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CANADIAN MINING REVIEW

Established 1882

Vol. XIX—No. IX.

OTTAWA, SEPTEMBER 30th, 1900.

Vol. XIX—No. IX.

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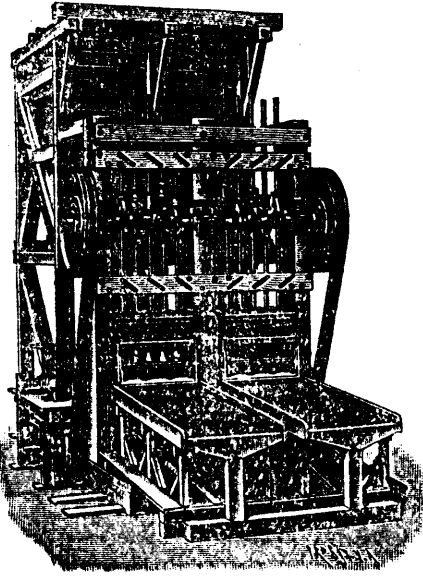
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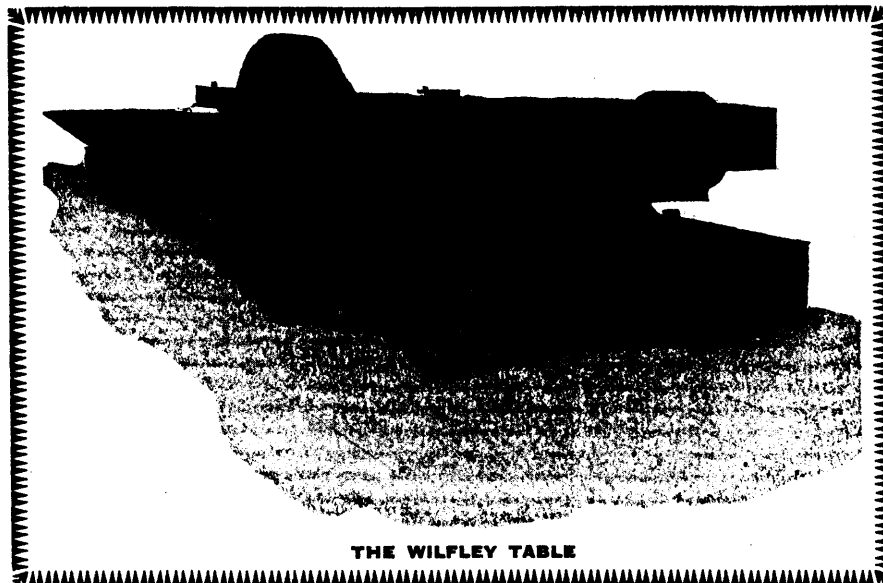
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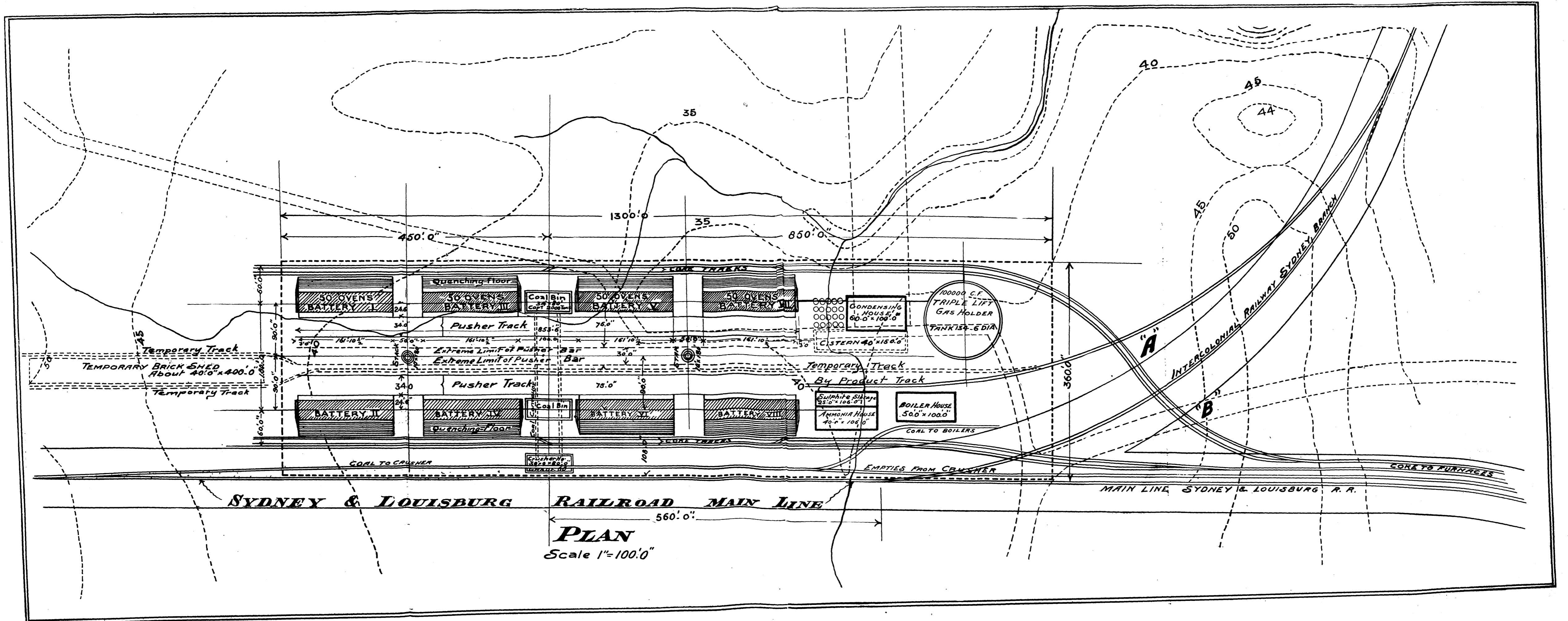
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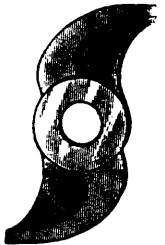
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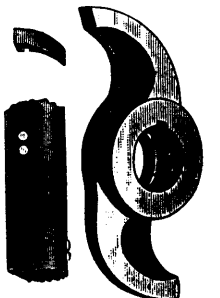
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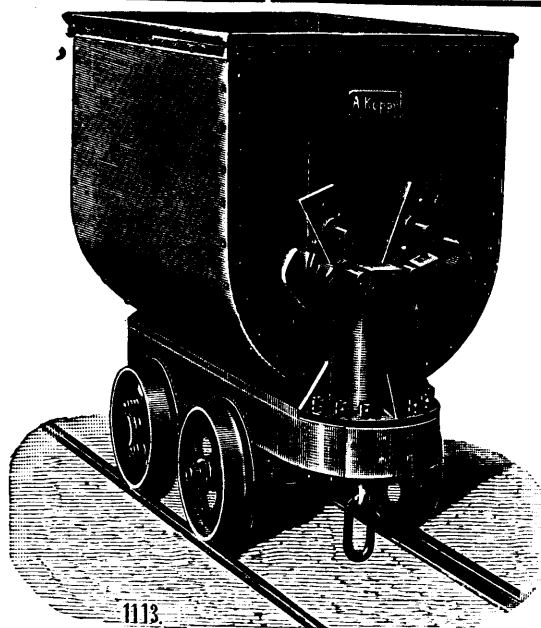
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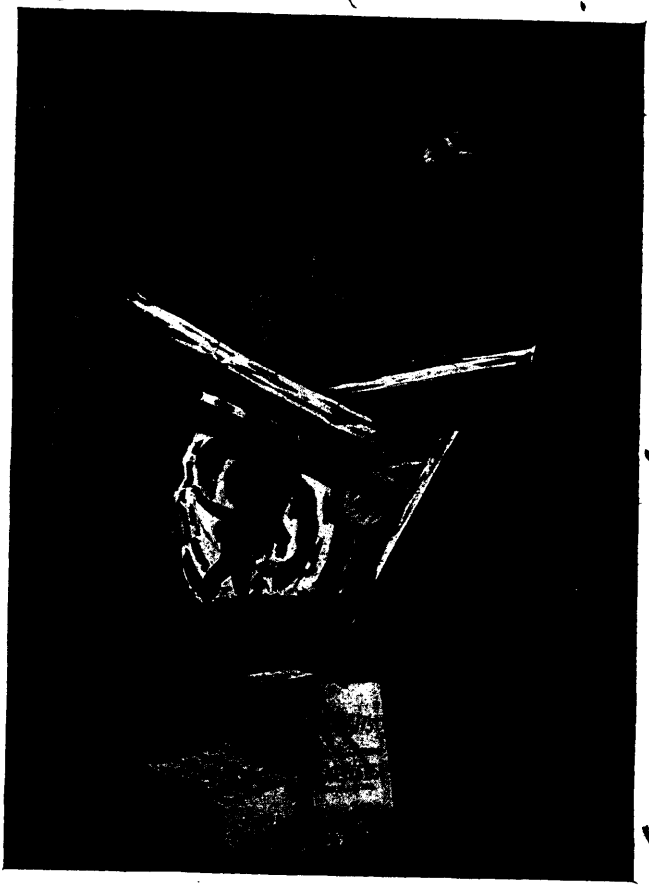
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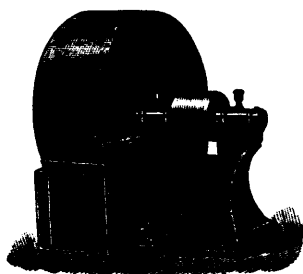
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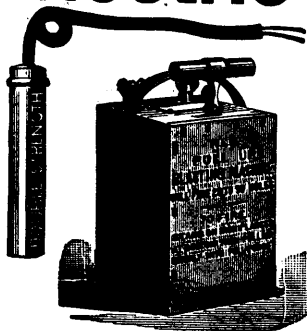
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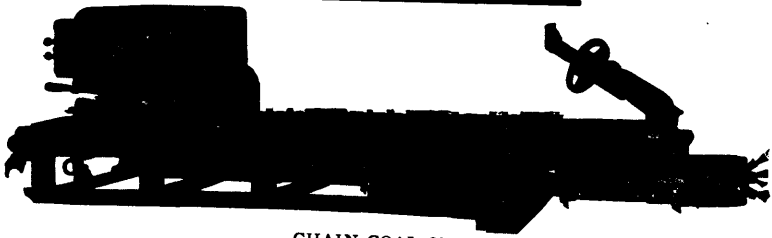
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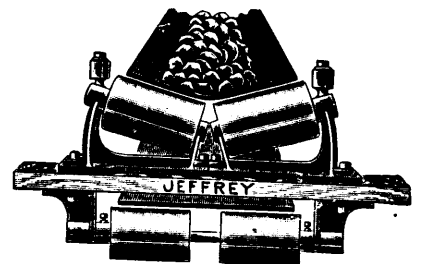
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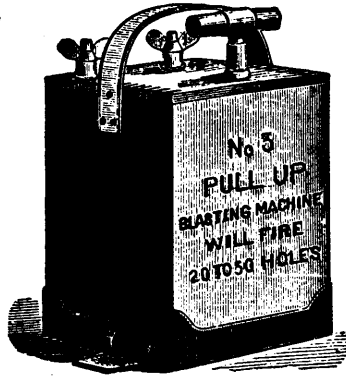
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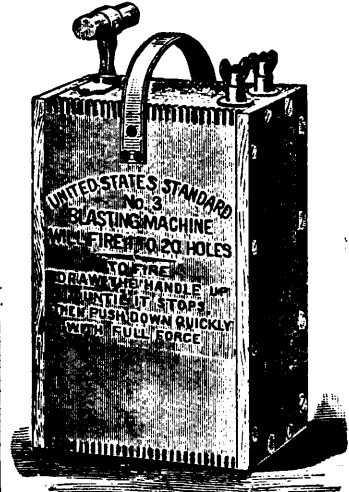
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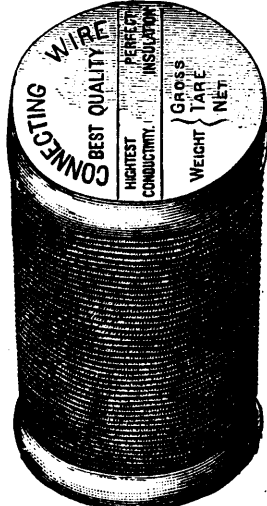
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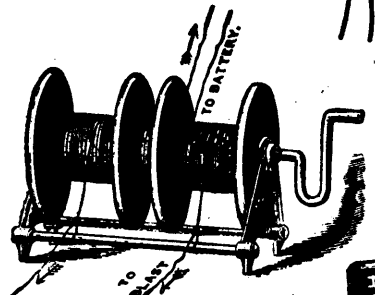
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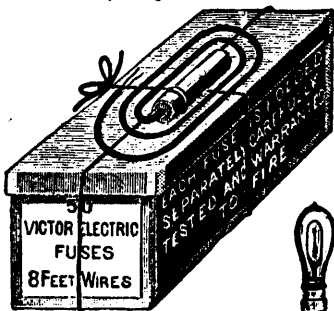
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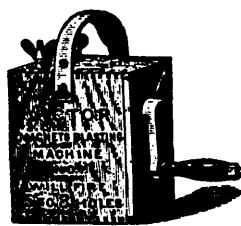
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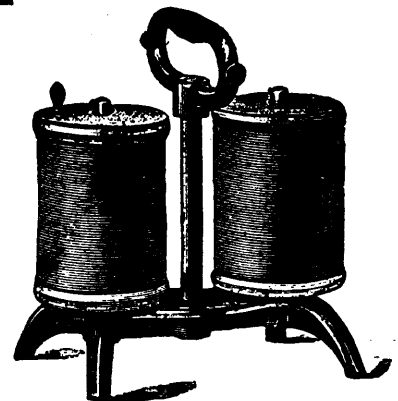
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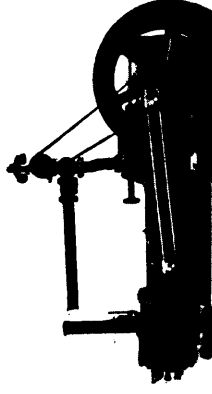
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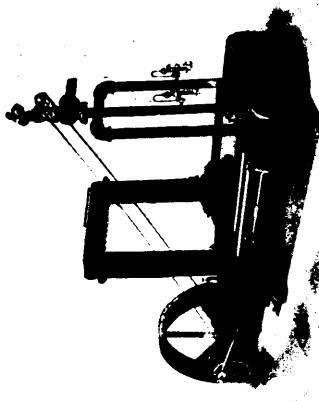
Cross-Compound Corliss Compressor.



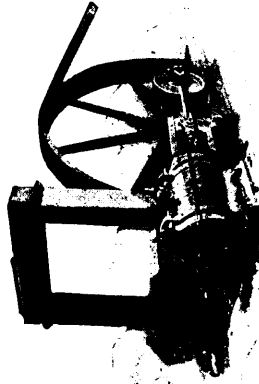
Straight-Line Belt-Driven Compressor.



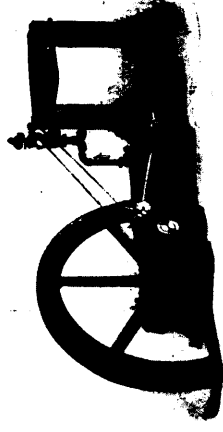
Straight-Line Steam-Driven Compressor.



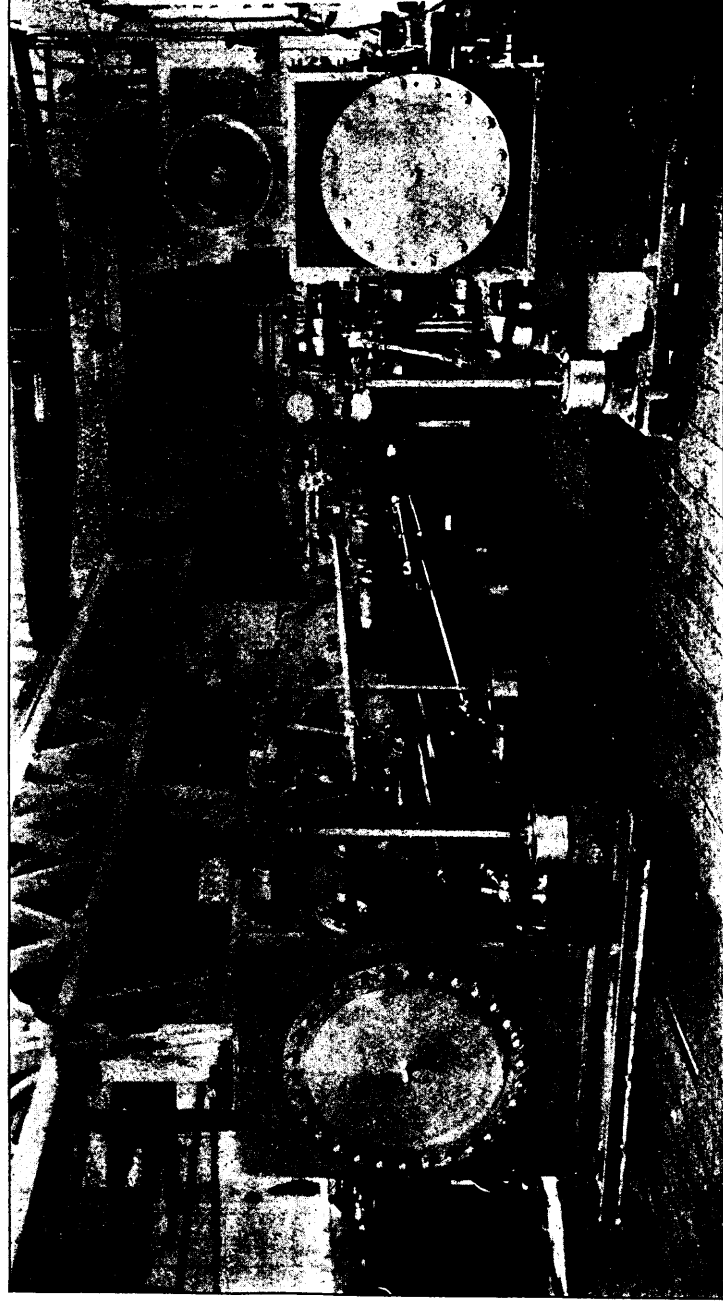
Class B Compressor
(Air Cylinder next to Frame)



