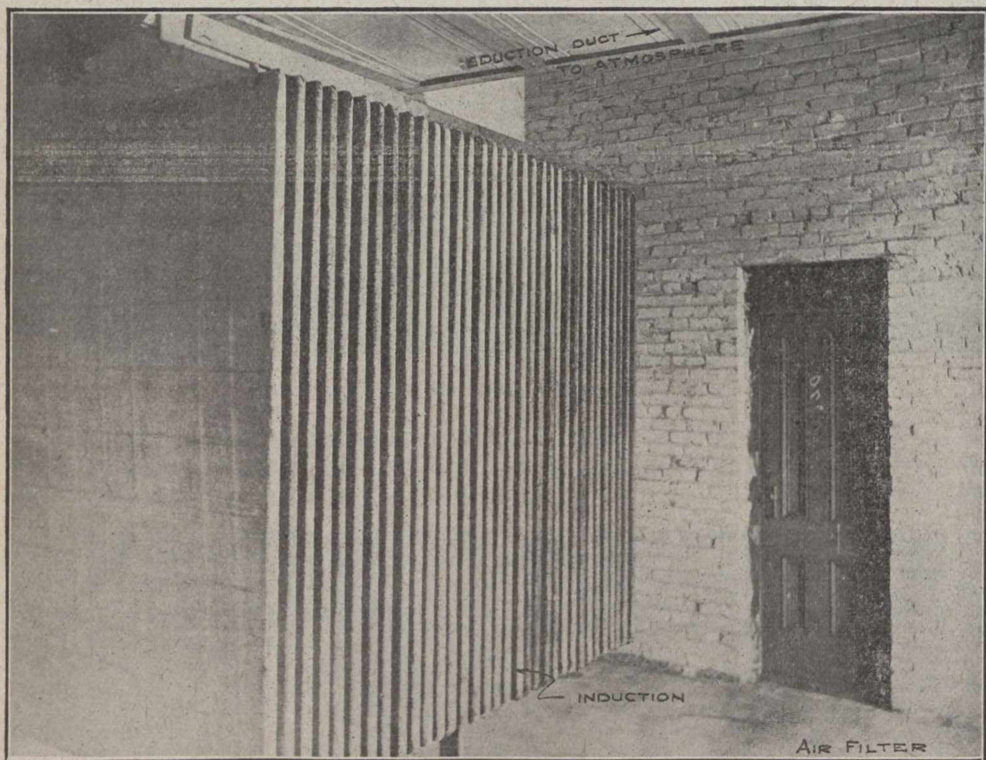
when the switch trips a red lamp is lit, this light being placed in prominent position on the switchboard so as to be observable by the engineer in charge. The main generating control panels are fitted with the usual apparatus for the control of the exciters, exciting currents, syncronising for parallel running, etc. Provision is made so that in the case of one exciter failing, another can be used immediately. Adjacent, and to the right of, the main control panels is mounted a "Tirrell" regulating apparatus. These are too well known and beyond the scope of this article to warrant a description here, but at the same time, it may be interesting to note that in conjunction with this apparatus there is connected an ingenious signalling arrangement. When a heavy load is thrown "on" or "off", the signal is given visually by coloured lamps, and at the same time acoustically, by means of bells. Their importance is obvious. Two of the panels on the H. T.



Albion Winding Engine.

Circulating Pumps.

board are for the control of the primaries of the main transformers. These transformers are placed in a special room in the basement of the building and are of the oil cooled type. They have a capacity of 350 k.v.a. (killowatts, volts, amps). and are supplied with a current of 62.2 amps at 3,150 volts, which is transformed to one of 3.86 amps at 525 volts. This secondary current is conveyed to the low tension switchboard. This switchboard is also in black marble, and consists of nine panels. These panels control all the various auxiliary motors for the condensing plant, screens, crusher, carpenter, machine shops, etc., as well as the lighting for the plant and part of the town of Stellarton. H.P. current at 3.150 volts is transmitted by one and a half miles to the Albion mines, by three core cables specially insulated, lead covered, and armoured with two layers of steel band, their size being three inches diameter by 120° m.m.. These cables are laid in duplicate to ensure an uninterrupted service.



Air Filter.

Boiler House.

The installation consists of six 450 h.p. Babcock & Wilcox water tube boilers, each having a grate area of 108 square feet, and a heating surface of 4,510 square feet. These boilers are fitted with superheaters having a heating surface of 1,320 square feet, and giving a total superheat of 300°C. The chain grate stokers are driven by a 12 h.p. steam engine, and arrangements are being made to put in an electric motor as a stand by. The feed water after passing through a Webster "Star Vacuum" feed water heater, is led to two Wier direct acting feed pumps having two 13½ inch diameter steam cylinders and 10 inch diameter plungers by 24 inch stroke, the duty being under full load at the rate of 8,500 gallons per hour.

The coal and ash handling appliances are of a very complete nature and have been eminently satisfactory since their installation. The outline drawing shows the approximate positions of the conveyors, and is self-explanatory. It may be of interest to give the power of the motors used, therfore the following particulars are given: Overhead coal conveyor, 15 h.p., 500 volts, 750 r.p.m.; conveyor from railway to crusher, 10 h.p., 500 volts, 750 r.p.m.; conveyor for ashes, 10 h.p., 500 volts, 750 r.p.m.; crusher, 35 h.p., 500 volts, 750 r.p.m.

Screening Plant.

To the south of the boiler house a modern bankhead has been erected with a screening plant complete, designed to deal with 3,000 tons per day. The headframe is a very fine structure giving one an idea of great strength, without undue weight. The pulleys on this headframe are not yet in position. The company are now putting in the foundations for a modern steam winding plant, the position of which is shown on the plan. The coal from No. 2 shaft is brought to No. 1 shaft by means of a car haul, and then elevated to the level of the new bankhead. There are at present single deck cages both Nos. 1 and 2 shafts. It is intended to draw all the coal at No. 1 shaft as soon as the new winding engine is ready. Four deck cages will be installed for the purpose.

The arrangement of the screening plant is as follows: The boxes gravitate from the hoist and No. 1 shaft cage, and pass along to the automatic tipples, after being unloaded the coal is weighed, and then passes over moving bar screens on to the jigging screens. The first screen, over which the lump coal passes, is perforated with 1¾ in. diameter holes, through these holes pass the nuts and slack, this in turn is deposited by means of a shoot on to a Zimmer conveyor which carries it across the building to an elevator, this elevator deposits the material on to a knocking screen with a half inch wire mesh, the nuts pass over this screen into the cars by means of a shoot, the culm passing through the screen being deflected by another shoot and thence to the cars. The picking belts are fitted with rising and falling jib ends. These belts are 54 feet long by 5 feet wide.

The motors used in addition to those already mentional up to the present time, at the Allan shafts are as follows Machine and smith's shop, 25 h.p., 500 volts, 750 r.p.m. carpenters, 25 h.p., 500 volts, 750 r.p.m. two underground pumps, five stage Rateau centrifugals, head 1,040 ft., gallons per minute 550, h.p. of motors 300, r.p.m. 3,000, volts 3,000.

Albion Mines.

There are two slopes at these mines, namely the McGregor and Albion, the pitch averaging approximately 23 degrees, the McGregor being 272 feet long from No. 5 level, and the Albion 2,800 feet. The boxes are hauled up these inclines by electric winding engines. These engines are in duplicate and are each placed in engine houses measuring 40 feet by 41 feet. The drums are 9 feet diameter by 4 feet wide, driven by double reduction machine cut gearing from a motor of 320 h.p., running at 500 revolutions per minute and taking 3,000 volts. Fifteen 1-ton boxes are to be run at one time on these slopes, at a speed of 600 feet per minute. Two electrically rope driven Walker air compressors, running at 120 revolutions per minute and giving 1,600 cubic feet of air per minute at 100 lbs. per square inch, are installed, one running on night load and the other on day load. The motors are 320 h.p. each, running at 500 revolutions per minute and taking 3,000 volts. It is interesting to note that these motors are interchangeable with the winding motors. Underground there are placed two Ratean 7-stage centrifugal pumps with a capacity of 550 gallons per minute against a head of 1,480 feet, direct coupled to 440-h.p. motors taking 3,000 volts at 3,000 revolutions per minute. There are at present under construction two Capell fans, 12 feet 6 inches diameter by 4 feet wide, with a capacity of 100,000 cubic feet per minute, running at 215 revolutions per minute with a 5½-inch water gauge. These fans are to be rope driven by motors of 150 h.p. running at 750 revolutions per minute, the voltage being 3,000. These fans are for ventilating the McGregor and Albion mines.

The screening plant for the Albion and McGregor mines is almost the same as that described for the Allan shaft and it is not proposed to give any further description here; at the same time perhaps some idea of the electric motors installed to deal with the work, would not be out of place.

Motors Used For	H.P.	R.P.M.	Volts
Main Picking Belts, Screens and Zimmer Conveyor.	45	750	500
Box Car Loading Conveyor and Elevating Gear for Picking Belts.	25	"	"
Car Haulage (1)	25	"	"
Car Haulage (2)	25	"	"
Creeper.	10	"	"
Knocking Screen	10	"	"
3 Down Car Hauls (3)	10	"	"
Trip Hauls (4)	10	"	"
Main Tipples.	10	"	"
Tipples, House, Stone, Coal and Refuse.	10	"	"

Remarks.

(1) Main car haulage from McGregor to Albion.
(2) Albion full car haulage.
(3) Albion side.
(4) One motor for Albion and one for McGregor.

In addition to the above motors there is a 45 h.p. installed for driving machinery in the carpenters and machine shop.

The substation, containing the switchboard for the motors and feeder cables, also the transformers, is built of hollow terra-cotta blocks, the building measuring 57 feet by 27 feet.

There are two transformers in the substation transforming current from 3,150 to 525 volts, the lower voltage being used for the motors previously mentioned. A separate cable is run from the substation to each H. T. motor, each having a distributing panel controlled by an automatic relay switch with time limit. The L. Tension panels have an automatic switch with overload and no voltage release. There are several spare panels fitted to the switch board for future developments.

The whole of the power plant is of an up-to-date nature and no expense has been spared to make it efficient. The Acadia Coal Company expect to draw a large quantity of coal from its mines in the near future, and there is no doubt that the expense incurred in laying down this very fine plant will be more than justified in a very short space of time.

[Editor's Note:—Supplementing this article will be found another describing fully the new bankhead, which was constructed entirely in Nova Scotia.]

THE NEW "HARMET" FLUID COMPRESSION PLANT OF NOVA SCOTIA STEEL AND COAL COMPANY, LTD, AT SYDNEY, MINES, N.S.

Written for The Canadian Mining Journal.

Nowadays we frequently find railway and other disasters explained as due to the failure of some part of the equipment which is composed of steel. The offending member may have been a steel rail, axle shaft, connecting rod or any vital part of the machine. The opinion undoubtedly exists that steel is liable to unaccountable failures. This opinion is not new. In the early days of steel, when it was fighting for its existence against iron this was the cry. Since then steel has proven its worth and superiority, and now has for most purposes almost completely replaced iron.

Yet an occasional unaccountable failure does occur and reminds us of how much there is yet to learn. Frequently, when the individual cases have been studied closely, it has been found that the steel in question was of normal composition or at least contained no constituent that explained its weakness.

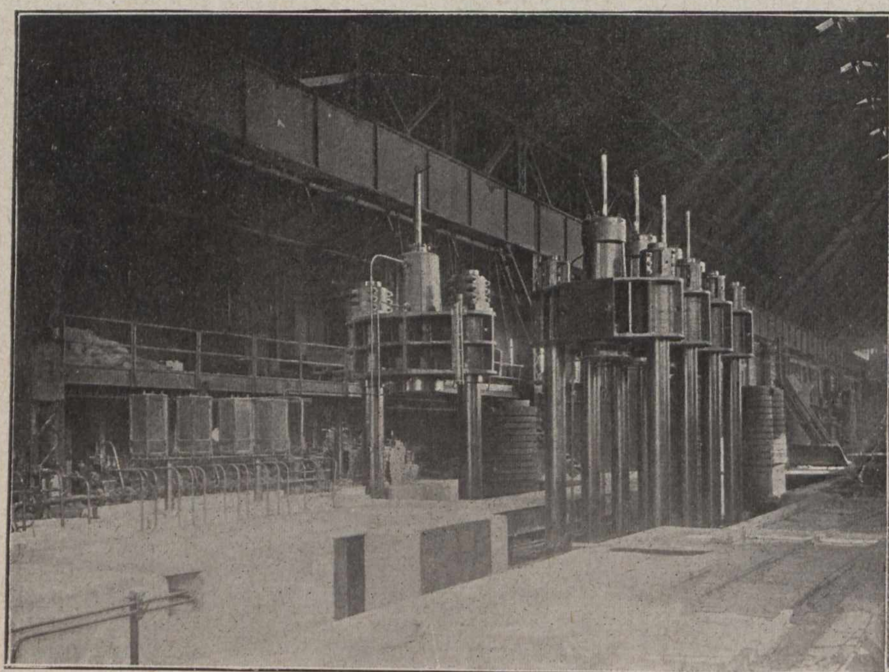
But what do the authorities say on the subject? While there is a lack ofconformity in opinion upon some points of the question still under controversy, yet perhaps most competent and experienced metallurgists would agree in putting the majority of inexplicable results obtained down to variation in molecular structure. If pressed further they would talk of pipes, cracks, segregation, blowholes, occluded gases, internal strains, crystallization, etc.

That such defects exist is common knowledge, and it is a fact that the critical time for the inception and growth of these evils is during the period when the steel passes from a molten liquid into a stable solid.

But, it is asked, what are steel manufacturers doing about it? Most of them are doing nothing, because for ordinary purposes the usual merchant-brands of steel are satisfactory, and any extra cost of treatment is prohibitive.

Those manufacturers, however, who produce the highest grade steels for use where utmost reliability is demanded, as for high-grade forgings, subject the metal to a high pressure while it passes through the dangerous transformation stage; in short, they fluid-compress it.

In order to appreciate the ultimate effect of the process upon steel, it is necessary to consider the various stages in the production. With this in view, the production of marketable steel has been divided into three stages, as follows:—



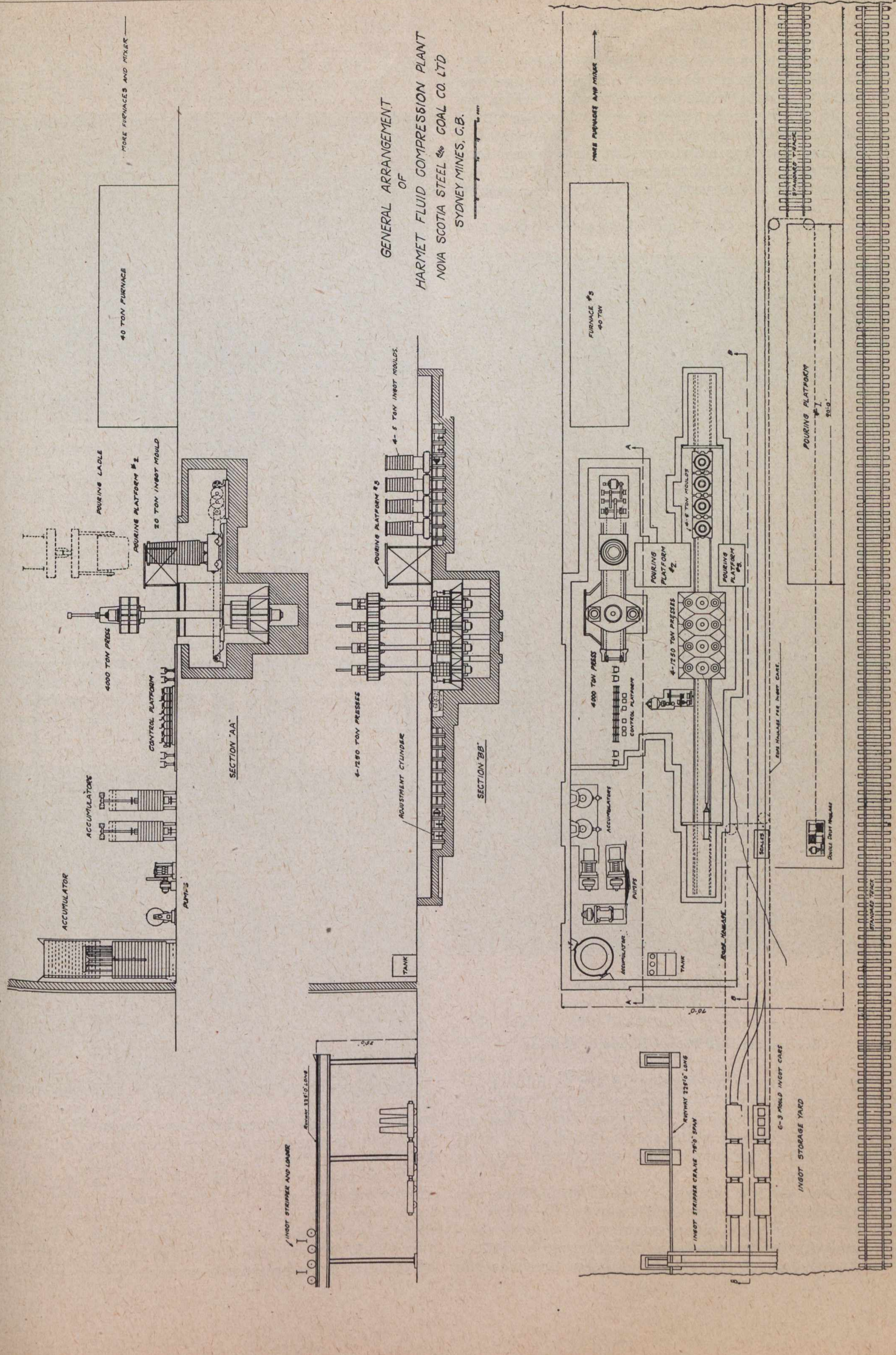
Fluid Compression Plant showing control valves in left foreground

1. The production of liquid metal with the desired chemical composition, without admixture of slag, without gases in solution, oxides, or non-metallic inclusions.

2. The transition from the liquid to the solid state within the ingot-mold, this being a crisis attended with many risks, since the violent contraction is apt to seriously strain and rupture the metal mass, and cause defects which appear almost impossible to completely remedy in a satisfactory manner later on in the manufacturing process.

3. The third stage consists in the conversion of raw salid material into finished products, such as billets, bars or rods, accomplished by reheating, rolling or forging.

Of these stages the third is the most open to control, and the least delicate; although special care in treat-


GENERAL ARRANGEMENT
OF
HARMET FLUID COMPRESSION PLANT
NOVA SCOTIA STEEL & COAL CO. LTD
SYDNEY MINES, C.B.
MORE FURNACES AND MIXER
40 TON FURNACE
POURING LADLE
POURING PLATFORM #2
20 TON INGOT MOULD
4000 TON PRESS
CONTROL PLATFORM
SECTION "AA"
ACCUMULATORS
ACCUMULATOR
PUMPS
4-5 TON INGOT MOULDS
POURING PLATFORM #3
4-1250 TON PRESSES
ADJUSTMENT CYLINDER
SECTION "BB"
TANK
INGOT STRIPPER AND LOADER
FURNACE #3
40 TON
POURING PLATFORM #1
STANDARD TRACK
SCALES
INGOT STRIPPER CRANE
INGOT STORAGE YARD

ment and expert knowledge are requisite to attain the best product in each case.

The first stage, that of producing the molten metal, being carried out in a furnace at a high temperature, is difficult to control, while the second stage, which has to do with the physical qualities and molecular structure of the components of the metal, imperceptable to the naked eye, has only come up for solution comparatively recently, and is the most difficult of all.

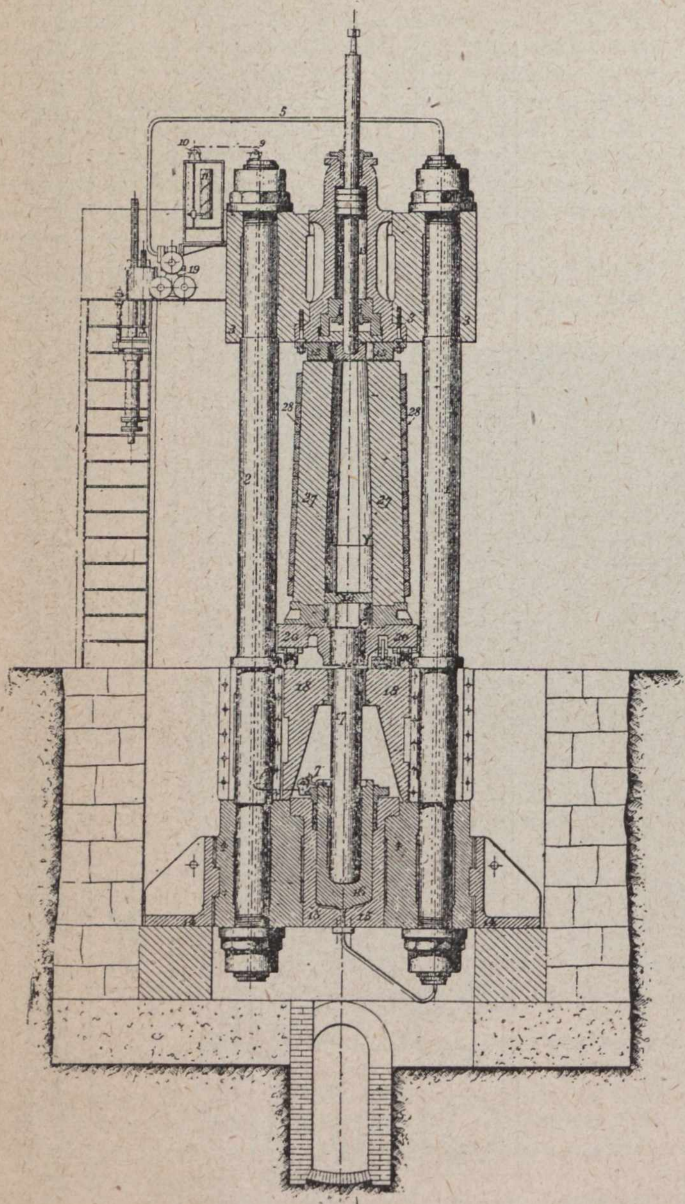
The defects, almost invariably found to occur in steel that has been cast in an ingot-mold are as follows:—

The upper portion of the ingot is affected with pipe, and blowholes are present. The whole mass is seamed with cracks, torn by internal stress, and cleft by crystallization; while the composition is rendered irregular by liquidation.

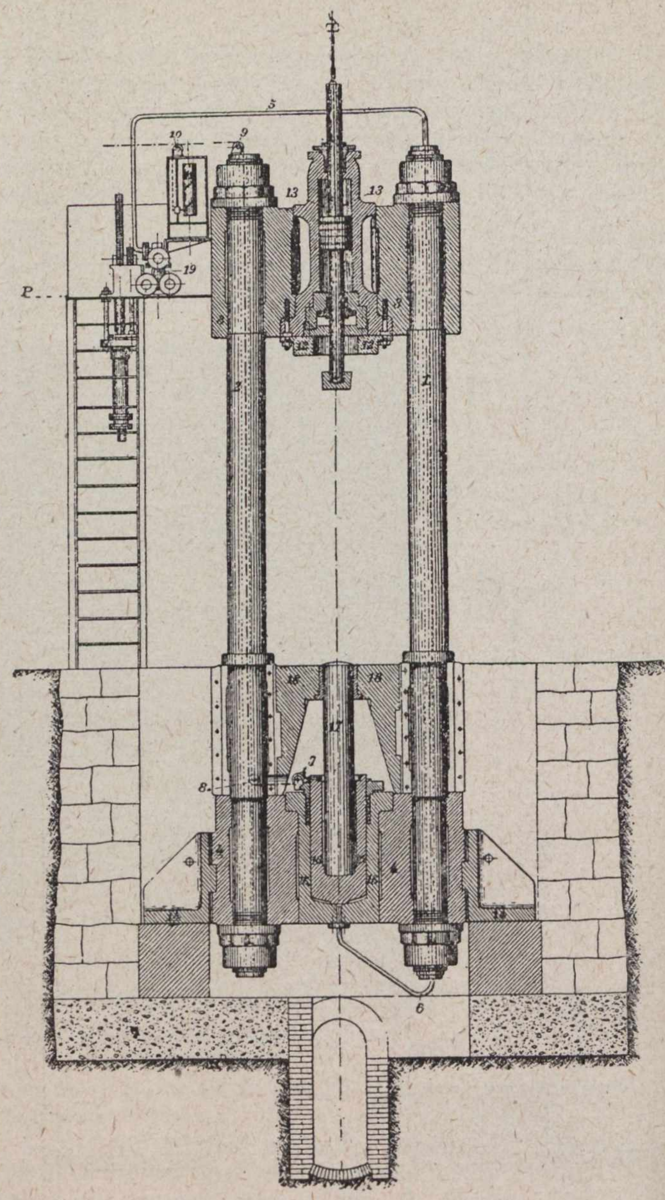
Of these, piping, blowholes and segregation, or liquidation, are most commonly known by users, as they are by the steel manufacturers, who most carefully and constantly watch for these irregularities.

To guard against the effects of their presence the most affected portion is cropped. Where utmost reliability is essential, further efforts are made to minimize their influence by hollow-boring the ingot, etc.

All these irregularities in composition and unhomogeniety in structure are ultimately due to two forces, namely, crystallization and shrinkage. These two forces are always present and acting vigorously. Further, the time in which the trouble develops is limited to that period in which the liquid metal passes through the so-called solution stage into the stable solid state.



Section through Press—Mould in Position



Mould not in Position

Owing to the natural difficulties in the way, such as high temperature, the weight of the mass to be handled, and the tremendous forces required to be controlled, little was done to solve the problem until about 1865, when Whitworth undertook the task.

The solution which suggested itself to him was to submit solidifying steel to great pressure. This would force some, if not all, of the occluded gases to exude, reduce the blowholes to insignificant dimensions, and also would prevent the formation of pipes. Further, by equalizing the pressure thorughout the mass, a more homogenous steel, both physically and chemically, would be obtained.

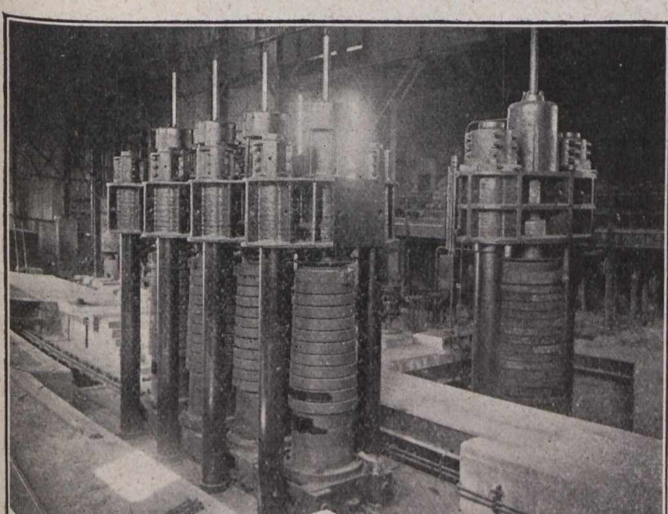
The Whitworth process consisted, in brief, of subjecting the fluid steel, which had been poured into a side-strengthened sylindrical mold designed so as to let

Pumps and Accumulators for Compression Plant

the gas escape through its wall to a pressure of above two tons per square inch, and preferably six tons or more.

It was found when this pressure was applied, enormous volumes of gas were driven through the opening in the mold with a loud roar and the ingot shortened rapidly at first, but later on more slowly; the entire shortening amounted to about 8 to 10 per cent. less than when cooled in the ordinary manner.

The objection to this process is the high initial and operating cost that is necessary, and also its technical deficiency, in that the pressure applied is upon the top of the ingot only. This is its strongest point, and to accomplish compression the maximum amount of energy has to be applied.



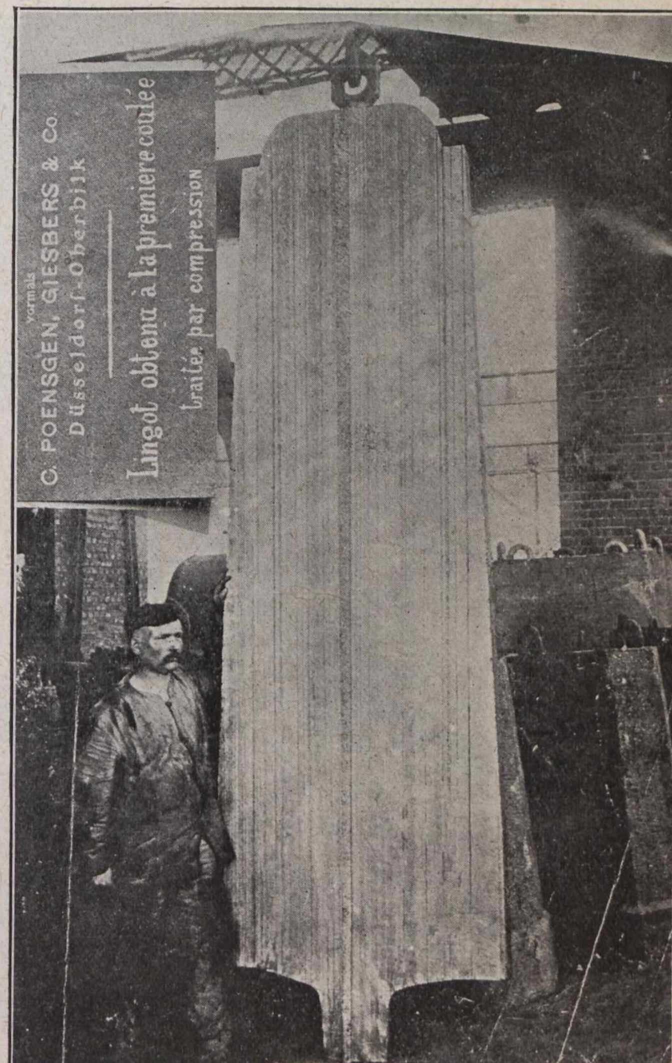
One 4000-ton and four 1250-ton Hydraulic Presses

To create a slight pressure within the soft interior, the most unyielding portion, the early freezing walls must naturally compress in the direction they resist most powerfully.

A further disadvantage of the Whitworth system is that the pressure tends to make ingots open up like the staves of a barrel, thus forcing the rich segregated matter through the interior into the crevices thus formed on the outside.

These imperfactions are serious. The improvements made in the quality of steel, however, are very important, and the subject has been carefully studied and experimented with ever since.

Within the last few years an effective method of fluid-compression, which can be operated at a reasonable cost, has been perfected. This was done by M. Harmet, of Saint-Etienne, France. A full description of his process will be found in both The Journal of the Iron and Steel Institute and Stahl und Eisen.



Harmet Fluid Compression Ingot

M. Harmet calls his process wire-drawing, and states that in it the main object is not so much to remedy the defects of the metal already mentioned, as rather to foresal their development. In order to do this, pressure is applied to all sides of the steel. This is effected by using a slightly cylindrical mold, of greater area at the bottom than at the top, thus obtaining intense compression with a relatively small expenditure of power due to wedge-action.

The mechanism by which this is accomplished is very heavy and quite ingenious. (See accompanying photographs.)

The work expended in compression is constant, for steel of any definite character, and proportionate to the total contraction of the mass upon which it acts. That is, the compression by wire-drawing acts on the laterial surfaces as well as the ends of the ingots, crushing them inward to diminish the volume; at the same time work is performed proportional to the amount of closing in the material, that is to say, to the contraction for each pound of metal.

It will be seen that the Harmet process possesses all the advantages of the Whitmore press, while the chief objections to fluid-compression as carried out by that method are overcome.