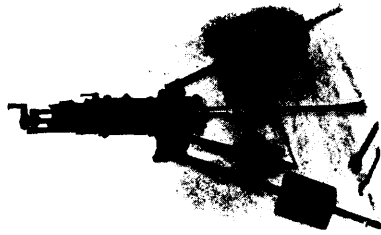
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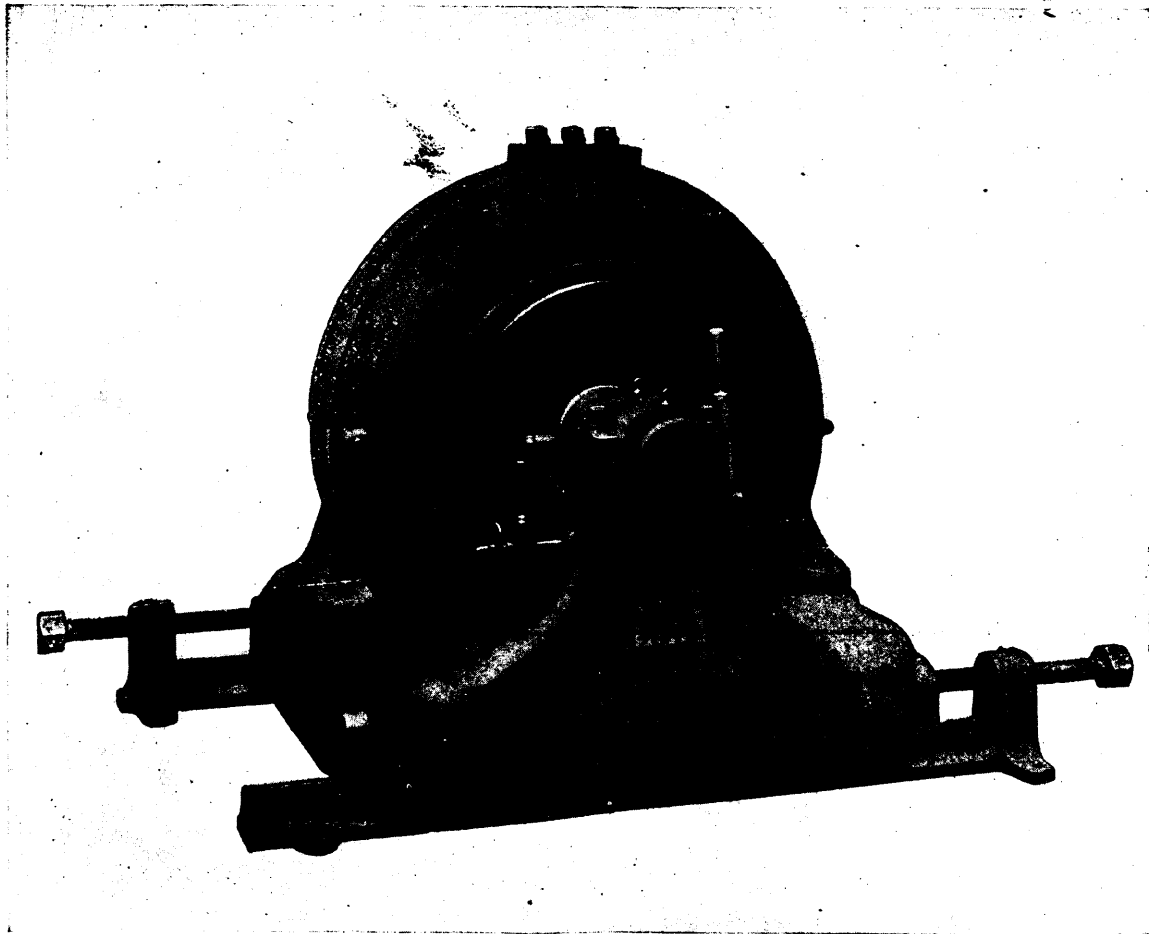
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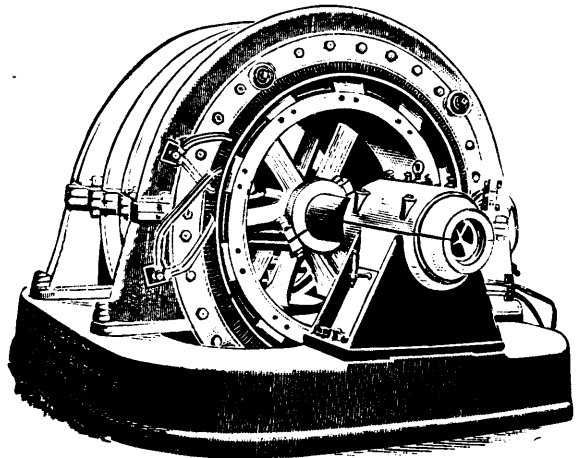
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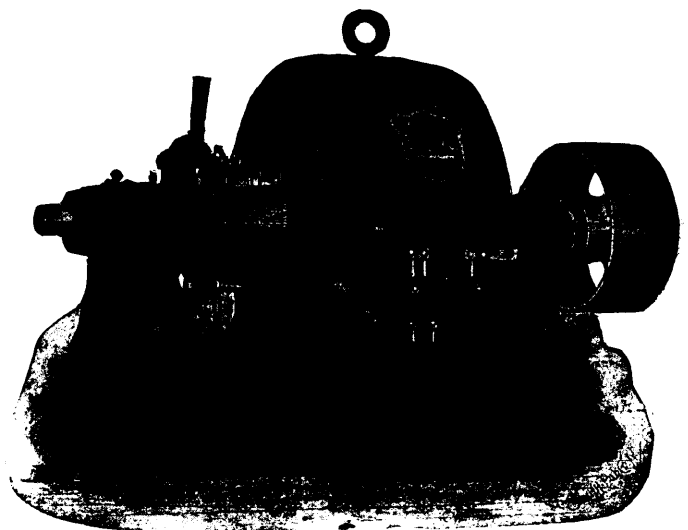


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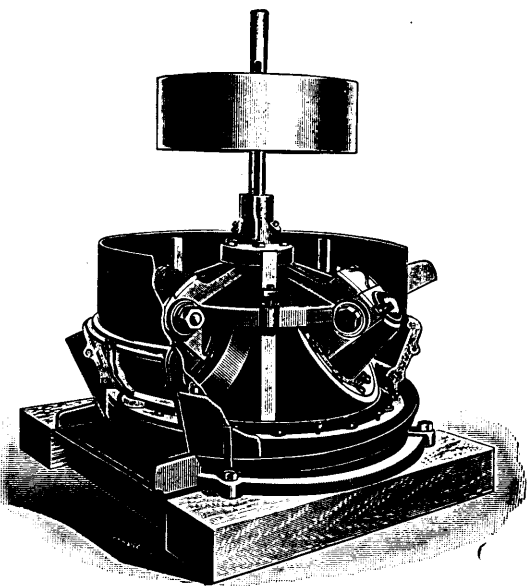
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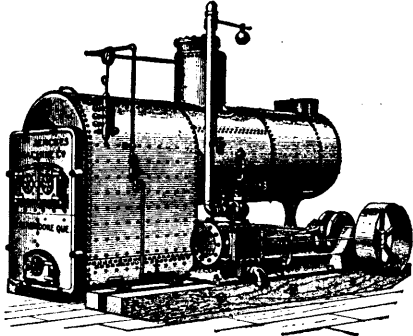
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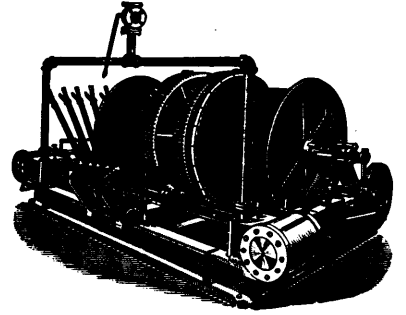
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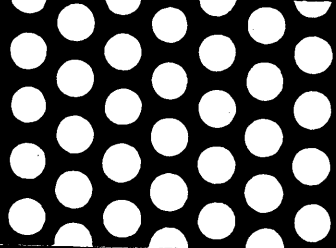
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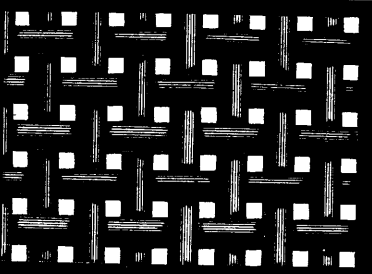
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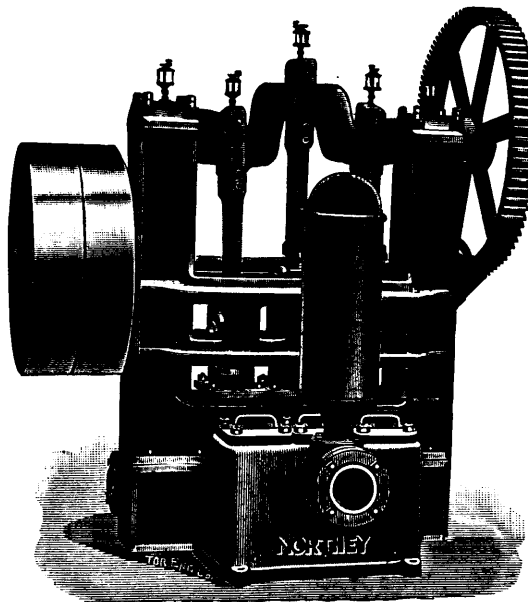
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OFFICES { Slater Building, Ottawa;
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VOL. XIX., No. 9.

SEPTEMBER, 1900.

VOL. XIX., No. 9.

The Prosperity of Cape Breton.

Coal is still King in Cape Breton Island. For many years he has lorded it in solitary grandeur. Now, however, his sway is to be shared in by another. It would perhaps be incorrect to say that a rival to the crown has put in an appearance. The claims of coal to the Kingship are too solid and well-founded to be upset or challenged. Rather is it true that the King is taking unto himself a Consort in the person of Iron to share his throne. The suitability of the match cannot be disputed, and the advantages that must accrue from the alliance not only to the contracting parties, but also to the kingdom over which they will jointly reign, can hardly be over-estimated. The bride comes richly dowered, while the bridegroom is a man of substance and beyond question an eligible parti. Much may be hoped from this happy union and we can in imagination picture a fine crop of thriving infant industries as the natural result thereof.

The recent meeting of the American Institute of Mining Engineers at Sydney, afforded us a very agreeable and ample opportunity for testing the truth of all that has been said and written during the past year or so concerning the great and rapid developments that have been taking place in this, the most eastern point of the Dominion. We have been, we have seen, and we have come away convinced. The work that is now being done on the shores of Sydney Harbor and at the neighboring collieries can only be described as marvellous. The investing of so many millions of Canadian money—to say nothing of what our American friends are putting up—has naturally caused the eyes of business men throughout the Dominion to be turned expectantly in an easterly direction, and Cape Breton has for a year past been attracting more attention than any other part of the Dominion, British Columbia or the Klondyke not excepted. We are now, after what we witnessed in August, in a position to assert that this keen interest is fully justified and Canada may well be eager to watch the growth of an industry which must have such far-reaching effects on the commercial life of the country. The transformation of Sydney from a quiet and rather humdrum village into a busy city teeming with possibilities, has been rapidly accomplished. Work upon the blast furnaces, coke ovens, steel mills, etc., of the Dominion Iron and Steel Company, was commenced in July last year. Taking into account geographical and climatic disadvantages—the distances from bases of supply, the utter inadequacy of local transportation facilities by rail, and the long winter during which outside operations could be carried on only under serious drawbacks, the progress that has been accomplished is simply phenomenal and speaks volumes for the energy, determination and resource of the men who have had the direction of the work.

By the 15th of October, or fifteen months from the striking of the first blow, it is confidently expected that one of the blast furnaces will be in operation and turning out pig metal. We may be astray but we doubt if the history of the iron industry the world over can show anything to beat this for rapidity in construction. Starting the first furnace in October with a daily capacity of 250 tons, other three furnaces will follow at intervals of a few months apart until a daily production of 1,000 tons of pig iron is reached, and when this point is touched it is more than likely that an extension of the plant will have been decided upon. The work of constructing the blast furnaces is being done by the Riter-Conly Manufacturing Company of Pittsburg. The coke ovens, under construction by the United Gas & Coke Co., also of Pittsburg, are keeping time with the blast furnaces. They follow on the lines of the coke ovens built at Everett, Mass., coke being the staple product, while all other constituent properties in the coal are treated as by-products. The open-hearth buildings and blooming mills, altho' not at so advanced a stage of progress, are also well under way. For two or three months past ore has been coming along in large steamer loads from Wabana, Newfoundland, and a large pile of many thousands of tons is already in stock on the works. The number of men employed is not now so large as in the spring and summer. The pick and shovel work has to a great extent been finished and skilled laborers are now mostly in evidence.

Wonderful indeed, it is to see a district comprising some 500 acres which barely a year ago was farming and waste land, covered with substantial buildings, gigantic iron structures and towering chimneys.

Aud yet this is only a part of what we were privileged to see in Cape Breton. The coal business has to a certain extent been overshadowed by the rapid growth of a new industry alongside of it, and yet an immense amount of development is being accomplished at the mines of the Dominion Coal Company. The present year has seen a tremendous impetus given to the industries that are dependant upon coal. And the strain would make it appear as if the coal fields of Great Britain had not only reached their limit of productiveness, but perhaps touched a point from which a slow but gradual decrease may be looked for, English coal-owners have in many cases found successful rivals in American competition in European markets where hitherto they have had undisputed sway.

Under these circumstances the vast deposits of coal in Cape Breton—so far exploited to but a comparatively slight extent—gain additional value. No coal regions on this side of the Atlantic Ocean are so conveniently situated on the sea-board for easy shipment as are these, and it may be asked why are not the fortunate proprietors

taking advantage of the present scarcity and high prices of coal in Europe to ship their coal across the Atlantic? With Welsh coal selling as high as 27s. and 28s. a ton at Cardiff, what an opening there should be for a first rate steam coal such as the Dominion Coal Company are known to supply! The reason for the company holding their hand is that their works of development have not been able to keep pace with the rapidly increasing demand, and so far from being able to export coal to Europe, the company cannot supply the demand nearer home. Scarcity of laborers and a disinclination amongst the miners for steady work, begotten of higher wages and constant employment the year round, have militated against the output, an unusual demand for bunker coal, from liners as well as from tramp steamers, due to the scarcity and dearness of English coal, has also shortened the supply available for other purposes. The result is that all Canadian and Newfoundland markets show a rather alarming shortage of coal at a time of year when stocks should be getting comfortably large. In order to meet the requirements of their Montreal customers the Dominion Coal Company, we understand, expect to ship some 150,000 tons to them by rail, *via* Portland, after the season of navigation has closed. The New England Gas & Coke Works, at Everett, Mass., are exacting about 1,500 tons a day and the Iron and Steel Company are about to make a further demand upon the daily output.

Under these circumstances every effort is being made to push the work of development and the opening of new shafts and slopes, but it would look as if some time must elapse before the Dominion Coal Company have any surplus coal wherewith to test European markets. The company are and have been during the present year in the position of having rather too much of a good thing. The position may, perhaps, have its discomforts, but it is a very healthy one all the same, with vast stores of coal easily and safely mined—splendidly equipped railway and shipping wharves, and two harbors for shipment that are among the very best, the prospects of the Dominion Coal Company are indeed enviable. If it requires an effort to recall what the coal trade in Cape Breton was 10 years ago, it taxes the imagination to a still greater extent to picture what it may be 10 years hence. Cape Breton with its splendid mineral resources has lain practically dormant and comparatively unnoticed for a century.

It is now coming to the fore with a suddenness that is almost startling, and yet we think those gentlemen who in August last enjoyed the hospitality of the twin corporations of coal and iron, who witnessed the tremendous amount of work being done, and who could form some idea of the solid foundations upon which enterprises so vast are being built, will agree with us that Mr. H. M. Whitney and his associates have made no mistake in pinning their faith to and putting their capital into the ancient Isle Royale. Not until such time as iron and steel ships are being built along the shores of the roomy harbor of Sydney, shall we believe that Mr. Whitney has realised all that he has in his mind for Cape Breton. And when that happy time shall come, may we be there to see.

WASH-UPS FROM CARIBOO.—Advices from British Columbia indicate that before another issue of THE REVIEW is in print further good news of another large clean-up from the property of the Consolidated Cariboo Hydraulic Mining Company, at Bullion, B.C., will be made public. This large property, which has involved a very large expenditure in initial development and suitable plant may reasonably be expected to be on dividend paying business before another season has passed. News from the 43rd Mining and Milling Company property at Omenica points to a good was-up before the season closes.

The Proposed Nickel Tax and the Frasch Process.

The *Toronto Globe* has re-published an editorial from the *Engineering and Mining Journal* of New York, giving certain details in regard to the so-called Frasch nickel refining process. Examination of this article leads us to question whether the process can properly be called a nickel refining process. Mr. Frasch invokes the aid of electricity to get the metals contained in a nickel and copper matte into solution, and the business of separating them and producing the refined metals is apparently expected to follow well known lines. The tremendous power involved in breaking up the brine solution is of course very offensive. As is often the case, the sanguine inventor, and his friends, believe that the by-products will pay the whole cost of the process; but under the spell of the great power furnished at Niagara, and at the Soo, caustic soda, as a by-product, may soon become a drug upon the market, and the process so far as nickel refining is concerned, must stand upon its own merits as compared with the other processes now in use.

It no doubt seemed very wonderful to the party of visitors assembled at Hamilton, to see the button pressed and green liquors run out which they were assured carried the all-important nickel and other metals. But they did not know that the same apparent result could be obtained quite as readily and much more cheaply by any one of a half dozen well tried processes. The trouble is not in getting the metals into solution, it is in separating them and producing the nickel in a refined form suitable for the market. A few months ago, our Hamilton friends were quite as enthusiastic about the prospects of the Hoepfner process as they are now of the Frasch process. Perhaps when they have experimented further, they will find that there are practical difficulties in this process as in the other.

Mr. Frasch will certainly not claim that there is anything original in the filtering tank which he has constructed, as it is the old familiar form of tank used in countless processes and experiments, and always having the same inherent vice, namely, that the sand becomes clogged and requires continual re-handling and re-washing, which, while to the gentleman who made his observations for the *Engineering and Mining Journal* seemed very simple and a cheap way, yet is cumbersome, and involves for operations of any importance an enormous plant.

We are permitted to publish an extract from a letter which serves to confirm the old saying that "There is nothing new under the sun," and that the Frasch process is nothing new at all; at least so much of it as its backers have seen fit to make public:

"We are glad the *E. and M. Journal* published the article about the Frasch process, for it enables us to show that it is absolutely worthless. From August 30th, 1894, to November 18th, 1895, we were experimenting on refining copper-nickel matte in identically the same line as Frasch is doing, but were compelled to abandon it for the reason that the sand diaphragm soon became so pasted together with copper-nickel oxide that the current will not pass through it; besides, he nickel is fouled by the sulphur in the salt. We found it an easy matter to dissolve the matte partially, but to make a complete dissolution of it we were compelled to tear out the sand diaphragm and dig out the partly dissolved matte and start the bath again with new matte. So far as we are concerned the whole scheme is ancient history."

As to the suggestion in the article that the discovery of this process may make the enforcement of the export duty on nickel mattes a wise thing for the Province, we are tired of having our American friends dictate to us the policy we are to pursue, first Mr. Ritchie, then Mr. Clergue, and now Mr. Rothwell of the *Engineering and Mining Journal*, all good Americans, and all presumably much more interested in the welfare of the United States than of Ontario. Where

then is the colored individual in the woodpile? Have they a private and personal end to serve in their suggestions? If yes, then it behooves us to remember "*Timeo Danaos et dona ferentes*" and to study out the situation for ourselves. On the one hand, we have an industry well established, growing, and constantly employing more and more men. On the other hand, we have some individuals who have been claiming that first one process and then another is a wonderful improvement on anything known elsewhere in the world; that, in fact, it is so wonderful that the nickel can actually be produced from the mattes without cost. If this be true, why do these gentlemen ask aid from the Government? The old commercial methods are amply sufficient. Let them work cheaper than any one else, and show that they are prepared to do the work, and they will get plenty of it to do. Until that time comes, it would be a crime to interfere with the comfort and happiness of the prosperous community now established in the nickel mining region near Sudbury.

Wilfley Table Practice.

Some months ago we called attention to the limitations of the Wilfley table, or rather of riffle washers in general, and pointed out the importance of hydraulic classification of the sands prior to feeding them to such appliances. It is interesting to note that this practice has become nearly universal in the best mills of the West. It is also noteworthy that the effort to use riffle washers in the concentration of slimes is being very generally abandoned, this finer material being treated on improved forms of buddles. In this connection it should be mentioned that in the concentrating works at Great Falls, Mont., the buddle has been made to serve a curious double function, at one and the same operation concentrating the slimes and acting as a classifier for the coarser sands, which are then sent to appropriate riffle washers. This classification is accomplished by means of a cycloid fresh water feed, which causes the sands to be rolled off to the periphery, the volume of water being sufficient for this purpose, but insufficient to produce an amount of scouring action which would disturb the slimes that have settled upon the surface of the buddle. The Wilfley tables thus take the sands thrown off from the buddles, the material sent to the buddles being the crushed jig tailings. The Wilfleys are then operated with as thin a film of water as possible, dependence being placed on the motion of the tables rather than on the quantity of water to effect separation. An important modification in the operation of the Wilfleys consists in causing the "heads" or clean concentrates to discharge from the foot of the table instead of from the side, an auxiliary water spray being used across the foot to wash the last portions of gangue down with the middlings. The capacity of a table thus operated is 10 tons per diem.