The effect claimed for this treatment is that it:—

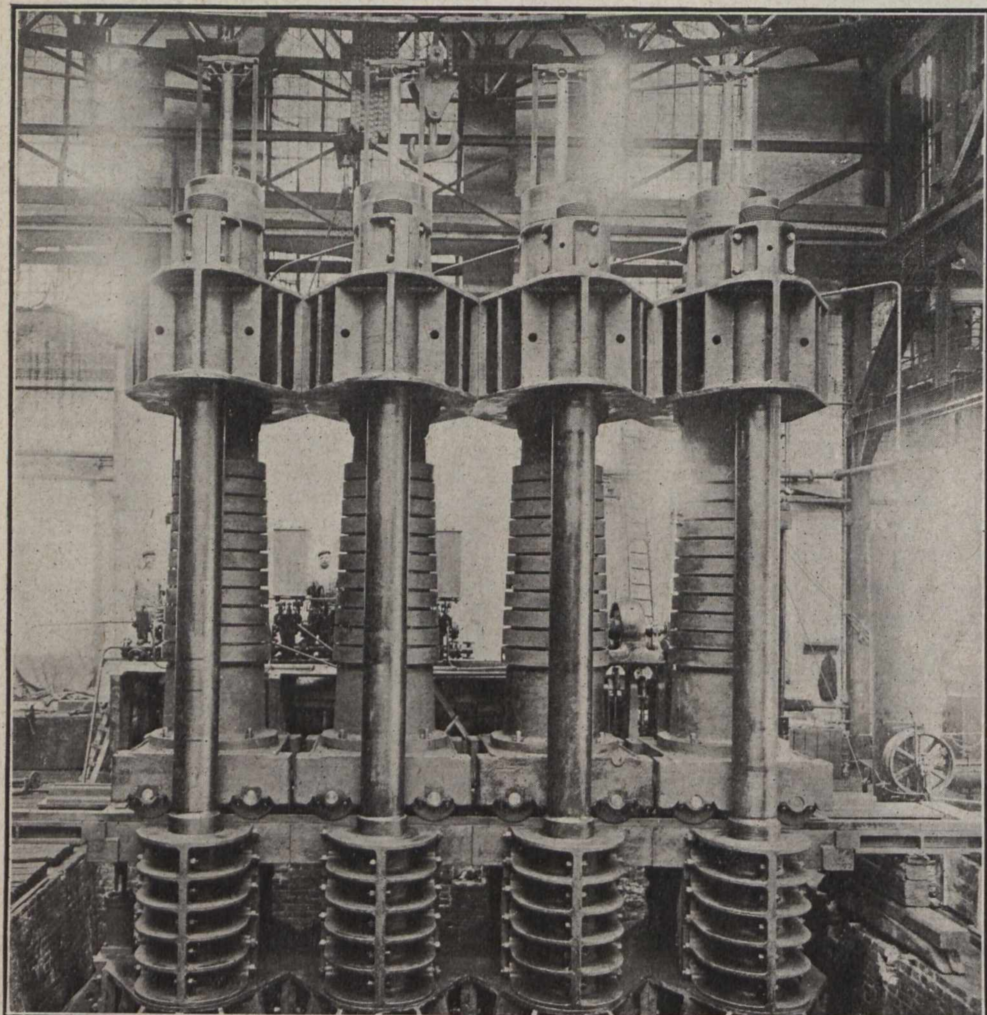
6. Greatly reduces liquidation.

7. Generally improves physical properties, owing to the mechanical effect being similar to forging.

8. Reduces waste of ingot, due to crop ends, since the uniformity in composition and absence of cavities or pipes is maintained throughout the whole of the ingot.

9. Prevents formation of stresses, crack or fissures, due to shrinkage.

That the Harmet method of fluid-compression does effect improvements on the points mentioned has been proven in practice, and is now generally acknowledged.



Group of four 1250-ton Harmet Presses

1. Prevents formation of shrinkage—cracks in the outside wall of the ingot.

2. Causes early cessation in crystallization of metal as the pressure hastens transition from liquid to solid.

3. Lessens segregation, e.g., reduces tendency of carban and other impurities to accumulate in the upper part of the ingot. The movement of the top of the ingot into the upper and cooler portion of the ingot-mold adds to this tendency.

4. The resulting lateral pressure prevents the formation of any "pipes" or interior cavities, and thus preserves the absolute solidity of the ingot.

5. Produce a fine crystallization without a cleavage plane.

It is only necessary in concluding this section to give the following opinions upon the value of fluid compressing steel:—

The eminent authority on iron and steel, Professor H. M. Howe, referring to liquid compression, says: "To sum up, in proper hands, the liquid compression of large masses, if powerful enough, does, according to our present evidence, prevent pipes, blowholes and cracks almost completely."

Professor Arnold says that as far as his knowledge goes the only trustworthy and practical way to prevent liquidated regions, pipes and pockets in steel is to cool the ingot under fluid-compression, and to prevent segregation the Harmet process, he says, seems very successful.

Finally, Mr. Bradley Stoughton, the well-known American metallurgist, sums up a recent article on this subject as follows:—"In conclusion, compression during solidification lessens the liability of steel to contain the remnants of pipes, blowholes, segregation and external cracks, and partially prevents the development of a weak structure during crystallization.

"So far as shown by the tests we have been able to find, it also slightly increases the strength of finished steel and increases its toughness under impact besides making the different parts of the ingot more uniform in quality both before and after rolling."

The Nova Scotia Steel and Coal Company, realizing the importance of fluid-compression as a valuable aid in producing reliable and first-class steel products, has purchased the Canadian rights from M. Harmet whereby they secured the sole rights in this country to use his process. This advance they considered advisable in order to keep abreast of modern progress, and particularly that their high reputation as manufacturers of heavy railway and machine forgings should be ustained and advance with the best current practice.

The fluid-compression plant of the Nova Scotia Steel and Coal Company, recently laid down at Sydney Mines, C.B., consists of one group of four Harmet presses, each of 1,250 tons and capacity to handle 3½- and 5-ton ingots; and one of 4,000 tons to handle 18- and 25-ton ingots. The presses proper are equipped with the necessary pumps, accumulators, manipulating valves, etc.

These accessories include three 3-throw motor-driven pumps, one of 200 litres per minute at 50 atmosphere, and two 25 litres capacity at 450 atmosphere.

The presses and accessories are erected in a extension to the existing open-hearth building and situated close to the furnaces, and arranged so that the pouring-ladle containing the metal to be compressed has, as it comes directly from the furnaces, only a short distance to go to the pouring platform. (See accompanying plan.)

The process of compression is quite simple in theory, and all the difficulties to be faced are mechanical ones. The presses are all similar in design.

The press proper consists of two hydraulic cylinders, actuating pistons, having at their ends rams designed to fit loosely the inside of the top and bottom of the ingot mold respectively.

The cylinders are held a certain fixed distance apart to allow the ingot-mold to be introduced between them, when the rams are withdrawn. This is effected by heavy tie-rods, which are fastened to the lugs upon the cylinders.

The ingot molds are cast-iron, tapered and strongly reinforced with steel bands to withstand great pressure, and stand upon heavy movable cast-steel buggies, through the floor of which a short shaft transmits the pressure as received from the lower ram piston to the bottom of the ingot.

The upper ram over it is brought directly in contact with the metal in the top of the ingot, and merely acts as a buffer to the bottom ram which supplies the power for the actual compressing. The upper ram is slightly withdrawn from time to time as the ingot is pushed further into the mold.

The mold buggies are movable and run on an horizontal track which extends sufficiently far on either side of the presses proper to give plenty of standage room. In the case of the group-press there is standage room for a train of four molds quite clear of the presses.

The buggies are hauled along the track by means of an hydraulic operated conveyor until the correct position is attained under the press, where it is securely held by means of similarly actuated stops which come up through the floor.

The pouring platform, upon which the ladle and stopper men stand when pouring the heat, is situated at the side of this track slightly removed from the presses.

As mentioned, the empty mold is placed in its movable buggy and when ready to receive metal is moved to a position immediately next the pouring platform. As soon as the mold is filled with metal it is propelled into position immediately under the press, and the process of compression commenced. Each of the group molds is poured successively and compression commenced on each immediately it is in position under the press.

Once this position is attained a water spray is turned on to cool the top of the ingot and the top ram let fall to come in contact with the metal. The bottom ram is then brought into service and a pressure gradually increasing up to three tons per square inch of ingot bottom area is employed.

The total pressure upon the ingot in the case of 3-ton ingots amounts to 1,250 tons.

The length of time before full pressure is reached depends upon the size of the ingot, and may be taken as fifteen minutes for each ton of metal or, say, 45 minutes for three tons. The total time under press for these conditions is about two hours.

Connected with each of the press rams there is a system of cords connecting with and operating a pencil moving over the surface of a constantly rotated cylindrical drum. The vertical movements of the pencil show the contraction due to longitudinal shrinkage of the ingot, and thus a continuous time-displacement curve is obtained throughout the compression period. The pressure upon the ram cylinders may be read directly from pressure gauges, situated with the above-mentioned diagram, in front of the hydraulic controlling valves upon the press operator's platform.

It has been found that in order to produce steel of the best quality for ingots of a certain size, form and composition, a definite curve must be followed. Once this curve is obtained for any particular condition, it is only necessary to cause the pencil or pointer to follow it by regulating the pressure.

When the compression is finished, the bottom ram is withdrawn and the top ram brought into play, thus stripping the ingot. The mold is then removed in the ordinary way and the ingot taken to the ingot yard.

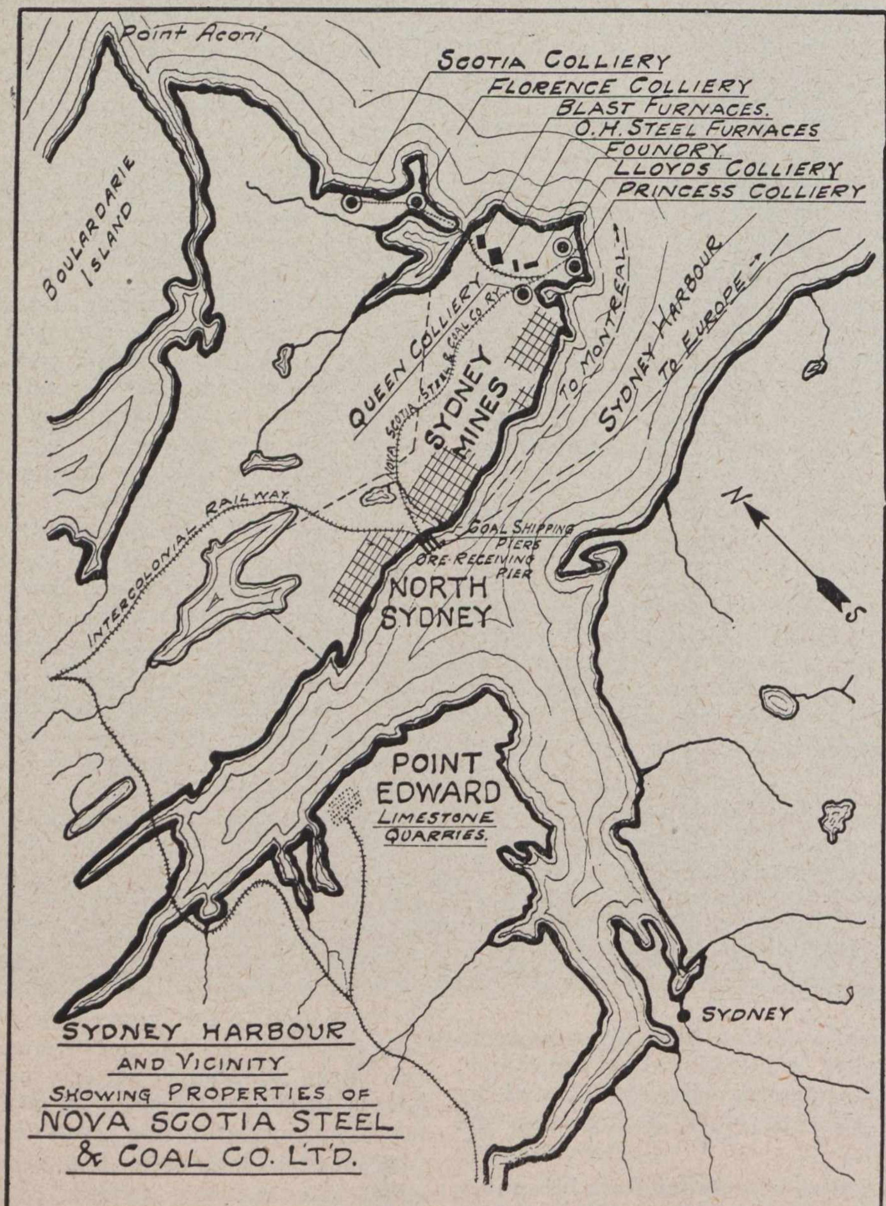
All the output of the compression plant is sent to the New Glasgow works of the company. The 3-ton ingots are there cogged into billets and then forged into railway car and locomotive axles and light forging or manufactured into special material in which the utmost reliability is desired.

The 5 to 25-ton ingots are used solely for making heavy forgings at Scotia's modern steam hydraulic forging plant at that place.

COAL MINES OF NOVA SCOTIA STEEL AND COAL COMPANY

Written for The Canadian Mining Journal.

When the General Mining Association secured the Duke of York's grant of all the minerals in Nova Scotia and inaugurated systematic coal mining in that province, it selected the Sydney Mines district to commence operations, on account of the excellence of its coal. In the eighty years of that association's history, it operated in nearly every district now worked in the province, but when absorbed by the present owners it held only the areas first mined, having retained these in preference to all others because of the superior quality of the coal. For steam, metallurgical, and general purposes this coal is regarded as equal to any other Nova Scotian product.



The "Scotia" Company hold altogether four different areas, which are estimated to contain over 2,500,000,000 tons of coal. These are the Sydney Mines land, Sydney Mines submarine, Boulardarie land, and the outer submarine areas. The first three areas run continuously from the north side of Sydney Harbour to the south side of the Great Bras D'or Lake, a distance of ten miles, while the outer submarine areas extend from Cape Dauphin to Cape Percy, forming a belt along the entire Cape Breton coal field. Within their areas of seventy-one square miles are supposed to occur every seam which exists in this district, the most important in the province.

The following table shows the different seams in the various areas, and the estimated tonnage in each as reported by the Canadian Geological Survey:

Boulardarie Land Areas.

Bonnar Seam, 6 ft.	2,300,000
Stubbert Seam, 8 ft.	11,500,000
Seam "C," 2 ft. 9 in.	7,100,000
Mill Pond, 4 ft. 6 in.	17,300,000
Black Rock, 3 ft.	20,200,000
Total	58,400,000

Sydney Mines Land Areas.

Lloyd's Cove, 8 ft.	8,400,000
Chapel Point, 4 ft. 2 in.	6,400,000
Sydney Main, 5 ft. 6 in.	31,600,000
Indian Cover, 5 ft. 6 in.	47,500,000
Collins.	44,100,000
Total	138,000,000

Inside Submarine.

Cranberry Head, 3 ft. 3 in.	5,600,000
Lloyd's Cove, 8 ft.	29,100,000
Chapel Point, 4 ft. 2 in.	16,100,000
Sydney Main, 5 ft. 6 in.	24,800,000
Indian Cove, 5 ft. 6 in.	24,800,000
Collins or Stoney, 5 ft.	22,500,000
Total	122,900,000

Outside Submarine—North Sydney Harbour.

Cranberry Head, 3 ft. 3 in.	69,700,000
Lloyd's Cove, 8 ft.	176,600,000
Chapel Point. 4 ft. 2 in.	100,800,000
Sydney Main, 5 ft. 6 in.	147,800,000
Indian Cove, 5 ft. 6 in.	147,800,000
Collins or Stoney, 5 ft.	134,400,000
Total	777,100,000

Lingan Section (Outside Marine).

Seam "A," 3 ft.	37,400,000
Car, 6 ft. 6 in.	81,100,000
Barrasois, 12 ft.	149,700,000
David Head, 8 ft.	100,000,000
Seam "D," 3 ft.	37,400,000
North Head, 4 ft.	50,000,000
Lingan Main, 8 ft.	100,000,000
Mullins, 6 ft.	75,000,000
Total	630,600,000

Glace Bay Section (Outside Marine).

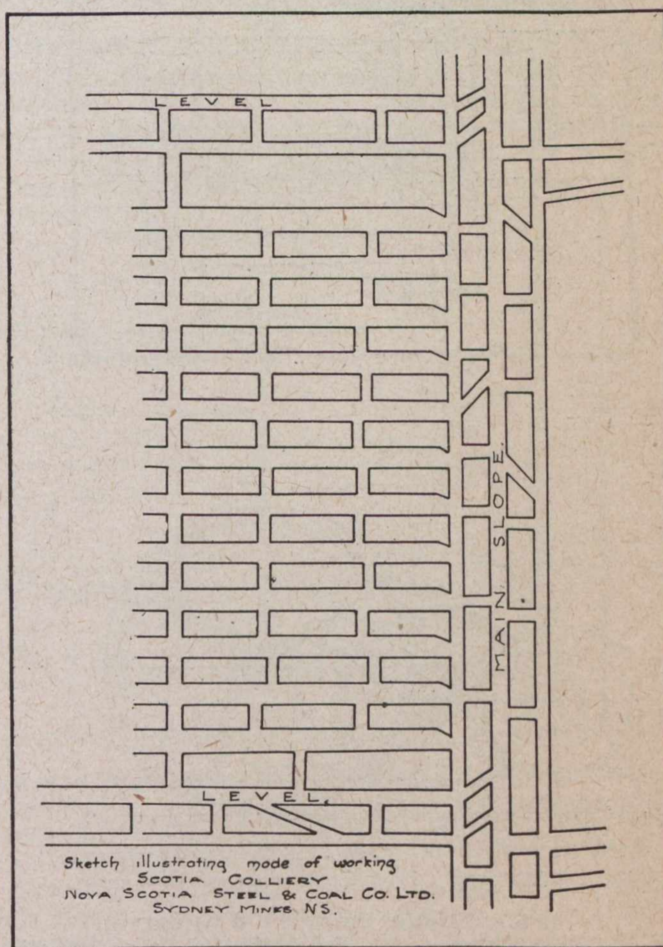
Hub, 9 ft. 5 in.	209,700,000
Harbour, 5 ft. 3 in.	115,900,000
Black Pit, 4 ft. 9 in.	104,700,000
Phalen, 8 ft. 3 in.	190,000,000
Ross, 5 ft. 6 in.	121,300,000
Lorway, 4 ft.	88,300,000
Total	829,900,000

Recapitulation.

Land areas	196,400,000
Inside marine	122,900,000
Outside marine	2,237,600,000
Total.	2,556,900,000

Only a comparatively small portion of these areas has been worked in the ninety years of mining at Sydeny Mines. Operations have been confined almost entirely to the southern part of the Sydney Mines land and submarine areas, collieries having been opened in the central portion of that district only within the last two or three years, while as yet not a pound of coal has been taken from the northern side or from the Boulardarie or the outer submarine fields. So extensive are these areas that a new mine could be sunk on them every year for twenty years.

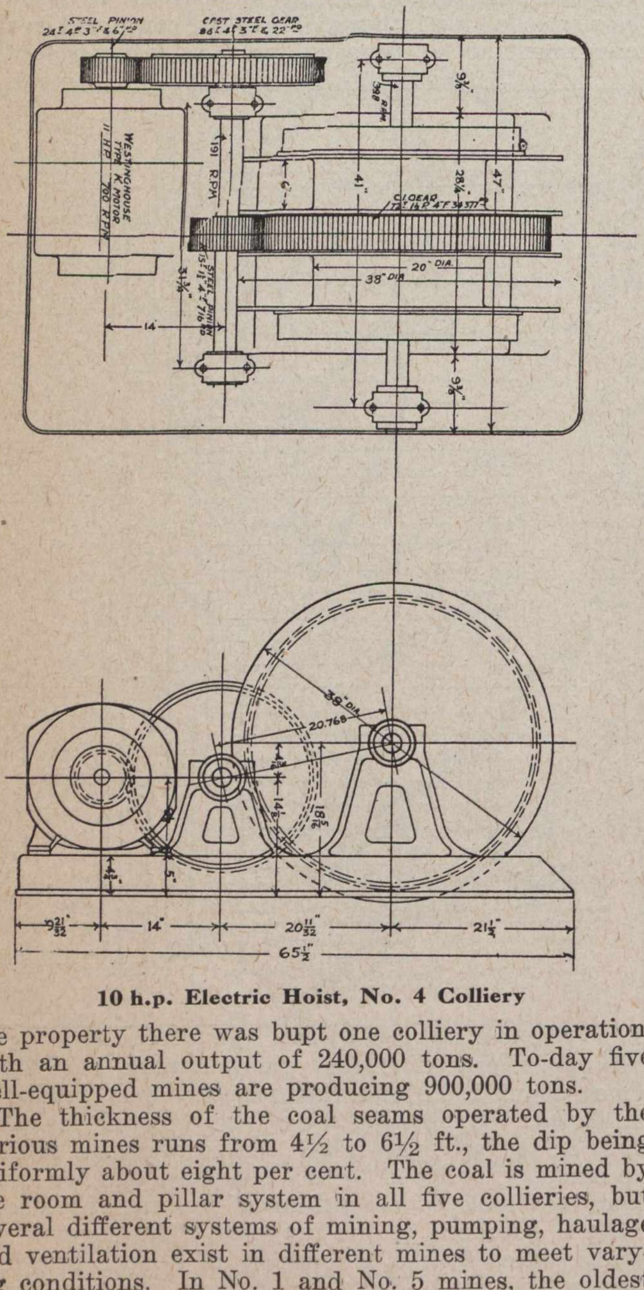
The history of the General Mining Association is closely bound up with the industrial development of the province. This company was organized in 1825 by Messrs. Rundall, Bridge and Rundall, of London, and secured a lease of all the minerals of the Province from the Duke of York, to whom they had been granted by his brother, George IV. Mr. Richard Brown, an eminent mining engineer and geologist, was sent out to develop the coal fields and in the eighty years of the General Mining Association's existence it had only two managers, Mr. Brown and his son, Mr. R. H. Brown, who succeeded his father in 1864, and continued in the management of the property until its transfer to the



present owners. The first pit was sunk at Sydney Mines about 1830, and this property was gradually developed. Operations were soon started in other parts of the province, which led to agitation against the monopoly enjoyed by this company, and for many years the "Duke of York's Lease" was one of the chief political questions of the province. The dispute was finally settled by the Government of Nova Scotia purchasing His Royal Highnes's interest in the minerals of the province, an arrangement being made with the General Mining Association whereby that company abondaned its holdings outside of Cape Breton, for which it received concessions in the way of rentals and taxation.

Various collieries were opened by the General Mining Association under the new agreement, at different points. The most important of these was the "Queen" pit, sunk in 1854, but subsequently abandoned and re-opened by the present management as Sydney No. 5 colliery, and the "Princess," or New Winning Pit, work on which was commenced in 1878, and which, as Sydney No. 1, is one of the chief collieries of the province. It took eight years to compete this mine, and its sinking called for considerable skill for those days, as the sea-water leakage was very heavy. This difficulty was overcome by lining the shaft with cast-iron tubing, and so well was the work done that no trouble has been experienced since.

Sydney Mines has been transformed since the General Mining Association went out of existence. When the Nova Scotia Steel and Coal Company took over



10 h.p. Electric Hoist, No. 4 Colliery

the property there was bupt one colliery in operation, with an annual output of 240,000 tons. To-day five well-equipped mines are producing 900,000 tons.

The thickness of the coal seams operated by the various mines runs from 4½ to 6½ ft., the dip being uniformly about eight per cent. The coal is mined by the room and pillar system in all five collieries, but several different systems of mining, pumping, haulage and ventilation exist in different mines to meet varying conditions. In No. 1 and No. 5 mines, the oldest of the collieries, the coal is mined by handpicks. Compressed air coal-cutters are used in No. 2 and No. 3, while electrical machines win the mineral in No. 4. Pumping, ventilation and underground haulage in No. 2 mine are done by compressed air, electricity being used for these purpose at No. 4, and steam generally at the remaining mines. The main haulage engines in all the collieries are operated by steam. No. 1 and No. 5 mines have vertical hoisting shafts, while Nos. 2, 3 and 4 are slopes. The workings of No. 5 and No. 1 merge; any water that enters the latter mine being allowed to run down the slope to the former pit, which is 3,000 feet away, to be handled by the pumping equipment there. The ventilating equipment at No. 5 also supplies air to No. 1.

No. 1 mine is situated near Cranberry Head, the northern boundary of Sydney Harbour, and has been working in the submarine areas for many years. Its workings are now over two miles from shore, 1,000 ft. below the ocean bed, and cover two thousand acres. There are separate haulage systems in the pit, an endless service in the south side, with over 25,000 feet of rope in service, and a plane haulage 7,200 feet long on the north side. About seven hundred men are employed underground, and the daily output averages one thousand tons. The surface plant here is the most extensive of any of the collieries, being used as a central plant for much of the operations of No. 2 and No. 5 mines. There are six Babcock and Wilcox boilers, three of which burn the waste gases from a battery of thirty Bauer coke ovens, the remainder being fired by a mixture of slack coal and coke breeze. The coal is hoisted with a direct-connected 36-in. by 60-in. engine with 20-ft. drum. The hoisting cages are in balance, each carrying two tubs of coal; on reaching the deckhead the tubs are run from the cages to a quick-reading platform scale, then dumped by a tipple on to a bar screen, which separates the coal into two sizes and delivers the screened coal to a combined picking belt and elevator, where it is picked and elevated to a sufficient height to load into 15-ton hoppers. The men are hoisted by a separate man-engine, equipped with both regular and safety brakes. The ventilating equipment is in duplicate, consisting of a Capell fan and a Walker Guibal fan, each supplying 120,000 cubic fee of air per minute. These are located at No. 5 mine, and ventilate both collieries. Compressed air is furnished at 80-lb. pressure by a Walker compressor, which supplies 4,000 cubic feet per minute. The water from the lower part of the mine is pumped to a pump near the pit bottom by a Duplex Northey and two Cameron pumps, and is handled from that point to the surface by a 600-gallon Janesville pump.

No. 2 colliery is equipped to produce 500 tons per day. The mining is done with compressed air machines, and the same power operates the ventilating equipment. The coal is hauled from the levels and headways to the haulage slopes by small engines. The compressed air is supplied from the No. 1 plant, and the haulage engine is also operated at the same point.

No. 3 mine is some two miles north of No. 1. Six hundred men are here employed, and the daily output averages one thousand tons. There are three parallel deeps which are now down 8,800 feet. One is used for haulage, the second for a travelling road, and the third for ventilation. Six 240 h.p. Sterling boilers supply steam for the various engines at this mine, and are equipped with forced draught fans to facilitate the burning of the wash-plant waste, black band and coke breeze used as fuel. Double-end, single-friction hoists haul the coal out of the levels and headways and an endless rope haulage delivers the coal tubs on the bank-head floor. The tipples, screens and picking belts are in duplicate, each set being capable of handling 75 tons per hour. The mine pumps are driven by compressed air.

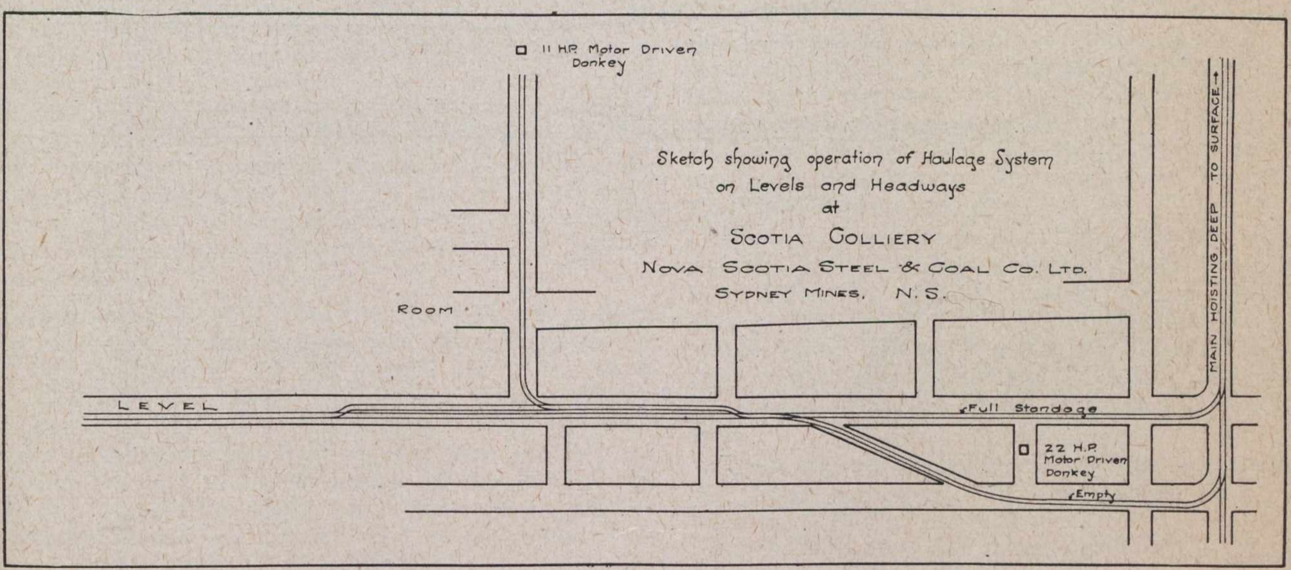
The remaining colliery, No. 4, was the last to be opened, and is one of the most interesting coal mines in the province. This is not because of its size or the magnitude of difficulties that were overcome, but because of its being electrically operated underground.

It is the only colliery in Canada in which mechanical appliances are utilized to the utmost and yet which does not contain a steam or air-pipe. All cutting of coal, haulage and pumping is done electrically.

Beyond this feature the equipment of this colliery is marked by its simplicity, and we commend to those interested in such matters the following account of the plant and operating methods, by which 1,000 tons have been mined per day, with a minimum capital investment and low working cost.

No. 4 Colliery

Situation.—No. 4 Colliery, or, as it is now known, the "Scotia," is situated about three miles to the north of No. 1, or "Princess" Colliery, and was opened in 1906 to work that portion of the coal areas held by the company lying between the Little Pond and the Little Bras D'or Gut.



The seam worked is tht famous "Old Sydney Main," and the coal is won by means of a slope following the seam from the outcrop and extending downwards on the full dip in an easterly direction.

Three slopes are driven in the coal, the main or haulage slope being twelve feet wide, and two companion slopes ten feet wide, which are used for travelling and ventilating purposes.

Surface Plant.—The colliery is operated on the most approved mining methods, and is fully equipped with the most modern and up-to-date appliances for coal-getting, hauling, pumping, ventilating, screening and lighting, signaling and telephoning.

Boilers.—The boiler plant consists of five Matheson return-tubular boilers, each of 175 h.p., and one Lancashire boiler, 28 ft. x 7 ft., all hand-fired, and carrying 80-lb. pressure, with natural draft.

Generators.—The electrical equipment consists of two Crocker-Wheeler generators, each of 100-k.w., 275 r.p.m., 275 volts, direct-driven by Robb-Armstrong engines, cylinders 15 in. x 16 in.

An ample switchboard contains the necessary meters for recording output and consumption, cut-outs, switches, etc., for controlling and distributing the current to the many points where it is used.

Main Haulage Engine.—The main haulage engine is self-contained, and consists of a pair of 16 in. x 24 in. cylinder, geared to a shaft carrying two drums each six feet in diameter and thirty inches wide. The spur-wheel is eight feet in diameter and the drums each carry 5,000 feet of 7-8 steel wire rope, which hauls the coal from the various levels in the mine to the surface. An output of 135 tons an hour can be easily handled.

Fan.—The mine-ventilating fan is of the type known as the "Sirocco," 54 inches diameter and 60 inches wide, running at a speed of 300 r.p.m., and circulating 48,000 cubic feet of air a minute, with 1 6-10 inch water gauge, and capable of producing 150,000 cubic feet a minute with five inches W. G.

The fan is belt-driven by a Robb Automatic engine 12 in. x 14 in., 150 r.p.m., the belt pulleys being in ratio of 2 to 1.

Screening.—The screening plant consist sof a Browne Machine Company tipple, which, revolving on its longitudial axis, discharges the coal out of the pit tubs on to an ordinary fixed straight bar screen, over which it passes on to a Matheson picking table, 5 feet wide, travelling at a speed of 50 feet a minute, allowing ample time to pick out any stone and impurities that may have been filled among the coal.

The slack coal passing through the bars of the screen falls into a hopper across the bottom of which a belt runs which carries away the slack and discharges it into standard railway cars. The front of the picking table is movable, and can be raised and lowered as the loading of the car proceeds, so as to minimize breakage in loading.

Workshop.—Ample and commodious workshops are conveniently placed and well equipped with forges, lathes, drills and tools of all kinds, suitable for effecting general repairs at the colliery, heavy undertakings being done at the general machine shop of the company.

Warehouse.—The warehouse contains a large amount of material, such as is used in connection with the colliery, while any unusual demand can be met by calling on the general warehouse centrally located to the other collieries and works, a few miles distant.

Lamphouse.—Safety lamps being in use exclusively by the workmen employed underground, a suitable and commodious lamphouse is placed close to the entrance to the mine, where all lamps are cared for, cleaned and repaired. There are 375 lamps in use.

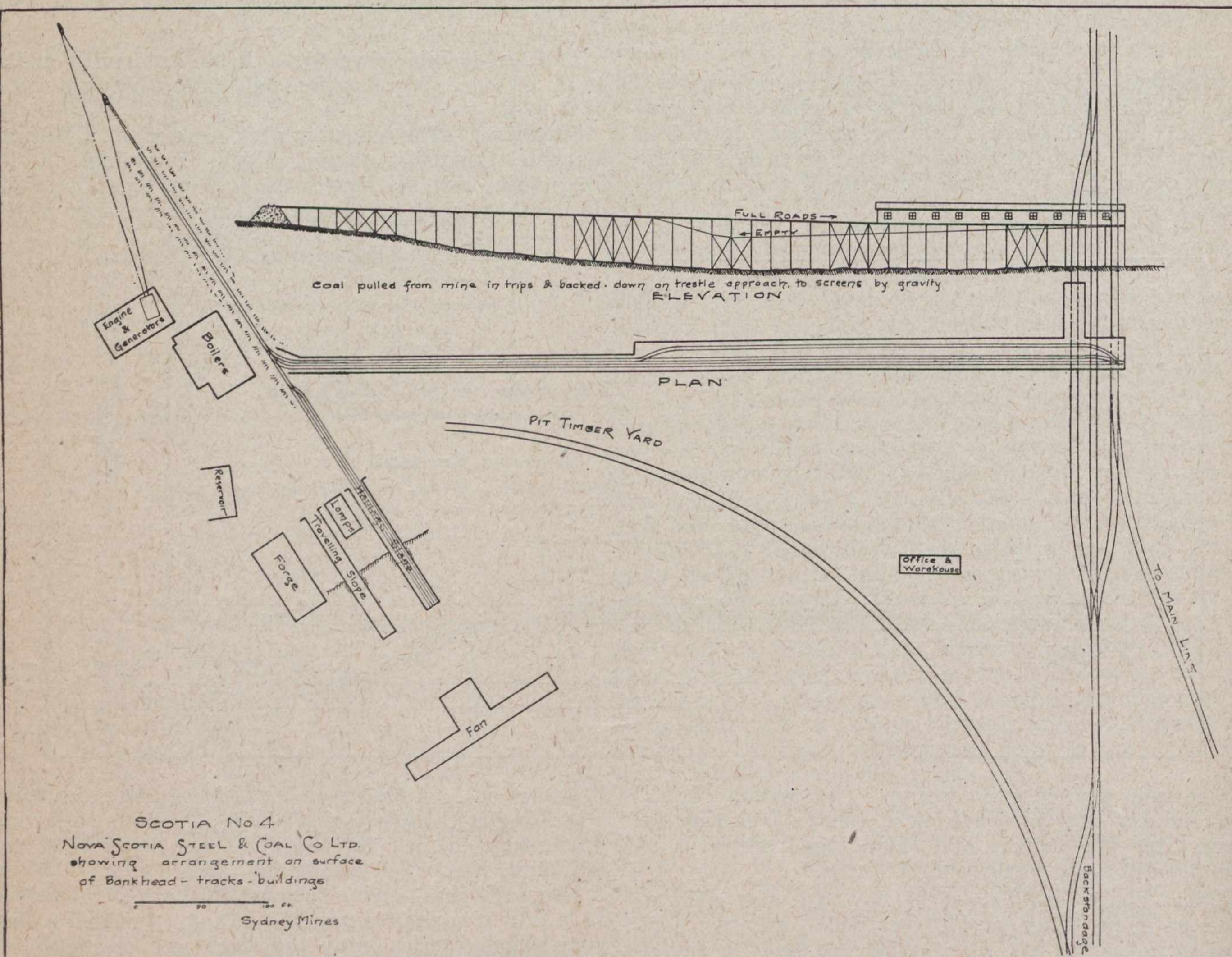
Steam is used only to operate the main haulage in bringing the coal from the various levels underground to the surface, to run the generators and the fan; all other operations, both under and overground, being carried on by electric power.

Mode of Working.—The method of working, which is shown by the accompanying sketch, is what is known as the bord and pillar, and in developing the mine, three slopes are driven down to the dip, and at intervals of 600 feet, pairs of levels are broken off at right angles. As these levels proceed, headways are driven up to the rise, at intervals of 300 feet, having a course parallel to that of the main deeps. From these headways, rooms are broken off, and driven parallel to the levels. The width of the levels and headways is 14 feet, the rooms being 20 feet, while in two sections the rooms are worked to a width of 40 feet, with two tracks.

Coal-cutting machinery is applied to the fullest possible extent in mining the coal, two types of machine being in use. The equipment consists of four "Sullivan" longwall chain machines, and 24 pneumelectric machines of the puncher type. The chain machines have given great satisfaction, and can easily cut an average of four rooms a shift, while on a test, seven rooms have been cut.

The puncher machines cut an average of two rooms a shift, the depth of undercut being from 5 to 6 feet.

Timbering.—In timbering the main deeps and landings, booms 16 ft. x 7 in. diameter at small end are used. The method employed in putting them up is described as "stay" and "sancker." It consists of a hole cut in one wall, into which the thin end of the boom is placed, and a recess cut into the opposite wall, which affords a rest for a short prop, which is driven hard home to tighten the boom.



On the levels and headways and at the faces, 8-foot or 10-foot booms are used, commonly put up with two props, and in the ordinary roof in the workings, props 5 inches diameter and caps 2 feet long are used.

Track.—The main deep and landings are laid throughout with 28-lb. rails, with a track gauge of 30 inches. The main deep is double-tracked from the surface down to the fourth level. All levels and headways and all other tracks in the exterior of the mine are laid with 18-lb rails.

Haulage.—The pit tubs or boxes in use in the mine carry an average weight of about one ton of coal, and with the exception of the short haul between the working places and the headways, which never exceeds 300 feet, the hauling of the whole output is effected by mechanical means.

At the entrance to each level, a small electrically-driven donkey engine is placed, which operates an auxiliary endless haulage on a single track, which brings the coal from the foot of the headways to the standage where the main haulage trips are made up.

Near the top of each headway, a smaller electrically-driven engine is placed, which, by means of a plain drum and length of ½-inch rope, hauls the empty boxes from the level up to the room ends and lowers the full boxes down by gravity to the same point.

At the foot of each headway, on the level, sufficient standage is provided on the high side to accommodate 10 or 12 boxes.

The tubs are raised and lowered singly on headways, while between the headways and the main deep standage the coal is conveyed by the endless rope in trips of 8 to 10 boxes.

The question might arise as to the possibility of working these sections by the back-balance method, but it has been demonstrated that the pitch of our seam, five degrees, is not sufficient to make it a success. The necessity of a balance of comparatively enormous weight and consequent size with its accessories making it a formidable and expensive method in comparison with the present system, where the only difficulty is the removal and setting up of the engine upon the completion of a section. It can be readily seen from the accompanying sketch of this 14h.p. machine, which weighs only 3,200 lbs. and is of very compact design, that its loading upon a tram and removal to and installation in some other location is of little or no account.

In following the coal from the face where it is filled into the boxes by the loaders, who work in pairs, the full box is "pushed" by the loaders out to the headway, and delivered to the chain-runner, who, in return, delivers an empty box to the loaders. While the loaders are pushing the empty box to the face, the full box is being lowered to the standage at the foot of the headway and another empty box picked up and hoisted to another room end, the process being repeated as long as coal is available at the faces.

When the trip at the foot of the headway has been made up, the level trip-runner moves it out over the endless rope on the track and attaches it to the rope by means of the ordinary screw-grab, and follows his trip out and delivers it on the full road of the standage for the main haulage. He then picks up another empty trip on the empty road of the standage, attaching the same grip used on the full trip outward to the ingoing portion of the endless rope and goes in bye for another trip.

The standage for the main haulage consists of two separate roads, the two levels being used for that purpose. The low level is used for the empty trip, and the upper level for the full trips. The lower level is driven and graded to facilitate the running of the empty trips, while the upper level is also graded to allow the full tubs to run out close to the deep, and facilitate hooking on to the rope.

There are seven landings or levels in operation, all of which are connected by telephone with the surface, and as each landing tender makes up his trip of 15 to 18 boxes, he at once calls the boss at the upper landing, who directs and controls the haulage, and gives each landing their turn.

Following the main trips from the landing to the surface, the two tracks in the upper portion of the hoisting slope converge at a point a short distance above the mouth of the slope and here the full trip is brought to a stop and gently allowed to back down over a trestle leading to the screening plant.

On reaching a given point the trip is stopped, the rope detached and hooked on to the empty trip standing in readiness, and is hoisted back again to the same point, and lowered into the slope, another full trip being hoisted at the same time.

As has already been stated, an output of 135 tons an hour can be easily handled.

The full trip having been left standing as aforesaid, the tubs are uncoupled and passed singly on to the scales, where they are weighed and passed on to the tipple, where they are emptied on the screen, the coal passing down on to the picking table, as has already been described.

The accompanying sketches show the arrangements for receiving and despatching the trips on the bankhead at surface, also main deep landings, and auxiliary haulage landings on levels and headway turnouts.

There is no limit to the number of headways that can be operated on one level by means of the endless rope single-track system, but in practice it has never been found necessary to have more than three headways in operation at any one time, for by the time a level has been extended far enough to permit a fourth headway being driven, the first headway opened out would be worked out.

The small haulage engines in use underground consist of a pair of drums 20 inches diameter by 6 inches face, driven by a Westinghouse, type K motor of 11 h.p., at 700 r.p.m. through double reduction gearing. Motor pinion having 24 teeth, 4 pitch and 3-inch face. Intermediate pinion 15 teeth, 1½-inch pitch, 4-inch face; drum gear, 72 teeth, 1½-inch pitch and 4-inch face.

These engines are in some cases, as when operating the levels, equipped with two motors, thus bringing them up to 22 h.p. capacity.

Some have only one drum fitted, while others have a small bull-wheel fitted on one drum, and can thus operate both an endless haulage rope and a plain haulage rope at the same time.

Pumping.—All the water met with in the mine is pumped to the surface by electrically-driven pumps. In the sinking of the main deeps, considerable quantities of water had to be dealt with, due to the upper portion of the mine underlying a bog.

In the initial stages of development, with a minimum quantity of water to handle, against an ever-increasing head of water, small pumps were used, which, however, required frequent shiftings as the deeps receded from the surface.

As the work progressed and levels were opened out, pumps had to be multiplied and temporary lodgments made to overtake the ever-increasing burden, until a suitable point was reached at which some permanent provision could be made for dealing with the water.

To add to the trouble of unwatering the mine, numerous "dishes" or "lags" were encountered as the mine was opened out, into which the water always found its way, and necessitated the placing of numerous small pumps at as many different points all over the mine.

A large permanent lodgment has been made ot the No. 6 south levels, which in a short time will be greatly enlarged, and be sufficient to contain several months' water, and at this point a borehole 8 inches in diameter has been put down from the surface through which the water is pumped, thus doing away with a long line of 3,000 feet of piping to the mouth of the slope. The borehole is 225 feet in depth.

All the water made in the mine above this point, which includes most of the wet ground, finds its way to and is diverted into this lodgment, while all that makes below that point is pumped up and discharged into the standage and pumped to the surface.

All the other pumps in use draining water out of the aforementioned "lags" discharge their water at suitable points where it flows down hill to the lodgment.

The small service pumps, three of which are in use, are all Duplex, water ends $3\frac{1}{4}$ in. diameter by 6 in. stroke, driven through a hardened steel worm, working into a bronze gear. The worm is one-inch pitch, three-inch lead triple right-hand thread 4.08 in. outside diameter, the wheel having 42 teeth, 1 inch pitch, $14\frac{1}{4}$ in. diameter.

The pump is driven by a 5 h.p. Electric Dynamic Company interpole motor, type 3S., running at 1,000 r.p.m By means of worm and worm-gear there is simply a single reduction in this speed.

At No. 3 level, is installed one 5-stage turbine pump, made by Gwynne, Limited, London, England, having a capacity of 250 gals. a minute, against a pressure of 125 lbs. per sq. in. at 1,400 r.p.m., driven by a British Westinghouse 45 h.p., 240 volt, direct-current motor.

At No. 5 level is installed a $2\frac{1}{2}$-in., 4 stage Worthington pump, having a capacity of 100 gallons a minute, against a pressure of 100 lbs. per sq. in., direct-connected to 20 h.p. type M-S-3 Lundell, 240-volt, direct-current motor, running at 1,200 r.p.m.

At No. 6 level, where the permanent pumping station has been located, and large lodgment prepared, a temporary pump has been installed, while the permanent work is being completed.

This pump is an 8-in. x 10-in. Triplex, made by the Canada Foundry Company, having capacity of 125 gallons a minute, against a head of 295 feet, driven by a 50 h.p., 800 r.p.m., 240-volt Canada General Electric motor.

The permanent pump now being installed is as follows:—

One 4-stage, Rees Raturbo pump having a capacity of 500 gals. a minute, against a head of 295 ft. when running at 1,400 r.p.m. This pump is coupled to a 70 h.p., 240-volt direct-current motor, made by the same company.

There are also in operation two 4-in. x 6-in. brass fitted triplex horizontal single-acting mine pumps, driven by 5 h.p., 240-volt, direct-current, Allis-Chalmers-Bullock motor, and in the main and back deep sinkings, two Dean Triplex pumps are used.

Lighting.—Electrical energy being distributed so generally throughout the mine, a most liberal application of the same has been directed toward the lighting of the mine, and at all points where coal is being assembled, the operations are greatly facilitated by the excellent light provided.

On the main deep, at all the main landings, on both full and empty roads, along the levels at the foot of the headways, and at all standages, electric lights are installed, which relieve the gloom and should play an important part in reducing to a minimum accident to life and limb, where so many boys and men are employed among swiftly moving tubs and trips.

As has already been stated, safety lamps are in exclusive use in the mine, no open lights now being permitted underground.

Signals.—In connection with the main haulage, and

The type of lamp in general use is the "Marsaut", which has been found to be reliable and give fairly good light.

on the levels where the auxiliary haulages are in operation, electric signals are in general use, while a complete telephone system connects all the main landings and the surface together, and by these means the whole system of haulage is under complete control.

General.—The general surface arrangement is such that there is no crowding, and ample room is provided for extension in any direction, while the yard affords ample room for the storage of timber and all bulky materials, and ample scope is available for disposing of waste material of all kinds from the mine and the screening plant.

The railway accommodation is of the most perfect kind, the sidings being long and providing good standage for a largeoutput.

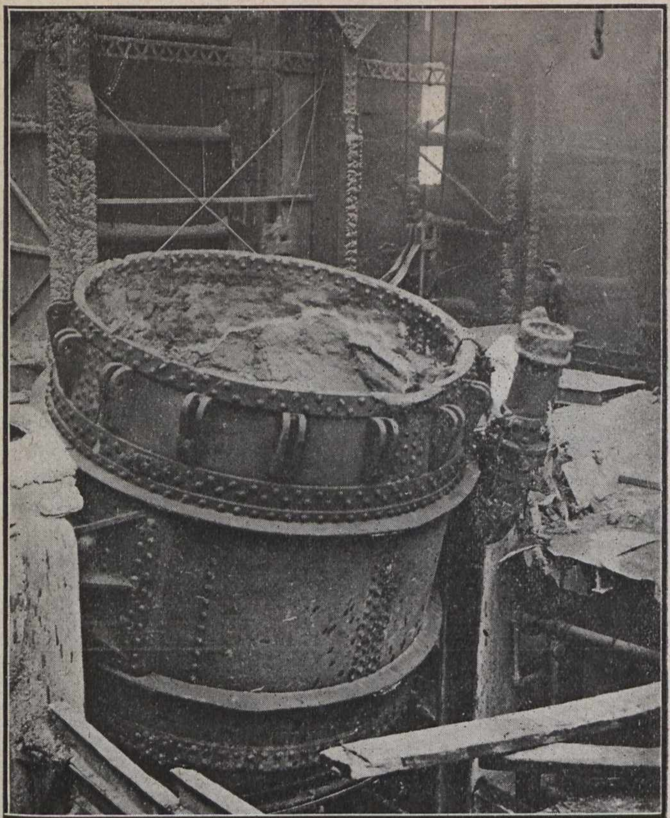
The tracks are well-laid and well-graded, and no trouble is experienced in moving single cars or whole trains, such operations being conducted with a minimum of cost.

The whole of the plant is of a substantial and serviceable character, having nothing superfluous or ornamental about it, but designed and laid out to meet the requirements of the colliery in a combination of efficiency and economy.

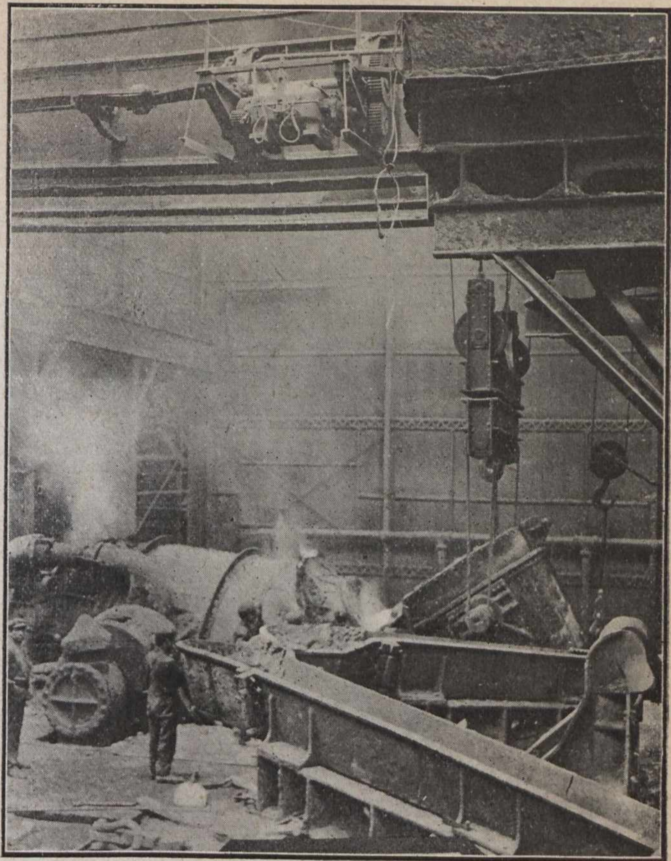
THE DUPLEX PROCESS AT SYDNEY, N.S.

By A. P. Scott, Superintendent Steel Dept., Dominion Iron and Steel Co., Ltd., Sydney, N.S.

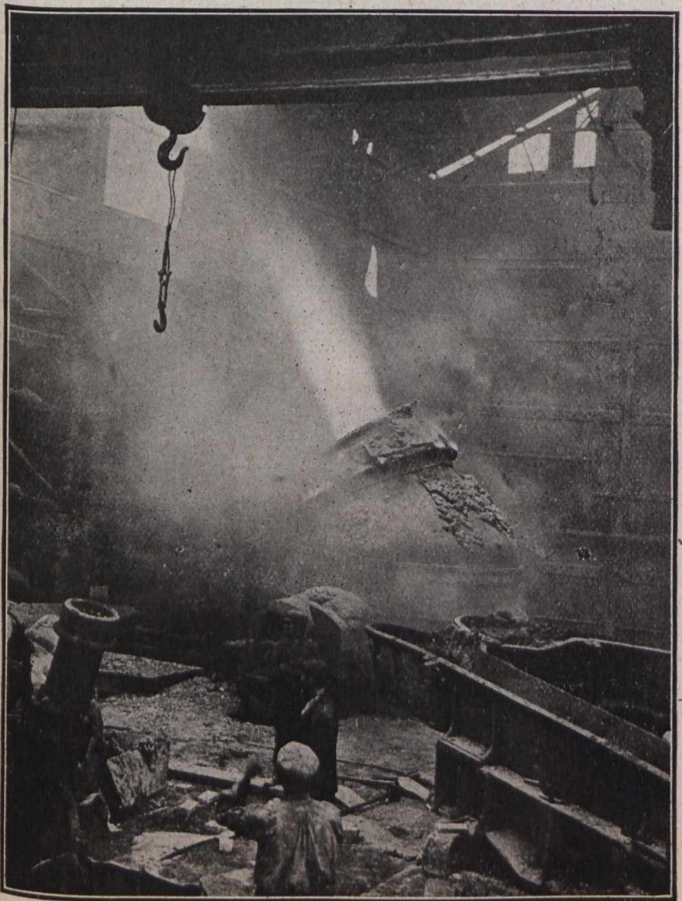
The gradual exhaustion of the world's supply of low phosphorus iron ores, and the necessity of depending for steel upon an almost unlimited supply of ores whose phosphorus content is above the Bessemer limit, have been primarily responsible for the development in the last quarter century of the Basic Open Hearth Process, by which by far the greater part of the world's steel tonnage is now produced. This process—beautiful in its simplicity, and in its perfect adaptability to almost any metallurgical problem within its range, has, nevertheless, especially as compared with the extremely rapid Bessemer Process, the disadvantage of slowness: the basic open hearth furnace can make good steel from almost anything in the way of stock, but it takes time, a fifty-ton heat requiring from eight to fourteen hours, depending upon the character of the raw materi-



Converter Turned Up—With Bottom Off For Relining.



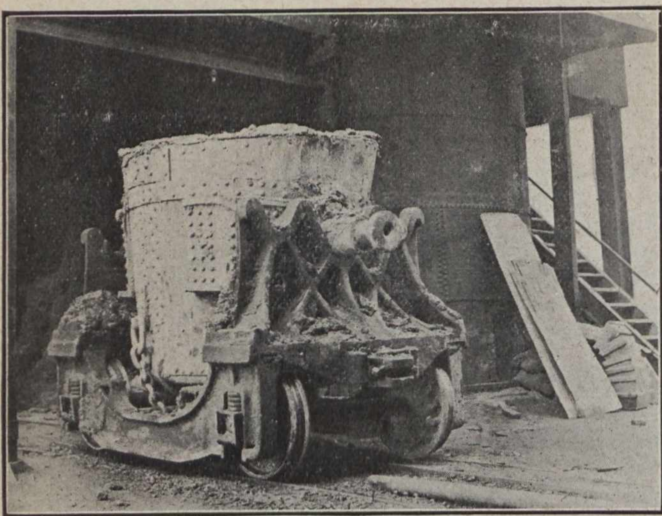
Charging Converter.



Silicon Flame—Regular Blow.

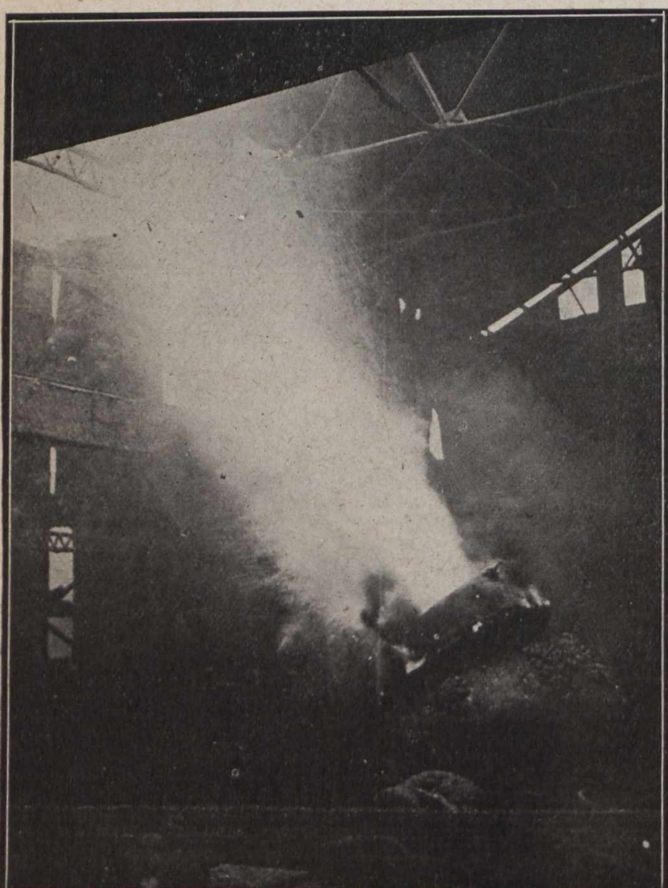
Blowing in a New Bottom.

als, whereas, by the Bessemer Process, ten tons of fluid pig can be converted in as many minutes. It is also true that the open hearth yields more steel per ton of pig iron used than does the Bessemer, because the ore employed in the former contributes a large part of its



Hot Metal Car.

metallic content to the bath, and avoids certain mechanical losses that are almost inevitable in a pneumatic process. It is only natural, however, that the ironmaster, forgetting the merits of the straight basic

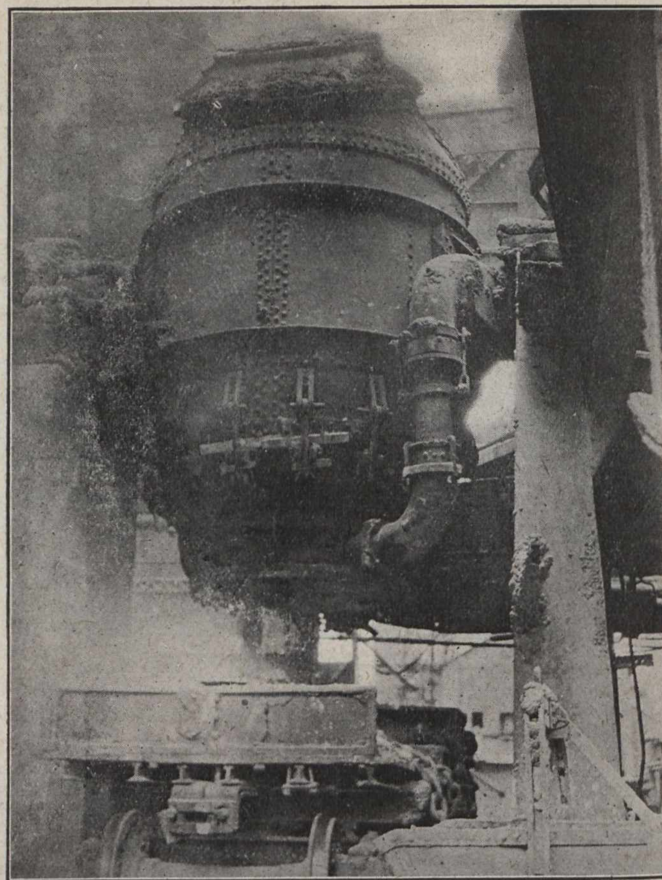


Carbon Flame—Regular Blow.

open hearth process, should have chafed at its one defect and attempted every sort of remedy. The majority of such attempts have, of themselves, been failures; others, of which we may mention the Hoesch, Bertrand-Thiel, Talbot and Duplex Processes have met with some measure of success.

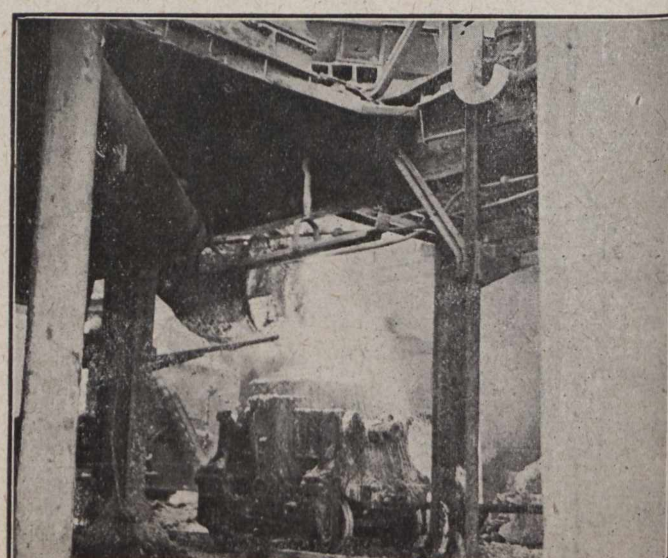
General Considerations.

The Duplex process, which has been developed almost exclusively on this side of the Atlantic and



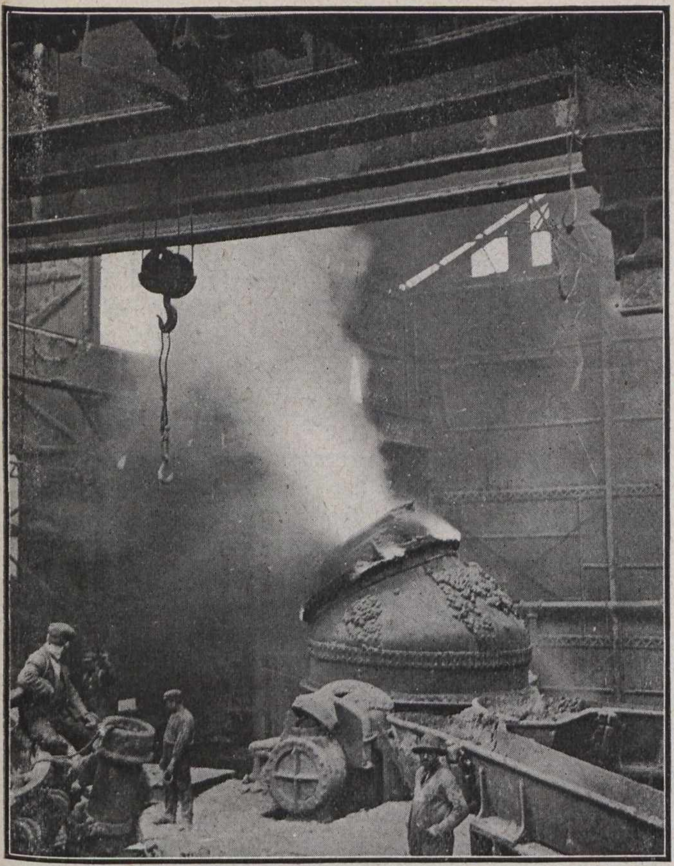
15-Ton Basic Bessemer Converter.

within the last few years, is the result of an endeavour to combine the rapidity of the Bessemer Process with the elasticity of the Open Hearth Process and the ex-



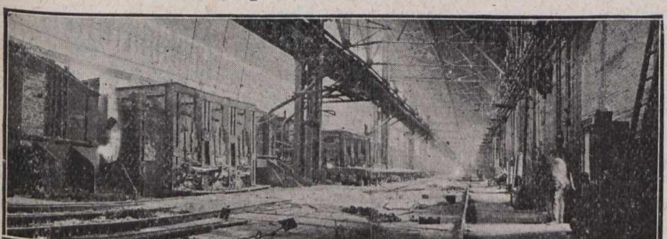
Pouring Blown Metal Into Hot Metal Car.

cellence of the Open Hearth product. This is done by desiliconizing and more or less decarburizing pig iron in the acid Bessemer converter, and thereafter transferring the blown metal to a basic open hearth furnace, where phosphorus is removed and the refining completed, the combined operations from start to finish, occupying an hour or two, as against the period already



After Blow—Regular Blow.

given as necessary for an open hearth heat. Such a Duplex Process is in successful operation at the Ensley plant of the U. S. Steel Corporation; at Sparrow Point, Maryland; at Steelton; at the Saucon plant of the Bethlehem Steel Corporation, and elsewhere. At cer-



Charging Side—Basic Open Hearth

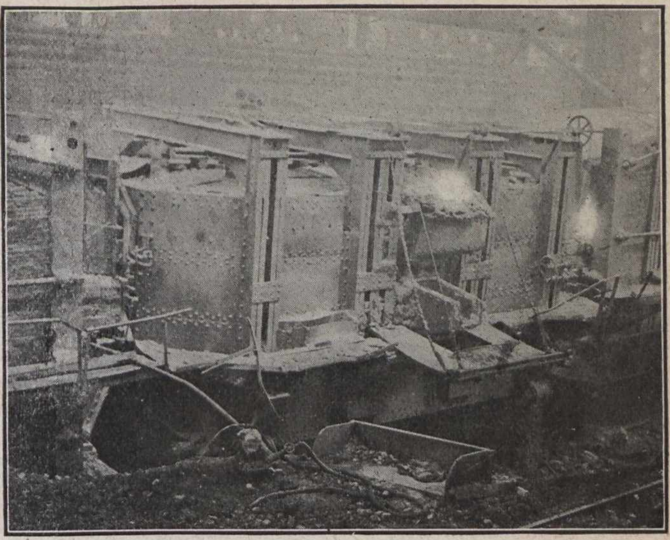
tain plants duplexing is resorted to only at such times as orders and prices for finished material warrant increased ingot production, under some conditions, undeniably increased cost. Again, rather than build additional furnaces, it may be considered desirable to boost open hearth tonnage by duplexing with existing Bessemer plant that would otherwise lie idle. Aside from such special cases, the economy of duplexing as against open hearth practice is essentially a function of pig iron cost, of the scrap market, and, to a lesser extent of the price of fuel and open hearth ore.