Recent Advances in the Science of Vein Geology.

The Washington meeting of the American Institute of Mining Engineers will long be memorable for a group of papers recognizing certain phenomena in ore deposition which give to that study a more correctly scientific basis than it has ever before possessed. From the researches of Sandberger with his conclusions in favor of a lateral secretory origin of most ore bodies, to those of Posepny with his brilliant argument for ascending waters as the agents of mineral deposition in veins, it is but a logical step in advance to combine the two theories, to trace in our veins the united action of concentrations laterally from the bounding rocks, and of solutions rising out of the zone of plutonic waters. The objections to Posepny's notion of a "barysphere" where the heavier minerals had been stored by separation due to gravity

while the earth was plastic, whence solutions subsequently leached out the soluble portions, bringing them up only to redeposit them in lodes, were promptly and energetically made. It was generally conceded that no necessity existed for looking farther than the ordinary rocks of the earth's crust for a source of the metals which the solvent action of heated waters, containing carbonic acid, would leach out. The result then was merely an extension of Sandberger's lateral-secretion theory, applying the general principle to both the relatively cool and the relatively hot zones within which it was conceded that water could exist and circulate through the rocks.

But the conviction has more recently been forced upon students of vein geology that descending waters play an important part in forming and modifying ore deposits, and that the peculiar enrichment of the upper portions of veins, rendering them valuable to moderate depths, while usually becoming lean at greater distances below the surface, was due wholly to this hitherto unsuspected function of the downward percolating atmospheric waters. The clearest conception of this phenomenon and of its attendant circumstances, has been reached by Prof. C. R. Van Hise, and presented in an elaborate paper entitled "Some Principles Controlling the Deposition of Ores," which is only an advance statement of a still more elaborate treatment in a monograph on Metamorphism by the same author, soon to appear in a Report of the United States Geological Survey. The papers by Weed on "The Enrichment of Gold and Silver Veins," and by Emmons on "The Secondary Enrichment of Ore Deposits" are valuable additions to the same line of argument, giving concrete examples from a wide range of observation. They are furthermore peculiarly interesting as showing how other investigators have independently arrived at the same conclusions.

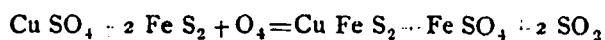
Following Schlichter ("Theoretical Investigation of the Motion of Ground Waters," 19th Ann. Rep. U.S. Geol. Surv.) Prof. Van Hise shows how the meteoric waters descend through the rocks to the lower limit of circulation and then complete the cycle by rising through trunk channels, performing the function of dissolving and precipitating mineral matter under varying physical and chemical conditions. The theory briefly stated is as follows: "First comes the action of the downward-moving, lateral-moving waters of meteoric origin which take into solution metalliferous material. These waters are converged in trunk channels, and there while ascending, the first concentration of ore-deposits may result. After this first concentration, many of the ore-deposits which are worked by man have undergone a second concentration not less important than the first, as a result of descending, lateral-moving waters. In other cases a concentration by descending, lateral-moving waters alone is sufficient to explain some ore-deposits. It therefore appears more clearly than heretofore that an adequate view of ore-deposits must not be a descending water theory, a lateral-secreting water theory, or an ascending water theory alone. While an individual ore-deposit may be produced by one of these processes, for many ore-deposits a complete theory must be a descending, lateral-secreting, ascending, descending, lateral-secreting theory. The descending, lateral-moving, and ascending waters are alike driven by gravity. Each performs its own work."

The best examples of the effect of downward percolating waters in producing secondary enrichment of veins are those afforded by most copper deposits. The typical condition of a copper bearing vein in a region subjected to normal weathering of the rocks, where glaciation has not occurred, has been shown to be as follows: On the surface a gossan, more or less pronounced, dependent upon the conditions of moisture and vegetation, below which come more or less carbonate of copper (malachite and azurite), with minor quantities of oxide (tenorite). This condition will extend to permanent water level, and

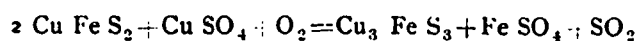
sometimes a short distance below. But normally a zone of highly enriched copper sulphide ore is encountered at water level, consisting of bornite, chalcocite and covellite associated with chalcopyrite. The covellite is rare, but the two former minerals are almost invariably found. Often the chalcocite is present in an amorphous form, sometimes constituting a black band of high grade ore. The distance to which the chalcocite and bornite extend downwards is extremely variable, in some instances as much as 2,000 feet from the surface. Below this zone comes the normal vein, carrying chalcopyrite, the copper contents of the ore decreasing as the bornite and chalcocite disappear. Frequently the quantity of chalcopyrite will thence decrease, until the vein matter contains iron pyrites only.

The re-actions given by Prof. Van Hise to account for the observed facts are the following:

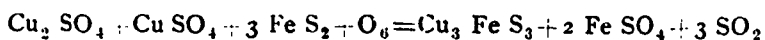
Chalcopyrite would be formed when copper sulphate came into contact with iron pyrites, thus:



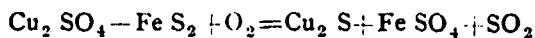
and bornite by the re-action of copper sulphate upon the chalcopyrite, as shown by the formula



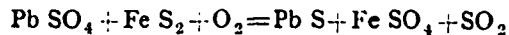
or by re-action upon iron pyrites alone, when cuprous and cupric sulphates were present, expressed by



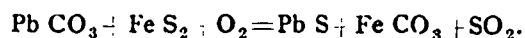
The chalcocite would be formed by the action of cuprous sulphate upon iron pyrites, as follows:



In a similar manner the enrichment of the higher portions of gold and silver and lead veins may be explained, the re-actions for the latter being



and



It will be observed that iron pyrites constitutes the precipitating agent for many salts of the base metals. Ferrous sulphate, on the other hand, is probably the chief precipitant of gold and silver, throwing them down in the metallic form, with the production of ferric sulphate in the solution.

The recognition of a secondary enrichment of metalliferous veins is of the utmost practical importance. It explains many hitherto obscure phenomena which have puzzled men engaged in actual mining operations, and it affords a means for determining how far exploratory work may be carried with any hope of success in many mines. The deductions of Profs. Van Hise, Emmons, and Weed, therefore, merit the careful consideration of mining engineers directing practical work.

Of no less importance is the clear explanation given by Prof. Van Hise of the manner of vein filling. The details are too numerous and complex to admit of a comprehensive summary here, but we may call attention to his division of the zone of fracture of the upper rocks of the earth's crust into two other zones, which he calls respectively the zone of weathering and the zone of cementation. In the belt of weathering the processes of carbonation, hydration, oxidation, and solution are constantly going on, "the minerals which remain are usually few and simple; the volume of the rocks is diminished; they soften and degenerate; and they are finally destroyed as coherent solids." The process of carbonation is of peculiar importance. It produces carbonates of the alkalis, of the alkaline earths, and of iron, and less abundantly the carbonates of other metals, all of which are readily soluble, with or without the aid of carbonic acid. Moreover, in the carbonation of the silicates the silica separates as silicic acid,

and the amount of silicic acid thus liberated is enormous. This passes into solution, and is redeposited below in the fissures, joint planes, and fissility planes of the rocks in the belt of cementation. To state the matter boldly, the quartz of the quartz veins discovered in the earth has been derived by a process of leaching from the superficial rocks due to the action of percolating waters carrying carbon compounds resulting from the decay of vegetable matter on or near the surface. No satisfactory explanation of the solution of silica by the deeper seated waters has ever been given, but through carbonation due to downward-moving waters the concentration of silica in fissures from above downwards is rationally and fully accounted for. It does not follow that the concentration of metalliferous minerals in the quartz necessarily occurred at the same time and as a part of the same process, though Prof. Van Hise inclines to the view that a great many metal-bearing veins were thus produced, although more probably the larger number of original sulphide concentrations were effected by deposition from ascending solutions, the sulphur being mainly derived from the sulphides present in igneous rocks, oxidized to sulphites and sulphates by the descending waters, and then reduced to sulphides in the presence of organic matter on the return flow of the solutions through trunk-channels toward the surface.

This brief review will serve to show how revolutionary is this latest statement of the theory of ore-deposits. It is, however, but the logical deduction from the accumulated facts of experience, a setting in order of our knowledge and the derivation therefrom of controlling laws. The final word on this question of course is not yet spoken, but but that we are emerging from a period of conflicting theories to one of true scientific explanation of the origin of ores, is manifest.

Some New Developments in Jigging.

In the concentrating works at Great Falls, Montana, which today stand as the most perfect example of modern methods in America or even in the world, a peculiar departure has been made from the old system of jigging, which seems to negative many of the results which have been obtained concerning the laws of jigging in the past. Perhaps the best exposition of the laws operative in concentration with jigs which has ever been made, was that set forth by Prof. Robert H. Richards in his "Cycle of the Plunger Jig" (*Trans.*, A. I. M. E., Vol. xxvi, pp. 1-32). He there enumerates and discusses the four laws, viz.: 1. The law of free settling particles; 2. The law of hindered settling particles; 3. The law of acceleration; 4. The law of suction. According to Rittinger, the law of free settling particles (which he calls the law of equal settling particles), and the law of acceleration, are those which determine the separation of ore from its gangue. In accordance with this view the best results should be obtained when the ore was sized, and consequently the mills of Germany and other European countries introduced a system of close sizing before jigging, which has been largely copied in America, but which gave rise to a great deal of criticism, and was finally abandoned by the most progressive mill-men on this side of the Atlantic. An elaborate experimental investigation by Prof. Munroe, of Columbia University, New York, established a third law of hindered settling particles, by showing that particles of ore falling *en masse*, as actually happens in the bed of material on the jig screen, are impeded in settling by falling through interstitial spaces, which is equivalent to their falling through narrow vertical channels of circular cross section. As the interference increases with the size of the ore particle relatively to the diameter of the interstitial space through which it falls, it is evident that small particles of heavy ore, which would be equal settling with considerably larger particles of gangue, will enjoy a superior opportunity of

being separated and saved. This was in entire conformity with more recent experience in actual milling operations, and explained at once the advantages which had been observed to follow the jigging of ore previously classified with hydraulic classifiers. The classifier accordingly superseded the trommel, and close sizing before jigging became relegated to the past. In other respects there was no material difference between European and American practice. A jig, consequently, while giving a remarkably clean product, could not be crowded without throwing large quantities of ore off with the millings, and any increase of speed produced the same result. The speed was determined by the velocity of rising current needed to lift the particles of gangue which would be equal settling with the smaller ore particles left in the classified product fed to the machine. Here was its limitation, closely and accurately confined, and the tendency of most mill-men was to force through a larger tonnage than that for which the jig is calculated, with the inevitable result of loss of values.

It is to be noted that this limitation was fixed in accordance with the theory of particles falling in water after having reached the period of a uniform rate of fall, that is, after the resistance has increased with the increasing velocity of the particle until it counteracts the normal acceleration due to gravity. From this it follows that the jig stroke must be relatively long to allow the particles to reach this period of uniform rate of fall. According to the practice built up from this theory the length of stroke for ore particles $\frac{1}{8}$ inch in diameter would be from 2 ins. to $2\frac{1}{2}$ ins., repeated about 80 times a minute. A stroke as short as $\frac{1}{2}$ inch would not be used with particles larger than 1 m.m. ($=\frac{1}{32}$ inch), at a speed of not over 125 strokes per minute. Only with jigs for the finest sands, material such as is now concentrated on vanners, and riffle washers of the Wilfley type, were short strokes of from $\frac{1}{4}$ th to $\frac{3}{8}$ th inch, and speeds of from 200 to 350 strokes per minute employed.

Attempts were often made to increase the speed, but the resultant losses were so great that mill-men hastened to retrieve what was looked upon as an error, and so the possibilities of doing good work on relatively large sizes of sands at very high speeds were not discovered. This is the peculiarity of the practice inaugurated by Mr. W. J. Evans at Great Falls, which has proven so successful that the system of high speeds and short strokes will be introduced into the 6000-ton concentrating plant being erected at Anaconda, Mont. At Great Falls ore crushed to pass a $1\frac{1}{2}$ in. mesh screen is jigged with 180 strokes per minute, $1\frac{1}{2}$ in. long, and other smaller sizes in proportion. In general the length of stroke should be approximately the same as the diameter of the maximum size of ore particles fed, making due compensation for the relatively greater resistance to falling in water on the part of very small sizes of grains. The result of this is to take advantage of the acceleration before the period of uniform velocity of fall has been reached, and thus to assist gravity many times a minute. Mr. Evans would dissent from this way of stating the matter, his view being that jigging depends less on gravity than on frequent assisting of gravity by quickly applied suction at the moment of reversal of motion. This is a widely different thing from the so-called law of suction proposed by Prof. Richards. He says: The law of suction seems to be that jigging is greatly hindered by strong suction where the two minerals are nearly of the same size, the quickest and best work being then done with no suction; but that when the two minerals differ much in size of particles, the quartz being the larger, strong suction is not only a great advantage, but may be necessary to get any separation at all" (loc. cit., p. 8). Directly opposed to this, it would seem that the practice adopted by Mr. Evans would logically lead to a return to the continental system of close sizing

before jigging, since the larger grains would yield more readily to the forces operative at such high speeds.

Another feature of the new system adopted at Great Falls is an increase in the depth of the jig bed, with the use of screens of larger mesh. That this has been necessitated by the change to higher speeds and shorter strokes indicates that Munroe's law of hindered settling particles plays here a role which in some respects must be different from that which it performs with classified ores under the prevailing American practice. There are features here which are manifestly novel and require further investigation. That greatly increased capacity per unit of screen area is obtained by Mr. Evans' system, without causing losses of valuable mineral, is indubitable, and thus the value of the jig is still further enhanced. In order to obtain the best results with high piston speed, it is important to secure a vertical motion with the piston held rigidly in a horizontal position. This end has been secured in a jig designed by Mr. Evans, having double piston rods working through boxes fixed in the cover of the piston compartment.

Sample Ignorance About the Nickel Industry.

In the *Toronto World* of the 15th inst., there is a long article written by the firm of Clarke & Co. of that city, on the nickel industry. It would be very amusing to read only for the oracular style of it. For instance, they locate the Sudbury district to the northwest of Sault Ste. Marie, and make the nickel-bearing belt run from there to Hudson's Bay. They also say that owing mainly to Clergue's enterprise three refineries are being built in this district now, one at Copper Cliff, another in Denison and the third at Worthington. To correct this ridiculous yarn, we may state that the new works at Copper Cliff are simply a concentrating plant; and the works in Denison are a combined smelting and bessemerizing plant, and the works at Worthington are merely a small 50-ton smelter on the Jack McDonald process for making matte. The Canadian Copper Co. bought the fine water power on the Vermillion River at Nickel City two years ago with the intention of putting up a nickel refinery there just as soon as they can find a workable process. This is the only step that has so far been taken to erect a refinery in the Sudbury district. But it is in discussing the Frasch process that the worst mistakes are made in the article referred to. The following statement may be taken as a sample: "The result is that the nickeliferous pyrrhotite at Sudbury can now be mined, and its various constituents reduced to marketable commodities, at a total cost of \$3.00 per ton." Here are the facts: The Frasch process can only treat matte, not ore at all, and the cost of mining the ore and making it into ordinary matte is more than \$3.00 per ton. The way they describe some of the ore deposits is equally absurd. But the funniest of all is that at the close of the article the writers deplore "the general ignorance and indifference as to the Sudbury district." The particular ignorance in their case is still more to be wondered at.

Granite Gold (Nelson, B. C.)—The following corrected statement has been sent us for publication:—Mill working 26 days; tons crushed, 1,365; bullion produced, 593 ozs.; estimated value, \$10,000; concentrates, 36 tons; estimated gross returns are \$11,100; total cost will be \$8,500.

McDonald's Bonanza (Klondike)—Cablegram from the mine, dated September 3rd:—"Clean-up after 15 days' sluicing September 1st 3,650 tons resulted in 1,409 ozs. The estimated value is \$22,000. The falling off is due to gold (being) much lighter."

The Yukon Goldfields, Limited.—The following cable has been received from the company's representative at Dawson City, Yukon:—"Adam's Hill United: August output, \$19,750. The total receipts for the month are \$25,000. Disbursements this month amount to \$23,000."

CORRESPONDENCE.

The Bridge River District, B.C.

To the Editor Review:

SIR,—In the able paper on the Bridge River Mining Camp read before the Canadian Mining Institute by Mr. Fritz Cirkel, M.E., the author says: "A recently discovered lead, particulars of which are not to hand." It may be of interest to your readers to learn something more about the recently discovered leads in this camp.

There appear to be two systems of parallel veins in this camp, one of which has a strike of N. 70° E. mag. and dips about 70° to the north, and the other having a strike of N. 45° E. and a slight dip to the N.W.

One of the former veins was discovered in 1897 and was developed by a shaft sunk to a depth of 70 feet and by some open cuts. The values and the width of the quartz in this vein appear to be irregular; some good ore was found, and when the bond under which this work was done was thrown up, the owners built an arrastra operated by an overshot water-wheel and took out \$800; this was in the fall of 1898.

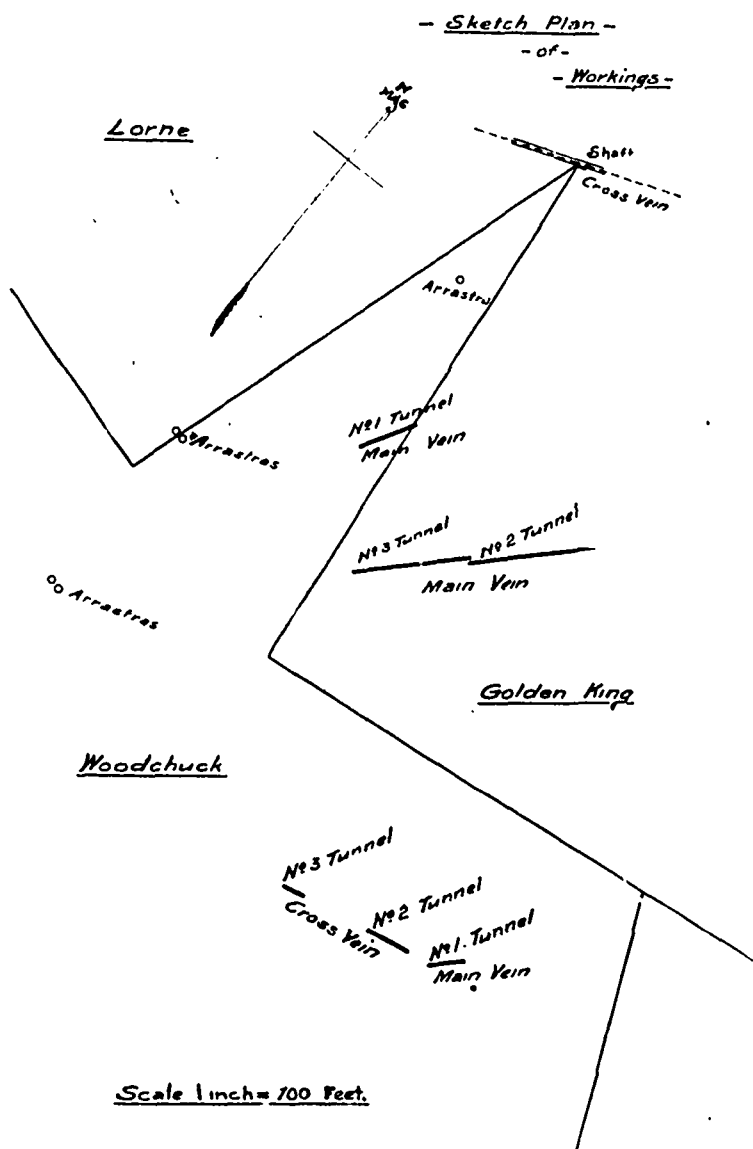
In the same year float from a richer vein was discovered, but the vein itself was not located. The whole hill is covered with wash to a great depth and the float has been carried a long way from the veins, entailing a large amount of surface work in tracing the veins. Two veins belonging to the second system were discovered in 1899, and the owners erected two more arrastras.