Dominion Practice.

The blast furnaces of the Dominion Steel Corporation, with an all-Wabana burden, produce basic iron of the following typical analysis:—

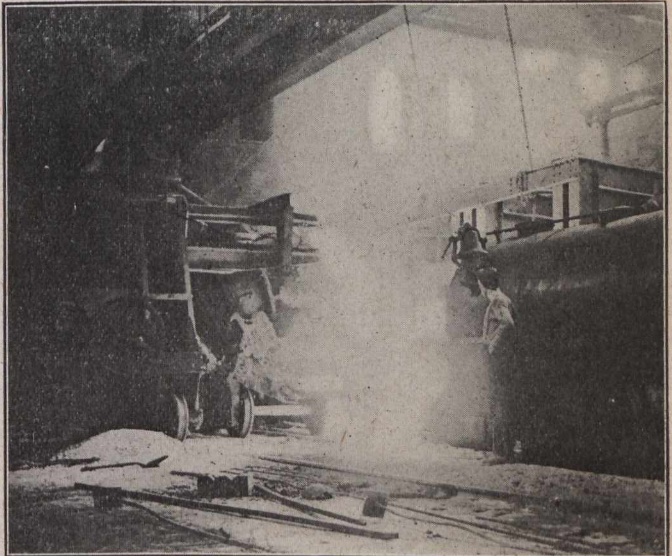
Total carbon	4.25
Silicon	1.00
Sulphur	.05
Phosphorus	1.50
Manganese	.20

practically the entire make, at the present moment, being converted to ingots. The steel-making department



Tapping Side—50-Ton Basic Open Hearth.

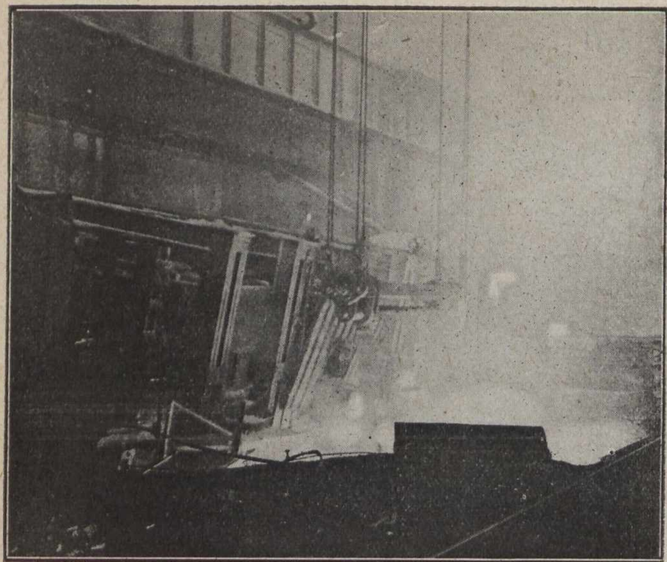
comprises one 200-ton metal mixer, two 15-ton Bessemer converters and ten 50-ton basic open hearth furnaces of the Campbell tilting type. Furnaces No. 2 to No. 10, inclusive, are operated according to the straight open hearth process. Furnace No. 1 is operated, in conjunction with the Bessemer plant, in the duplex process; but whereas the process in use at Ensley, etc., may be



Charging Blown Metal Into 50-Ton Basic Open Hearth.

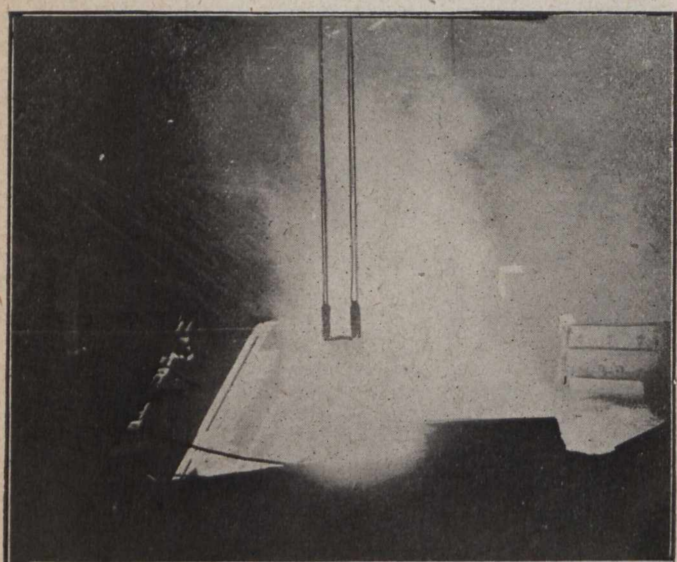
termed "Acid duplex," the Dominion Steel Corporation combines the basic Bessemer and the basic open hearth, so that the Bessemer blow removes not only silicon and carbon, but phosphorus as well, and although some portion of the refining is reserved for the open hearth, the latter functions rather as an equalizer and deoxidizer.

When duplexing was first introduced at the Dominion Works in May, 1907) an Acid Bessemer lining was used, with results which, though gratifying, were still considered somewhat short of the possibilities and it was determined to try blowing on a basic lining. This was a somewhat daring step in view of the fact that at least 1.80—2.00 per cent. of phosphorus is usually considered the low limit in basic Bessemer iron; however, Mr. F. W. Harbord, the distinguished English metallurgist, pronounced the scheme a metallurgical feasibility, the



Tapping a 50-Ton Furnace.

necessary lime bins and charging and mixing machinery were accordingly installed, the mica schist lining of the acid vessels was changed to one of stamped dolomite and tar, and basic Bessemer blowing was begun without the smallest hitch, and is regularly carried on at the present time. As a result the average monthly ton-

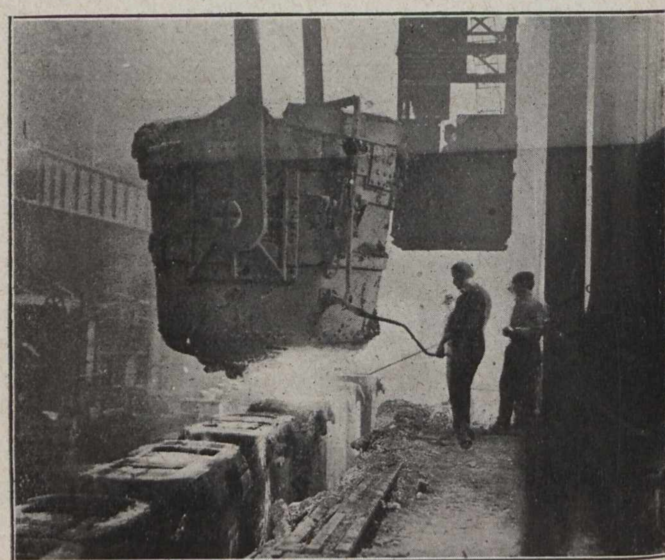


Recarburization in 50-Ton Ladle.

nage of ingots has mounted above the 30,000 mark as against a former average of 24,000 or less.

The Bessemer Lining.

The converters are lined throughout with stamped dolomite and tar. The dolomite, which must be the purest, is from the quarries of the corporation, at George's River, C.B., and burned at the steel plant in natural draft kilns, using coke for fuel. Carefully selected portions of the calcined material are ground to pea size, and thoroughly mixed with 10 to 15 per cent. of anhydrous tar (one of the by-products of the Corporation's coke plant) in a steam-heated mixing machine of special design, the greatest care being taken to exclude moisture. The lining is rammed up in three separate parts, the nose, the bottom, and the vessel proper. For lining the vessel proper, a hollow cast iron core in three sections is centred within the shell, which during relining remains suspended in its housings. Into the space between shell and core the hot air and dolomite mass is rammed with heated rammers. A wood fire is then lighted within the core and the lining thoroughly baked. Ramming and baking must be performed with the most scrupulous care, or the life of the lining will be seriously curtailed. Bottoms are rammed up in the conventional way (see Harbord and Hall, "The Metallurgy of Steel, 1911," p. 58 et seq.) a large number of baked bottom plugs being kept constantly on hand. Under Sydney practice twenty to twenty-five heats are obtained from one bottom and 180 to 200 on a lining, the bottom being renewed when necessary by



Teeming Ingots From 50-Ton Ladle.

means of an hydraulic jack tar, run beneath the vessel. From forty to forty-five hours are required for lining the vessel, all ofwhich must be conceded to be extremely good basic practice.

The Blow.

From 2,600 to 2,800 pounds of burned lime are charged into the empty converter, and on this about eleven tons of fluid pig iron from the metal mixer. The blast is turned on (at 18 to 20 pounds pressure, the tuyere plate having seventy-three ¾-inch holes) and the vessel turned up. Silicon and carbon flames, the "boil," the "drop," and the "after blow" (timed to two minutes' duration, more or less, according to the iron, the age of the lining and the condition of the bottom), follow in that order, and the vessel is turned down. The slag is then skimmed into a cast iron box car, and the metal thereafter poured into a ladle and transferred to the open heart shop. The entire basic blow occupies from twelve to fifteen minutes.

During the after-blow the phosphorus is oxidized to phosphoric acid and retained in the slag as calcium phosphate. If this stage of the operation be unduly prolonged, the iron of the bath becomes oxidized, and a replacement of phosphoric acid by iron oxide appears to take place in the slag, with corresponding reversion of phosphorus into the metal. If, on the other hand, the after-blow be cut short, the phosphorus is only partially removed. It will be seen, therefore, that the blower's task is no mere matter of routine, but requires the constant exercise of good judgment and unremitting watchfulness as to lining, raw metal, flame and slag. Under good average practice the blown metal at Sydney contains:

	Per cent.
Carbon	.03
Phosphorus	.07
Sulphur	.05
Manganese	None

and the slag is constituted as follows:—

	Per cent.
Silica	13.0 to 14.0
Alumina	1.00
Lime	48.0 to 51.0
Magnesia	2.0 to 4.0
Phosphoric acid	17.0 to 19.0
Manganous ovide	1.5
Iron Protoxide	13.0 to 15.0

Open Hearth Treatment.

The open hearth furnace, "patched," if necessary, after the previous heat, receives three or four charging boxes of burned lime (in all, perhaps, four thousand pounds) and from six to eight tons of molten mixer metal. The silicon of the iron is oxidized to silica, which, with or without addition of fluorspar, combines with the lime to form the necessary slag. Five pots (the product of five blows) of Bessemer metal are then charged as rapidly as they can be had from the converters, and shortly thereafter the heat is ready for tapping. The six to eight tons of mixer metal above mentioned is so calculated as to give sufficient carbon for the "reboil" (which effects complete deoxidation of the blown metal and produces a true open hearth steel) and for as close an approximation as possible to the carbon desired in the ingot. Excess carbon is removed by ore addition, and carbon shortage is made up either with pig iron in the furnace, or with coke in the ladle. Ferro manganese and other desired alloys, are added in the usual way. The whole operation, from the first pot of metal to the tap, occupies only from two to two and a quarter hours, as against eleven to twelve and a half hours, the time normally required for a straight open hearth heat. Labour and fuel cost thus become extremely low, and ore cost is practically eliminated: brick repairs are also somewhat lower, because the duplex is always hot, instead of being subjected to the alternate heating and cooling necessitated by the direct process.

A by no means insignificant factor in the economy of the basic duplex process above outlined is the revenue from the Bessemer slag, which, when ground and prepared by the Cross Fertilizer Co., of Sydney, appears on the market as "Scotia Basic Slag" (Thomas Phosphate Powder) and is a most valuable fertilizer, practically the entire phosphate content being "available."

TORBROOK IRON DEPOSITS

The Development of the Torbrook Iron Deposits by the Canada Iron Corporation, Limited.

The territory embraced by the titles of this company extends practically from the county line between Annapolis and Kings counties westerly to the Nictaux River, a distance of over five miles, and has a width throughout its entire length of one and one-eigthth miles. This district may conveniently be divided into two sections, namely, the north and south section. The veins of iron ore run nearly east and west. The north section contains the outcrop of three veins of ore and the south section the outcrop of two. The outcrops of the north and south sections run parallel to each other. We have every reason to believe they form the upper edge of a syncline of continuous veins of ore, that is, the outcrop on the north dips under the intervening valley and outcrops again in the south section along the edge of the south mountain. The northern outcrop has been prospected very extensively. The eastern end of the outcrop has been exploited by the workings of the Leckie mine and by numerous drillings and surface pits. The Leckie mine on the Hematite vein was operated by an incline shaft to a depth of 350 feet, levels being broken off 50 feet apart and extending east and west many hundred feet. These workings have produced 350,000 tons of merchantable ore, averaging 51.1% Fe.

About one mile west from the Leckie mine a test pit was sunk 165 feet on the Shell vein. This vein proved to average 5½ feet in thickness. A cross-cut north was driven at the bottom of this pit to prove the existence of the Hematite vein. This was intersected at about 100 feet.

Two miles west from the Leckie mine an incline shaft, known as No. 1 mine, was sunk 170 feet on the Shell vein, which at this point averaged over six feet in width, and in many places widened out to 10 and 14 feet. Levels were broken off this shaft at intervals of 80 feet and are driven several hundred feet in either direction, proving a large body of shell ore to exist at this point. A crosscut was also driven north at the foot of this shaft to the Hematite vein, which was intersected at about 112 feet.

Equipment at No. 1 Shaft:—Boiler power; four 125 h.p. McDougall ret. tube boilers 72 in. x 16 feet, with 60 feet 34 inch steel stacks.

Air Compressor:—One Laidlaw-Dunn-Gordon, two stage cross-compound steam cylinders 15 x 24 in. Air cylinders 24 and 15 in. Stroke 24 in. Capacity 1,600 feet of free air per minute at 127 r.p.m. pressure 85 lbs.

Electric Plant:—One 34 k.w., A.C.B. generator 240 volts direct connected to 9 x 10 horizontal Robb engine. One 250 K.V.A., C.G.E. 60 cycle 3-phase 2,300 volts alternator. 600 r.p.m. belt driven from 18x20 Robb slide valve engine. One C.G.E. exciter 12 k.w. 125 volts, 1800 r.p.m. belted to alternator.

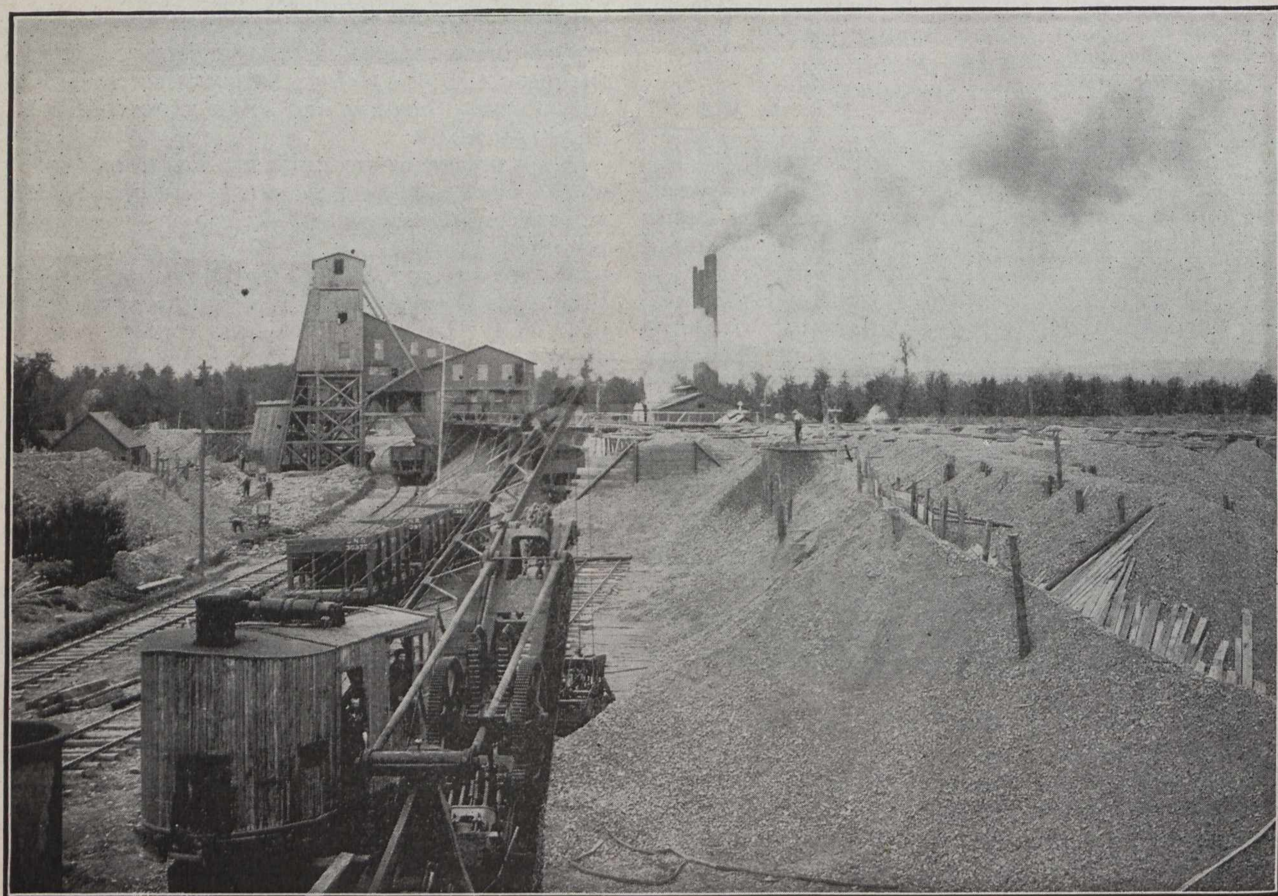
Water Supply:—One 2 stage McDougall turbine pump direct connected to 15 h.p. motor. Capacity 50 gallons per minute against head of 150 feet.

Winding Engine:—One Georgian Bay Engineering Co. 12 x 15 double drum, geared winding engine with 5 foot drums.

Employees' dwellings:—Twelve cottages have recently been erected at No. 1 mine to accommodate employees. These cottages are furnished with running water and electric light.

No. 2 Mine.—The main shaft of this mine is situated about half a mile west of No. 1 and is sunk to a depth of 500 feet on the Hematite vein. Levels are broken off at intervals of 100 feet on either side. This shaft is 7x14 feet, and has three compartments, two for skips and one for a ladder and pipe way. The levels extend from 500 to 1,200 feet on either side. About 200,000 tons of ore is already blocked out in the Hematite vein. The Shell vein has also been opened up by cross tunnels from Nos. 2 and 5 levels, and at this point lies about 90 feet to the south of the Hematite. The thickness of this vein here is about 7 feet. A large block of this ore is ready for stoping.

The method employed for working these mines is ovrhead stoping. The main levels are cut out about 12 feet high. They are timbered and lagged over with poles to a height of 7 feet. Chutes are installed every 20 feet. The stoping begins above the pole lagging, the ore being blasted on to the pole lagging and loaded by gravity through the chutes into one-ton cars. The walls being solid, very little timber is used in the stopes. For driving the levels, No. 43 L.G. Canadian Rand drills give good satisfaction. In the stopes, Murphy hammer stoping drills are in use. The explosive used is 50% dynamite, it takes about one-half pound of dynamite to procure a ton of ore. Two skips, each two tons capacity, working in balance and operated by a winding engine, raise the product of this mine to the surface. The skips automatically dump the ore in to two No. 6K Gate crushers placed on foundations 35 ft. from ground. The foundation of the crushers is placed inside the main headframe. The headframe is 65 feet high and 30 feet square at the base.


Torbrook Surface Plant

The ore is crushed to pass a two-inch ring. From the crushers the ore passes on a Zimmer steel plate conveyor. These conveyors are 4 feet wide and are operated by a jigging motion causing the ore to move forward at a slow rate of speed. This slow speed enables the conveyors to be used for picking tables if required. They are equipped with discharging gates at intervals through which the ore drops into a series of 50-ton pockets, and thence by gravity to railway cars which transport it to the concentrating mill at Nictaux.

Equipment at No. 2 Mine:—Boilers, two 125 h.p. McDougall ret. tube 72 in. x 16 ft., with 60 ft. stacks. One 65 h.p. McDougall ret. tub. 54x16 ft; one 65 h.p. McDougall ret. tub. 60 in. x 12 ft., and one Matheson ret. tub. 80 h.p. one 600 h.p. Erie feed water heater.

Winding Engine:—One Georgian Bay Engine Co. winding engine, 14x18, double cylinder, double drum. Reversing engine capable of winding 7,000 lbs. 500 feet per minute.

Crushers:—Two No. 6K. Gates gyratory crushers.

Conveyors:—Two lines of conveyors of the Zimmer type.

Steam Engine:—One Leonard Ball Tandem Compound, 13 and 22 by 12 in., operating crushers and conveyors.

Mine Pumps:—Two Knowles vertical sinking pumps, 14 x 7 x 14 in.

The mines are served by two spur lines of railway, the Dominion Atlantic from Wilmot, and the H. & S. W. from Nictaux Station. The latter line now handles the output of the mine to Port Wade on the Annapolis Basin, where the Canada Iron Corporation have a loading dock for foreign shipments. The product of these mines at present is being shipped to Europe.

Concentrating Mill for Iron Ore.

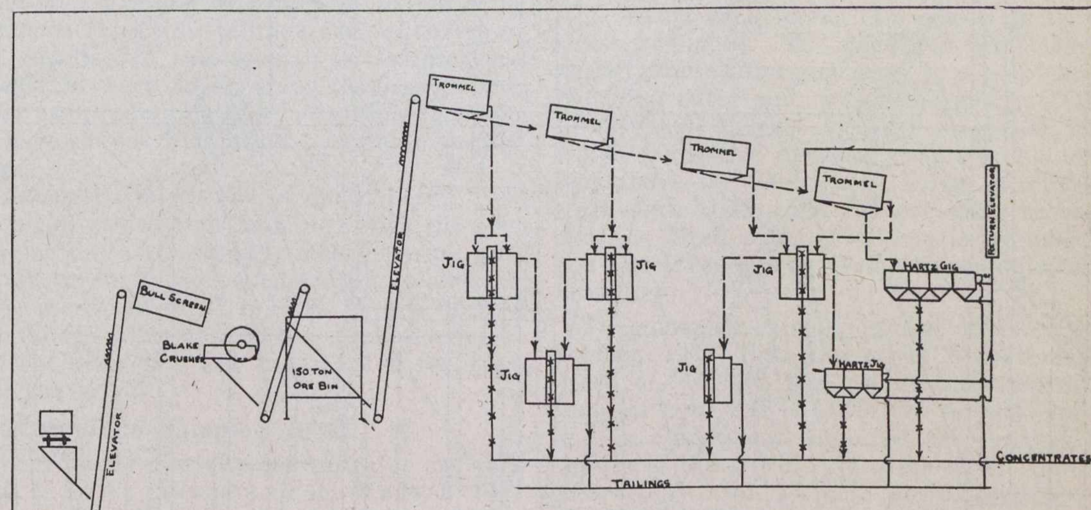
The crude ore produced at the Torbrook mines is put through a jigging process to wash out rock and low grade ore. The concentrating plant is situated at Nictaux Falls, two miles from the mines, and on the mines spur of the H. & S. W. railway. After being concentrated, the treated ore is shipped in 30 ton ore cars to the dock at Port Wade, on the Annapolis Basin.

The yard arrangement at the mill provides siding room for an incoming train of crude ore, with a 1½% down grade, so that individual cars may be dropped down by gravity, dumped, loaded up with concentrates and then dropped down until a train load is ready.

The crude ore as received at the mill has been crushed to pass a 2½-inch ring, but for good jigging it has been found necessary to further crush it to a 2-inch size. This is done by screening and crushing the oversize of 2-inch in a 24x12 New Century Blake Crusher. The entire product then passes to a storage bin and thence to the mill proper. From the storage bin the ore is elevated to the top of the mill in a continuous steel bucket elevator, 53 ft. centres. Here it discharges into a series of four trommels where it is classified into the oversize of 1⅜ in., ¾ in., ½ in., and ¼ in. and undersize of ¼ in. By referring to the accompanying flow sheet, the flow of ore may be readily followed. In general each size is treated twice, that is, the tailings from the first treatment are re-jigged.

The jigs for the treatment of sizes over ¼ in. are in many respects a distinct advance over any yet produced, and are capable of producing good results with ore as large as two inches. The jigs are 14 feet long, 14 feet wide, and 10 feet high, with two separate jigging compartments, and a centre compartment containing an elevator which recovers the concentrates produced, dewaters and discharges them to a concentrates belt conveyor. The sieve is 60 x 60 in., supported on grate bars and supports a bed of ore ranging from 6 in. to 12 in. dependent on the size of the material being jigged. The plunger is of a heavy cast iron construction 54 in. in diameter, working in a heavy iron cylinder with four inlet water valves 8 x 10 inches. An adjustable eccentric provides for a variation in the length of strokes. A 4 in. stroke at 100 r.p.m. is necessary to properly stratify a bed of 2 in. ore. The plunger shaft is fitted with tight and loose pulleys to enable the jig to be put out of commission without effecting other jigs. A worm conveyor carries the hutch product or what passes through the holes in the bed screens to the centre compartment where it is delivered to the concentrates elevator.

The heavier material on the jig bed rapidly works its way to the bottom of the jig bed and is drawn off at the front of the jig through a draw-off valve 48 in. long, while the lighter material passes over an apron on the top of the bed. This draw off valve is capable of wide adjustment. The concentrates after passing the draw-off valve fall down a 45 degree slope to the elevator boot in the centre compartment, where the elevator composed of 16 x 11 x 10 in. steel buckets carried on No. 111 Hercules chain elevates them, dewaters them and finally discharges them on a belt conveyor.



FLOW SHEET
50 Tons/Hr Iron Concentrating Mill Nictaux, N.S.
Canada Iron Corporation Ltd.

The plunger of the jig is driven by an 8 in. belt from the main line shaft, while the elevator, worm conveyor and draw-off valves are actuated by means of sprocket chains from a centre shaft.

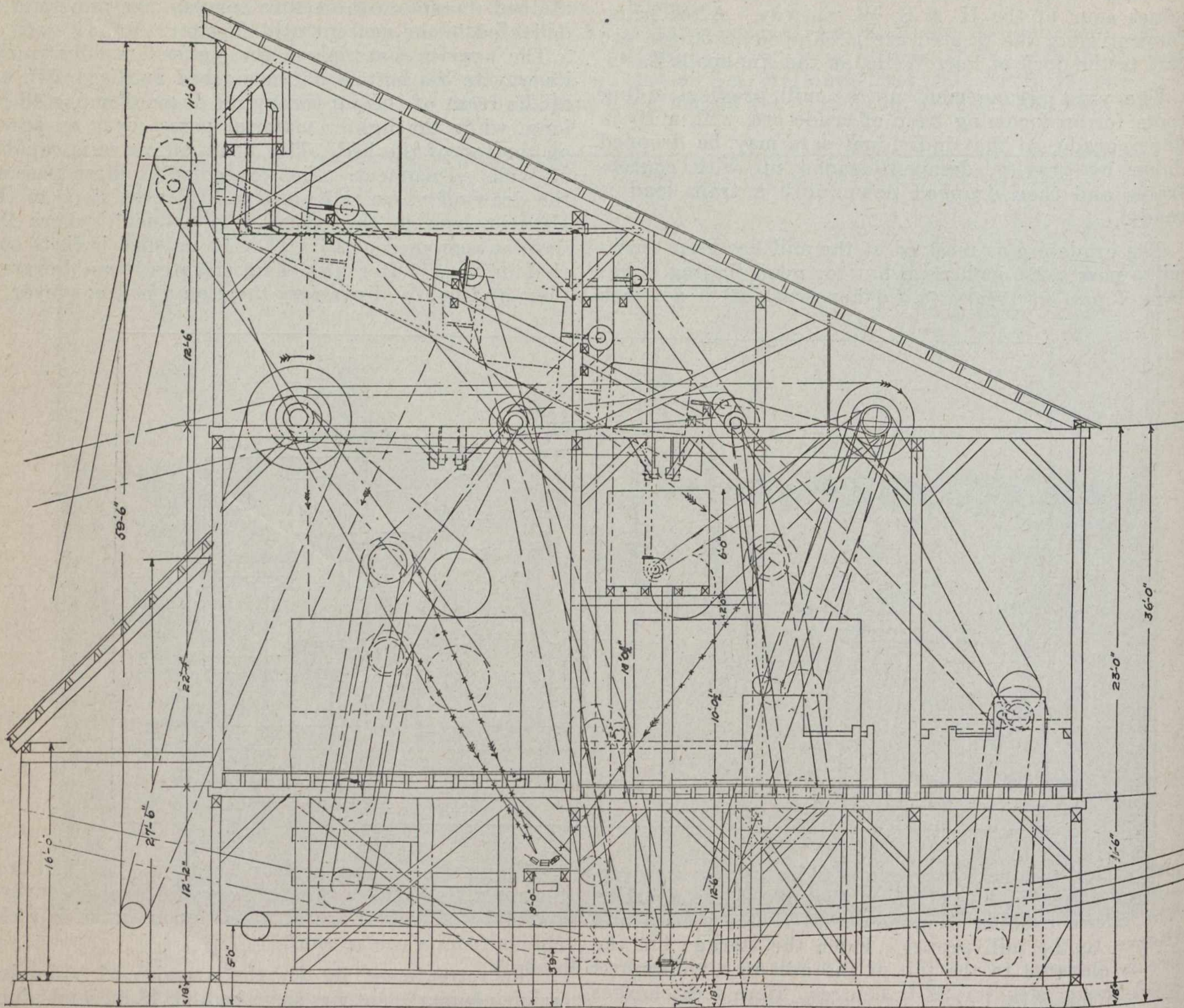
The retreatment jig for the oversize of ½-in. is a single compartment jig, sieve bed 36x48 in., and plunger 36x48 in.

The retreatment jig for the oversize of ¼-in. is a three-compartment Hartz, with sieve beds 30x42 in., running at 125 r.p.m.

The jig which treats the undersize of ¼-in. is a four-compartment Hartz with sieve beds 32 x 42 in., running at 180 r.p.m. Concentrates are drawn off the bottom of each bed by an adjustable draw-off valve with the exception of the last compartment of these Hartz jigs; this product together with its hutch product is treated as middlings, and is flushed into a return belt elevator which discharges into the last two trommels and in consequence returns to its Hartz jig for retreatment. The hutch product and concentrates from all but the last cell of both Hartz jigs is flushed into a dewatering elevator which elevates and dewaters these concentrates before discharging them on the concentrates conveyor.

All concentrates are conveyed by a 16-inch rubber belt to a 50-ton loading bin which is placed next to where the crude ore is dumped; after the crude ore is dumped from a car, this car is run under the loading bin and loaded with concentrates. Tailings are carried out of the mill on a 14-inch conveyor belt.

An interesting point in connection with this mill is the water circulation. The water is kept in continuous veyor belt. In this manner very little water is allowed to escape. It has been found necessary to provide means of drawing off a constant stream of water to prevent the circulating water becoming too thick with slimes. These slimes run very low in iron and high in silica and are consequently wasted. The method of doing this is by a spitzkasten or hydraulic classifier into which all return water is emptied. Here the velocity of the water is reduced to such a point that the slimes settle to the bottom and are drawn off through



END ELEVATION

ANNAPOLIS CONCENTRATING PLANT

AMERICAN CONCENTRATOR CO., JOPLIN, MO.

circulation through the mill, being used over and over again, but replenished by a fresh supply of 300 gallons a minute to replace waste and to keep the circulating supply from becoming too thick. 2,000 gallons a minute are kept in constant circulation by an 8-inch centrifugal pump in the basement, drawing from the settling tanks.

Concentrates are dewatered with perforated bucket elevators. Tailings are run over perforated screens or gratebars before proceeding to the tailings con-

a number of 1½-inch holes while the clean water is carried off from the top to the pump tank.

The mill is designed to treat 50 tons of crude ore an hour.

Two motors of 50 and 100 h.p. respectively operate the mill, and a 35 h.p. motor for the crushing department.

There are two sources of power, one a water power plant on the Nictaux River a quarter of a mile from the mill, the other an auxiliary steam plant at Torbrook.

A 30 foot head of water is available at the water power plant. For this purpose a concrete dam was constructed on the site of an old wooden dam; this dam is 230 feet long and 8 feet high, 130 feet being a spillway section. From the dam a wooden flume 400 feet long carries the water to the power house. Here is installed a 25 inch horizontal Jenckes turbine of 200 h.p., driving a 150 k.w. 3-phase generator, and a 4-in. single stage McDougall turbine pump which pumps 300 gallons of water a minute to the mill through a 6-inch C.I. pipe.

The auxiliary steam plant at Torbrook consists of an 18x20 Robb engine belted to a 250 k.w. General Electric generator. Three phase current at 2,300 volts is transmitted to the concentrating plant two miles distant by three No. 1 bare aluminum cables on cedar poles spaced 125 feet apart, part of which is located on a private right of way and the remainder on the H. & S. W. railway right of way.

The concentrating plant was designed by the American Concentrator Co., and the machinery installed by them; the remainder of the work was performed by the staff of the Canada Iron Corporation.

A sampling plant consisting of a Fraser & Chalmers sample crusher and grinder is attached to the mill. Samples of concentrates and tailings are taken every half hour, in addition to this special jig samples are taken every day to keep in constant touch with the performance of each individual jig. A sample monthly mill sheet is here shown, indicating how these results are kept daily.

There are numerous intrusions of rock in the Torbrook Mines, all of which rock is mined with the ore. This run of mine ore average 45% metallic iron, and after being put through the concentrating plant the iron content is increased to 51 to 53% with a corresponding reduction in silica and with a minimum rejection; this latter being now on the market for concrete and road material.

Port Wade Shipping Dock.

Concentrates from the Nictaux concentrator are carried by the H. & S. W. railway to Port Wade, a distance of 45 miles. Port Wade is situated on the Annapolis Basin, opposite the town of Digby.

A pier 850 feet long, 50 feet wide, runs at right angles to the shore out to deep water, providing a berth at the outer end for a steamer with 25 feet of water at low tide. The rise and fall of tide at Port Wade is 27 feet, this great tide made the rapid loading of steamers at all conditions of tide a difficult problem.

Plans were first considered for the construction of a long ore pocket to hold 7,000 tons on the pier, similar to docks on the great lakes. This construction, however, involved a greater expenditure than the conditions warranted, in addition to which there was a serious doubt of its stability under existing conditions. Consequently it was decided to adopt the plan so successfully used by the N. S. Steel & Coal Co., and the Dominion Iron & Steel Co., at Wabana, Nfld., and place the ore pocket on shore and load by a conveyor. This system has been installed at half the estimated cost of the original proposition.

The ore pocket is 150 feet long, 30 feet high, with sloping sides at an angle of 45 degrees and holds 7,000 tons of ore. Two parallel railway tracks at 14 foot centres on the top provide means of filling the pocket. The top is reached by a long railway approach with a maximum grade of 1.75%, about 150 feet is trestle, the remainder earth embankment. The pocket is constructed of hard pine throughout.

A tunnel runs under this pocket in which the conveyor is placed. The conveyor after leaving the ore pocket follows the pier level to a point about 150 feet from the outer end, where the grade of the conveyor alters from a level to 33% up grade, at the top of which the ore is discharged into a 200-ton pocket 50 feet above the pier level. From this pocket a heavy steel chute discharges the ore into the steamer. The chute is fitted with an automatic trimmer at its outer end which renders any hand trimming of the cargo unnecessary.

The conveyor is composed of 824 steel buckets each holding 1,000 lbs., and when operating at its rated speed of 200 feet per minute has a capacity of 2,000 tons per hour. It is 1,000 feet between sprocket centre and is consequently one of the longest bucket conveyors in the world. It is operated from the tail end sprocket by two 14 x 18 geared engines, capable of developing 300 h.p. Steam is furnished by two 125 h.p. 72 in by 16 ft. return tubular boilers at 125 pressure. The conveyor was manufactured by I. Matheson & Co., New Glasgow, N.S.

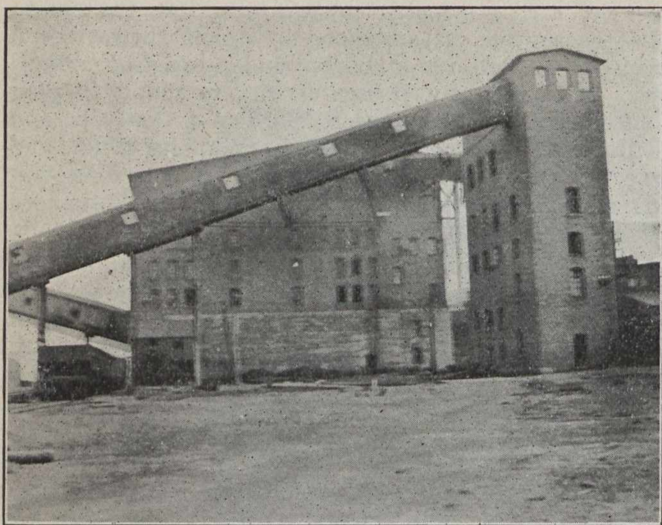
BY-PRODUCT COKE MANUFACTURE AT SYDNEY

By F. E. Lucas, Supt. Coke Oven Department, Dominion Steel Corporation, Sydney, N. S.

The coke plant consists of a coal crushing and washing plant and 500 ovens, each taking a charge of five and a quarter tons of coal, and one hundred and twenty ovens taking a charge of eight and a half tons each. Both lots of ovens are equipped with condensing house, ammonia plant, boiler plant, gas mains, etc., to enable the by-products to be recovered. There is also a sulphuric acid plant for making the acid, to recover the ammonia in the form of sulphate of ammonia.

The coal we are using, as is the case with practically all of the coals of the Maritime Provinces, has to be washed to remove sulphur and ash before making a good coke for metallurgical purposes. Types of washing plants almost without number have been devised for this work, but the one principle common to all, is that some means is taken to keep the coal sufficiently agitated in water so that the slate and sulphur, usually in the form of iron pyrites, can by reason of their greater specific gravity fall to the bottom. From there they are removed by various mechanical means. In giving a description of the methods of washing the coal, or preparing it for coking on this plant, it is not meant to imply that it is the best method in all cases. Before erecting a washing plant or other apparatus for the preparation of coal for coking, the particular coal to be used should be carefully studied and tested by every possible means. Different coals vary greatly in specific gravity and in the difference between the specific gravity of the coal itself and the impurities to be removed. The manner in which the sulphur and ash are associated with the coal will also be a determining factor in the type of crushing and washing machinery to be installed.

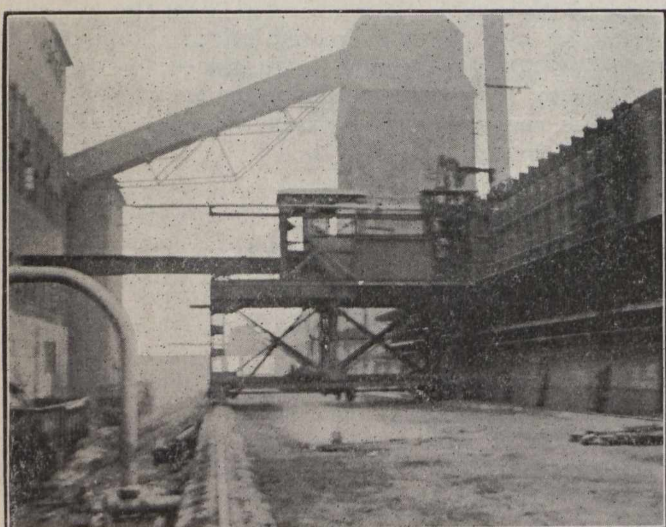
In the plant to be described the coal is first dumped through a long trestle about thirty feet high, having storage room for twelve thousand tons. Underneath this trestle are 30 inch belt conveyors so arranged that



Crushing and Washing Plant

they delive rthe coal to the incline conveyors which carry it to the top of the crushing building and deliver it into a hopper shaped bin holding 75 tons. From this bin the coal falls on a steel conveyor table which regulates the feed to the Bradford breaker. The breaker also acts as a dry cleaner, removing large scrap iron or pieces of pit props and ties which would damage the crushers if allowed to get that far. It also removes large pieces of slate and pyrites which are too hard to break while traversing its length.

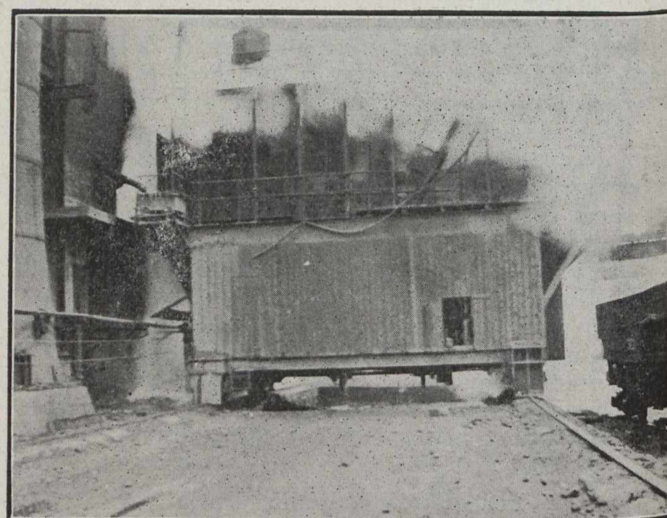
The breaker is twelve feet long and nine feet in diameter inside. It consists of a steel plate shell ⅝-in



Pusher and Leveller

thick. This shell has $1\frac{1}{4}$-in. square hole a cloe to gether as the strength will allow. In between the holes at certain distances apart and arranged spirally are breaking blocks, presenting a wedge-shaped edge to the coal. There are also three shelves ten inches wide, spaced at equal distances around the circumference and running the full length of the breaker. Outside the breaker proper and concentric with it is a screen with half inch round holes. This is attached to the breaker shell by brackets. The breaker and screen are mounted on trunions and revolve at sixteen to nineteen revolutions per minute.

The coal admitted at one end is carried around by the shelves until the angle becomes such that it falls off through almost the full diameter of the breaker on to the sharp edge of the breaking blocks. This action is repeated several times before the other end is reached. The coal being carried forward by the spiral arrangements of the blocks. By the time the outlet is reached, if the diameter and length of the breaker have been properly proportioned for the coal used, there will be nothing left except, as stated above, pieces of wood, iron or stone. This material falls down a chute into a car. The coal which has passed through the $1\frac{1}{4}$-inch hole falls onto the half-inch screen. All that goes through this screen is fine enough for our purpose, the tailings falling first on the magnet belt to remove such small iron, as spikes, pick points, etc., and from there to the crushing rolls. The fine coal



Quencher and Loader in Action

from the rolls together with that from the screen then goes to an elevator which carries it back to the top of the building and delivers it to the belt conveyor, which in turn carries it to the bin over the washing tables in the main building.

The washing is done by means of Campbell tables. The tables are 9 ft. long by 2 ft. wide, with a curved bottom, so that there is about 5 inches of coal at the deepest part. The entire bottom is covered with riffles pointing toward the high end. The tables are supported, with a slight incline toward the end the coal is discharging from, by means of a rod at each corner so arranged that they can swing freely. In front of each table is a post against which it is caused to bump by means of a cam and rocker arm at a speed of 60 r.p.m. The coal comes on the table with the water at the high end and the agitation of the table causes the heavier particles to settle to the bottom where they are caught by the riffles. The successive bumps carry this heavy material ahead on the riffles to the high end of the tables where it is discharged into a chute and carried to the refuse bin, while the current of water flowing over the lower end of the tables carries the cleaned coal with it to the drainage bins.

The drainage bins have grid bottoms with sewers underneath which allow the water to drain back to the pump pit and be used over again if necessary. From these drainage bins the coal is elevated to belt conveyors and carried to the storage bins over the ovens.

In describing the ovens we will take the larger ones as they are more modern and up-to-date than those of smaller size.

The ovens are of the United Otto type, 34 ft. long, 9 ft. high, and 17 inches mean width, having a taper of 4 inches in the length. They are supplied with two regenerators of ample size, which are alternately heated by the products of combustion on their way to the stack, and at stated intervals the gas is reversed and the air for combustion is drawn through the heated regenerator, by which means air at a temperature of twelve to sixteen hundred degrees is supplied for the combustion of the gas burned to keep the ovens hot.

The coal is carried from the storage bin to the oven to be charged, by a larry which holds the requisite amount for one charge, and is then dropped into the oven through five charging holes in the top. The charge is then levelled by means of an electrically driven levelling ram. The levelling is done in order to allow a free passage for the gas from all parts of the oven to the standpipe which is connected with the collecting main running across the top of all the ovens. After the charge is levelled the covers are put on and sealed with plastic clay to prevent the escape of gas. In twenty-four hours from the charging time the oven is ready to push. That is, the volatile matter has all been distilled off leaving only the fixed carbon and the ash that were in the coal plus a certain amount of deposited carbon. This deposited carbon is due to the breaking up of some of the hydro-carbons in the gas due to contact with the incandescent coke and oven walls. At this stage the doors at each end of the oven are removed by cranes attached to the pusher and quencher, and an electrically driven ram pushes the charge out into the quencher and loader. As soon as the ram is withdrawn the doors are replaced and sealed with clay and another charge is put in from the top as before.

The quencher and loader is a rectangular iron box slightly larger each way than the oven. Mounted on wheels with the necessary driving motors and gearing, and also water piping for quenching the charge. The bottom is a heavy steel conveyor. The door at the end next the oven is raised to receive the charge. When the charge is in the door is closed and the machine is run to the quenching station wheer connection is made with a water hydrant and sufficient water admitted to the box to quench the hot coke. The steam escapes through exhaust heads on the top. The door at the outside end of the machine is then raised and the machine traverses along the line of cars, at the same time the conveyor is started and the coke discharged into the cars where it is ready for shipment to the furnaces.

We shall now go back and follow the gas. Immediately the coal is charged into the oven it begins to give off gas. The volume of gas given off increases for several hours then gradually falls until shortly before pushing time it has all disappeared. This gas is received in the collecting main, before mentioned, that run to the quenching station where connection is made densing house. It reaches the first coolers at a temperature of approximately 250 degrees F., and is cooled to about 150 degrees F., and then enters a second set of coolers coming out at 60 degree-80 degree F. From here it passes through the tar scrubbers. These are so designed that in the passage through, the gas will get the maximum amount of friction. By this means, when the gas has been sufficiently cooled, practically the last traces of tar can be removed. After the tar scrubbers, the gas reaches the exhausters or positive blowers. These pull the gas from the ovens through the coolers and tar scrubbers, and send it out on the other side under pressure to the ammonia washers. The washers are so designed that the gas is brought into very intimate contact with water, which has a great affinity for ammonia. The colder the water the greater the capacity it has for absorbing ammonia. The water containing the ammonia is known as ammonia liquor. This is received in tanks in the basement of the building, the same as the tar, and from there pumped to storage tanks in the yard. The gas after leaving the ammonia washers is then ready for use. Approximately 50 per cent. of it is used for heating the ovens, the remaining 50 per cent., amounting to about 5,000 cubic feet per ton of coal coked, is sent to the holder and from there is used in the steel department in various parts of the steel making process.

The tar is pumped to the works of the Dominion Tar & Chemical Co., which adjoins the coke oven plant, and there it is distilled, and pitch, creosote oil, light oils, carbolic acid and various other tar products are recovered. The total tar recovered at the ovens is from 8-9 gallons per ton of coal carbonized.

The ammonia liquor is pumped from storage to the ammonia plant where it is distilled by steam and the free ammonia is driven off, then milk of lime is added to liberate the fixed ammonia compounds. It is then redistilled. The steam and ammonia, and certain quantities of carbonic acid gas and sulphuretted hydrogen from both distillations are collected in one pipe and conducted to the saturator, which is a large box filled with sulphuric acid and fitted with an exhaust outlet. The ammonia in passing through the acid bath becomes fixed as sulphate, and remains, while the steam and other gases pass out the exhaust. The temperature of the bath due to the combining of the acid and ammonia remains so high that the steam cannot condense. The bath becomes saturated and the sulphate of ammonia is precipitated as a white crystaline salt. This is then ejected by means of steam or air out on a draining board from which any acid drains back to the saturator. At the same time sufficient acid is added to the saturator to keep the bath sufficiently acid so that it will fix all the ammonia coming over from the stills.

The sulphate is scraped from the draining board into a centrifugal dryer which removes all moisture down to about 2 per cent. It is then put into the stock house and bagged ready for shipment. Sulphate of ammonia recovered is equal to a little over one per cent. of the coal carbonized.

In describing the plant I have been as brief as I could well be, and at the same time convey any adequate idea of the various processes as carried on. I have also avoided as far as possible operating details which would probably be of little interest to any one not actually engaged in operating a coke plant.

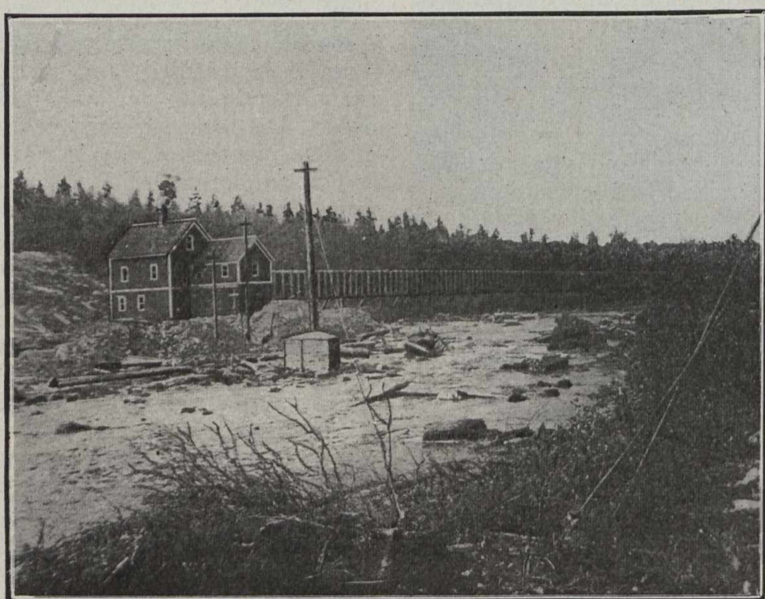
GOLD MINING IN NOVA SCOTIA.

(Written for the Canadian Mining Journal by H. B. Pickings.*

That the returns of the Department of Mines are considerably below the actual amount of gold recovered there can be no doubt. †These records do not include the years 1860 and 1861, and make no allowance for gold stolen by miners, disposed of as specimens, or made up in the form of pins, brooches and other small articles of jewelry; the value of the gold thus to be accounted for has been estimated at various amounts ranging from $1,000,000 to $5,000,000. An estimate of $2,300,000, sufficient to bring the total production of the province to $20,000,000, would, I believe, err on the low, rather than on the high side.

Early History.

The likelihood of gold being discovered in the province was mentioned by Sir Charles Lyell, in his Notes on the Geology of North America (1842); by Sir J. William Dawson in his Acadian Geology (1855), and by Sir Roderick Murchison in his ''Siluria.''



Power House, Dominion Mining Co., Tangier.

Several discoveries of gold were reported previous to 1860, the most authentic of which were probably those accredited to Captain L'Estrange in September, 1858, and the several discoveries reported to have been made by Mr. John Campbell, extending over the period from 1849 to 1860.

Gold mining, as an industry of Nova Scotia, however, commenced with the finding of several pieces of gold-bearing quartz in the bed of a small brook, at what is now known as the Mooselands Gold District, by John Pulsiver, in the month of May, 1860.

Pulsiver's discovery created considerable excitement and, in a short time, several hundred men were prospecting in the vicinity of his original find.

Work at Mooselands was discontinued before the close of the year 1860, and did not result in the finding of gold in any quantities. It had the effect, however, of encouraging prospecting at other places in the province, and gold was discovered at Wine Harbour by Joseph Smith in July, and at Tangier, by Peter Moser in October, but apparently no quantity of gold was recovered and prospecting was discontinued for the winter.

In the spring of 1861 work was recommenced at Tangier, Mooselands and Wine Harbour, and in a very short time several hundred men were engaged in prospecting and taking out quartz at these places, the number of men so engaged at Tangier alone being at one time during the summer, over 600.

New discoveries were made at many places and by the close of the year, areas had been taken up at Tangier, Mooselands, Ovens, Wine Harbour, Isaac's Harbour, Sherbrooke, Laidlaw's (now known as Waverley), Lawrencetown, Lynch's Farm (Sherbrooke), Malignant Cove, and Allen's Farm (Waverley). Actual mining operations had been commenced at Tangier, Wine Harbour, Isaac's Harbour, Country Harbour, Sherbrooke, and Laidlaw's.

Considerable gold was recovered during the year, but the exact or even the approximate amount is not known. There were no mills or crushing machinery of any kind at any of the districts—the gold recovered being broken from the quartz with hammers, and either disposed of on the ground or taken away in the specimen or nugget form.

The late Honourable Joseph How, at that time Provincial Secretary of the Province, in a report to the Earl of Mulgrave, dated September 4th, 1861, states: ''Though rumours have reached me of gold discoveries in many parts of the Province, and though the presence of gold in other localities has been ascertained beyond doubt, I do not think it prudent to include in this report any reference to discoveries which have not been thought of sufficient importance to demand the verification and direct action of the Government. At Tangier, Lunenburg, Lawrencetown, and Lake Thomas (Waverley), the facts collected are indisputable, and the interest taken in those mines by capitalists, at home and abroad, and by a very large number of the industrial classes, warrant Your Excellency in assuming, and so

*Inspector of Mines for Province of Nova Scotia.

†Gold mining has been carried on in Nova Scotia to a greater or less extent since the year 1860. The records of the Department of Mines show that to date 2,101,771 tons of gold-bearing rock have yielded 931,550 ounces of gold valued at (at $19.00 an ounce) $17,699,450.

reporting to the Secretary of State, that gold mining in those localities, whatever may occur elsewhere, will be permanently established as a new branch of industry, tempting to the capitalists, and attractive to the immigrant.''

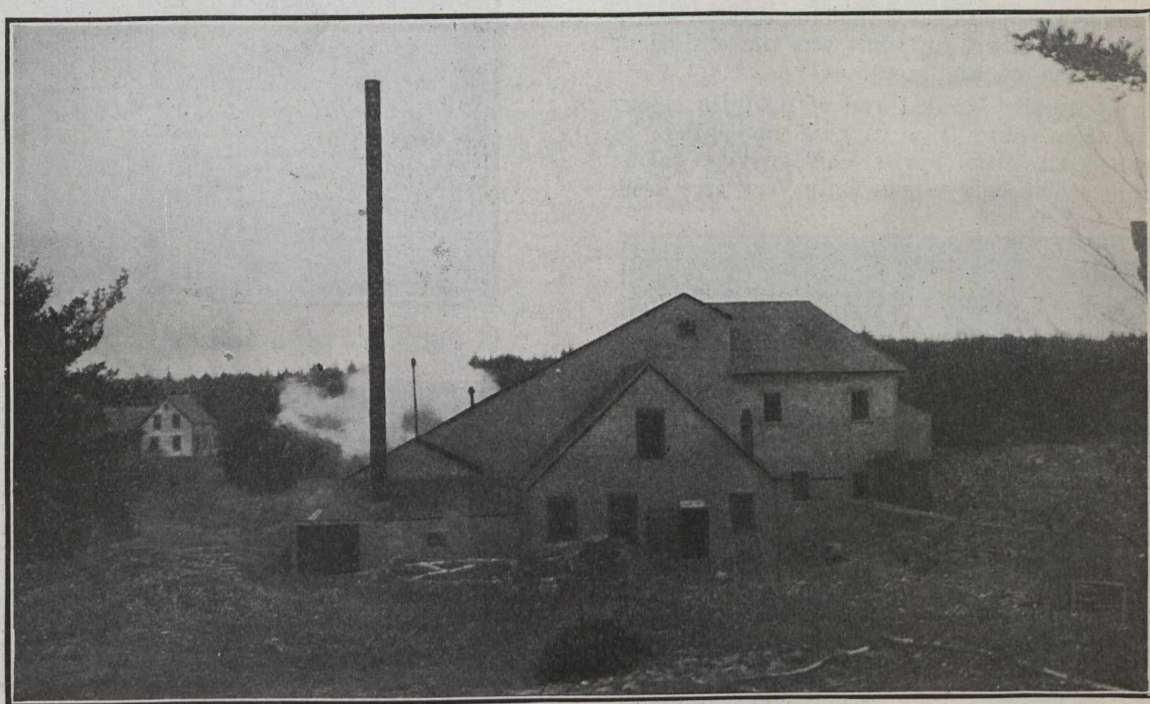
During the summer the Government commissioned Mr. John Campbell to visit the Eastern, and Mr. Henry Poole, manager for the General Mining Association, to visit the Western Counties, and to report the results of their geological observations.

These reports were published in the Journals of the House of Assembly for the year 1862, they are most interesting, forming as they do, the foundation of the gold mining literature of the Province.

In the year 1862 a separate department of the Government was organized to look after the mining industry of the Province. The Department had at its head Mr. Samuel Creelman as Chief Gold Commissioner, and in this year the first Mines Report was published. It contained, in addition to a general report, short detailed reports regarding each district, and valuable statistics pertaining to production, men employed, etc., and shows that during the year mining was carried on at Tangier, Mooselands, Wine Harbour, Sherbrooke, Isaac's Harbour, Country Harbour, Renfrew, Oldham, Ovens, Waverley and Lawrencetown, and that prospecting resulting in numerous new discoveries of gold took place at various other parts of the Province.

At the close of the year 30 crushing mills or machines had been erected at the different districts, the estimated cost of which was $107,100. A total of 6,964 ounces was recovered from the quartz and other material treated by these mills and 311 ounces of gold was recovered from alluvial washings of ores, bringing the total production of the Province for the year to 7,275 ounces.

Gold mining has been engaged in continually every year since, new districts have been discovered, mines opened and equipped, modern mining and milling machinery have been introduced. To date, as already noted, upwards of $20,000,000 worth of gold has been recovered and the industry has given employment to from 300 to 1,200 men annually.



Renfrew Shaft House, M. J. O'Brien Property.

Geology.

Much has been written upon the geology of the gold fields of Nova Scotia, and it is hardly necessary to do more than deal very briefly with the subject.

Gold in Nova Scotia is found in quartz veins of both the interbedded and fissure types of varying thickness, from the fraction of an inch up to 30 and 40 feet, veins of from 2 to 8 inches, however, predominating. These veins occur in highly altered slates and sandstones of great geological age, now generally classed as Pre-Cambrian. These rocks occupy that section of the Province lying along the Atlantic Ocean, and Bay of Fundy, from the Strait of Canso in the east to Digby in the west, and extending inland from 10 to 75 miles, covering an area estimated at 3,500 square miles.

Granite intrusions in the form of large masses and dykes are numerous—the eruptive rock at places partially divides, but for the most part forms the northern boundary of the stratified gold measures.

These gold measures have a known thickness of about 30,000 feet, divided into an upper and lower series. The upper series, in which dark slates predominate, have a thickness of 11,500 feet. The lower series, in which quartzite predominates, have an estimated thickness of 18,500 feet. These rocks have been subjected to successive periods of pressure and uplift, and to cross-folding, and as a result have been formed into large domes and troughs having their axes generally east and west.

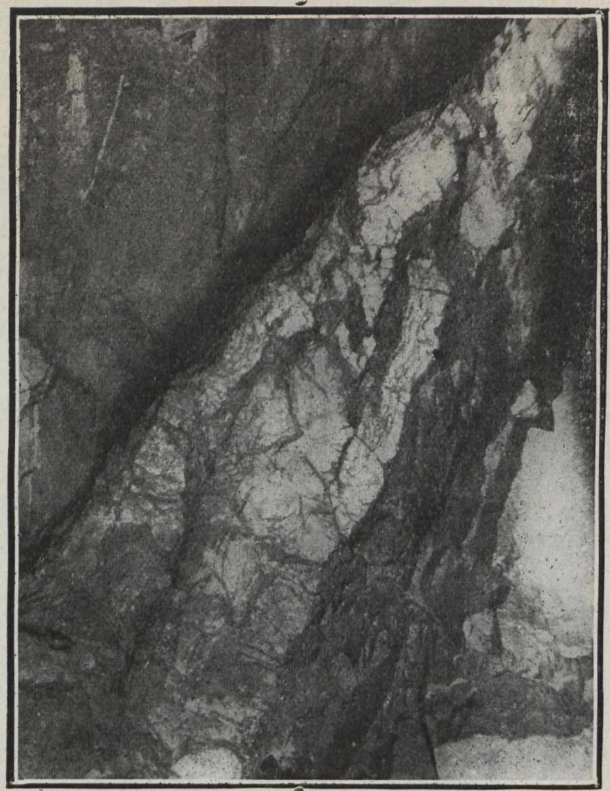
Metamorphism has accompanied the structural changes as shown by the sandstone, which has been generally altered to a very fine grained quartzite. Chlorite and muscovite have also been developed, the fine silt has been changed from mud to shale, and, finally, by the development of cleavage, it has become a true slate.

The quartz veins have, in places, been distorted until they resemble in shape corrugated iron, when small, and the backs of barrels, when large. These distorted veins have been locally termed "barrel" or "corrugated" veins; and have been by Rickard** termed "crenulated veins." A good example of one of the smaller of these "barrel" or "crenulated" veins is shown in the accompanying illustration of the Minnie Miller lead, at Caribou. "Crumples" and "rolls" are also very common and these crumples and rolls have been in many cases very productive.

Faulting has been very general, and varying in extent from the large cross-country fault to small local faults of a few inches in extent only.

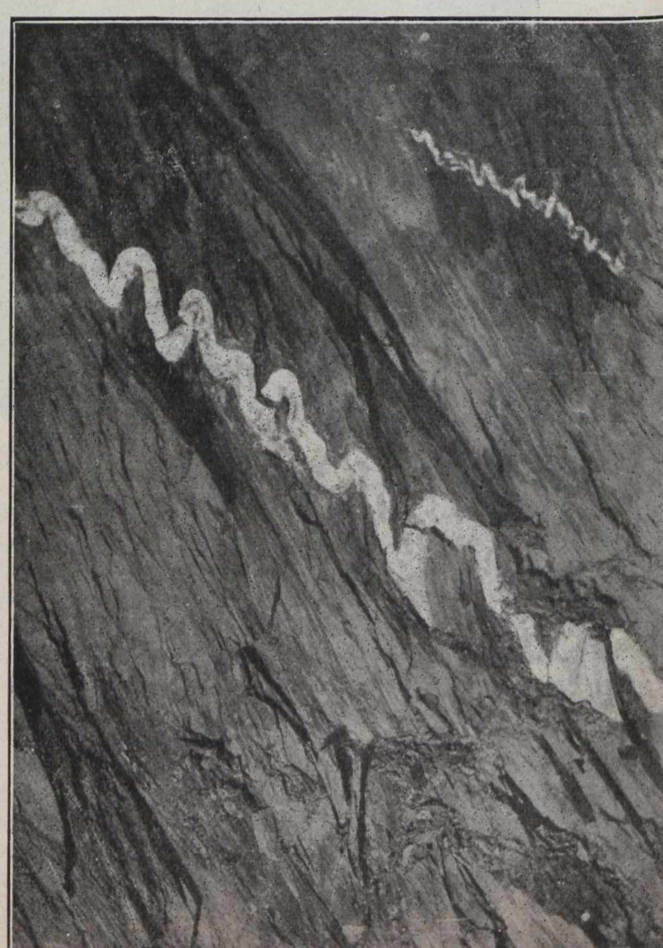
The present level or surface of stratified gold measures is estimated to be 30,000 to 40,000 below the original level or surface of these measures, this extent of the measures having been eroded and finally swept away by glacial movement, which indicates that the present worked section of the fields are on what was the middle or centre portion of the original measures.

The quartz is usually banded and of a bluish colour and almost always contains a varying percentage of arsenical arsenopyrite iron, pyrite, chalcopyrite, galena and zinc blende. The gold is generally very free from



Face of 340-ft. Level, Dominion Mining Co., Tangier.

Lake Vein, Lake Catcha.



Minnie Millar Vein, Moose River.