In 1899-1900 two veins were discovered on the "Woodchuck," a claim adjoining the "Lorne"; one of these veins belongs to the first group and one to the second, and they cross each other near the mouth of a tunnel driven on the second vein.

The veins having a strike of N. 45° E. appear to be the main veins on this hill. They are very regular and well defined, averaging about 4 ft. wide, and on the "Lorne" claim the ore chute on one vein is proved by tunnels for 300 feet in length and 130 feet in height and is traced further by open cuts. The quartz varies from white to bluish grey and very little free gold is visible to the naked eye, through careful examination with a glass shows frequent fine free gold. The gold is associated with iron and is free milling, even where the iron is not decomposed by exposure. The quartz is well banded parallel to the dip of the vein and there is a strong heavy gouge between it and the country rock. The three faces on these properties which were being mined and milled in the arrastras at the time of my visit gave the following values in gold and silver from large and carefully taken samples. viz., \$40.46, \$42.83 and \$34.98. The formation is an eruptive granite rock and from all the indications one would expect permanent veins. Mr. Fritz Cirkel in his account of this camp speaks very strongly of the regularity and strength of these veins.

But the really remarkable and interesting feature about these properties is the fact that the prospectors who discovered them have, without any capital and entirely by their own labor, been able to develop them and bring them to a producing and paying position. The owners of the "Lorne" group have built three arrastras and the owners of the "Woodchuck" group two arrastras. At the "Lorne" one arrastra produced in 1898, \$800 from a two months' run on ore taken from the cross vein first discovered. In 1899 they commenced to run on the main veins, and from July 1st to the close of the season in October they produced \$6,564.96 with three arrastras. This year up to August 6th they had worked 204 arrastra days, producing 446 $\frac{1}{8}$ lbs. of bullion. This bullion sold according to the returns from the United States Assay Office at Seattle, where the gold was purchased

for \$16.34 per ounce before melting. The duty of an arrastra will average one ton per day, making 204 tons milled, and producing \$7,293.76, equal to an average of \$35.26 per ton milled. During 1899 the ore was picked and only the best was sent to the arrastra



but this year they have milled the quartz just as it comes from the stopes and have also milled some of the second-class quartz left on the dump last year.

The Woodchuck arrastras have also been worked this season; 9 tons milled and cleaned up during my visit, producing 17 $\frac{3}{4}$ ounces of bullion worth \$290.03, and averaging \$32.22 per ton milled. The last clean-up from 14 tons is said to have produced \$800.00, or an average of \$57.14 per ton milled.

Considering that these high values obtained at the "Lorne" mine are from an ore chute of some 300 feet in length, a great future may be predicted for this camp, and I believe it is the only camp in British Columbia where the owners have been able to develop a gold property for themselves and without capital.

I am, Sir, &c.,

LESLIE HILL.

Vancouver, B.C., Sept., 10th, 1900.

Velvet (Rossland) Mine.—The following cable has been received from the consulting engineer, Mr. James Morrish, who has just arrived at the mine:— "Have recommended manager to push ahead with the adit level and the north drift at 300 feet level. The foundations for machinery are being proceeded with. Expect road will be opened beginning of October. There is a fine body of ore at the 300-ft. level, and an excellent showing at a recent discovery at the surface."

VISIT TO CANADA OF THE AMERICAN INSTITUTE OF MINING ENGINEERS.

Highly Successful Excursions to the Asbestos and Coal Mines. The Great Steel Works at Sydney and the Unique Deposits of Iron Ore at Newfoundland Inspected.

For the fourth time in its history the American Institute of Mining Engineers has been the guests of its confreres in the profession in Canada, and, as in the preceding occasions, at Halifax, in 1886, at Ottawa, in 1889, and at Montreal, in 1893, the event has proved a highly successful and thoroughly enjoyable affair. On this occasion the Institute visited Eastern Canada on invitation of the Canadian Mining Institute, under whose auspices and direction, with the hearty co-operation of the Mining Society of Nova Scotia, an exceedingly interesting and thoroughly enjoyable programme was carried out. Among those who participated in the excursions and meetings we may mention:—

Dr. James Douglas, New York; Dr. Rossiter W. Raymond and Mrs. Raymond, New York; Mr. Theo. D. Rand, Philadelphia; Mr. J. W. Dougherty, Steeltown, Pa.; Mr. S. M. Pitman, Providence, R. I.; Mr. Walter Hinchman and the Misses Hinchman, Philadelphia; Mr. C. S. Hinchman, Philadelphia; Mr. W. L. Kann and Mrs. Kann, Pittsburg; Mr. and Mrs. A. H. Wethey, Butte, Montana; Mr. and Mrs. F. J. Campbell, Denver, Colorado; Mr. and Mrs. W. Kelly, Vulcan, Mich.; Mr. E. T. Dumble, Houston, Texas; Mr. and Mrs. E. P. Jennings, Salt Lake City, Utah; Mr. C. S. Hill, New York; Prof. George E. Ladd, Rolla, Mo.; Mr. and Mrs. C. H. Tompkins, New York; Mr. and Mrs. H. J. Seaman, Catsanqua, N. Y.; Mr. F. R. Valentine, Woodbridge, N. J.; Mr. A. E. Noble, Anniston, Alabama; Mr. and Mrs. Horace See, New York; Mr. and Mrs. M. A. Valentine, Woodbridge, N. J.; Mr. E. L. Wiles, Wheeling; Mr. and Mrs. Guildford Smith, Buffalo, N. Y.; Mr. and Mrs. W. S. Edwards, New York; Mr. Levi Holbrook, New York; Mr. G. F. and the Misses Baer, Reading, Pa.; Mr. George Iles, New York; Mr. J. B. Cullum, Pittsburg, Pa.; Mr. and Mrs. C. H. Wellman, Cleveland, Ohio; Mr. and Mrs. Sherrerd, Highbridge, N. J.; Mr. J. A. Capp, Schenectady, N. Y.; Mr. J. W. Shook, Birmingham, Ala.; Mr. W. T. Wrightson, Durham, England; Dr. C. H. Jouet, Roselle, N. J.; Mr. A. W. Shaeffer, Pottsville, Pa.; Dr. T. H. Drown, Bethlehem, Pa.; Mr. Walter Wood, Philadelphia, Pa.; Mr. Theo. Dwight, New York; Major R. G. Leckie, Sudbury, Ont.; Mr. Henry S. Poole, Stellarton, N.S.; Prof. W. G. and Miss Miller, Kingston, Ont.; Miss Potter and Mrs. Korke, Sudbury, Ont.; Mr. James F. Lewis, Sherbrooke, Que.; Mr. George R. Smith, M.L.A., Thetford Mines, Que.; Mr. Charles Fergie, M.E., Westville, N.S.; Mr. Graham Fraser, New Glasgow, N.S.; Dr. W. L. Goodwin, Kingston, Ont.; Mr. R. T. Hopper, Montreal; Mr. and Mrs. C. H. Carriere, Levis, Que.; Mr. Hiram Donkin, Glace Bay, C.B.; Mr. J. S. McLennan, Boston; Mr. Mr. and Mrs. W. T. Bonner, Montreal; Mr. R. B. Koss, Montreal; Mr. C. A. Meissner, Sydney; Mr. J. Stevenson Brown, Montreal; Mr. D. M. Sexton, Montreal; Dr. E. Gilpin, jr., Halifax; Mr. R. E. Chambers, Bell Island, Newfoundland; Mr. W. W. L. Grammar, Bell Island, Newfoundland; Dr. J. Bonsall Porter, Montreal; Mr. Koehler, Hamilton, Ont.; Mr. and Mrs. B. T. A. Bell, Ottawa; Mr. W. L. Libbey, Northfield, N.S.; Mrs. and Miss Libbey, Brookfield, N.S.; Miss Taylor, New Bedford, Mass.; Miss Batchelder, New Bedford, Mass.; Mr. F. M. Huntress, Halifax; Mr. Charles Archibald, Halifax; Mr. J. P. Edwards, Londonderry; Mr. W. D. Taunton, Halifax; Mr. C. H. Porter, Halifax; Mr. T. R. Gue, Halifax; Mr. A. McNeill, Halifax; Mr. M. McNeill, Halifax; Mr. W. F. McCurdy, Halifax; Mr. George W. Stuart, Truro, N. S.; Mr. W. G. Matheson, New Glasgow; Mr. Harvey Graham, New Glasgow; Mr. James Carruthers, New Glasgow; Mr. George F. McKay, New Glasgow; Mr. Mat. Morrow, Halifax; Mr. C. C. Starr, Halifax; Mr. G. L. Burritt, Halifax, and many others.

AT SHERBROOKE, QUE.

The first social feature in connection with the meeting was the entertainment given by the citizens of Sherbrooke, Que., and the President and officers of the Canadian Rand Drill Company of that city, on Saturday, 18th August. Some forty members of the American Institute of Mining Engineers, with several ladies, arrived by the 6.40 a.m. train on the Boston & Maine Railway, and were joined at this point by quite a number of members of the Canadian Mining Institute, who took the occasion to stop over for the day on their way to join the special train at Levis. An elaborate programme had been prepared for their entertainment. They were met at the railway station by a committee of citizens and conveyed in two special electric cars to the Magog House for breakfast. The Harmony Band was in attendance and played several fine selections during the discussion of the excellent menu provided for the occasion. After breakfast a reception was held by the Acting Mayor and City Council, at which some interesting addresses were delivered.

Mr. J. F. LEWIS, President of the Canadian Rand Drill Company, expressed a few words of cordial welcome to the visitors. He reminded them that not very long ago medals were presented to Canadian veterans throughout the country for keeping certain gentlemen across the line from coming over here. The banner of these Canadian veterans bore the words "No Femians need apply." On the present occasion the cry was changed. Sherbrooke was captured by ladies and gentlemen from the United States, and was glad to be captured. The citizens of Sherbrooke were glad to see them and to welcome them, and he trusted that they would be delighted with their visit, even though their stay was brief. Mr. Lewis then read the following telegram from Mayor Belanger, who was absent on a tour in the Maritime Provinces with the Premier of Canada, Right Hon. Sir Wilfrid Laurier:—

HALIFAX, August 26.

J. F. LEWIS, Sherbrooke:

Exceedingly regret unavoidable absence. Tell our guests I am with you in spirit and welcome them heartily to "Gate of Canada." Annex them, especially the ladies, through much hospitality and kindness.

L. O. BELANGER.

Mr. LEWIS also announced that he had sent the following reply to the Mayor:—

"American Institute of Mining Engineers are having a delightful time. All exceedingly regret your absence, especially the ladies."

Mr. LEWIS proposed the toast of "The Queen," which was enthusiastically received, the Americans vicing with their Canadian cousins in doing honor to a queenly sovereign and womanly woman.

ACTING-MAYOR LIEUT.-COL. WORTHINGTON, in a few words, further expressed the official welcome. In the name of the citizens he extended the visitors the freedom of the city. "You may annex us for to-day," Col. Worthington said, "but only for to-day." (Laughter and applause.) He hoped that their stay in Sherbrooke would be pleasant, and that they would carry away pleasant recollections of their visit to the metropolis of the Eastern Townships of Canada. (Applause.)

DR. CAMIRAND, President of the Board of Trade, in a few graceful words, welcomed the American visitors in the name of the business men of the city.

GEN. LANG, United States Consul at Sherbrooke, also bade them welcome to that city. It seemed fitting that they should pause on the threshold of Canada to spend a day in this thriving little city, to visit its prosperous industries, to view its natural resources, and to experience its magnificent hospitality, which was never exhausted. He referred eloquently to the cordial good feeling which existed between the government of the United States and the government of Great Britain. (Applause.) Perhaps at this moment the soldiers of the United States and the soldiers of Great Britain were fighting side by side beneath the Stars and Stripes and the Union Jack before the walls of Peking to rescue their imprisoned countrymen and advance the banner of civilization. God grant them success. Gen. Lang reminded the visitors that they had entered a country as large as their own, extending from the Atlantic to the Pacific, rich in all natural resources, and which awaited foreign capital for development. This should come from the United States, and he hoped his countrymen would take advantage of the opportunities offered. (Applause.)

DR. JAMES DOUGLAS, President of the American Institute of Mining Engineers, and a former resident of Quebec, replied on behalf of the visitors to the welcome they had received. The cordial reception was appreciated, and they anticipated a pleasant day in Sherbrooke. He referred to the Capelton Copper Mines, and reviewed their history. As mining engineers they would have been glad to visit these mines, but time would not permit it on this trip. In conclusion, Dr. Douglas desired the citizens of Sherbrooke to accept the hearty thanks of his party for the greeting given them. (Applause.)

The party then began its tour of the city, visiting various industries and other points of interest in the following order: Dominion Carpet Company, Victoria Park, Jenckes Machine Company, Electric Light Station, the Paton Mills, and the Canadian Rand Drill Company's works. They were most cordially received at each place. While the gentlemen were visiting the Jenckes Machine Company's works, the Electric Light Station, and the Paton Mills, the ladies were given a carriage drive through the city under the escort of Lieut.-Col. King.

After winding up at the Canadian Rand Drill Company's works, the party was entertained at luncheon through the courtesy of Mr. J. F. Lewis, the President of the Company, the 53rd Battalion Band being in attendance.

After luncheon, DR. JAMES DOUGLAS, President of the American Institute of Mining Engineers, said that Dr. Raymond would return thanks more eloquently than he could, and would likewise perhaps be able to explain the paradox that he, a Canadian by birth, was representing the American Institute of Mining Engineers, while a thorough going Yankee was representing the Canadian Mining Institute. Sometimes the Canadians resented the assumption of the term American as representing Americans south of the line. However, as in this case, they had in their host an American who might be supposed to represent the peoples on opposite sides, and this would perhaps explain the paradox, and until some more euphonious term than United States should be invented there was a good reason why the Americans should assume the more convenient term American.

DR. R. W. RAYMOND, Secretary of the American Institute of Mining Engineers, referring to Dr. Douglas's remark about his being a Canadian representing the Americans, and Mr. Lewis being an American representing the Canadians, pointed out that from the beginning the American Institute of Mining Engineers had always had members who were citizens of Canada. They had had presidents from Canada and vice-presidents from Canada, and they felt themselves just as much Canadians as they were Americans.

Mr. LEWIS said he wished to call upon a gentleman, who although the rector of St. Peter's Church, Sherbrooke, was at present engaged in what might be called mining work.

REV. DR. DUMBELL, in a happy speech, remarked that he felt a little out of place in being asked to speak at a mining re-union. The Chairman's allusion was probably because he was at the present time having the rock taken out in order to get a foundation for the new church they were about building, and he humorously added that he was finding the rock which was being taken out as firm and as hard as he had ever preached it. Dr. Dumbell also alluded to the pleasant feeling now existing between the people of the United States, where he had lived for so many years, and the people of the Dominion of Canada, and to the fact that at present in China the American and the British troops were at this moment fighting together for the preservation of life and the cause of Christianity.

The American visitors were delighted with the hospitality accorded them, and all were profuse in their expressions of gratitude for the entertainment provided for them, and were especially grateful to Mr. Lewis for his untiring efforts to this end.

AT THETFORD ASBESTOS MINES.

At three o'clock the party left on a special Quebec Central Railway train, kindly placed at their disposal by Mr. Frank Gundry, general manager, and Mr. J. H. Walsh, general freight and passenger agent, for the asbestos mining region of Thetford and Black Lake. At five o'clock they were received at Thetford by Mr. George R. Smith, M.L.A., manager of the Bell's Asbestos Company, Limited; Mr. Andrew Johnson, of the Johnson's Company; Mr. R. F. Hopper, Montreal, and Mr. B. Bennett, of the King Bros. Asbestos Company, and were taken over the different mines, after which the party were entertained at supper at the Thetford Club. The whole town was in gala attire, the various private buildings being handsomely decorated with flags and bunting, and the St. Jean Baptiste Society, with their band, were also present to assist in welcoming the distinguished visitors.

The method of mining and treating the asbestos bearing rock of the Eastern Townships has been repeatedly described in these columns, but by way of reference to the photos of the pits and plant of the Bell's Asbestos Company, the largest operator, which we reproduce in this issue, the following notes on the work being carried on by this Company may be of interest:—

The mining is carried on in open quarries, what is known as the big pit at Bell's mine being several acres in area and about 150 feet deep. The serpentine is drilled and blasted and is conveyed to the surface by cableways and derricks. The first task is the separation of the asbestos bearing rock from the barren rock, and this is done by hand-picking. The portions containing asbestos are then conveyed to the cobbing house, where old men and boys knock off the long-fibered asbestos from the serpentine. Generally, cobbing is limited to veins from $\frac{1}{4}$ -inch thick upward, the separation of the asbestos carried by the thinner veins being done mechanically.

The mechanical separating process is a simple one. From the cobbing room the rock is deposited in chutes leading to a battery of rock breakers below. At Bell's mines gyratory breakers of the Gates' type are employed, and from them the coarser fragments pass to a set of crushing rolls. From these rolls the crushed rock passes on to travelling belt picking tables, where boys standing alongside pick the fragments of barren rock off the belt and throw them to one side. The mineral bearing fragments pass from the picking tables to cyclone pulverizers in which the final crushing is performed and where a current of air separates the light asbestos fibre from the heavier rock dust. At various points between these crushing and picking operations the material is screened, and finally the asbestos fiber is screened from the fine dust and finely broken fiber. The operation is a continuous one, the rock passing from the top floor downward through the various processes until the final product—commercial asbestos—is turned out at the ground floor. Except for the work of the boys at the picking tables the operation is a mechanical one throughout.

The separated asbestos is divided into three grades for the market. The first grade comprises the long-fibered material which is separated by cobbing. The two other grades are similarly determined according to length of fiber, color and freedom from foreign matter. The material not good enough to be included in any of the three commercial grades, but which contains fiber, is called "waste" and really constitutes a fourth grade. The sorted asbestos is packed in bags of 100 lbs. capacity for the market. At the Thetford mines about two tons of commercial asbestos is obtained from every 100 tons of rock which is crushed. Altogether about 600 men are employed in the mining operations of the three companies working the deposits at Thetford.

At the conclusion of their hasty round of the mines and works, the members of the party were assembled to partake of the excellent dinner provided by their hosts of Thetford. Previous to speeding them on the remainder of their day's journey to Quebec, Mr. George R. Smith, M.L.A., manager of Bell's Asbestos Company, acting as the representative of the three companies, welcomed the guests in a neat speech, encouraging their exertions to dispose of the good things which heaped the tables before them.

WELCOMED AT QUEBEC.

From dinner the party proceeded to the train, which landed the company, tired but enthusiastic, in Quebec at 11 o'clock. Here were found the western members of the Institute and the Canadian party who had previously arrived, and who had provided an English supper of sandwiches and ale in the grill room of the Chateau Frontenac, where a number of the city's officials and the Quebec Minister of Colonization and Mines welcomed the American guests with brief addresses.

Hon. A. TURGEON, Commissioner of Colonization and Mines for the province, said that it afforded him the very greatest pleasure—as he had been requested by the Premier and the Provincial Cabinet, as well as by his colleague, Mayor Parent, who was unavoidably absent from the city—to extend to them the fullest welcome and hospitality to the City of Quebec. He drew a graphic word picture of the beauties of the ancient capital, so rich in historical data, and where the great Wolfe and Montcalm had fallen, and where one of their own generals (Gen. Montgomery) unfortunately lost his life. He went on to say that he hoped the visit of the members of the American Institute of Mining Engineers through such centres as Sherbrooke, Thetford, and along the Quebec Central Railway, would be the means of giving a fresh impetus to the development of the plenteous resources of this grand old province, in her mines, her pulp, her water powers, etc. With the necessary capital and energy these resources could not fail to become sources of inexhaustible wealth. In conclusion, he expressed the hope that they would be greatly interested in the historic city. (Applause.)