** "Domes of Novia Scotia," by T. A. Richard, Transactions of the Canadian Mining Institute, 1912.

impurities and when taken from the mortars and plates is usually worth from $19.00 to $19.50 an ounce.

Massive arsenical iron pyrites, when met in the quartz, are in many cases, important containers of gold.

The gold is usually found in the quartz in the form of irregular masses or nuggets, sometimes weighing as much as three or four ounces, or in small microscopic particles; occasionally it is found to a limited extent in the wall rock immediately adjoining the quartz. At a few places (notably at the Richardson mine at Isaac's Harbour), where large beds have been worked in which the quartz and slate are much mixed, the slate has been equally productive, indeed sometimes more productive than the associated quartz.

Small cross veins or ''angulars'' are numerous, often extending from one vein to another, at times apparently causing enrichment and impoverishment in the veins so intersected, and they have for this reason been termed locally, ''feeders'' and ''robbers.''

The distribution of gold in the veins is variable. Occasionally the distribution is fairly uniform over a considerable area of the vein, but more often it is confined to comparatively small, well-defined portions of zones outside the limits of which the vein will be found to be practically barren. In some veins, locally termed ''Nuggety veins,'' at fairly uniform distances apart, ''nuggets,'' or small isolated bunches or masses of gold are found, this condition oftentimes continuing over a considerable extent of the vein.

These specially enriched zones, or as they have been termed, pay-streaks, are well defined enrichments of from 10 to 100 feet in breadth, sometimes accompanied by enlargement in the size of the vein, they dip at constant angles; usually, but not always, they lie approximately parallel to the pitch of the nose, anticlinal axis of the structural fold. As to extension in depth, little is yet known. At two mines only has a vertical depth of 1,000 feet been attained.

The laws governing the occurrence and extent of these ''pay streaks'' cannot be said to have been as yet fully understood.

Districts.

There are, in Nova Scotia, upwards of 150 gold districts, among the more important of which may be mentioned Sherbrooke (including Goldenville and Cochrane Hill), Stormont (including Isaac's Harbour, Goldboro, Seal Harbour, Country Harbour and Forest Hill), Wine Harbour, Ecum Secum, Harrigan Cove, Salmon River (Dufferin), Fifteen-Mile Stream, Tangier, Lake Catcha, Montague, Waverley, Caribou, Moose River, Oldham, Renfrew, Gold River, Leipsigate, Brookfield, Malaga, Whiteburn, Mount Uniacke, and Rawdon.

At all of these districts, and at many more not mentioned, actual mining has been engaged in.

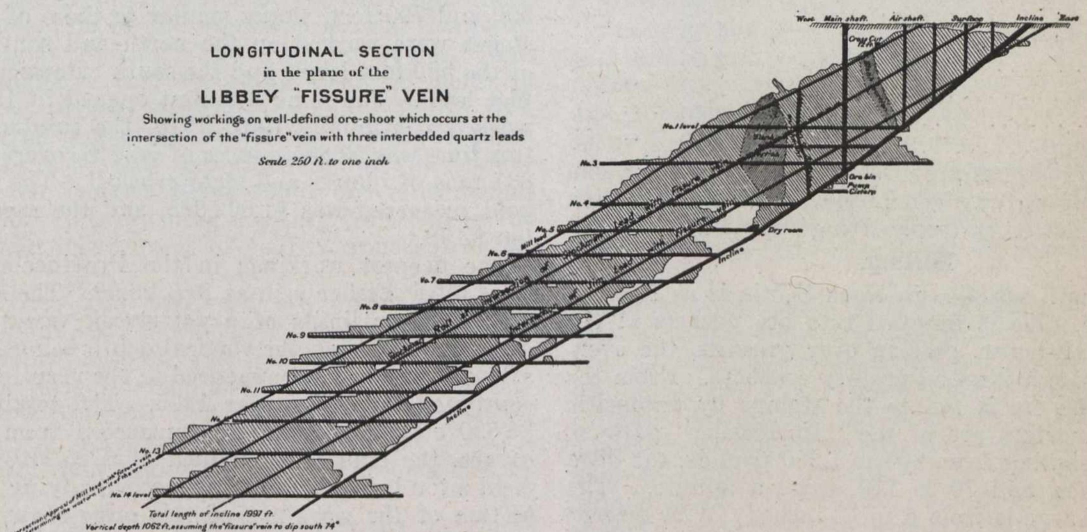
The districts producing the largest qauntity of gold are: Sherbrooke, $2,908,711; Stormont, $2,275,132; Waverley, $1,329,630; and Oldham, $1,277,102. The districts showing the highest average yield a ton are: Montague, with 1 oz. 8 dwts.; Whiteburn, 1 oz. 8 dwts.; Oldham, 1 oz. 3 dwts.; and Lake Catcha, 19 dwts.

The lowest average yield a ton is Stormont with 4 dwts, 14 grs. The average yield a ton for the Province is 9 dwts. 1 grain.

In all districts the areas are laid off in rectangular blocks 250 feet by 150 feet, having their longest lines running generally north and south. The extent of the districts varies, but are usually from 1½ to 2 miles north and south, by 2 to 3 miles east and west.

Prospecting.

The surface material overlying the gold measures is composed of earth, clay and boulders, and rarely exceeds 15 or 20 feet, generally being from 5 to 15 feet. The usual practice in prospecting is to follow the quartz float or drift with trenches or pits running in a north and south direction, extending these to bed rock when the approximate position of the source of the drift has been located.



LONGITUDINAL SECTION in the plane of the LIBBEY "FISSURE" VEIN Showing workings on well-defined ore-shoot which occurs at the intersection of the "fissure" vein with three interbedded quartz leads *Scale 250 ft. to one inch*

Mining.

Generally speaking, the methods of opening up and carrying on mining are as follows:

A shaft is sunk on the vein it is proposed to work, the shaft following the dip of the vein. Levels are driven off, on the vein, at varying distances of 50, 100 or 150 feet apart, and the vein stoped, usually by the back or overhand method. Ore chutes in the level are put in from 15 to 30 feet apart and the ore trammed to the shaft, where it is usually dumped directly into the skip or tub. The width of the workings depends upon the size and character of the beds accompanying the quartz vein, usually from 3 to 5 feet, the ore is either rough sorted below ground or the quartz is left standing, and taken down after the barren adjoining material has been scaffolded. Both skips and tubs are used for hoisting purposes, these running on wooden guides or steel rails, and operated by steam, air, or electric driven hoists, dumping to ore pockets located at the top of the shaft house.

Air drills are almost universally used, the piston drill being used for sinking and driving, and the hammer drills for stoping.

The stopes and levels are timbered with stulls, the wall-rocks are usually strong and little timber is required.

The majority of the mines are comparatively dry and the pumps need to be operated for a few hours only each day, both the "Cornish" or "bob" and steam pump are used.

The Nova Scotia miner enjoys a good reputation both at home and abroad. He is intelligent, sturdy and accustomed to working in hard rock.

The present scale of wages paid at the gold districts is:

Shift bosses	$75.00 to	$100.00	a month.
Machine men	1.75 "	2.00	a day.
Machine helpers	1.50 "	1.75	"
Timbermen	1.50 "	2.00	"
Muckers	1.25 "	1.50	"
Engineers and hoistmen	2.00 "	2.25	"
Blacksmiths	1.75 "	2.50	"
Blacksmith helpers	1.50 "	1.75	"
Carpenters	1.75 "	2.50	"
Amalgamators	2.00 "	2.50	"
Millmen	1.75 "	2.00	"
Ordinary labour	1.35 "	1.50	"

Most of the districts are close to tide water or within a few miles of railway communication and little difficulty is experienced in transporting supplies.

Milling.

The usual mill practice in Nova Scotia is as follows: Ore from the mine is dumped into ore pockets at the top of the shaft-house, passing over grizzlies, the oversize going through jaw or gyratory crushers. From the ore pockets the ore is fed to the stamps by automatic feeders, the mortars are of the "Homestake" pattern, the stamps weighing from 800 to 1,200 pounds, the drop 5½ to 8 inches, and 70 to 110 drops a minute. The depth of discharge is from 6 to 12 inches. Wire screens principally are used of a fineness of from 24 to 48 mesh. The plates are from 8 to 12 feet in length, 4 to 4½ feet wide and set at a slope of from 5½ to 8 degrees, both the straight surface and drop plates are used, the straight plates, however, predominating.

Gold is recovered both from the mortars and from the plates, where the gold occurs very coarse, as for instance the Sterling mine at Oldham, as high as 95 per cent. of the total recovery is from the mortars, where very fine, as at the Richardson mine, the mortars do not give more than 10 or 15 per cent. of the total recoveries.

Concentrating tables (chiefly "Wilfley") are in use at about half of the mills, the product made equalling from 1 to 5 per cent. of the ore crushed, the concentrates yielding from $15 to $100 a ton.

Bromo-cyanide plants have been constructed and successfully operated at the Brookfield mine at Brookfield, the Micmac mine, at Leipsigate, and the Boston Richardson mine, at Goldboro; at the latter mine the concentrates only were treated, at the other two the mill tailings were treated. Several efforts have been made to treat old accumulations of tailings at some of the mines by the bromo-cyanide process, but the recovery has usually been so low as to cause the failure of such efforts.

The mills of the Province vary in extent from 5 to 60 stamps, mills from 10 to 20 stamps predominating. Roughly, 30 per cent. of the mills are operated by water power, some few by electric power, the remainder by steam.

Operations.

The most extensive underground workings in the Province are those on the Richardson lode at Goldboro, operated by the Richardson Gold Mining Company and its successors, the Boston-Richardson Mining Company and the New England Mining Company. The lode worked was from 5 to 20 feet in width, composed of quartz and slate, originally operations were carried on from three incline shafts following the lode and located, one on the north and one on the south legs of the fold and one on the nose of the fold. When a vertical depth of about 300 feet had been attained, a vertical shaft was sunk, located so that it would intersect the nose of the fold at a vertical depth of 400 feet; from this shaft levels were driven around both legs of the fold, the north level a total distance of 900 feet, and the south level 1,200 feet, the last 600 feet of drifting on the south level being for prospecting purposes only.

When the ore was exhausted above the 400-foot level an incline shaft was driven on the nose of the fold of the lode and levels driven from it at a vertical depth of 550 and 700 feet, stopes similar to those of the 400-foot stopes were worked on the north and south extensions of the 550-foot levels and the south extension of the 700-foot level. The mine was first opened in 1893 and was worked continually until 1910, the production during this time was 53,835 ounces of gold recovered from 395,831 tons of quartz and slate crushed. The value of the gold recovered was $1,002,965, and the average yield a ton $2.58.

The deepest workings in the Province are those on the Libbey Fisher vein at Brookfield. The shaft is sunk on the lower limits of a pay-streak; measured on the dip it is 1,997 feet, the vertical depth being 1,062. Operations at this mine commenced in the year 1894 and were continued until the year 1905. The total production, 36,590 ounces of gold, was recovered from 93,611 tons of ore, the gold being valued at $725,210, the average yield a ton being $7.75. The accompanying longitudinal section of the workings of this mine show their extent and character.

At Caribou, on what is known as the "Lake lode," also a fissure vein, a vertical depth of 1,000 feet, was attained. The mine was worked by the Guffy-Jennings and Baltimore & Nova Scotia Mining Co. Operations were carried on from a vertical shaft 700 feet deep, crosscuts being made to the vein. From the 700-foot level west a winze was sunk between 300 and 400 feet. The total production of gold from this mine was 11,854 ounces, valued at $225,226, and recovered from 47,119 tons of ore, giving an average yield of $4.78 a ton.

Other extensive operations have been carried on at many of the districts, among which may be mentioned the Dufferin mine, Salmon River; the Royal Oak mine, Sherbrooke; the Micmac mine, Leipsigate; the Waverley and Tudor mines at Waverley; the Taylor Hardman mine at Oldham, and the New Edgerton mine at Fifteen-Mile Stream.

The maximum gold production of the Province was in the year 1898 when 31,104 ounces were recovered, the minimum production was in the year 1862 when 7,275 ounces were recovered, while the yearly average production was 19,101 ounces.

It will be seen from this that gold mining in Nova Scotia has never reached important proportions in comparison with which the industry has been carried on in other countries, especially when considering the extent of the gold bearing measured. Before dealing with this phase of the subject it may be well to briefly consider the industry as it is to-day. At the present time gold mining of a limited extent is being carried on by the following companies:

S. R. Giffin & Company, Goldboro.

Goldenville Mining Company, Goldenville, Sherbrooke.

Boston & Goldenville Mining Company, Shiers Point.

Gladwin Mining Company, Beaver Dam.

Caribou Gold Mines, Caribou.

Stillwater Mining Company, Moose River.

Dominion Mining Company, Tangier.

Petpeswick Mining Company, Lake Catcha.

W. A. Brennan, Oldham.

M. J. O'Brien and associates, Renfrew.

Uniacke Mines & Power Company, Gold River.

Switzer Mining Company, Fifteen-Mile Brook.

Of the above operators the most extensive operations are being carried on by the Dominion Mining Company. This company is working what is known as the "Kent lead" at Tangier, a lead averaging about 18 inches in width; it is at present sinking at a depth of 675 feet, and mining from stopes over its 500-foot level. Its plant is operated by electricity generated at its water-power situated on the Tangier River about one mile distant from its mine. It is crushing monthly from 600 to 700 tons of ore and its recovery of gold is from 200 to 300 ounces.

M. J. O'Brien and associates are working what is known as the McLeod or "Nuggety Lead," at Renfrew; their main shaft is down 475 feet and they are now stoping from their 460-foot level. Their monthly tonnage crushed is from 200 to 300 tons. Their recovery of gold is from 100 to 150 ounces. Their mining power is steam and air; their mill "20 Stamps" is operated by water power.

The Boston & Goldenville Mining Company, at Shiers Point, has lately reopened what was formerly known as the "Moosehead Mine," the surface building and plant of which were destroyed by fire in 1900. It has constructed and equipped a new mill (20 stamps, 10 operated by water power and 10 by steam) and a new shaft house. As yet it has done little mining. The lode, on which work is being commenced, measures 4 feet in width and gives 20 inches of crushing material. Its main shaft is 200 feet deep, with levels east and west at this depth, 200 feet in extent each way.

At Caribou, the Caribou Gold Mines is working what is known as the "Ross Lead" and is prospecting and developing other leads from a vertical shaft 100 feet deep. Its workings are small and the tonnage handled as yet very limited. Seven hundred and fifty-four tons of ore crushed in 1911 yielded 850 ounces of gold.

The Switzer Mining Company is reopening the "Lowe Mine" at Fifteen-Mile Brook. As yet, no crushing other than small tests have been made.

At Lake Catcha the Petpeswick Mining Company is developing, stoping area, or what is known as the "Coleman Lead.", A shaft has lately been put down to a depth of 460 feet and extensive levels driven east and west. In the east level a feeder of water was met, and for the time being work has been discontinued at the bottom level, and levels commenced east and west at a lesser depth.

At Goldenville, Sherbrooke, the Goldenville Mining Company is preparing to commence mining; it is at present engaged in completing the construction and equipment of a hydro-electric plant at Liscomb River, about 7 miles from its mine.

At the other properties mentioned prospecting and mining on a small scale is being engaged in. The industry at the present time is less active than has been the case for a number of years, and the production of gold for the year will not likely exceed 7,000 ounces.

Gold mining as an industry of Nova Scotia is now very inactive and, further, has never reached the proportion expected of it. The causes why the industry has not shown greater growth and is not to-day more active, are many. Space does not permit me to do more than deal very briefly with a few of the more important.

Probably the most important cause of unsuccessful gold mining in the Province may be attributed to the failure to recognize and determine, even in a general way, the extent, strike and economic value of ore shoots, or in brief to determine whether or not an ore shoot exists. And further, when the ore shoot is recognized to disregard the strike, and to sink a shaft that but a few feet from the surface deviates from it and soon necessitates long and expensive level extensions in order to mine it.

The next important cause of failing has been the non-determination of the probable life of the mine, by prospecting first and development later, a factor of particular importance where small veins are worked.

Again, Nova Scotia has long suffered along with other mining companies from mine promotion for sale of stock purposes and not mining at a profit. Nova Scotia is, unfortunately, particularly adapted for this class of operation on account of its geographical position and the fact that spectacular specimens can quite readily be obtained from almost any of the districts.

One other disastrous feature has been the all-to-frequent practice of trying to make a large mine on a lead of very limited extent, resulting in the loading of the property with a capital expenditure far in excess of what may ever be reasonably be expected to be returned.

Gold mining in Nova Scotia, undertaking with due regard to the limited size of the ore shoots and the location of shafts and other workings with proper respect to the strike of the ore-shoots from an economical standpoint, offers reasonable chances of success.

Mining in general, and gold mining in particular, in its initial stages, must always mean the outlay of money with seldom even equal chances of return. The Nova Scotia gold fields do not in this respect differ from other gold fields, and for the person or corporation who is prepared to undertake gold mining along conservative lines, Nova Scotia offers a promising field for investment.

NEW BANKHEAD AT ALBION MINES.

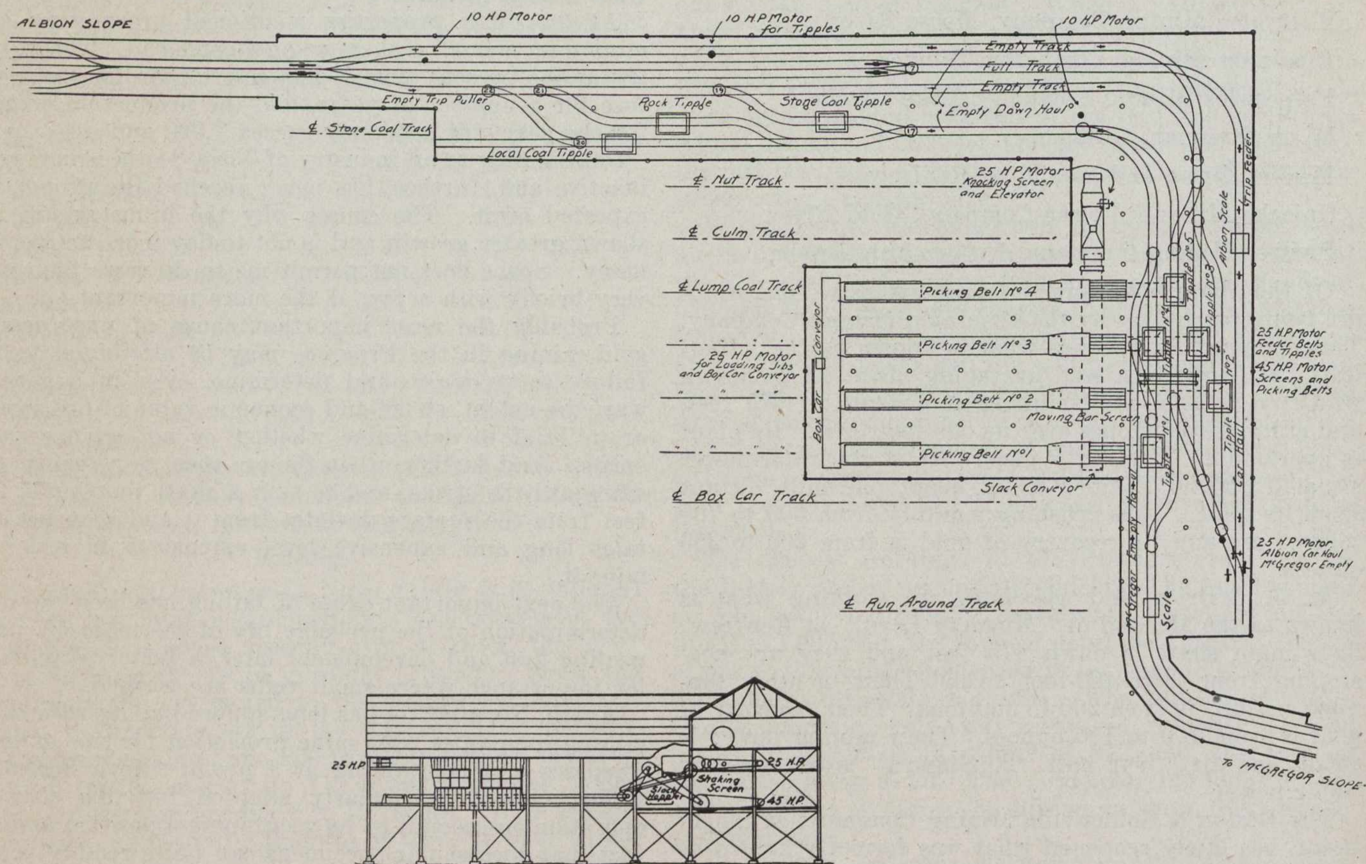
Acadia Coal Company, Limited, Stellarton, N. S.

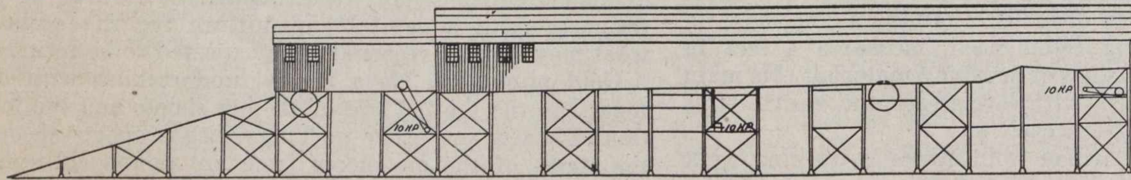
Written for the Canadian Mining Journal.

Control of the Acadia Coal Company, Limited, whose mines comprise the Albion Colliery at Stellarton, the Allan Shaft at Stellarton, the Acadia Colliery at Westville, and the Vale Colliery at Thorburn, was recently acquired by a syndicate of Belgian capitalists, who instituted a vigorous course of development.

and all auxiliary machinery to handle an output of two thousand tons per day.

The design and erection, complete, of this whole work was trusted to the Brown Machine Company, Limited, of New Glasgow, N.S. In February, 1911, a contract was closed, and work was started in the





Among the first improvements decided on was the replacement of the surface equipment of the Albion Mines, which is the largest producing mine owned by the company. This scheme comprised the installation of a new bankhead to handle the output of two slopes, viz., the Albion, which produces about one thousand tons a day, and the McGregor, which produces four to five hundred tons a day. These two seams are worked from slopes, the openings of which are only some five hundred feet apart at the surface, so that utilizing one bankhead for the two mines was quite feasible. It was proposed to erect a modern steel frame bankhead with complete equipments of tipples, screens, picking belts,

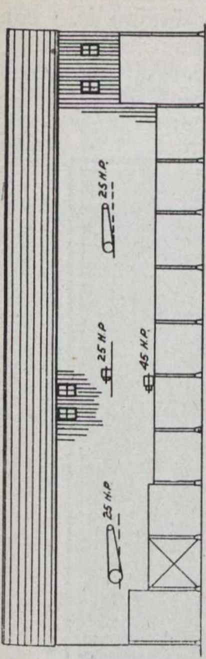
early summer.

The bankhead has recently been placed in full operation, and the erection of all the plant and buildings was completed without any interruption to the working of either mine.

Before describing the layout of the bankhead, some of the other improvements added to the colliery might be mentioned.

At the Allan Shaft during the summer of 1911, the installation of a new steam turbine driven electrical plant was started, and cable laid underground to the Albion mine. This enabled a complete electrical hoisting equipment to be installed there, and each slope at the Albion is equipped with a 300-h.p. Siemens Bros. geared hoist, operating with 3000 volt alternating current, and equipped with all the latest safety appliances for braking and controlling.

Two Walker compressors were also installed. These are rope driven by Siemens motors. All the auxiliary machinery for the bankhead and slopes is also being converted to electric drive.



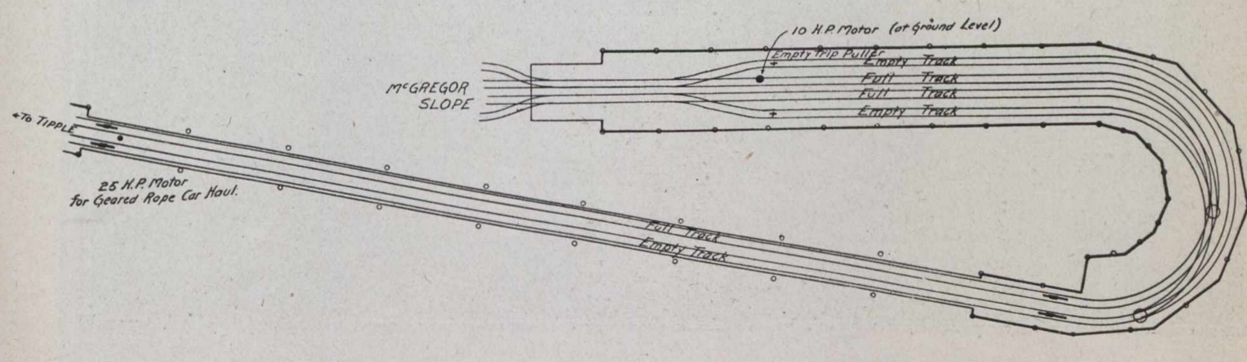
screens; also the elevator for slack coal to knocking screen, and the knocking screen for nut and culm coal. The upper floor at a general elevation of 35 feet carries all tracks and tipples, etc., to dump coal to screens. The picking belt house is 60 feet span by 90 feet long, joining to north side of tipple house, and has one floor only about 16 feet above grade, which carries the picking belts, etc.

The Albion approach is 35 feet span and 240 feet long, connecting slope mouth to tipple house, and has one floor about 24 feet above grade. It also contains three tipples and bins for handling rock, stope coal, and coal for local sales. The connection to the slope is by a steel trestle of five bents, 15 feet apart.

In the construction of the building 6 feet or 8 feet columns were used, except around screening plant, where 10 inch H columns are used, stiffened by 2-15 in. 33 lb. channels. All longer columns were made 8 in. H up to top floor, and 6 in. H column extensions spliced to them.

The floor beams through for main floor are 18 in. and 15 in. "I" beams, and the whole structure is thoroughly braced by heavy struts and angle cross bracing. The roof trusses are all 15 feet centres, and purlins are 6 in. channels with 2 in. by 6 in. wood nailing strip bolted on to take the roofing.

The plan used for floors was to keep all steel floor beams two feet below grade of base of rail, and a hard pine cap 8 in. by 10 in, was then bolted to steel beam. Under each rail a 6 in. by 12 in. hard pine stringer was placed, resting on 8 in. by 10 in. cap. Stringers 4 in. by 12 in. were used for floor not carrying tracks. On account of all tracks being graded, and



The Brown Machine Company, Limited, has supplied two 12 ft. 6 in. dia. by 4 ft. Clifford fans, which are now being erected. These fans are driven by 150 h.p. Siemens motors with rope drives. They were built by the Brown Machine Company, Limited, at New Glasgow, under the superintendence of the Clifford Fan Works, of Jeanette, Pa.

A number of new buildings were erected by the Acadia Company, for the installation of a Draeger apparatus, and new lamp and wash houses.

The Main Bankhead.

The specifications for the buildings called for steel structures throughout, and the building comprise: The McGregor approach, 22 ft. span by 135 ft., with curved portion same size connecting to a steel trestle carrying two tracks which join the McGregor and Albion bankheads. This trestle is about 320 feet long, with maximum height of 34 feet at delivery end. The main tipple house is 37 ft. span by 160 ft., with 42 ft. 6 in. posts. The tipple house contains three floors, viz., conveyor floor, elevation 14 ft. 6 in., on which are located slack conveyor, slack bins, and drive shafting for

in many cases the grades varying considerably, this form of construction enabled the stringers to be framed into the caps to suit track grades. The main floors were laid with 3 in. by 6 in. surfaced spruce grooved flooring with ½in. by 1 in. hardwood tongues, and rails laid directly on this floor.

The floors in the picking belt house and the feeder and conveyor floors are of two thicknesses of 2 inch surfaced spruce, spiked to 4 in. by 6 in. nailing strips bolted to the steel. All outside floors, as on trestles and bank slopes are 3 inch deal.

The roofs of all buildings were laid with 1¼ inch tongued and grooved sheathings and covered with two ply rubberoid.

All the sides of the buildings are covered with 22-gauge corrugated iron, and an ample supply of light is furnished by placing two twelve-light windows in every 15 foot span, except in picking-belt house, where twenty light-frames are used.

The tracks throughout were laid with Nova Scotia Steel and Coal Co. No. 40 standard rails, and complete equipment of frogs and split switches were installed.

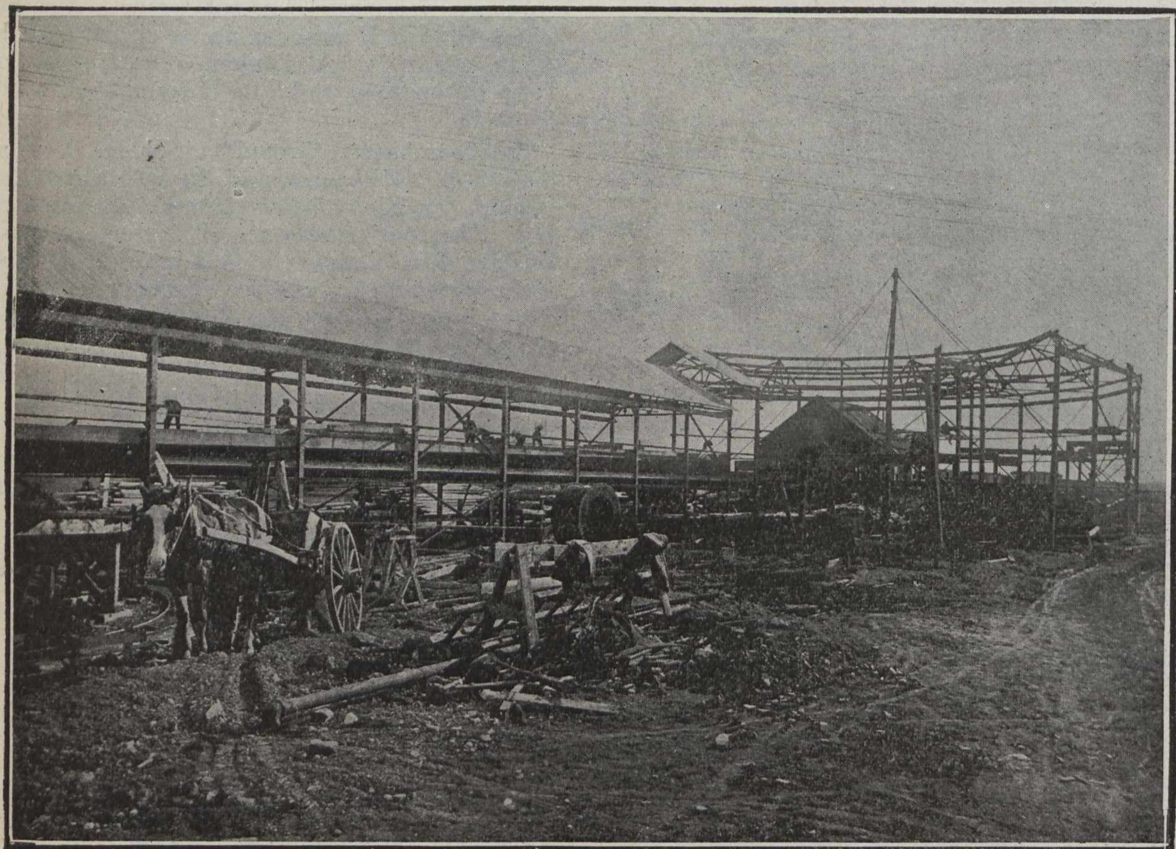
Scheme of Operation.

The scheme of operation porvides for handling rakes of fifteen boxes, and each box contains about two thousand pounds of coal. The coal from the Albion mine is hoisted on a three-rail main haulage track, with passing-tracks halfway down the slope. When the rake is landed and uncoupled from the rope, it runs by gravity around curve to foot of rope car haul, where cars are taken singly to the tipple floor.

This car haul is a standard type of rope car haul, with hooks spaced about 12 feet apart, and travels at a speed of 36 feet per minute.

On reaching the top of the trestle the cars run by gravity to the scales and from there to the tipple. On Brown Machine Company cone clutch. These tipples are capable of being operated at a speed of five boxes per minute continuously.