DR. JAMES DOUGLAS, President of the American Institute of Mining Engineers, in acknowledging the cordial welcome extended by the Hon. Minister, said that the tables ought to be reversed, and that he should be the reception committee. "My recollection of Quebec," he went on to say, "goes back to the forties, when the Chateau St. Louis stood upon the site of the beautiful Chateau Frontenac of today; when the old riding school, which is now nearly all cremated, stood on the glacis nearby; when there were no water works in the town, and the water carts were taken down to the river where the market place now stands, and being filled from the plenteous St. Lawrence was carted to the upper town and the water poured into tanks for distribution through water valves, etc., to our houses; when the town was only illuminated by coal oil lamps; even before steam ferries crossed the river, and when they were carried from side to side by horse boats; when wealthy people lived in St. Paul Street; when the first east wind brought up a fleet like a flock of winged birds and so completely covered the river, without any berth between St. Charles and Cap Rouge, and when 100 to 200 large wooden ships were built during the winter and launched the following spring. My experience likewise extends back

to the early days of gold mining on the Chaudiere. I had always regretted that hydraulic methods were not applied to the placers of the Chaudiere, as I am satisfied that some of them could be remuneratively handled in that way. I had had bitter experiences of the copper mines of the province; but at the same time I thought that though the ore was very lean, with railroads and proper appliances those low grade ores might possibly be made to pay, and if they could there were immense resources within the Province of Quebec; that if the deposits of titanite, such as those of Baie St. Paul, could be utilized the province contains some of the very largest deposits of iron ore in the world. With these minerals known to exist, it opened up great mining possibilities for the province, and I thought that it must be probable, with the Laurentian range to the north with its boundless area of crystallized rocks and the Notre Dame range to the south, the extension of the Appalachian chain must contain immense mineral wealth, but that covered as the ground is for six months in the year by snow and at all times by a heavy growth of timber, prospecting and exploration would necessarily be slow, and that therefore the very rapid progress made by the mining industry of the extreme west could not be expected in the Province of Quebec. (Applause.)

DR. R. W. RAYMOND, Secretary of the American Institute, added that while their president (Dr. Douglas) seemed to be at home in Quebec, this was his very first visit to the ancient capital, and his presence there at this time was the fulfilment of a dream of many years. They did not require the imagery of the past to realize that Quebec was full of historic interest; they could still see it on every hand. He only regretted that he could not stay longer, but every moment of his visit would be filled with delight. (Applause.)

On Sunday morning at ten o'clock, the Quebec Light and Power Company placed two electric cars at the disposal of the party, and they were driven around the city and landed at the Citadel. From here they came down the new Dufferin Terrace extension, and the whole party, especially the ladies, were in ecstasies over the delightful views of the city and the noble river flowing placidly by beneath.

In the afternoon, through the courtesy of the Hon. the Minister of Marine and Fisheries, the government steamer "Druid," with Commodore J. U. Gregory on board, was placed at the disposal of the reception committee, and with the Royal Artillery band to discourse sweet music, the visitors were taken up the harbor as far as Sillery and the site of the proposed new bridge. They were then entertained by the Hon. R. R. Dobbell at his beautiful residence "Beauvoir." Having returned to the steamer, they proceeded down the river as far as the Island of Orleans, and enjoyed a view of the Montmorency Falls, the Graving Dock at Levis, and the extensive establishment of Carrier, Laine & Co. Just before disembarking at the wharf, Dr. Douglas, in a happy vein, proposed a hearty vote of thanks to the Minister of Marine and Fisheries and to Commodore Gregory, which was received with three cheers and a tiger.

At nine o'clock in the evening, a special train comprising five Pullman sleepers, dining and baggage car was boarded at Levis for Sydney, Cape Breton, the ultimate destination of the party. During Monday the train traversed the beautiful Metapedia Valley, the great salmon and trout fishing region, and along the Baie de Chaleur, where the Gaspe Peninsula stands out boldly and impressively. Port Mulgrave, on the Strait of Canso, was reached on Monday evening, and the train was held here until daybreak on Tuesday morning, when the cars were ferried across to Point Tupper, and the journey continued to Sydney, which was reached shortly before noon.

AT SYDNEY, CAPE BRETON—THE STEEL WORKS.

Immediately upon arrival at Sydney, the visitors were met by the local committee, headed by Mayor Crowe and the officers of the Dominion Iron and Steel Company, and were at once started on a tour of inspection of these immense works now under construction, and the progress that has been made within one year is simply marvellous. In fact, with the exception of a few who were aware of the facts it was difficult to realize that so much had been accomplished within the short space of twelve months. The result has been that to-day the population of Sydney is over 12,000, and is going up by leaps and bounds.

The work of the Dominion Iron and Steel Company, of which Mr. Henry M. Whitney, of Boston, Mass., is the President and leading spirit, contemplates not only the erection of a modern steel plant at Sydney, but the manufacture of coke from the coal mines of the Dominion Coal Co., the mining of iron ore at Belle Isle, Newfoundland, 400 miles by water from Sydney, and the opening of limestone quarries at Georges River, Cape Breton. The new coke plant of the Dominion Iron and Steel Company will consist when completed of eight batteries, each containing 50 Otto-Hoffman by-product coke ovens, or, altogether, of 400 ovens, the total capacity of which will be 1,600 tons of coke per day. The gas from these ovens will be utilised in the company's open-hearth furnaces, while the other by-products, ammonia and coal tar, will be marketed. The plant is substantially a duplicate of the coke plant of the New England Gas and Coke Co., built by Mr. Whitney at Everett, a suburb of Boston, Mass., which has been in operation for some months, using the same Cape Breton coal for the raw material which will be used at the Sydney plant. As proof of the certain success of coke making from its Cape Breton high sulphur coals, the new company points to the success of the Everett plant, and to the fact that the Nova Scotia Steel Co. has used coke made from the same coal in its Ferrona furnaces for a number of years. In this connection it will be interesting to quote from some recent analyses of washed coal slack from the Cape Breton mines and of the coke made therefrom by the Nova Scotia Steel Co.:

	Washed Coal		Coke	
	Ash.	Sulph.	Ash.	Sulph.
Hub	4.37	2.38	11.2	1.34
Phalen	7.05	2.87	11.3	2.13
Harbor	5.5	3.12	12.8	2.79

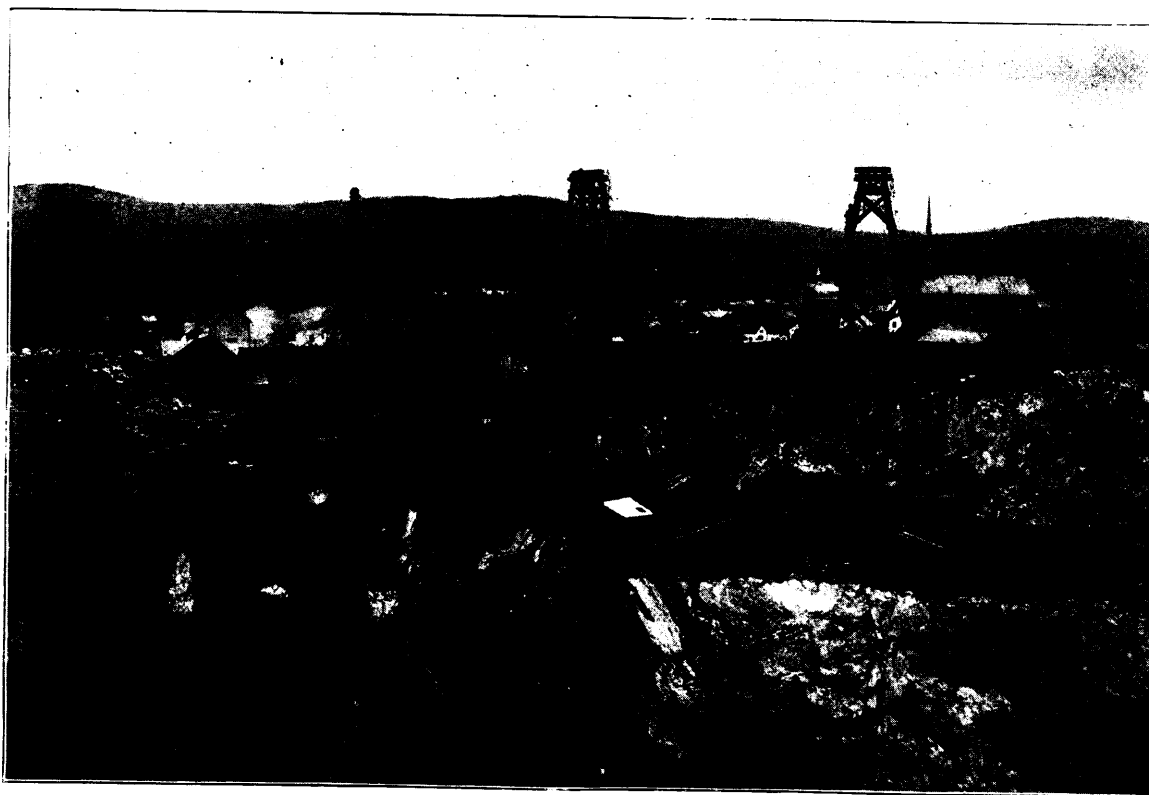
Regarding the expectations of the company in the shape of profitable by-products from its coke ovens, no better illustration can be presented perhaps than the following brief quotation from a pamphlet which it has widely distributed in Canada:

"At Everett the New England Gas and Coke Co. sell their sulphate of ammonia at 2½ cts. per lb., and get about 30 lbs. from a ton of Cape Breton coal in the process of coking. Assuming that only 28 lbs. of sulphate of ammonia will be obtained at Sydney, and that the selling price will be only 1½ cts. instead of 2½ cts. per lb., it will yield 49 cts. per ton of coal. The by-product ovens at Everett also obtain from a ton of Cape Breton coal about 12½ gallons of tar, which is sold at 2 cts. per gallon, and about 5,000 cubic ft. of gas, which is sold at 20 cts. per thousand. At Sydney the surplus gas will be used in the steel mill, and it will be fair to estimate its value at the cost of natural gas in the most prolific natural gas districts of the United States, or 5 cts. per 1,000 ft. This will give the steel mill as cheap fuel as if it were located in a natural gas district. It is calculated that the quantity of gas produced at Sydney will be somewhat less than at Everett, as the coke will be treated somewhat differently to suit the blast furnaces, but it will not be less than 3,000 ft.,



Interior view of the Main Pit of the Bell's Asbestos Company, Limited, at Thetford Mines, Que. This company is the largest producer of high grade asbestos in the world.

VISIT OF THE AMERICAN INSTITUTE OF MINING ENGINEERS.

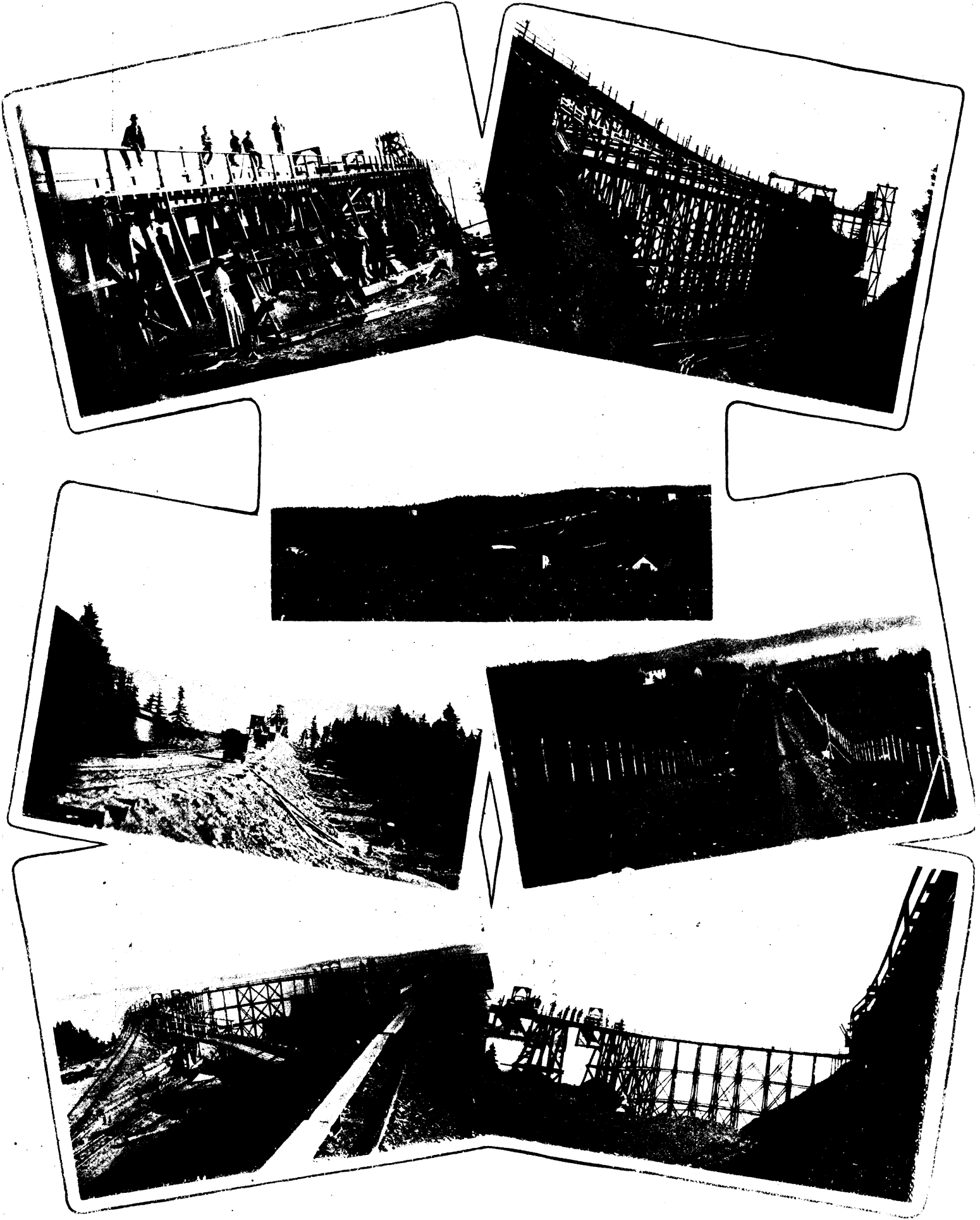


Cable Derrick Plant of the Bell's Asbestos Company, Limited, at Thetford Mines, Que.

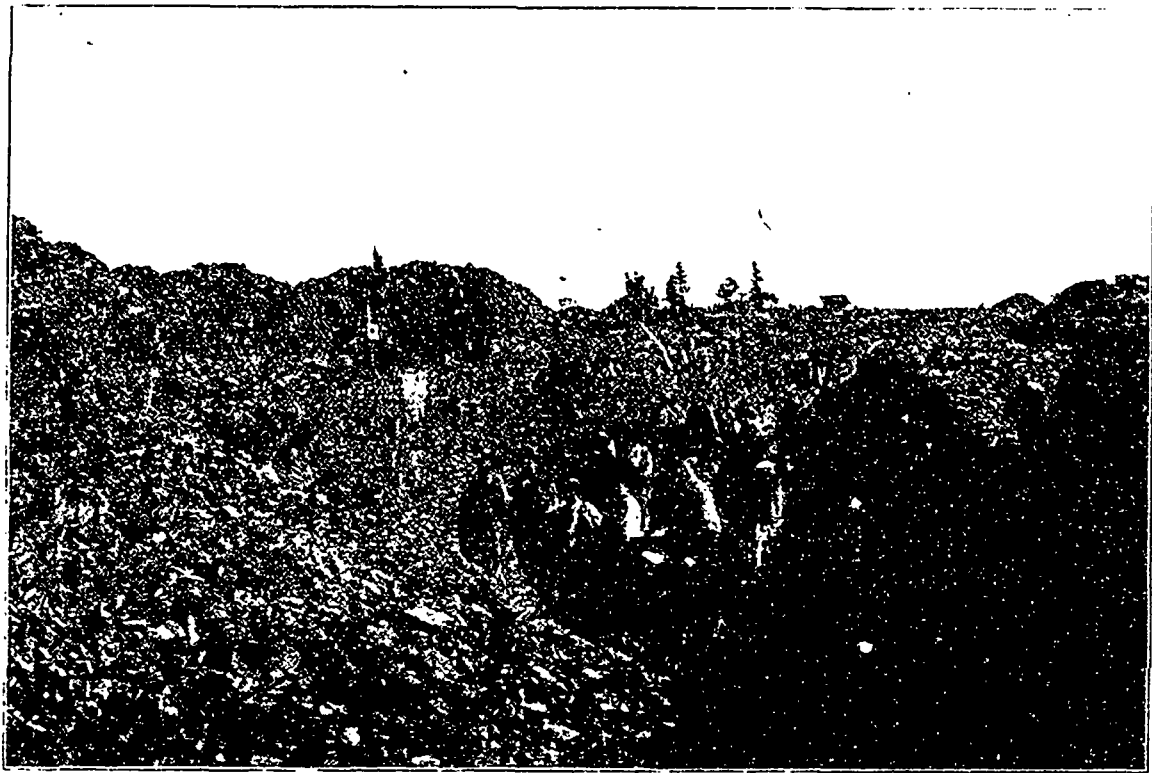


Asbestos Fiberizing Mill of the Bell's Asbestos Company, at Thetford Mines, Que.

VISIT OF THE AMERICAN INSTITUTE OF MINING ENGINEERS.



Shipping Piers and Tramways of the Nova Scotia Steel Company, Limited, and the Dominion Iron and Steel Company, Limited, at Bell Island, Conception Bay, Newfoundland.

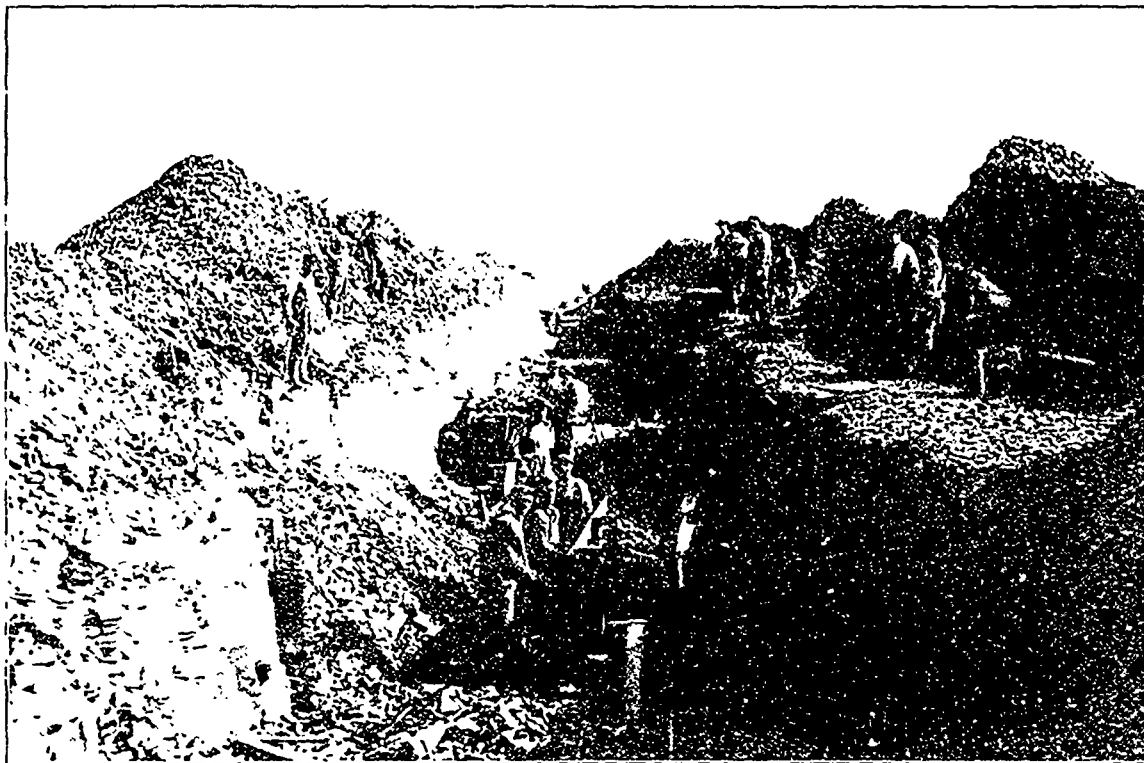


Open Cast Workings in the famous Red Hematite deposits of Bell Island, Newfoundland.

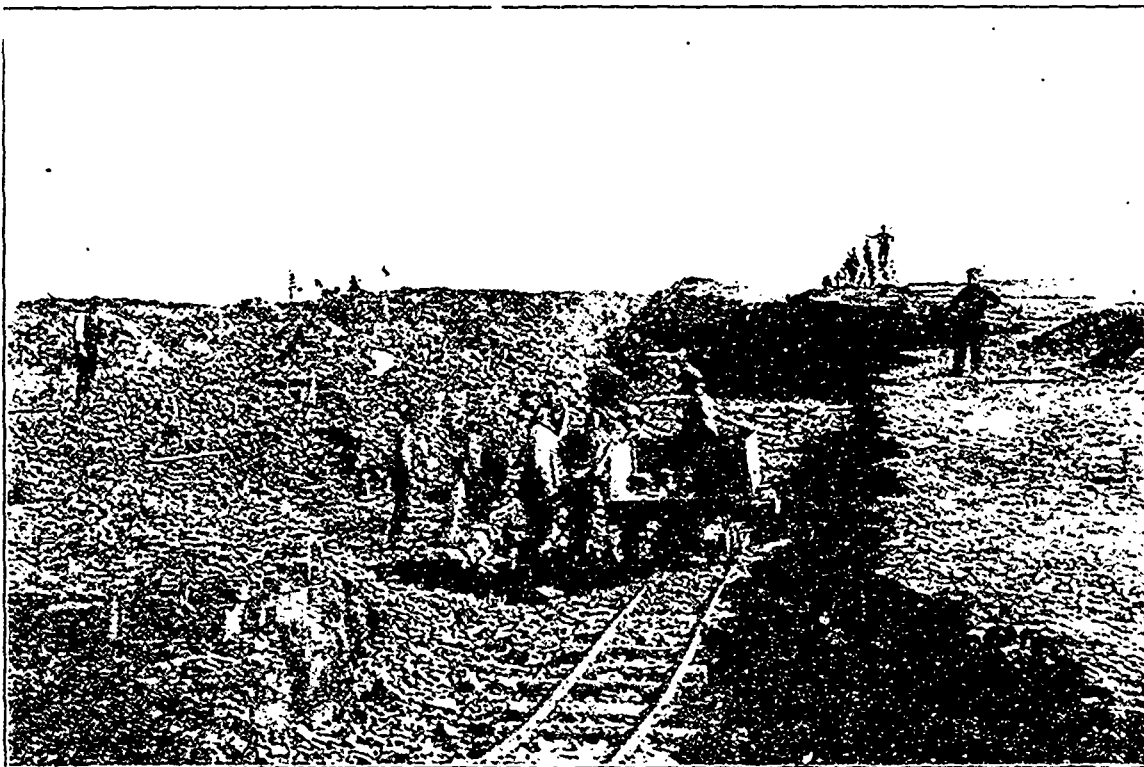


Sullivan Drills at work on the Red Hematite Mines of Bell Island, Newfoundland.

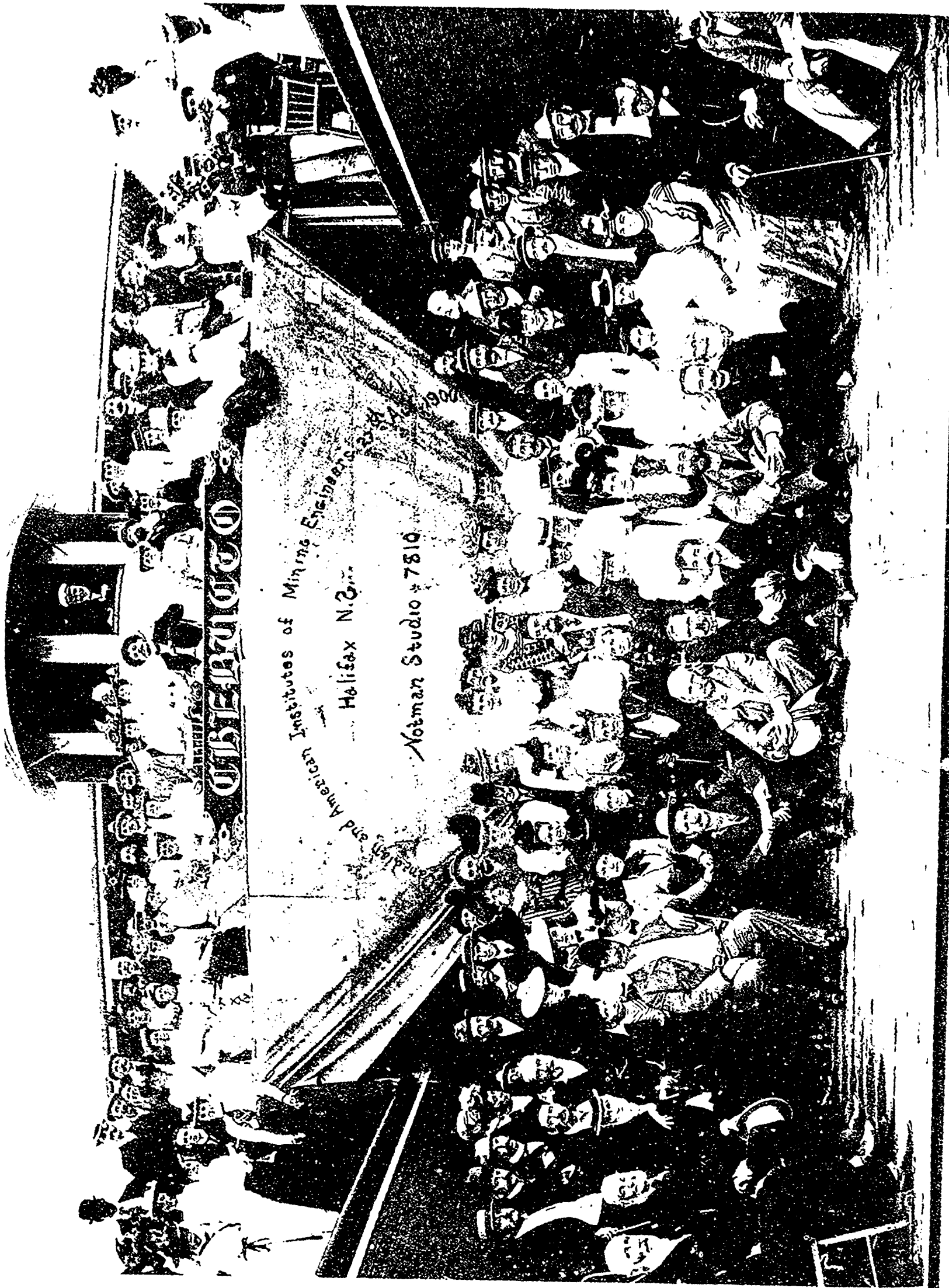
VISIT OF THE AMERICAN INSTITUTE OF MINING ENGINEERS.



Great Open Cut on Seam about 18 feet thick worked by Dominion Iron and Steel Company at Bell Island, Newfoundland.



Mining Operations of the Nova Scotia Steel Company, Limited, on their great Red Hematite deposits, Bell Island, Newfoundland.

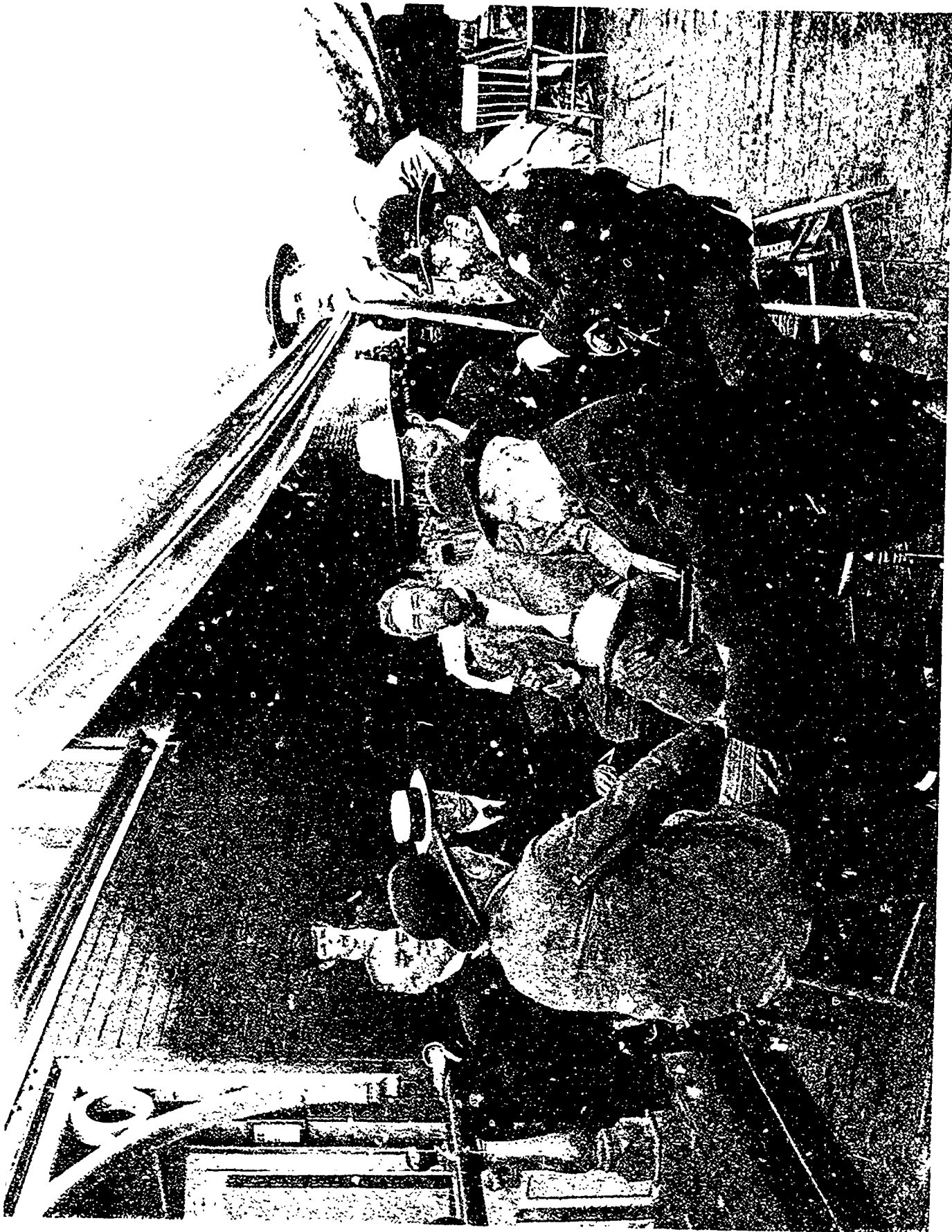


AMERICAN INSTITUTE OF MINING ENGINEERS

and American Institutes of Mining Engineers
Halifax N.S.

Notman Studio 7810

1900

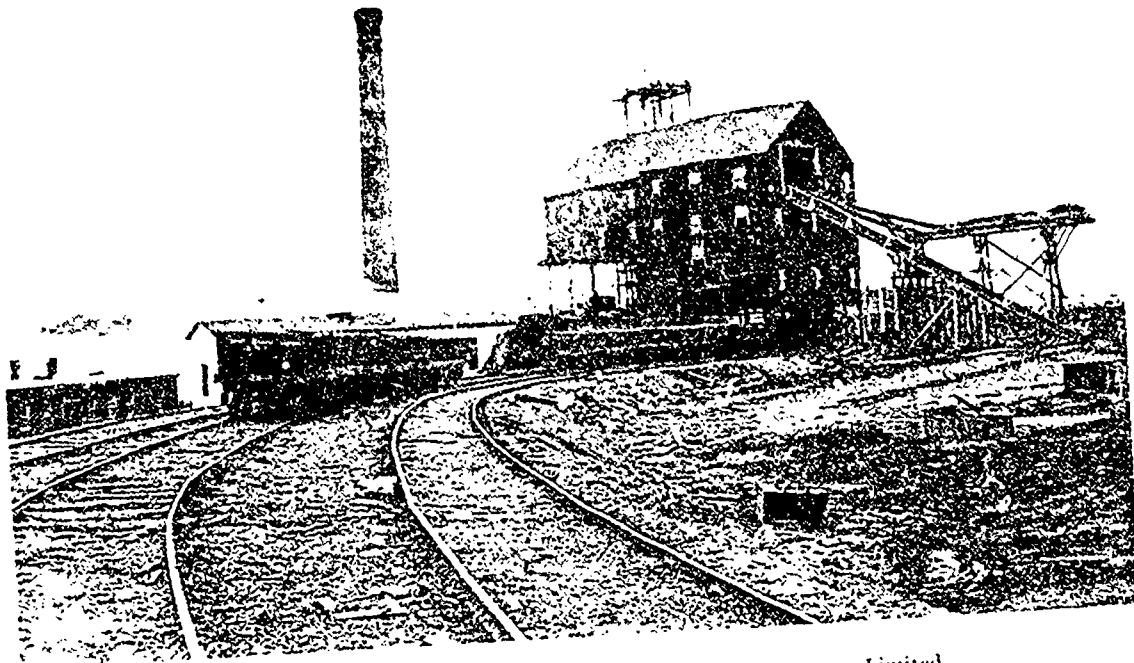


AN INTERESTING GROUP ON THE STEAMER "CHIBUCTO."

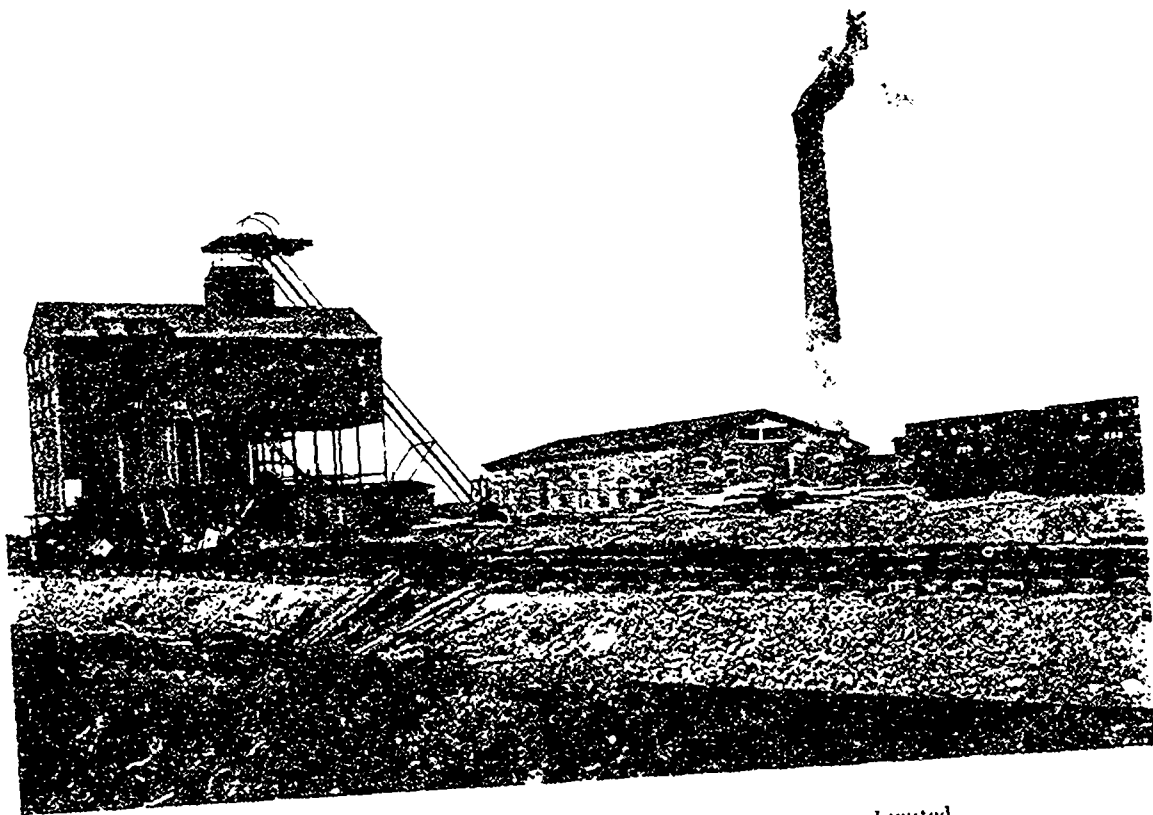
Hon. George Murray, Q.C., *Premier of Nova Scotia.*
Hon. W. B. Ross Q.C.

Mr. J. E. Baer.
Mr. B. T. A. Jell, *Secretary*
Mr. Levi Holbrook.
Col. Wyld.
Mr. Keith.

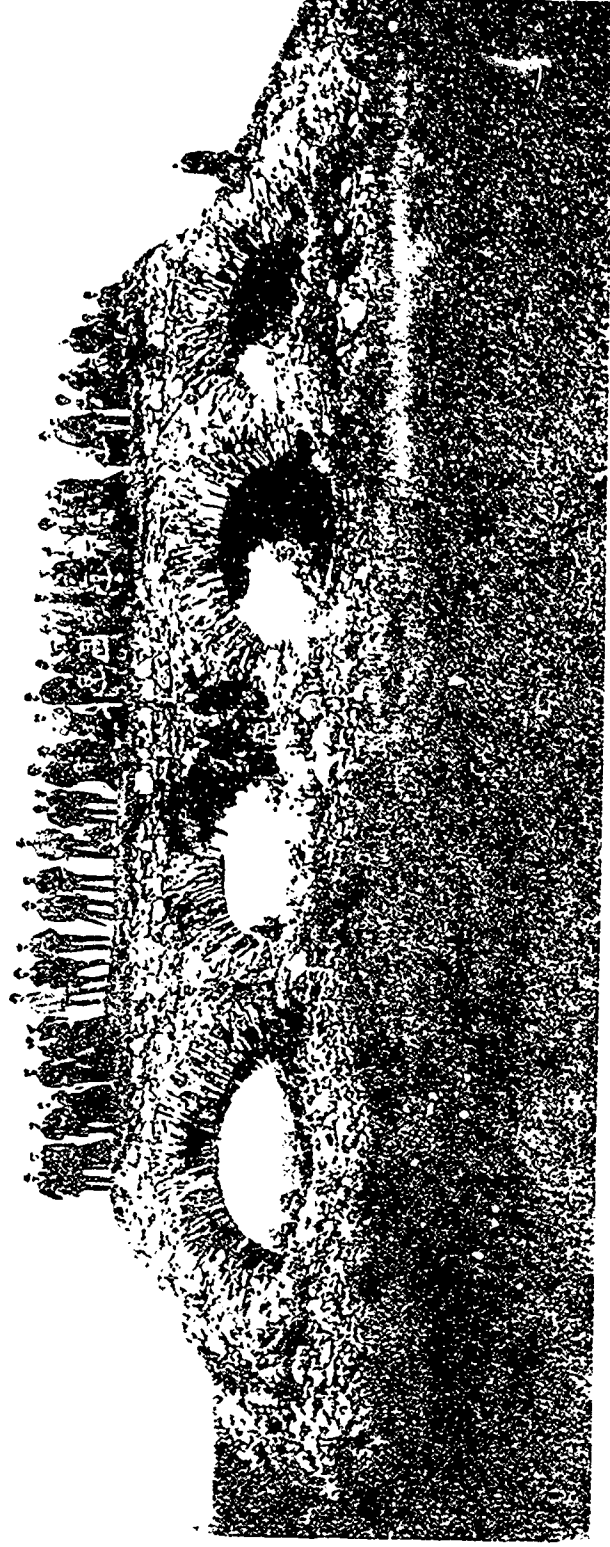
VISIT OF THE AMERICAN INSTITUTE OF MINING ENGINEERS.