The installation in the picking belt house calls for three belts at present, with provision for one additional belt later. In describing the screening plant further, the course of the coal after having been dumped at any one tipple is the same for all the rest. Having taken the coal to the tipples, it is then dumped on feeder belts, which delivers to the screens. The feeder belts are Brown Machine Company design and consist of endless steel plate conveyors. The steel plates are cold pressed with curved lapover joints and are 3/16 plate, 4ft. long, attached to two strands of roller chain



Bank Head, Albion Mine

being dumped, the cars runs through and crosses over to empty track to a kickback which starts car on return trip to mine. A short car haul catches car to raise it sufficiently to return to empty side of rope car haul which lowers it to McGregor bankhead. On leaving car haul the boxes are run by gravity to empty tracks where rakes are made up, and on each empty track near brow is a short chain trip puller which starts rake over the brow after coupling up.

The tipple used is of standard Brown Machine Company design, and consists of two heavy end castings connected with steel plate sides and cast iron seperators and provided with standard axle locking device, which releases the boxes automatically. The ends, and revolving part of tipple, are all assembled and treads turned off in one setting which insures a smooth running cage. The cage is mounted on rollers supported on cast iron frame, and drive mechanism is by a belt off main line shaft controlled by a standard 12-inch of 4 in. pitch. The chain and side plates of feeder belt are supported on a structural steel frame. The driving shafts are at outer end and are belt driven from main line shaft. The feeder belt delivers the coal to a set of cast iron moving bar screens. These bars have slots about 1⅛ in. by 9 in. long, and are worked by eccentrics that give each alternate bar a horizontal and slight vertical movement, so that bars are working in opposite directions and the smaller coal is worked through the bars on the steel plate shaking screen underneath. The lump coal passes over end of bars to a chute which delivers it on picking belt.

The shaking screens are 6 ft. 3 in. by 19 ft. long and have 1 in. by 2¼ in. perforations. The frame is of heavy angle and screen is supported by ¾ in. by 3 in. swinging rods with heavy forged ends bored and bushed for the pins. The screens are operated by eccentrics from the same shaft that drives the moving bar screens.

All the lump coal having been delivered to the picking belts, it is carefully picked and delivered to the cars. All coal for gondolas and hopper cars is loaded by lowering picking belt jibs through floor to car, and a cross belt conveyor for loading box cars is provided to take coal from picking belts and carry it to the west side of picking belt house where box car loader is situated.

The picking belts are standard B. M. C. design having seven inch flat plate and 1/4-inch thick, 5 feet long, with cast steel lugs riveted on and coupled together with 5/8 diameter rods. The belts are supported on 6 by 4 angles for upper belt and 3 by 3 angles for return side; these angles are supported at intervals by cast iron stanchions which are bolted to floor. The length of belt ais 40 ft. 3 in. to the knuckle, and jib extension is 21 ft., or a total length between centres of 61 ft. 3 in.

The loading jibs are raised and lowered by worm geared hoists driven off line shaft by a motor. The capacity of these belts is rated at 500 tons each per 10 hours, although considerably more can be carried.

The driving arrangement for feeder belt and tipples is grouped to one line shaft, and each tipple and feeder belt is separately controlled through an individual clutch. The screens, picking belt and slack conveyor are driven off main line shaft and separate friction clutch is provided on line shaft to separate each set of screens.

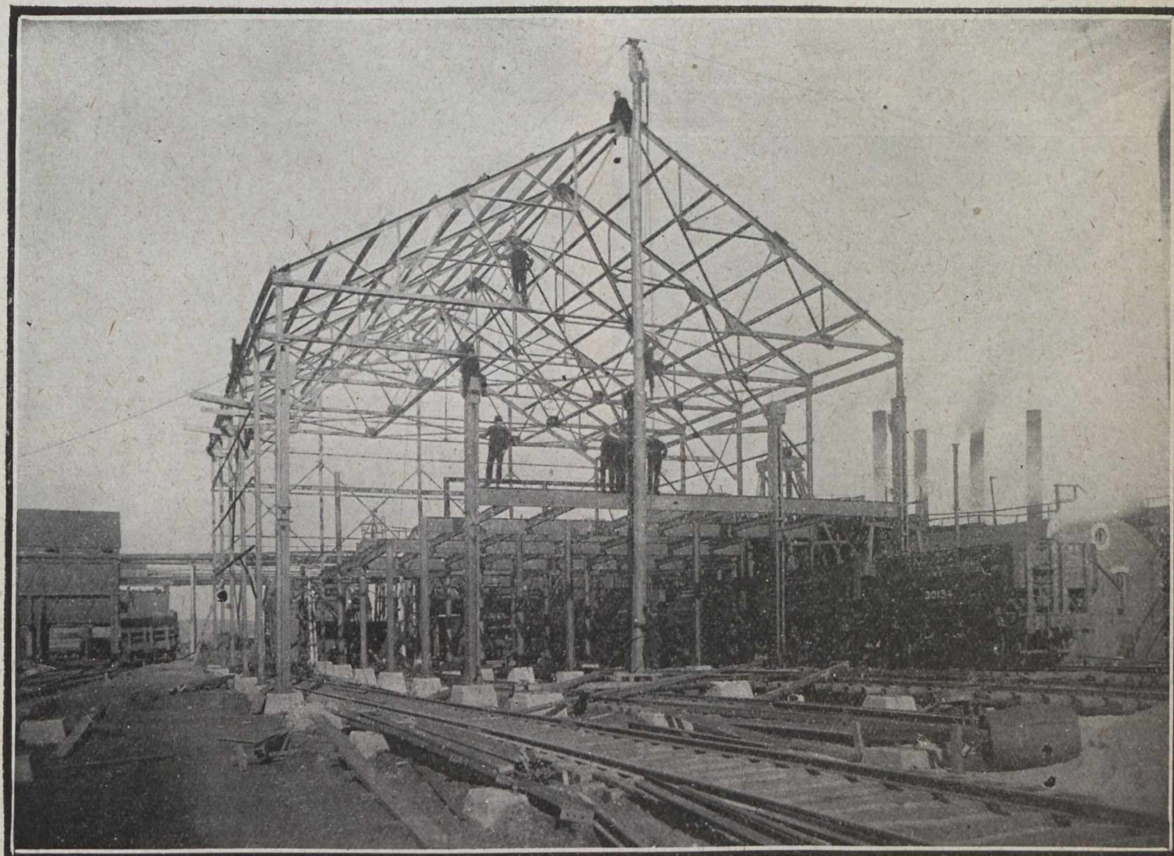
All slack coal from screens falls into hoppers with gates on bottom and these hoppers deliver it to a vibrating conveyor 6 feet wide, which carries the coal across building to an elevator. This elevator has a double set of buckets and a capacity of about 60 tons per hour, and by it the coal is elevated sufficiently to be delivered to a knocking screen, which separates the nut and culm coal. Hoppers are provided for each size and when shifting cars the gates may be closed and machinery run without interruption.

The above arrangement provides for making the following grades of coal; lump, run-of-mine, slack, nut, and culm. The run-of-mine coal is taken from screens to picking belt by putting veil plates over perforations in shaking screen, and the slack coal is taken direct from conveyor by opening a door in bottom of vibrating conveyor and letting coal drop through to car underneath.

The method of handling mine boxes for the Albion is as follows:

Rakes of fifteen cars each are delivered on bankhead and after uncoupling are run by gravity to a trip feeder which delivers cars singly to the scales. After the cars are weighed the main car haul raises them to the tipple floor. This car haul has hooks spaced 13 ft. 4 in., and a speed of 60 ft. per minute, and delivers cars on top of kickback which distributes cars to the different tipples. The maximum grade of this car haul is 32.38%, and the distance between the end shafts is 61 feet. This car haul, and also the one for the McGregor cars, are driven by a 25 h.p. motor, and an automatic braking device is fitted to prevent cars running back in case of any accident to the driving gear.

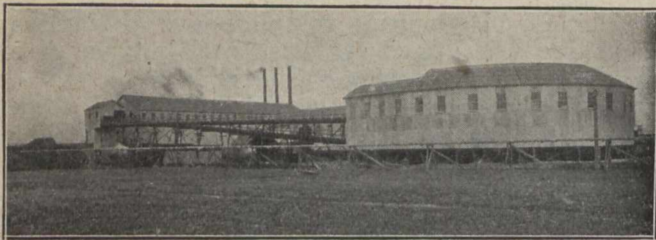
After passing through tipples, the Albion cars are returned to the bankhead by three down car hauls, two of which handle empty coal boxes and the third is used to lower the loaded boxes of rock and stone coal to the tipples over loading bins. The bins for domestic coal is also filled by transferring cars from main bankhead. The empty cars are assembled on two empty



Picking Belt House, Albion Mine

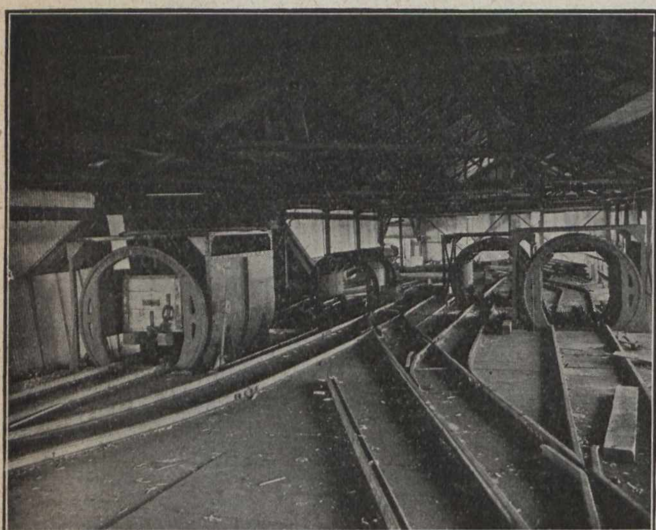
tracks, and a trip puller is provided on each track to start the rakes over the brow.

Besides the main machinery above mentioned all operating mechanism, rope pulleys, chutes, and hoppers were supplied complete and the plant was turned over to the Acadia Coal Co., Limited, ready to operate.



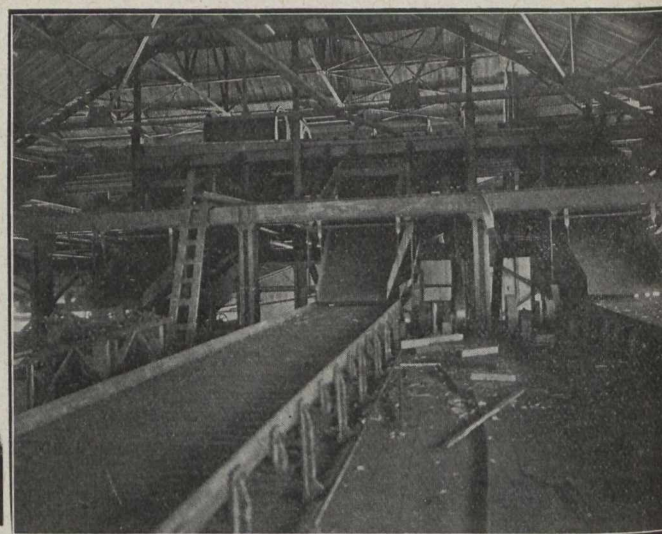
Albion and McGregor Bankhead

During the erection a number of difficulties had to be contended with, as all the new work had to be erected over old structures and all the existing tracks had to be kept clear until new tracks were provided. However, by putting in temporary posts and shoring up old work, by May 24th last all the new work had been put up and all the machinery was in place ready for operation, except 120 feet of the Albion approach and the slope bents. It was decided to connect up the McGregor slope first, and this was done on Friday, Saturday, and Sunday around May 24th; the slope being shut down for one day beside the holiday.



Tipple Floor, Albion Mine

To erect the balance of the Albion approach and tear out old machinery and buildings it was estimated that two weeks would be sufficient, and on Saturday afternoon, June 1st, work was started to tear down the old structures. By Sunday evening, June 2nd, all the old buildings, etc., were removed, and erection of the steelwork was started. All the steelwork was erected by Thursday, and by Monday, June 9th, all floors and tracks were laid and coal was hoisted over new bankhead on Wednesday, June 10th, or five days ahead of the time promised.



Screen and Picking Belts, Albion Mine

This bankhead is the first instance in Nova Scotia where one firm has taken a contract to furnish the equipment for such a plant complete, and all the structural steelwork, machinery, and other work was turned out of the shops of the Brown Machine Company, Limited, at Trenton, N. S.

Mr. C. W. Laing, lately construction engineer for the Dominion Coal Co., Limited, is chief engineer of the company, and was responsible for the design and turning out of the work from the shops. The field work of erection was in charge of Mr. J. A. Stairs.

MANUFACTURE OF FIREBRICKS.

Written Specially for the Canadian Mining Journal.

The Intercolonial Coal Mining Company, of Westville, Pictou County, N. S., not only mines coal and prepares coke, but also manufactures fire brick. At present this is the only place in Canada where fire brick is made from native clay.

The company has three seams of coal on its property. Its principal workings are in the upper seam which is 10 to 14 feet thick. The main haulage slope is 8,800 feet long on a dip of about 14 degrees. The present workings are thus about 2,000 feet deep vertically. The slope is the longest haulage slope in Nova Scotia and the coal is being extracted from a greater depth than in any other mine in the Province.

There are two other coal seams underlying the one in which the main working is carried on. The bed of fireclay lies just under the third or lowest seam. The thickness of the clay bed or seam is 5 ft. 6 inches.

Dr. Ries made some physical tests on this clay during a recent investigation into the Nova Scotia clays and shales for the Canadian Geological Survey. He reports the following results:

"The shale in its ground condition worked up with 13% of water to a gritty but fairly plastic mass. Its air shrinkage is 3.6% and average tensile strength 60 lb. per square inch. The wet-moulded bricklets behaved as follows:

"At cone 10, fire shrinkage 0 per cent., absorption 11.03 per cent., and colour buff.

"At cone 05, fire shrinkage 2 per cent., absorption 9.19 per cent., and colour buff.

"At cone 03, fire shrinkage 2.3 per cent., absorption 8.08 per cent.

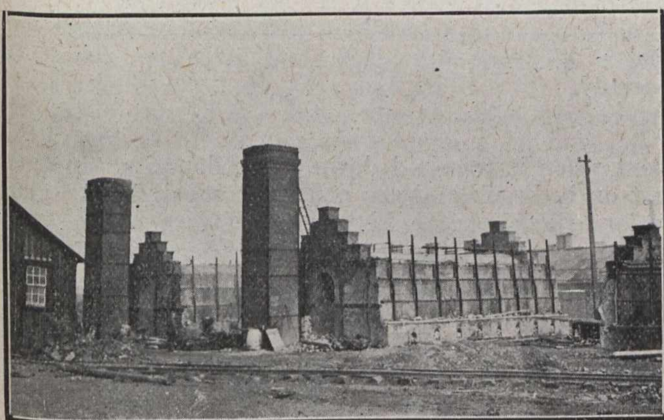
"Ot cone 1, fire shrinkage 0.4 per cent., and absorption 4.80 per cent.

"At cone 3, fire shrinkage 4 per cent., absorption 5.04 per cent., and colour still buff.

"The bricklets were not carried above this temperature, but the fusion point was determined to be about 14.

"The clay can be worked in either a stiff mud or dry-press machine, and gives a good dry-press body at cone 03. with an obsorption of 9.25 per cent."

In order to exploit the seam of clay a "stone drift" or haulage level was driven from the main slope to the fire-clay bed at a distance of 3.200 feet from the surface at a vertical depth of about 750 ft. Levels are first driven in the clay itself, back balances driven up in the bed and finally rooms broken off the balances. The pillars are left standing. The mining of the fireclay is done practically altogether by blasting from the



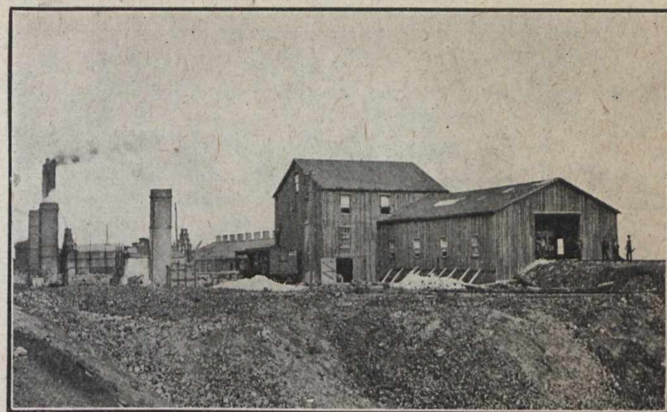
Brick Kilns

solid. Slant holes from the sides of the walls are first drilled toward the centre at the top and then powder holes to the walls near the floor. The fireclay is loaded into cars, hauled through the "stone-drift" to the main hoisting slope and there dumped into large railway hoppers. It is thence hauled to the brick plant by locomotive.

The fireclay is dumped from the hoppers into the stock house and carried in barrows to be crushed in a 9-foot dry pen. A bucket elevator carries the dry ground clay to a double shaft mixer which discharges the clay mixed with approximately the right quantity of water to a small pug mill where the plastic mass is brought into the proper condition for pressing the brick. The pug mill discharges the clay to a six-mold stiff plastic machine where the brick is formed and partially pressed. This machine automatically discharges the molded brick to a toggle press where each brick receives its final pressure.

From the press the bricks are taken by hand and placed on the steel floor of a large drying house and dried by steam heat. If the bricks are placed on edge they will dry sufficiently in one day, but it requires two days if placed on end. The manner of placing them on the drying floor simply depends on the exigencies of burning in the kilns.

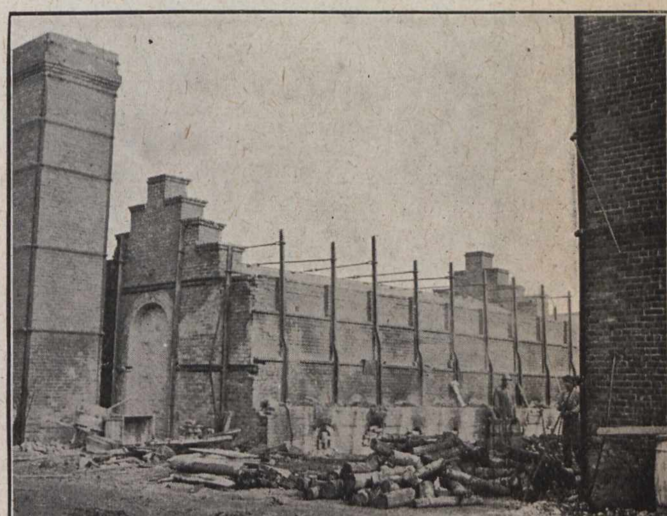
After the bricks have dried sufficiently they are carried in barrows to the kilns where they are stacked in the form of a long rectangular house with a pitch roof. They are so placed that there is an air space all around each brick. The kilns are rectangular down draft kilns with eight fireholes on each side. The fuel for firing is Drummond run of mine coal which is produced by the company. 35,000 bricks are placed in a kiln for each firing. The ends of the kilns are finally



Brick Kilns in Fire

all bricked up save for a peephole or two and the bricks are ready for the fire.

An esay fire is first started to drive on the moisture slowly, which part of the process takes about five or six days. Then the temperature is raised to the full firing point which is from 3000 deg. to 3200 deg. F. The temperature is judged by eye by the superintendent, and is also controlled by Seger cones. The heat is maintained at full fire for 55 to 60 hours, and then



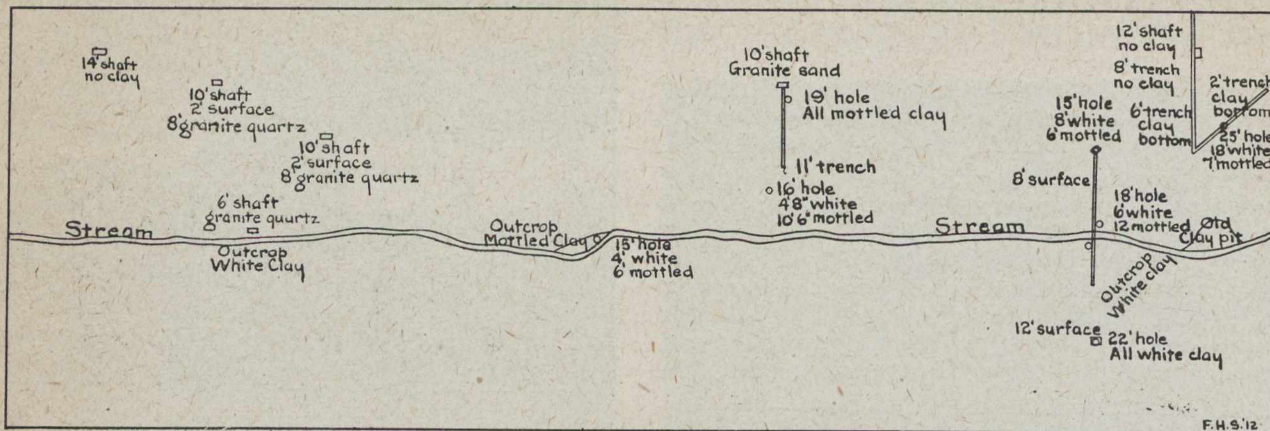
Fire Brick Plant

is gradually drawn down. It takes from five to six days for the kiln to cool off before it can be entered. The bricks are loaded directly into railway cars on the track which runs only, a few feet from the front of the kiln.

Last year the company sold 657,000 fire bricks. These went to the Dominion Steel Corporation and the Nova Scotia Steel and Coal Company. Both these companies find it to be the very best brick obtainable for lining ladles and slag cars.

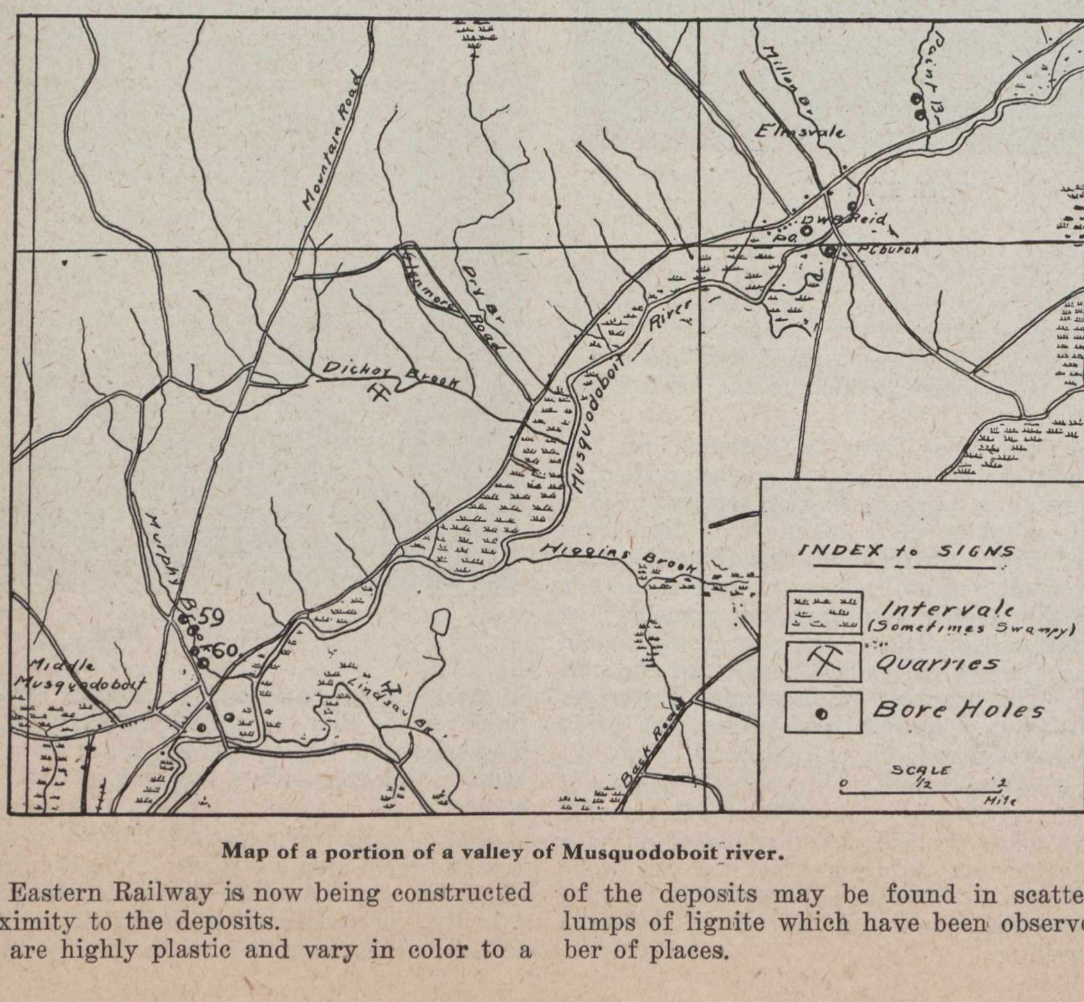
CLAY DEPOSITS OF MIDDLE MUSQUODOBOIT, NOVA SCOTIA.

There is a large undeveloped deposit or series of deposits of clay along the Musquodoboit River, near Middle Musquodoboit, N.S. The extension of these deposits is uncertain, but there are a number of outcrops for a distance of about seven miles from Murphy Brook at Middle Musquodoboit to Paint Brook, further up the river. These clays are now likely to be tested and perhaps exploited in view of the fact that the Halifax and Eastern Railway is now being constructed in close proximity to the deposits.



Sample Plan
Clay Deposit
Reid Farm, Middle Musquodoboit, N.S.

The clays are highly plastic and vary in color to a considerable degree. Some are white, some are dark gray, and some are mottled white and red. The red in the mottled clays seems to be due to the oxidation of particles of pyrites which were included in the sediment when it was laid down. The deposits appear to rest on bed-rock and are generally covered with more or less glacial drift. The geological age of the clays has not been exactly determined. The key to the age of the deposits may be found in scattered included lumps of lignite which have been observed in a number of places.



Map of a portion of a valley of Musquodoboit river.

Since the clays are covered with a mantle of glacial drift, these unconsolidated sediments are known locally as "underclay."

Dr. Ries, in a recent report (*) on the clays of Nova Scotia, refers especially to these deposits. It his opinion the "underclay" was laid down previous to the glaciation of the region, while the river valley was occupied by a body of still water, probably an arm of the sea. The clays may have been transported from the granite areas east of the present headwaters of the Musquodoboit River. During flood periods sands, silts and wood were washed in from the surrounding hills and deposited as impurities with the transported clay. Most of the iron oxide distributed through the beds of mottled clay was probably derived from the ferruginous slates which form the bed rock of the ridge on the north side of the river valley.

The clay deposits suffered severe erosion during the glacial period. The glacial drift, which consists mostly of a stiff boulder clay, contains a fairly large proportion of the "underclay" and occasional large masses of the latter.

The limited number of borings which have been made in these deposits show that there is not one mass of pure, high-grade clay as is generally believed in the neighbourhood, but that the occurrence is a stratified deposit of unconsolidated sediments made up of alternating beds of clays, silts and sands, with occasional layers of lignite and some concretionary iron pyrite. The sections obtained show considerable variation in the sequence and thickness of the beds even within short distances. This is evident from the borehole records given in a following paragraph.

The clay deposits are thick and of an unknown depth. The borehole records show the clays to a depth of 25 feet since this was about the limit of the apparatus. In boring for coal a few years ago a borehole was put down to a depth of 205 feet. At a depth of 65 feet they went through a bed of black clay about 10 feet thick and at a depth of 138 feet a similar bed carrying float coal and 15 or 20 feet thick was bored through:—

On property of Norman Deal, west bank of Paint Brook:—

	Ft.	Ins.
Soil	1	0
Bright red clay	8	0
Mottled red and grey clay	3	0
Grey sand	1	0
Mottled red and grey clay	8	0
Coarse dark red sand	0	6
Mottled red and grey clay	3	6
	25	0

On Paint Brook, 75 feet higher up stream:—

	Ft.	Ins.
Soil and gravel	3	6
Mottled red and grey clay	4	6
Light grey clay	2	0
Mottled grey and red clay	5	0
Dark grey clay	1	6
Mottled red and grey clay	1	6
	18	0

On road near Presbyterian church—patch of clay exposed on roadside:—

	Ft.	Isn.
Light grey clay	1	0
Coarse brown sand	4	0
Light grey clay	0	6
Yellow sandy clay	0	6
Mottled red and grey clay	3	0
Red and grey stratified sand, with some thin layers of clay	6	0
Mottled red and grey clay	1	0
Light grey sand	3	0
	19	0

Sections of the clay deposit on the lower portion of Murphy Brook show a body of clay from 17 to 20 feet thick, containing no sandy partings.

Borehole No. 1—Murphy Brook, about 225 feet above G. T. Reid's house (clay exposed in bed of brook):—

	Ft.	Ins.
Grey clay with some mottled red and grey beds	17	0
Silty clay	4	0
Mottled red and grey clay	1	0
	22	0

Borehole No. 2—Murphy Brook, about 400 feet above No. 1 (clay exposed at edge of brook):—

	Ft.	Ins.
Mottled red and grey clay	20	0
Dark grey clay, sand and lignite	1	6
Dark grey clay	2	0
Mottled red and grey clay	1	6
	25	0

Borehole No. 3—Murphy Brook, on west bank, 30 feet from brook about 250 feet above No. 2:—

	Ft.	Ins.
Soil	1	0
Mottled red and grey clay	1	0
Glacial clay	5	0
Dark grey clay	1	0
Red and grey mottled clay	1	0
Light grey clay	2	0
Red and grey mottled clay	1	0
Grey sandy clay	1	0
Red sand	1	0
White sand—water	2	0
	15	0

Borehole No. 4—Murphy Brook, about 250 feet above No. 3 (clay exposed on bank):—

	Ft.	Ins.
Light grey clay	3	0
Mottled red and grey clay	2	0
Mottled red and grey silty clay	4	0
Yellow, white and gray stratified sands	9	0
	18	0

Borehole No. 5—On William McCurdy's property (clay exposed at edge of Musquodoboit River):—

	Ft.	Ins.
Mottled white and red clay	1	0
Grey clay	3	0
Mottled red and grey clay	8	0
Red and grey silty clay	3	0
Grey clay	4	0
Brown and grey silty clay	3	0
Grey and mottled clay	1	0
	23	0

The plasticity of the clay is generally good, even the silty beds possessing fair plasticity, and as the shrinkage

(*) The clay and shale deposits of Nova Scotia and portions of New Brunswick, Heinrich Ries. Ottawa, 1911.

of the latter is less than in the purer beds, they may be manufactured into higher grades of structural material, such as pressed brick and floor tiles.

The physical tests and chemical analysis of the clay is given below.

No. 1 clay from Borehole No. 2, Murphy Brook, 91.6 per cent. passed through a 200-mesh sieve. It worked up to a smooth plastic mass with 30.8 per cent. water, the air shrinkage of which was 6.5 per cent. and tensile strength of 68 lbs. per square inch.

Wet -Moulded Bricklets.

	Fire shrinkage.	Absorption.	
Cone.	Pct.	Pct.	Colour.
010	0.1	21.68	Salmon pink
05	2.6	18.29	Light salmon pink
03	6.	12.96	Light salmon pink
1	6.3	7.00	Pink
3	6.3	5.41	Pink
5	7.3	3.66	Red
9	9.	0.29	Red brown

The bricklets had a good body at cone 05 and were steel-hard at 03. They preserved their form at cone 9, but the shrinkage was rather high.

No. 2 clay from Borehole No 4, Murphy Brook: 99 per cent. passed through a 200-mesh sieve. Air shrinkage 6.8 per cent., average tensile strength, 81 lb per. square inch.

	Fire shrinkage.	Absorption.	
Cone.	Pct.	Pct.	Colour.
010	0.4	19.3	White
05	2.3	16.71	White
03	6.0	15.92	White
1	6.0	7.41	White
3	6.0	7.71	Cream
5	7.3	4.89	Cream
9	8.0	4.34	Cream

The bricklets were rather soft at cone 110, fairly hard at 05 and steel-hard at cone 1. The clay fuses at cone 27, and may be classed as a No. 2 fire clay, suitable for the manufacture of stoneware, face brick or terra cotta.

Chemical Analysis of Clay No. 2.

	Pct.
Silica	55.14
Alumina	28.84
Ferric oxide	1.91
Titanic oxide	2.37
Magnesia	0.25
Lime	0.38
Soda	0.48
Potash	1.88
Water	9.24
	100.49

Mr. F. H. Mason made an examination of a portion of the clay deposit on Murphy Brook for a length of about 1,200 feet in 1900. A prospector brought him a sample of the clay, which was a little off colour, due to organic matter, but which burned to a pure white colour both in an oxidizing and reducing atmosphere. The clay had an extremely high fusing point, which made Mr. Mason think it would be a high-grade fire clay.