Bank head Caledonia Colliery of the Dominion Coal Company, Limited



Bank-head Dominion No. 1 Colliery, Dominion Coal Company, Limited.



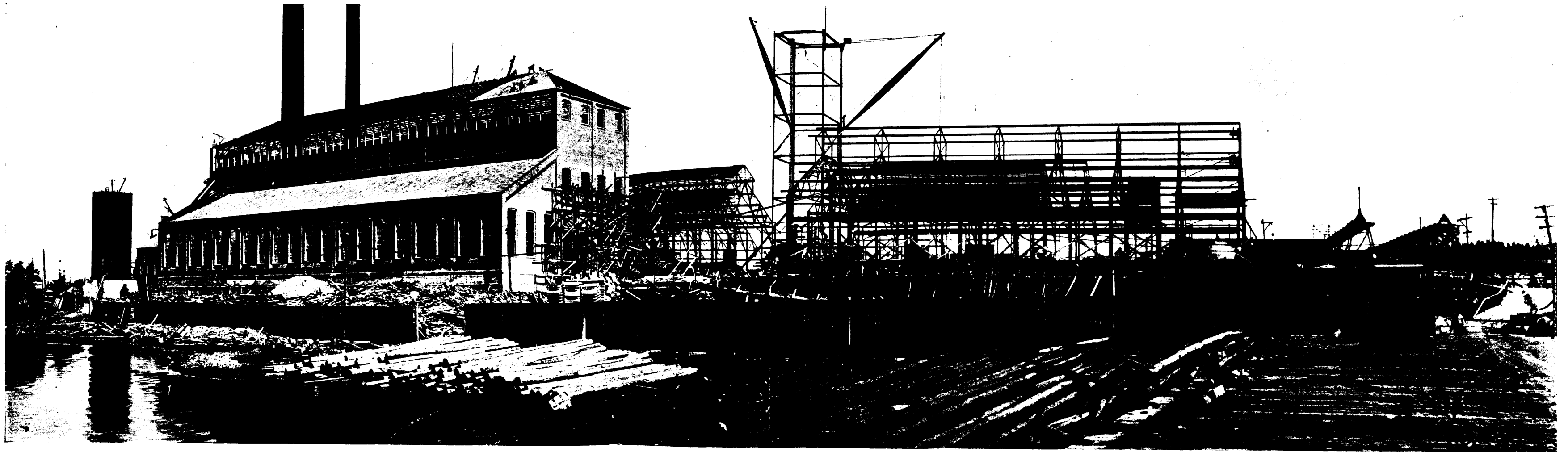
Party of Canadian and American Mining Engineers. Taken on the site of the old fortifications at Louisbourg, Cape Breton.

BLAST FURNACE PLANT IN COURSE OF CONSTRUCTION AT SYDNEY, CAPE BRETON.

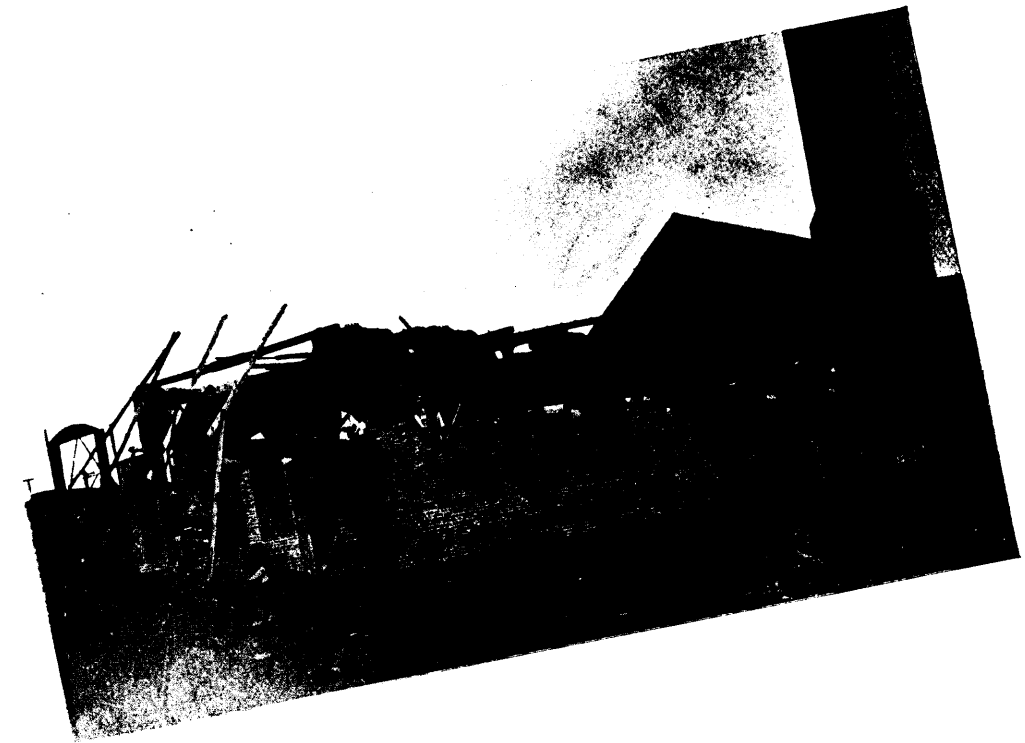
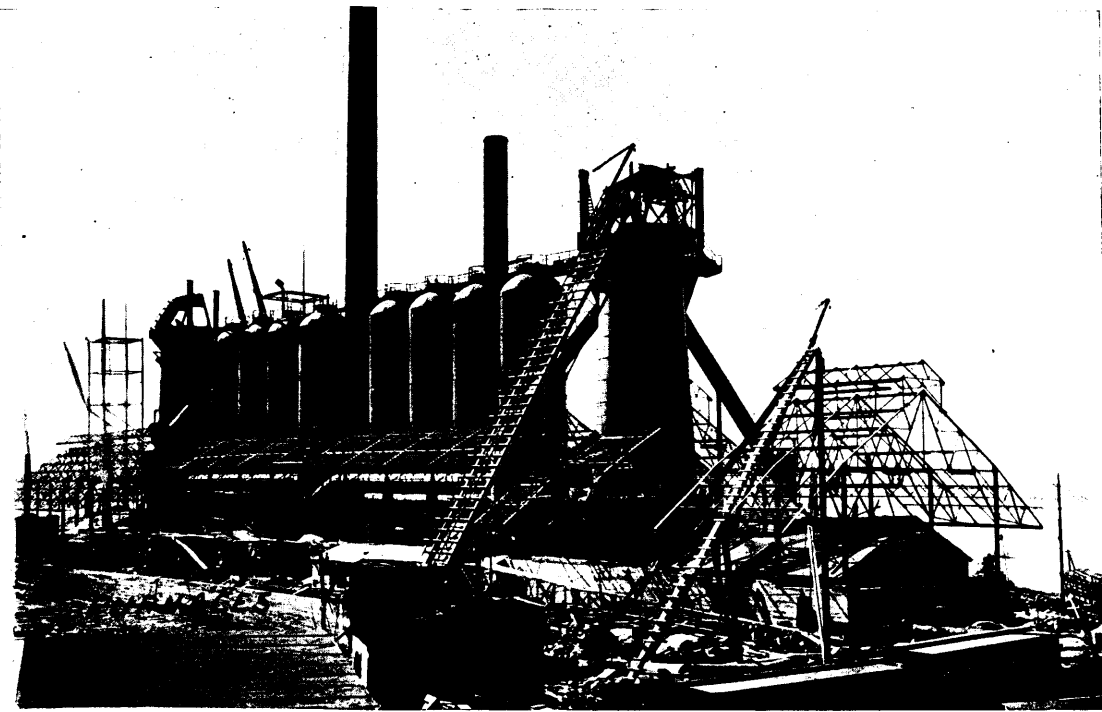
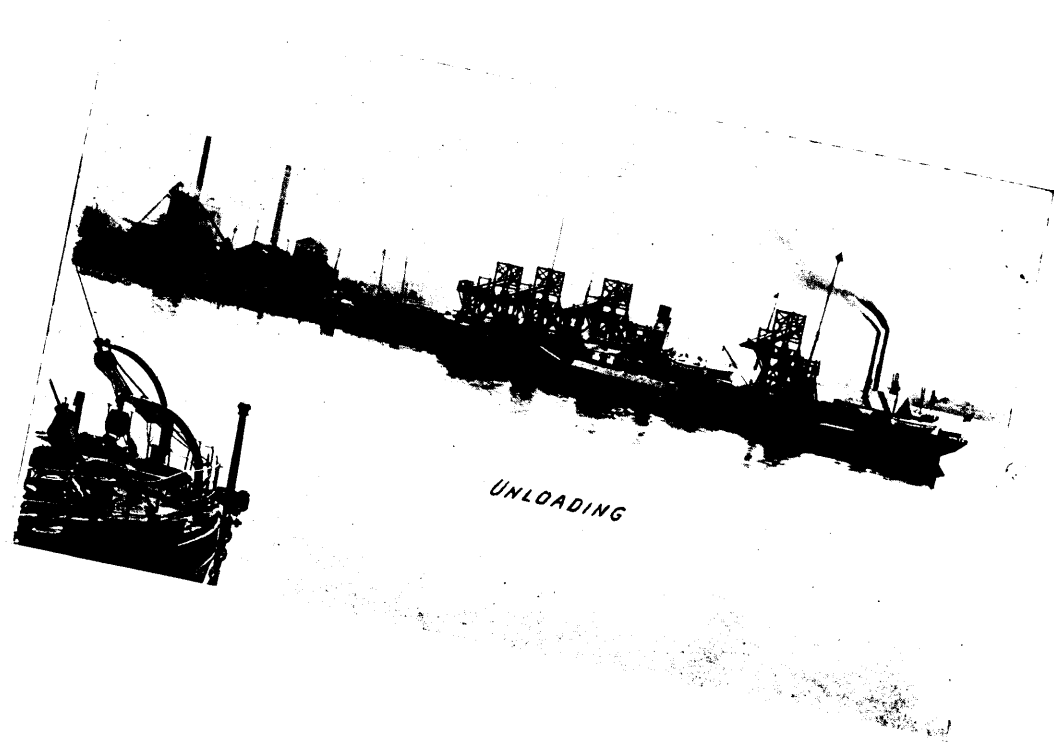
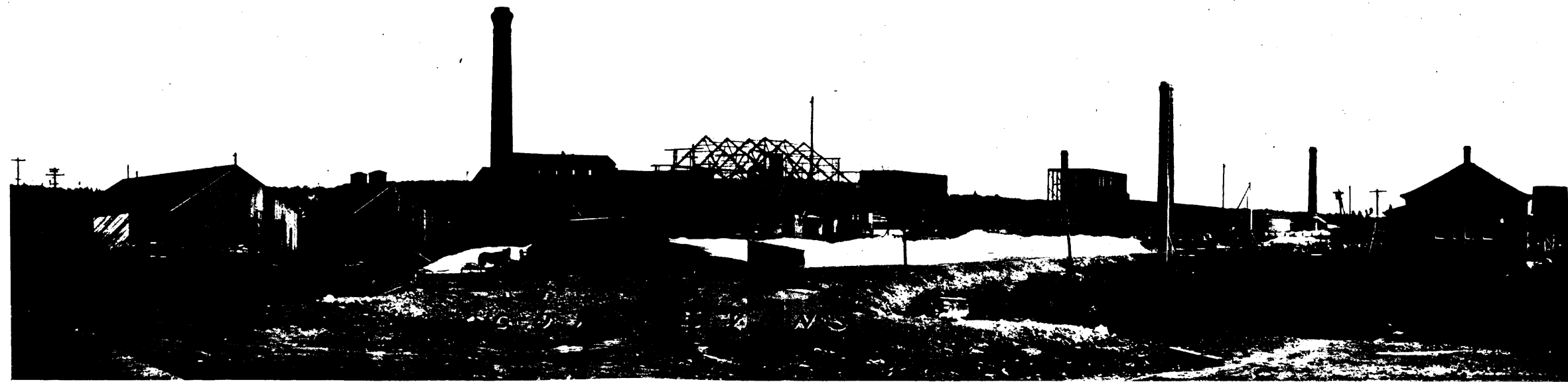
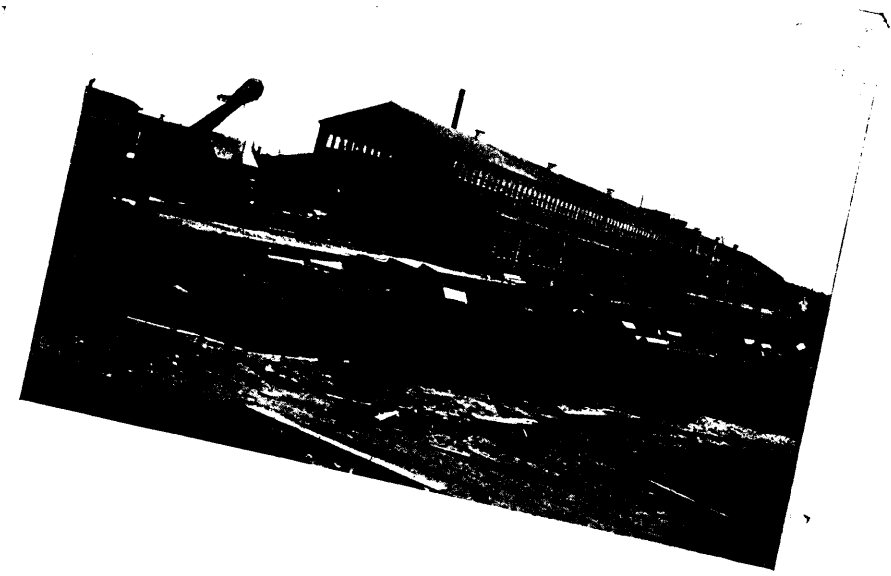
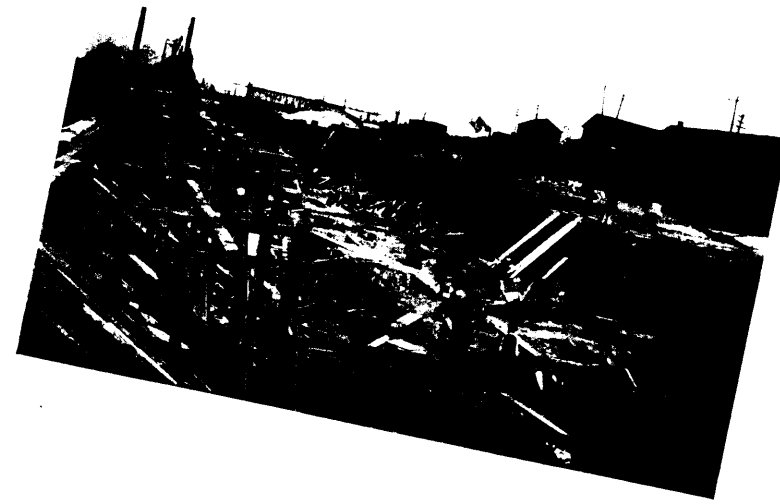
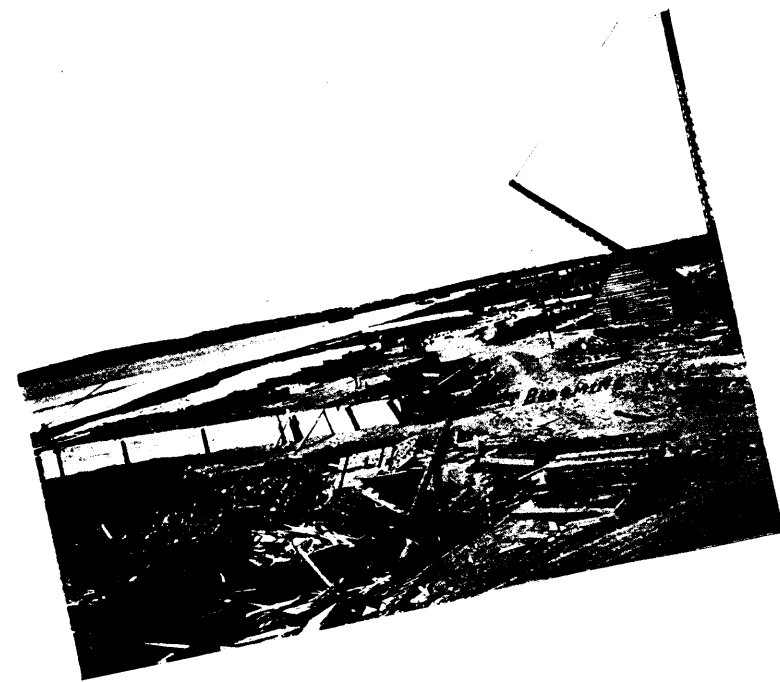
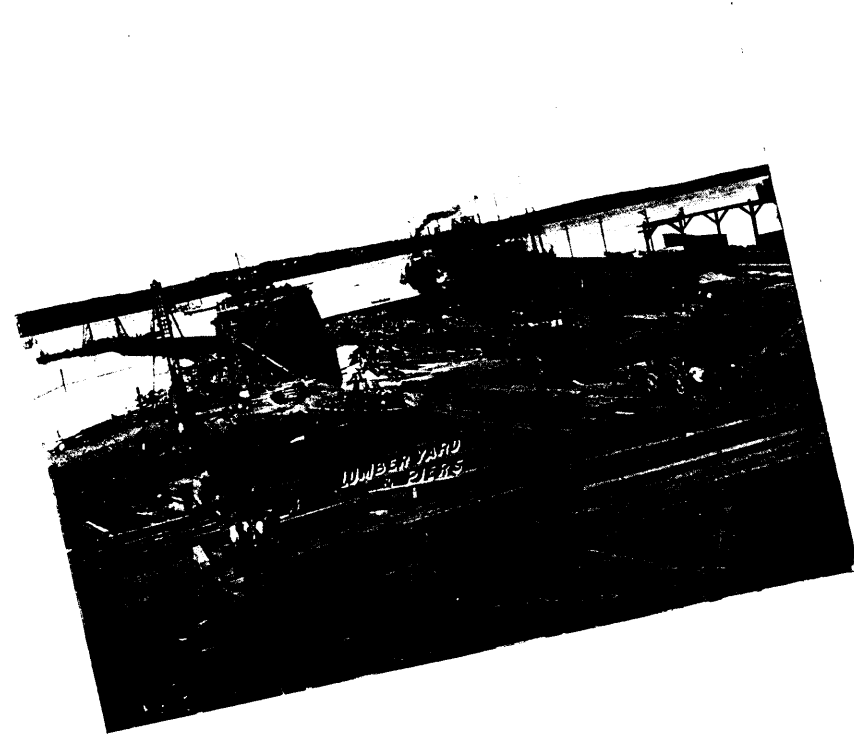


New Works of The Dominion Iron and Steel Company, Limited.

STEEL PLANT IN COURSE OF CONSTRUCTION AT SYDNEY, CAPE BRETON.



Works of The Dominion Iron and Steel Company, Limited, from a photo taken during the visit of the Canadian and American Engineers, August, 1900.



A series of views of the great iron and steel plant in course of construction at Sydney, Cape Breton. (Taken 3rd September, 1900, for THE REVIEW.)



Photo of a party of American and Canadian Mining Engineers taken at Dominion No. IV Colliery, Cape Breton, August, 1900.

which at 5 cts. per 1,000 ft. will be 15 cts. per ton of coal. The quantity of tar obtained will be about 10 gallons per ton of coal, which at 1 ct. per gallon, half the price obtained in Boston, would give 10 cts. per ton of coal. Thus the value of the ammonia, gas and tar obtained from each ton of coal will be not less than 74 cts., while the cost of manufacturing the coke and by-products will only be about 10 cts."

These estimates, if they prove reliable, certainly present very favorable figures. The construction and operation of the Otto-Hoffman coke ovens are pretty well known, and need not be described here. At the time the visit to the plant was made the several batteries of ovens were in various stages of construction, some of them being practically completed and others only just begun. The construction, as far as could be seen, bore every evidence of excellent workmanship and materials. The contract price of the plant is not known, but the preliminary estimates of the company placed it at \$1,250,000, or a little over \$3,100 per oven, which is certainly a low figure.