An analysis of this clay showed the following results:—

	Pct.
Silica	50.90
Alumina	37.30
Oxide of iron	Trace
Lime	Nil
Fixed alkalies	0.65
Loss on ignition	11.19

He sampled the clay with a drive pipe provided with a footpiece shaped like a cheese sampler. This tool could be used to penetrate to a depth of about 30 feet. The accompanying plan shows the location of the samples and the kinds of clay in the sections obtained.

The different clays were analyzed by cutting V-shaped sections out of each section of the core, and the results were as follows:—

	Average sample white clay from 18 ft. bore hole.	Average sample mottled clay foom 15 ft. bore hole.	Floated mottled clay.	Floated white clay.
Silica	53.20	63.91	52.90	53.00
Alumina	30.25	18.60	29.00	32.10
Oxide of iron	1.72	5.75	3.20	1.70
Lime	Nil	Trace	*	Nil
Magnesia	Trace	Trace	*	Trace
Alkalies	1.33	*	*	0.97
Loss on ignition	12.00	10.30	12.10	12.20
Titanic oxide	1.47	*	*	*

* Not determined.

The presence of quartz sand led Mr. Mason to conclude that the clay was a product of the decomposition of granite at some source from which the clay was transported. He also believed that the red spots in the mottled clay resulted from particles of pyrite because on close examination the mottled spots showed that the mottling radiated from centres or nuclei.

Mr. Mason was examining the deposit with one view, viz., the adaptability of the clay for the manufacture of firebrick. He sent samples of the clay to Col. W. C. Trotter of the Standard Pipe Company of St. Johns, Quebec, who made some sample brick and placed them in the lining of a blast furnace. Col. Trotter mixed the clay with 25 per cent. of silica sand in order to make the test firebricks. The bricks did not stand the heat in the blast for more than 24 hours, so that Mr. Mason abandoned the project.

With the advent of the new Halifax and Eastern Railway, however, which passes directly through these deposits of clay, there is no doubt but that they will be further investigated. There is every reason to believe that one or more clay working industries will be established in this vicinity in the near future.

THE NOVA SCOTIA MANGANESE CO., LIMITED.

(Writen for the Canadian Mining Journal.)

[Editor's Note:—On another page the reader will find an abstract of Mr. H. E. Kramm's paper on the geological occurrence of manganese ores at New Ross, N. S. The following article and the abstract referred to, give in small compass the principal data concerning the only manganese deposit that is being worked in Nova Scotia.]

As long ago as the year 1813, the Crown issued a grant of 5,500 acres of land in the north-eastern portion of Lunenburg County (see map), to the Bishop of Nova Scotia for the support of Dean and Chapter. To this day the Church of England holds this property, and the current title by which it is known is "The Dean and Chapter Grant." The church authorities indulged in no prospecting, nor, apparently, did they seek to colonize the land. They merely cut the pick of the timber and praised God for that.

In the year 1907, a prospector named Turner, a native of New Ross, discovered a showing of manganese on the property. He set to work stripping and sinking test pits, and finally uncovered a promising vein of pyrolusite and psilomelane. Unable to develop the property himself, he was fortunate in securing the assistance of Dr. H. W. Cain and Mr. E. Norman Dimock, both of Windsor, N. S. After a considerable amount of prospecting and preliminary work had been done, the Nova Scotia Manganese Company, Limited, was organized to take over and develop the property. The company's first step was to secure a 99-year lease on the Dean and Chapter grant. The terms of the lease provided for the payment of a royalty, and transferred to the company for 99 years all the mineral rights of the 5,500 acres, together with the privilege of cutting all timber necessary for fuel or mining purposes. In addition to this the company secured from the Provincial Government exclusive licenses to search for manganese and iron ores over an area of five square miles.

Since its organization, the company has been active. For the past two years, about 20 men have been employed in prospecting, development, and construction. The first vein has been traced for a distance of 1,500 feet on the surface, and a shaft has been sunk to a depth of 165 feet. At the 150-foot level a station has been cut and drifts have been run for 200 feet on the vein. A second vein was discovered near the first, by surface prospecting; and there is evidence, from "float," of the existence of other veins. Meanwhile 450 tons of high-grade ore, containing from 85 per cent. to 95 per cent. Mn O2, have been mined. The company estimates that the ore immediately available in the mine amounts to 5,000 tons.

The Ore.

The vein being developed consists of a series of irregular, roughly lenticular masses mainly of pyrolusite, but also containing psilomelane and some manganite, associated with iron oxides in a more or less decomposed state. In some places these iron oxides are loose and friable, while in others they assume the form of a fairly compact limonite. The walls are of gray granite, slightly pegmatitic, and much decomposed on both sides of the vein. It is, therefore, necessary to keep all workings timbered up to the working face.

The vein dips at an angle of about 85 degrees, and strikes approximately east and west. It varies greatly in width. In places the ore pinches out entirely, giving place to iron oxides and to decomposed vein matter, while in other places it swells out to three, or even six feet of manganese ore. The proportion of manganese increases with depth as decomposition from surface agencies decreases.

The accompanying diagram, representing a portion of the drift, shows the general form of the vein and the size and relation of the ore bodies.

Equipment.

The surface equipment includes a saw mill and a shingle mill to supply building material; a combined shaft house and store house, which contains a small engine operating a hoist and a Cornish pump; a main power building containing an 80 h.p. return tubular Robb boiler and a 50 h.p. engine; and the concentrating mill building, 66 feet by 59 feet, one and one-half storeys high. Besides these structions, the company has erected an office, a bunk house, a storehouse, and stables.

The mill equipment consists of a Sturtevant jaw crusher, a sample grinder, three Newago vibrating seperators, several Richards jigs, and a Wilfly table.

General.

The lack of adequate transportation is the principal difficulty that has had to be faced; and it has not been overcome. The mine is situated 20 miles in a south-westerly direction from the town of Windsor, and 10 miles north of the village of New Ross. It can be reached either from Chester Basin on the H. and S. W. railway, or from Windsor. The distance by road from either point is 29 miles; but the last seven miles are passable for vehicles only in winter. Naturally this has been a very serious obstacle and has entailed much otherwise unnecessary expenditure. Machinery and supplies must be hauled in during the winter by ox-team, and all shipments of ore have to be taken out in the same manner. However, the company is now constructing 9¾ miles of wagon road from the mine to Benjamin's Mills, whence a haul of 3¼ miles will permit of taking the ore to Mud Bridge, a landing on the Avon River. Here the ore can be transferred to lighters and towed down to Windsor, where it can be distributed either by rail or by water.

The value of the manganese ore depends upon its relative purity and upon the use to which it is to be put. Prices range from $15 to $400 per ton. The product of the Nova Scotia Manganese Company, it is believed, will bring an average price of $25 per ton. Recent shipments made to the Humphrey Glass Company, at Trenton, New Jersey, and to the Brandram-Henderson paint works at Halifax, brought from $50 to $80 per ton. The shipments are reported to have met all the requirements.

THE OCCURRENCE OF MANGANESE AT NEW ROSS, N. S

The following is an abstract of a paper presented by Mr. H. E. Kramm, of Cornell University, at the annual meeting of the Canadian Mining Institute, held in Toronto in March last:

Deposits of manganese ores are found in many localities throughout Canada; but production in commercial quantities has been limited to that obtained from mines in the Provinces of Nova Scotia and New Brunswick. In Nova Scotia, the mining of manganese was inaugurated in 1861; but no considerable production was made until 1887, and even in that year when output attained its maximum, the yield was but 691 tons. The exports in 1887 were 578 tons, valued at $14,220. Since then the production has been declining and erratic.

The Nova Scotian ores are usually found in the form of oxides in association with sedimentary rocks, such as limestones, shales and conglomerates of the Lower Carboniferous series. The deposit to which reference is here specifically made, is situated about 10 miles to the north of New Ross. The ore occurs in two fissure veins in granite, known respectively as the "Old" and "New" mines. Both veins strike about N. 50 degrees E., dip between 70 and 90 degrees, and have widths ranging from zero to a maximum of 70 inches.

The Old Mine was worked for a period of about three years, from 1900; but after reaching a depth of 115, litigation occasioned the cessation of operations. Active development of the New Mine was commenced in 1910, the vein being now developed by a shaft, 160 feet down, while at 150 feet a level has been driven on the ore body.

The granite in which the veins occur is a batholith, covering many square miles to the south of Windsor, with a general trend approximately east and west. The constituents of the granite, which is porphyritic in appearance, are orthoclase (the crystals of which attain a length of from half an inch to an inch), quartz and biotite. The biotite occurs in hexagonal crystals, from 1/8 to 1/4 in. diameter; it is readily decomposed and disintergrated by weathering, occasioning blackish-brown stains in the surrounding rock mass. Quartz is less prominent. The granite appears to have been scoured by glacial erosion; and, in places, smooth, level areas are exposed upon which rest boulders of granite and occasionally fragments of metamorphosed sedimentary rocks. The fact that the over-burden is so limited is favourable to prospecting. The presence of manganese is indicated by float, which can be traced to its source. A further indication is the presence of red ochre, which occurs in fissures in the granite, and is known to prospectors as "paint." Wherever "paint" occurs, manganese is likely to be found in depth.

The ore body at New Ross may be regarded as comprising four zones, the first consisting of a gossan (hematite, limonite and goethite), while nearer the surface is a solid mass of iron oxides, which nearer still to the surface becomes floury, changing into red ochre. The thickness of the iron cover ranges from 10 to, perhaps, 15 feet. The second zone (downward), consists prevailingly of pyrolusite and small quantities of manganite. There is a gradual transition from the first to the second zone. Masses of pyrolusite are found in the ochre, the quantity of the former increasing with depth and, in places, filling the entire width of the fissure vein and making sharp lines of contact with the granite wall. On the other hand, elsewhere in the same zone, the entire fissure may be filled with ochre. The ore is very pure and highly oxidizes, consisting, in the upper portion, entirely of pyrolusite, while in the lower portion there is a considerable percentage of manganite. Crystals of pyrolusite, pseudomorpous after manganite, are notably common; in fact, the greater part of the highly oxidized zone consists of a felted mass of these crystals or else prisms protruding from a solid ground mass of pyrolusite. From the same zone a specimen of pyrolusite, pseudomorphous after a carbonate, probably rhodochrosite, was obtained. In the third zone, pyrolusite is less abundant. The ore becomes more massive and harder, assuming a steel blue colour. This ore is composed of manganite and psilomelane, pyrolusite being only occasionally present as crystals in the cavities. Ochre, however, is present as a gouge; or it may fill the entire space between the fissure walls, but it is here less in evidence than in the preceding zone. The fourth zone comprises a hard bluish-brown ore, the main constituents of which are psilomelane, oxide of iron and some manganite.

Analyses show that the degree of oxidation of the manganese is highest near the surface, gradually decreasing as depth is attained. The average manganese content at from 28 to 42 feet was 97.0 per cent., while at from 75 to 90 feet the percentage was 93.9. Thus while the manganese content at these respective depths does not differ markedly, the manganese dioxide, representing the percentage of pyrolusite, decreased 37.20 per cent. within a very short distance from the surface. The percentage of iron, on the other hand, increased. In the New Mine oxidation is evident at greater depth than is the case in the other vein.

Respecting the origin of the ore, Penrose has suggested that the breaking down of minerals carrying manganese contained in the crystalline paleozoic rocks and in igneous rocks, liberates the manganese; and that these rocks are probably the source from which all managanese deposits have been derived. From tests of fresh granite it was found that orthoclase was barren of manganese; but the biotite gave strong reactions for this element. Biotite is the least stable of the minerals constituting the granite; and it appears that manganese and iron, both being equally soluble in water, are taken into solution by meteoric waters, which when freely exposed to the action of air, as would be the case in fissures, precipitate their mineral content which is deposited in the form of oxides or carbonates of managanese. At depths, where no secondary alteration has taken place, the oxide of manganese that was deposited, is, it is suggested psilomelane, and limonite was deposited with it, the two oxides forming a homogeneous mixture. In New Brunswick, where managanese is deposited on pebbles and boulders in creek beds at the present time, there seems to be a preference for the deposition of psilomelane. That carbonates were also deposited at New Ross is shown by the presence of pseudomorphs; and there is even a possibility that the entire deposit was laid down as carbonates (siderite and rhodochrosite); and that these, being unstable, gave up CO_2, leaving a mixture of iron and manganese oxides. This, however, is not probable.

Changes of a secondary nature produced conditions as at present existing. The oxide of manganese being (under certain conditions) more soluble than the iron oxide went into solution. The iron capping which is barren of manganese is a proof of the greater solubility of the manganese. Psilomelane probably, therefore, went into solution and was re-deposited as the hydrated oxide of manganese, "manganite." A further oxidation and dehydration again produced pyrolusite. Evidence pointing to the derivation of the pyrolusite from psilomelane is that even in the purest pyrolusite there are appreciable quantities of BaO, which psilomelane contains and which it seems remained with the manganese ore through all its secondary stages.

NOVA SCOTIAN BARITE.

(Written for The Canadian Mining Journal.)

The existence of large deposits of barite in the neighbourhood of Lake Ainslie, Cape Breton, has been known for some years. Frequent mention of these deposits has been made in the publications of the Geological Survey, and in the annual report of the Nova Scotian Department of Mines.

At present the two most important properties in the Lake Ainslie region are the Campbell and the McMillan —names that are entirely appropriate to Cape Breton. On both a certain amount of development work has been done, and from both shipments of crude barite have been made to the United States.

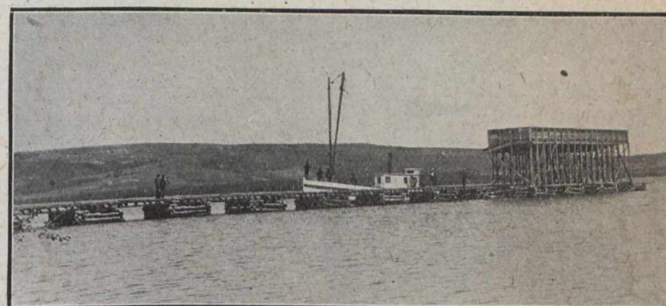
Only the Campbell property is being worked at present. It is located near the village of Scotsville and is owned and operated by Barytes, Limited. (It may be mentioned here that we prefer the less archaic variant "barite,") The head office of the company is in Halifax. Mr. S. M. Brookfield, a well-known contractor, is president, and Mr. H. H. Harrison is general manager.)

Barytes Limited Mill

The barite veins, of which there are two, at right angles to each other, are about half a mile from Lake Ainslie and outcrop on the top of a hill 400 feet above the lake. One of these veins has been traced by trenching for a distance of 4,000 feet, and apparently is continuous. It ranges from 6 to 12 feet in width, and is of good quality. Shipments have been extracted by means of open cutting. The other vein is from 10 to 16 feet in width, and dips at about 55 degrees to the southeast. It is from this vein that barite is being mined at present.

A shaft, 8 feet by 12 feet, has been sunk to a depth of 110 feet. It is well timbered, and is equipped with a double skipway and a manway. At the 50-foot level the vein has been drifted on for 50 feet in each direction. Another station has been cut and levels started at the 100-foot level. Drilling is done by hand. A large horse whim (see illustration) is used for hoisting. The whim is home-made.

The skips are operated in balance. They dump into a car which takes the ore to the stock pile. Thence it is conveyed in carts to the mill. This, however, is but a temporary arrangement as a back-balance skipway is under construction between the shaft and the foot of the mill. When this skipway and a gravity tramway to the mill shall have been completed, the ore will go first to storage bins at the foot of the hill, and thence, as needed, by the gravity tramway to the mill.



Railway Loading Pier

Deposit at Shaft Opening

The finished product is carried by the company's steamer six miles across Lake Ainslie to Strathlorne Station on the Inverness Railway for shipment to market.

The company's plant for the production of ground barite has but recently been completed. It consists of a substantial frame building, 115 feet by 52 feet, with power house attached, and is fitted with the necessary machinery for crushing, washing, and grinding the ore.

Milling.

The crude barite is first put through a small Blake crusher, set to one inch. It then passes by gravity through a rotary grinder which reduces it to about 4-mesh. Next it is elevated to a 16-foot log washer. The washed ore is delivered to one or four lead-lined tanks, each 12 feet in diameter and 3 feet deep, where it is subjected to treatment with dilute sulphuric acid. Such impurities as lime, iron, and managanese, which are present in various forms to the extent of 3 to 4 per cent., are thus removed. The quantity of acid used is about 5 to 6 per cent. by weight of the ore treated.

After three or four hours the acid solution is run off and the ore is thoroughly washed in the tank. It is then transferred to steam-heated drying floors. When thoroughly dried it is elevated and passed through four sets of buhr-stones. The stones are 48-inch diameter, top-runners, set in heavy wood husks, and are arranged in batteries of four, driven by gears from a single shaft. The ore is conveyed from set to set through the whole battery by a system of elevators and screw conveyors. The finished product is put up in barrels of from 700 to 800 pounds each. The capacity of the plant is one ton of ground barite per hour.

General.

The quality of the product is higher than that of any such material yet produced in Canada. It is white and free from grit. Analyses show it to contain more than 99 per cent. barium sulphate. Recent tests made in the United States have proved it to be quite equal to the highest grade German barite which for years has been the standard of the world.

The greater part of the output is being disposed of to manufacturers of paints and is being used by large concerns both in Canada and in the United States.

It is the intention of the company to add to the plant until the present capacity is doubled. Moreover, a subsidiary plant will be erected for the production of such commodities is precipitated barium' blance fixe, barium carbonate, barium oxide, lithophone, etc.

It is probable that work will be resumed on the McMillan property. Shipments made from the vein uncovered gave encouraging results.

The Nova Scotian barite industry is undoubtedly susceptible of expansion. But it is one of the branches of mining that needs considerable preliminary expenditure, both to erect plant and to secure market.

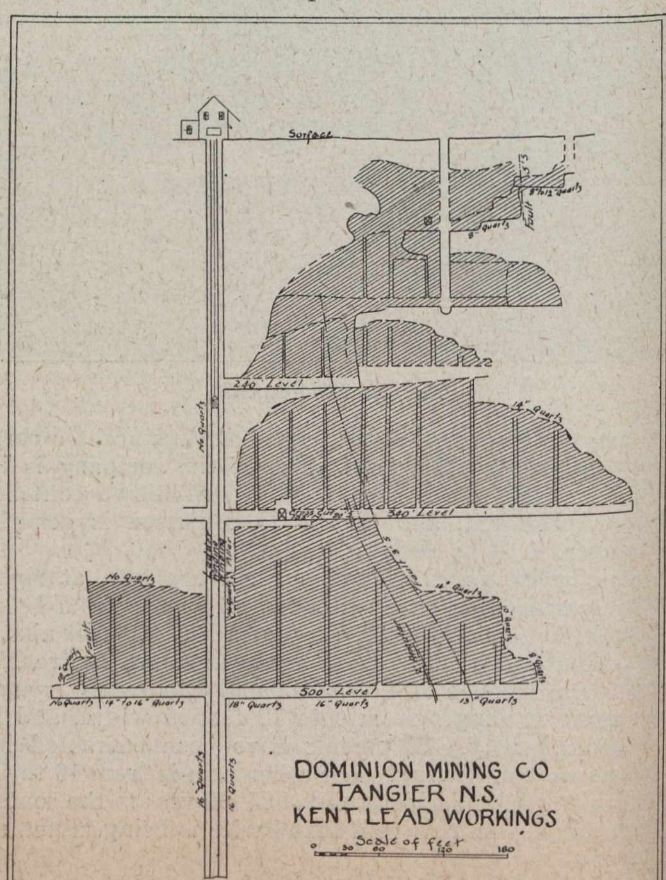
DOMINION MINING COMPANY AT TANGIER. N.S.

The gold district of Tangier in Nova Scotia is one of the three first localities where gold was first discovered in the province about 1860. There has been a good deal of work done in Tangier since its discovery, in the way of small mining companies, tributers and prospectors. The geological structure of this section of the gold-bearing area of Nova Scotia is one of the most symmetrical anticlinal domes in the Province. The axis of the anticline is nearly vertical, the dip of the legs is nearly equal, and the pitch of the nose on one end is almost the same as on the other end of the dome.

There are a number of quartz gold-bearing leads on the areas held by the Dominion Mining Company. Some of these have been worked before by a number of small operators. The leads that are being exploited by the present company are known as the Kent, Murphy Twin and Nigger Leads. The first-named lead is the one on which the main shaft has been sunk and in which the principal driving and stoping has been carried on. This lead occurs in a bed of slate and shows a thickness of quartz from 8 to 15 inches. The lead contains a little arsenopyrite, pyrite and galena, but is only sparsely mineralized. The strike of the lead is nearly east and west (magnetic) and the dip about 70 degrees. The plan and elevation of the workings show the general extent and pitch of the ore shoot and also the amount of ore which has been removed.

The Murphy Twin lead consists of two small veins of gold-bearing quartz; one one-half inch thick and the other two inches in thickness. This lead lies about 30 feet south of the Kent lead. The Nigger lead averages 12 inches in thickness.

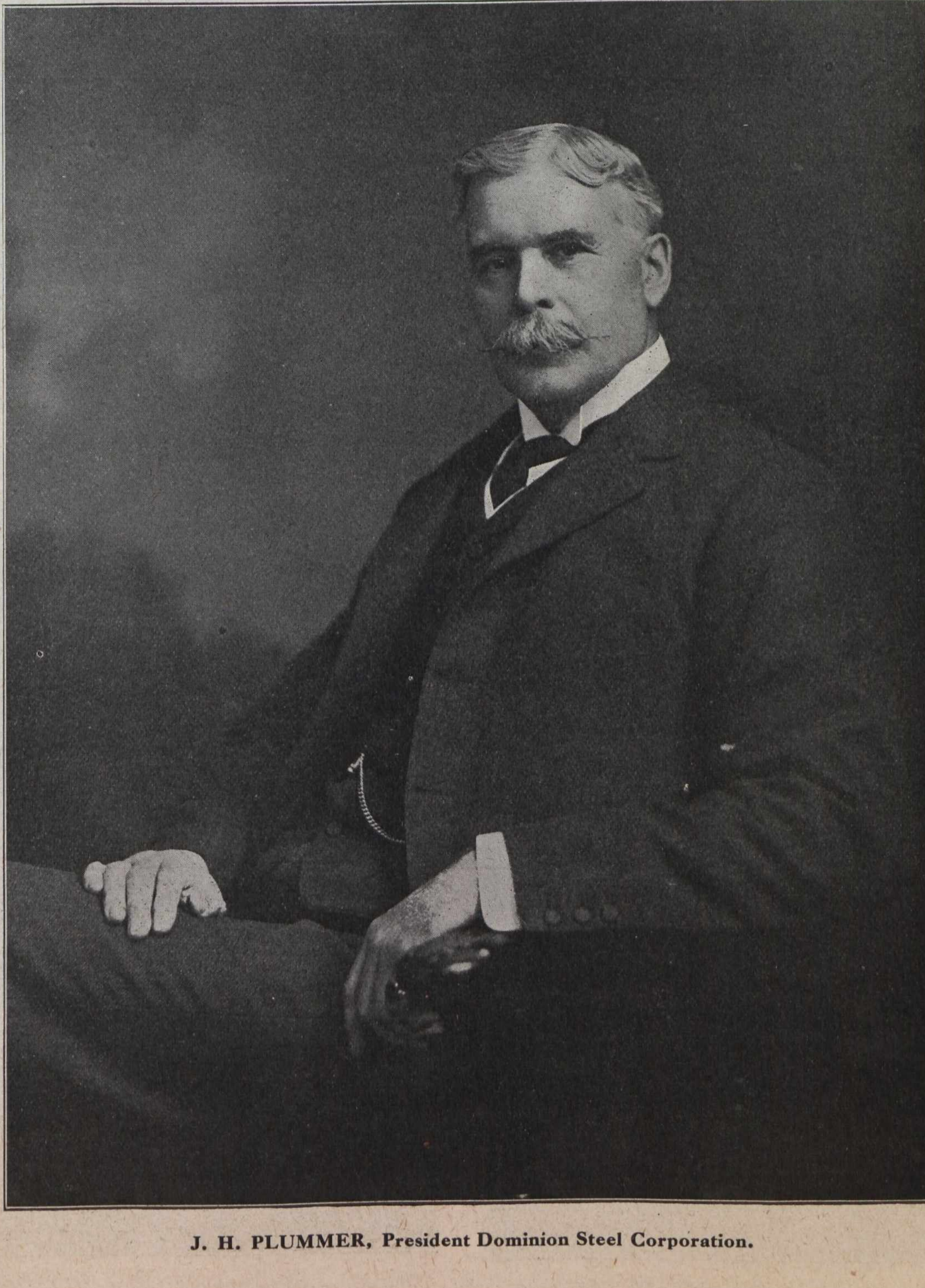
In order to cut down working costs in the direction of cheaper power, the company developed a nearby water power during the year 1909 and changed from steam to a hydro-electric plant for power. A dam was built across the Tangier River about one mile above the bridge on the Main Post Road. From this dam, the water is conveyed in a flume, 10 by 14 feet, for a distance of 925 feet to the power house. The total head



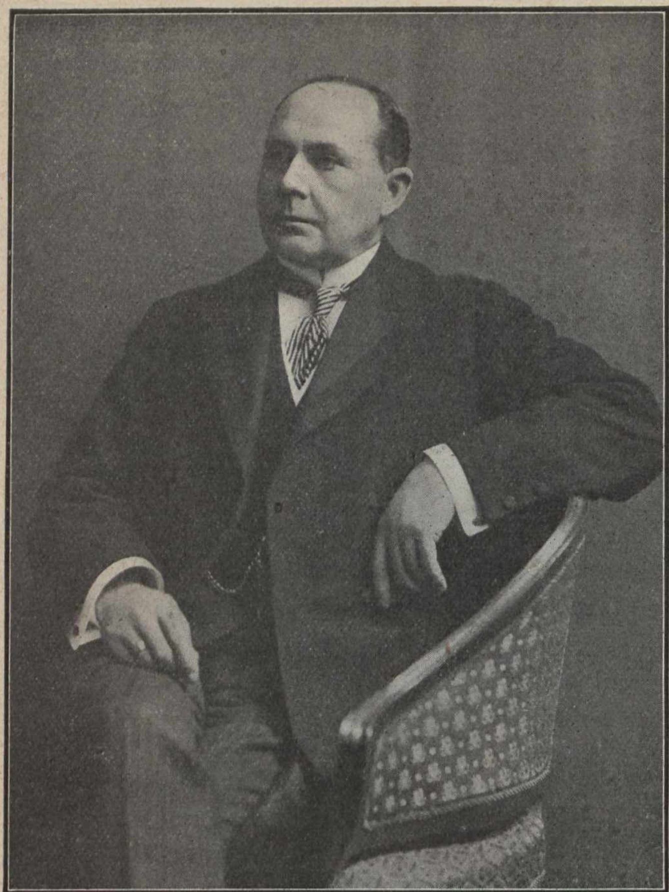
of water thus developed is 25 feet. Power is developed by two Smith-Morgan, 39-inch turbines working under a head of 18 feet and provided with 7-foot draft tubes. Electric power is generated by means of a 360 k.w., 2,200-volt, 3-phase, 60-cycle generator revolving at a speed of 360 r.p.m. The electric current is transmitted at 220 volts over the line to the shaft house, a distance of about a mile.

At the shaft house a 150 h.p., 3-phase, 2,200-volt motor drives a class D-2 Ingersoll-Sergeant duplex air compressor with compound air cylinders and vertical intercooler. The capacity of the compressors is 925 cubic feet of free air per minute and it revolves at a speed of 120 r.p.m. A 50-h.p., 3-phase, 2,200-volt motor drives a 30 h.p. double drum hoist manufactured by the Denver Engineering Company. The mill building is situated about one-fourth of a mile east of the shaft and contains 20 stamps. The rock breaker and stamps are driven by a 50 h.p., 3-phase, 2,200-volt motor.

The ore is almost entirely free milling, as is usually the case with Nova Scotia gold ores, and a high extraction is secured by amalgamation in the battery and on the plates so that no concentration or cyanidation is carried out on the mill tailing.

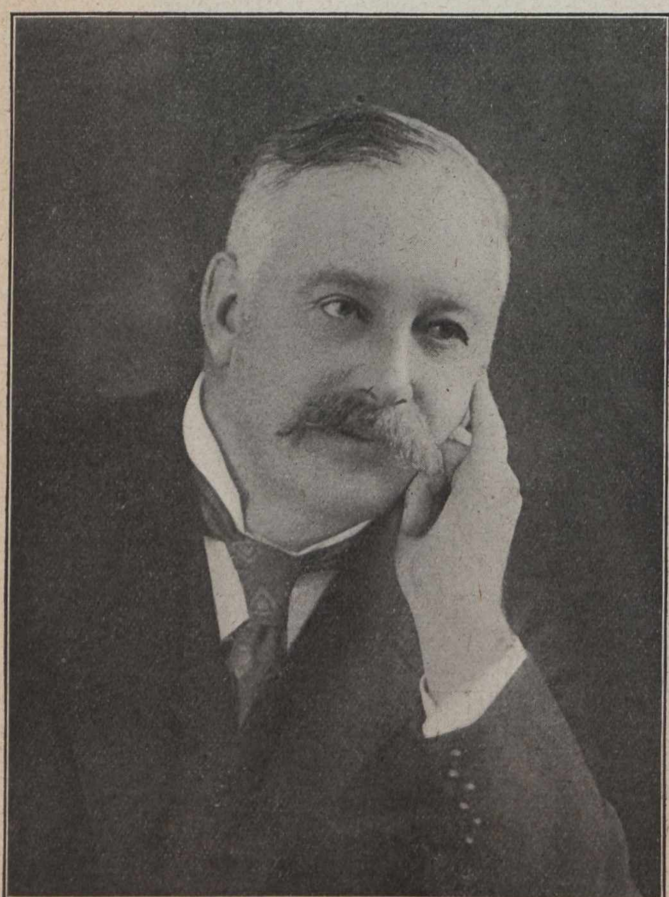


J. H. PLUMMER, President Dominion Steel Corporation.

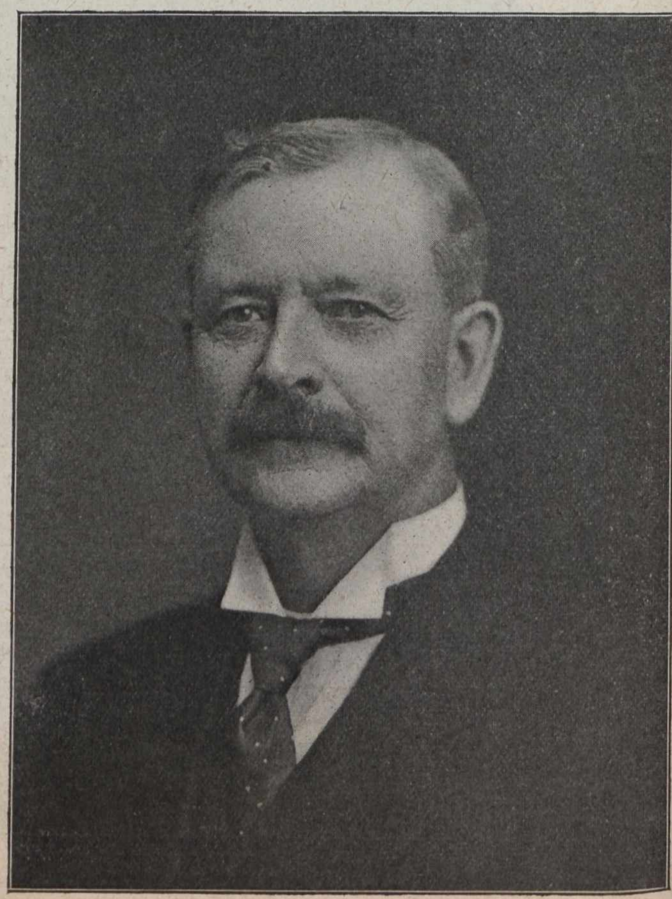


THOS. CANTLEY
Managing Director N.S.S. & C. Co.

R. E. CHAMBERS
Superintendent of Mines, N.S.S. & C. Co.



R. E. HARRIS
Pres. N. S. Steel & Coal Co.



M. J. BUTLER
General Manager D. S. Corporation