Steel Plant.—The site of the steel plant is directly on Sydney Harbor and comprises 460 acres of land and some 346 acres of water. In a future issue we hope to give complete details of the plant and its equipment so that here only its more general features will be mentioned. Briefly summarized the plant will comprise blast furnaces and open-hearth furnaces having a capacity of 1,400 tons of steel per day, blooming mills, general machine shop and foundry, unloading piers and wharfs, and all necessary subsidiary buildings. The only part of the plant now completed and in operation is the machine shop and foundry, which is 60 x 480 feet in plan. The blast furnace plant, consisting of four 350-ton furnaces, is next furthest advanced; indeed, the company expresses the hope of putting one of the furnaces in blast early this fall. The other main buildings had not advanced beyond the foundation work in any case. It may be noted in passing that this foundation work has been of a very heavy character and that concrete has been used almost exclusively.

Practically all of the construction materials and machinery have been imported from the United States, almost none of it being obtainable in the Province. Skilled labor has also come from the States, and the ordinary laborers are for the most part inhabitants of Newfoundland. The contractors for the blast furnaces are Riter & Conley, of Pittsburg, Pa., and the blowing engines are to be furnished by the Edw. P. Allis Works, of Milwaukee. The fire-brick and cement used are also imported, but much of the general structural work is being furnished by the Dominion Bridge Company.

In addition to the steel making plant proper, the works when completed will comprise extensive railway yards, water-supply and drainage systems, electric lighting system, boarding and lodging houses for employés, hospitals, offices, storage houses, yards, etc. The water supply will come from Sydney River about five miles from the works, where a dam is being constructed, and will amount to 3,000,000 gallons per day. About eight miles of mains will be included in the distribution system. The general layout of the works is along a comparatively narrow area of ground about two miles long, following the harbor front. At one end are the shipping piers, followed by the blast furnace plant, open-hearth furnaces, blooming mill, machine shop and coke plant. Nearly 20 miles of railway track will be required to connect the various parts of the plant and yards.

The manager of the Dominion Iron and Steel Company, of which Mr. Henry M. Whitney is President, is Mr. A. J. Moxham, Assoc. M. Soc. C. E., who will be remembered as having been President of the Lorain Steel Co., of Lorain, O., previous to its absorption by the Federal Steel Co., and also as having been associated for many years with Mr. Tom L. Johnson in the Johnson Co., with extensive works at Johnstown, Pa., for the manufacture of street railway rails, switches and track supplies.

LUNCHEON AT THE STEEL WORKS.

At noon the visitors, who had spent an interesting morning going over the new plant in course of construction, were entertained to luncheon in the spacious dining hall recently erected for its employees by the Dominion Iron and Steel Company. After luncheon had been served:—

MR. A. J. MOXHAM said:—Gentlemen of the American Institute of Mining Engineers, the Canadian Mining Institute and of the Mining Society of Nova Scotia, if you were not mining engineers I would commence with a few words of apology for the meagre hospitality that we have been permitted to extend to you, but as you all know with all industrial matters and in all new countries the first difficulties in regard to the inner man are always great. We here have had to think a great deal more of sand and cement and stone than we have had of ourselves. But while we cannot do very much in that line, we will try and make it up by extending to you the very heartiest of welcomes, and give you many, many thanks and ask you to forget a few of our little home trials. To you one and all we extend the very heartiest and warmest of welcomes. (Applause.)

DR. JAMES DOUGLAS:—Mr. Moxham, we desire—at least I and the Institute which I represent do—to thank you personally for the greeting you have extended to us and the substantial way in which you have expressed it. If it were merely to thank you for this lunch, we would use one of the stereotyped phrases used to return thanks, but it would be improper to stop short at that. I think that we see here around us and realize more than any of us ever dreamed of, whether we belong to the American Institute of Mining Engineers—who recollect are Americans and not United States—or whether we belong to the Canadian Institute of Mining Engineers or to the Mining Society of Nova Scotia. We have all had dreams in the past, and we believe really and not merely dream, I trust, that we have good substantial grounds for believing in the great possibilities of the mining and metallurgical advancement of the Dominion, and here for the first time we see something I wont say approaching the realization of our dreams, but far exceeding it. Any one who has ever attempted heretofore in Canada to develop these iron industries have been more or less proceeding on false grounds. Of course, we remember that old attempt of the forges at Three Rivers utilized in the old French times, and since that the vaccillating success on bog iron ores. In my recollection two notable attempts have been made to make some use of the iron ores of the Dominion. Both of them began at the wrong end. One was down at the Moisie, which was operated by Mr. Markland Molson; the other was at Londonderry, where instead of following the old lines they began to make steel direct by an untried method simply because it carried the name of Siemens with it. At Londonderry I believe they were wrecked upon Siemens' direct process. But here we find capital from across the line coming into this wilderness and erecting furnaces which from first to last has as its object the manufacture of coke and the saving of its bi-products, or to the end the manufacture of steel upon methods and processes well tried and well tested and of the most advanced and improved description. I think, therefore, as I said, that it would be altogether improper to confine our thanks to the Dominion Iron and Steel Company simply for the good things they have spread before us without extending our thanks to them for the far higher and more magnificent reason that these gentlemen have come here from the ends of the earth, and are erecting works, which will be a model

not only for Canada but for the whole world. I ask you to join with me in returning thanks not only for these immense mining works but to the Dominion Iron and Steel Company. (Applause.)

MR. CHARLES FERGIE:—On behalf of the Canadian Mining Institute, I beg to thank you for the kind manner in which you have received us to-day and for the opportunity you have afforded us of going over these extensive and interesting works. I can only say that I wish you every success and prosperity.

MR. J. F. LEWIS:—I wish to add one word in endorsing what Dr. Douglas said regarding the establishment of such works as this for the benefit of Canada. When we started from Quebec I thought we were going to visit Cape Breton, but since I have arrived here I have made up my mind that we are visiting New America. We see evidences of the great progress that has been made towards building this wonderful establishment of steel making and of all kinds of coke-making, and it seems to me, and I said to myself that this is surely an answer to prayer, because for the ten years that I have been doing business in Canada I have been praying for just such works as these. It is just what Canada needs, and I wish to say to you all that there has nothing been done towards forwarding the growth and extension of Canada that will at all equal these works.

DR. R. W. RAYMOND:—Of course, Mr. Chairman, I can easily appreciate Mr. Lewis' sudden piety when he finds what has been done in a wilderness in erecting the very works the Rand machine shops in Sherbrooke needed. But I have no doubt there is piety at the bottom of it. I do not believe that this great iron industry could be established as a mere pleasure. There must be duty in connection with it, even in the form of a tariff (applause). I can remember when I came up here nearly a dozen years ago. I came up to examine the iron resources, but unfortunately the utilisation of the Newfoundland ore did not occur to me, and I reported that there was a great deal of quiet and a great deal of piety and not much iron ore. I am sure that every one of us feels the progress that is being exhibited here as apart from our own progress. What we see here is a part of our own instruction and a part of our own triumph. I find gentlemen who are executing all the vast plans members of the American Institute of Mining Engineers on the other side of the line—if there is anyone who knows where the line is: I do not—and I have not had anything foreign happen to me except when the porter asked me for the key of my trunk. I have been considerably amused at my friend, Dr. Douglas, who was born in Canada, posing as an American from the United States, and my friend, Mr. James Lewis, who was born in the United States, posing as the most loyal of Canadians, and if you come to that, our own Institute, which belongs everywhere on the Continent, pretending to go around as if it were visiting strange places and be received by itself and thank itself for the entertainment which it gives itself. This is what makes the perfect harmony, as if a man meets a man who is, as Horace says "*animae dimiduum meae*" (the other half of his soul) the two are in such perfect harmony that both his thanks and the entertainment becomes a soliloquy. We are the most magnificent hosts and the most cordial guests of whom history gives any knowledge. (Laughter.)

SHIPPING PIERS OF THE DOMINION COAL CO.

Luncheon over the members were taken over to the new furnace plant and the site of the new docks, the whole presenting a scene of great activity. Thereafter a visit was paid to the great International shipping piers of the Dominion Coal Company.

PIER NO. 1.—900 feet beyond high water mark, stands 27' 0" above high water mark, double track, empties returned to yard by radial table, and return track laid between two outside tracks, which are used for shipping. Coal shipped direct from car to chutes to hold of vessel, and also by Ludlow towers and buckets; capacity 10,000 tons in 24 hours.

PIER NO. 2.—650 feet beyond high water mark, stands 37' 10" above high water mark, double track, shipping carried on by chutes from cars to vessel's hold. Empties run by gravitation to drop-table at end of pier, which works automatically, dropping cars to low level track, which is laid directly below upper tracks, whence the cars run by gravitation to assembly yard, capacity 10,000 tons in 24 hours. Built of South Carolina yellow pine, on creosoted piles, and protected by creosoted cribs at intervals of 100 feet. Built in 1898.

MEETING IN THE ROSSLYN RINK.

About two hundred mining engineers and others interested in mining assembled in the Rosslyn Rink, Sydney, where a meeting had been convened under the auspices of the Canadian Mining Institute. In the absence of Mr. Fowler, President, Mr. Charles Fergie, M.E., Senior Vice-president, was called to the chair. Mr. Fergie called upon His Worship Mayor Crowe to extend a welcome to the visitors on behalf of the Town of Sydney.

MAYOR CROWE:—Mr. Chairman, and gentlemen of the Canadian Mining Institute, as well as of the American Institute of Mining Engineers and the Mining Society of Nova Scotia, I suppose it is fitting that I, as chief magistrate of this town, should bid you a very hearty welcome not only to Sydney, but I hope I may say to the Island of Cape Breton. I have no very extended remarks to make, but I would like to say that the citizens of Sydney and of the Island of Cape Breton are peculiarly interested in having a visit from such a distinguished body of men as compose the American Institute of Mining Engineers. We pride ourselves that we have in Cape Breton a large body of mineral wealth, to some extent developed and being more and more developed rapidly each year. We know your visit this year has been particularly occasioned by a desire to see the work of the Dominion Coal Company and of the Dominion Iron and Steel Company, now under construction. If we have a regret at all it is that your visit should occur this year, when things are somewhat askew owing to the rapid growth of the town, and we cannot entertain you in the way that we would desire, but we trust that what you have seen to-day, and what you will see to-morrow and on Thursday, will induce you to return at some future time. We hope it is not too much to ask a visit in the very near future; we will give you the same welcome as to-day, and we will entertain you in a more becoming manner. I have not much to add except to say that the citizens of Sydney cordially greet you, and we regret that we are not able to put at your disposal the entertainment that you deserve. We have, with the assistance of the Steel Company, arranged for a trip through the Bras d'Or Lakes, and we trust that you will have good weather, and that you will enjoy the charming scenery of a vast inland lake of salt water practically non-tidal, and which is attracting tourists year after year. Let me conclude by again saying that the citizens of Sydney rejoice to see these different societies here, and trust that the time is not far distant when you will return to us. (Applause.)

MR. W. L. LIBBEY:—Mr. Fergie welcomed you on behalf of the Canadian Mining Institute, and I am very glad on behalf of the Mining Society of Nova Scotia to extend you a hearty welcome to our province. You are here to-day, particularly the American members, to see a little of an almost unknown land to you, to a great many of you at least. That was particularly brought to my mind to-day by the re-

mark of one member who was not in my own line of mining, but who said he did not know that Nova Scotia ever turned out any gold. Well, now I think that within a very few years all of you will know that it does turn out gold, and also that it is capable of turning out a vast amount of iron. We are only too glad that you are here to get a practical object lesson in what it can produce. Its possibilities to my mind are not yet known. The buildings being put up here by the Iron and Steel Company are a most practical object lesson, but it is not touched yet. We hope that what you see will cause you to give this province a great big advertisement. I am not a native born Nova Scotian, but the welcome which the Mayor has extended to you must assure you of the hospitality of the people. I can only do my own part as an individual operator and as a member of the local mining society. Gentlemen, you are welcome. (Applause.)

DR. JAMES DOUGLAS—It would be superfluous, gentlemen, to say that we heartily accept the welcome that is given us, and that as far as lies in our power we will do our best to make you an adequate return. We are not in the financial world, and whether, as our kind friend who preceded me intimated, it will take the return of dollars and cents remains to be seen, but that it does take the shape of hearty thanks and that it will take the shape of some little reform is extremely likely. I quite agree with him that what we have seen to-day is simply a forecast of what I believe will be seen in the future. I passed through Sydney some three years ago. I went out to see the developments of the Eastern Development Company, which as yet do not seem to have materialized, and that was the only large metallurgical interest in this neighborhood. To imagine that in that short period should have grown up such a magnificent enterprise as we have seen to-day would seem to be without parallel. At that time Bell Island had only been discovered, but little of the ore had been stripped, and its possibilities were not appreciated. The fact that these gentlemen have within that short period actually exposed what they feel confident is over 100,000,000 tons of iron ore within economical and accessible distance of their works, gives us a faint forecast of what lies before the Dominion of Canada. We hardly appreciate the amount of undeveloped territory upon this continent. I am rather inclined to think that if we took the map of North America and the map of Africa we would find that there is probably more undeveloped territory on the continent of America than there is unexplored territory on the continent of Africa. The statement seems perhaps startling at first sight, but look at Labrador. There are thousands and thousands of square miles on which the foot of white man has never trod. Take the great Northwest, which has just been touched by exploration in the Klondike. Its resources in copper are now for the first time about to be superficially observed by the Geological Survey of Canada. They have sent out this year to the Great Copper river, where all the vague reports indicate that there are vast copper resources. The Hudson's Bay is always open for a certain period of the year—not quite as long as Lake Superior, but to within two months of it—ergo, a short line of railway of two or three hundred miles will bring these copper resources to a point where they could be handled. And then there is Keweenaw Point, which is a well known copper mine jutting out of the south shore of Lake Superior, between the Wisconsin line and the eastern half of the lake. I merely mention this as one of the remaining possibilities that lie in the great Northwest and the great North American continent. Rocks of nearly every age exist there. In our immediate neighborhood we know that its crystallized rocks are all ore bearing, and the result of the mere superficial and extremely insignificant exploration that has heretofore been made, make it almost certain that the resources of this great northern section of the continent will produce the more useful if not the more precious treasures that are being extracted from the chief central and southern zones. Canada has, therefore, a great future before it. It lies in the province of every miner and every metallurgist to develop these resources of America, as we are all Americans, but it rests more especially of course upon the miners and metallurgists to do so. Heretofore they have not shown that intense energy which the stimulus of success I believe will give them in the future. To-day one reason given for that was that so many of us drift away from the Dominion to the neighboring States. Why do they drift away? I am afraid it is because the inducements at home were not strong enough to keep us here. But I think all that is changing and rapidly changing, and that in the future the young men of Canada will remain at home to develop Canada's resources, and there is an augury for the future from the fact that the education which is being given by the mining schools, at McGill University, Montreal, at Queen's College, Kingston, and elsewhere, is going to admirably fit them for their life's work. Therefore, I, as a Canadian, sincerely thank you for the hearty welcome which you have given the American Institute of Mining Engineers, and wish your two societies God speed in the work that you have in hand, and hope that the most unbounded prosperity will be the lot of Canada and your own. (Applause.)

DR. R. W. RAYMOND: Since I entered the Dominion upon this visit, Mr. President and gentlemen, I must confess that the thought that has been impressed upon my mind was somewhat different from the anxieties which seem to appertain to the mind of my Canadian friend, Dr. Douglas. I am a little worried as to how we are going to keep the American Engineers in the United States. I did not know that the doctor was hankering for the copper of the Northwest, and I am a little afraid that 99 John street may know him no more, and that I will no longer be able to find me near my brother. (Laughter.) I know that we have lost a good many smart men whom we could not afford to spare, such as a Libbey and a Lewis. But after all I do not see that it makes any difference. I could not see any foreign aspect. Wherever we go on this continent we are face to face with foreign forms, and even there I managed to find myself very much at home and to see in the face of all the people I meet an American type which seemed stronger than any type of local blood. I must confess that the very sudden development of this part of Nova Scotia had taken me very much by surprise. I evidently was not a prophet or the son of a prophet when I came here a dozen years ago. I was not wise enough to take stock in the Dominion Coal Company, and I even pitied my friend, Mr. McLennan, who seemed to be entangled in a coal undertaking up here. I do not pity him any longer, but rather feel envy. (Applause.) However, I feel that looking back upon the past we may fairly say that all our great developments anywhere in this western world have been similarly sudden. I do not know whether we are mining engineers enough to know where the next boom is going to be and to get in in time. I know an instance of where a man could have bought a property for \$10,000, but he cannot get it for \$50,000,000 now. Therefore, when we undertake to make a rule of prophecy out of it we are not able to look at one and the same time into the earth and into the future. If we forget the earth we study the future, and if we forget the future we study the earth. After all I think our functions will continue to be that as in all the centuries to let accident and the wisdom of others, rather than ourselves, direct the course of Empire and of progress, and we will come in to make that progress stable and permanent. Our vocation is not to look into barren land and recommend it for investment, or to make prognostications about what it will yield before it has ever been opened. (Hear, hear.) Every mining engineer knows how disagreeable that part of his business is; and the men who go out into the wilds and build stamp mills and

travel over the horrible roads of a new country, the men who look out in advance and execute step by step such vast enterprises as you see here to-day, are not worrying themselves in writing prospective criticism; we leave it to the newspapers to insult us, or admire us, or to call us down if they choose, but we simply bother ourselves in trying to do the thing and when the thing is done it speaks for itself. (Applause.) As long as we continue to be the men who do the things we shall continue to be a lot of good fellows, because the man who does the thing leaves him hours of recreation with his fellows, is most interesting in conversation, most hearty in his welcome, most retentive in his memory of welcome. For instance, I have been connected with the American Institute since 1871; it then had thirteen members, but it now has three thousand. If you come to any meeting of that Society and think that by sitting down in a hall and hearing some papers read you have struck the heart of that society you make a huge mistake. It is on the train, in the wagon, at the hotel over the evening pipe—I am afraid sometimes it is over the evening hot Scotch—(Hear, hear) that you, will find the real work of that Institute going on. We learn more in our interchange of reciprocal feelings, we teach more in our talks, in our clasping of hands, in our social intercourse, than we do in the printed page. (Applause.) In other words, the American Institute might just as well turn itself into a big publishing house and start a newspaper. The Institute of which I am the secretary will get out its transactions and see that you get big value for your money, and the material for the next big volume is already at hand. It is not a question of piling up statistics as a permanent record, but it is a question of welding these people who do things into a social, harmonious and organized institution. Our institution was the first on this continent to do that on a large scale, and these societies of ours have welded together a great profession and made it a great factor for happiness and prosperity and knowledge among men. That is why I like to hold meetings anywhere. (Applause.)

MR. FERGIE—More especially referring to the mining societies, I would like to take this opportunity while here in Sydney of reminding all those engineers, both in iron and coal, who are not now connected with any society the great advantage of joining. We have in Canada two prosperous societies—the Canadian Mining Institute and the Mining Society of Nova Scotia—and I would give all a very welcome request to send in their application for membership which will be duly considered.

MR. B. T. A. BELL—Mr. Chairman and gentlemen, as one who has to some extent been responsible for the inception and carrying out of this gathering, and as one who has also been primarily responsible for a number of meetings of the American Institute in Canada—going as far back as 1889 and 1891—I have great pleasure in expressing to-night on behalf of the Canadian Mining Institute our appreciation of the efforts, the successful efforts, that have been put forth for the reception and entertainment of our guests not only here in Cape Breton, but by also those mining companies which are represented here from other parts of the Province. I am a profound believer in the great and abundant wealth of our Dominion in natural resources, not only in coal and iron, but in gold and silver and nickel and copper, and all these minerals and metals which make for the greatness of a people, and in promoting this visit to Canada of the American Institute I was inspired by the hope that we had much to gain by asking you to come and see our country again, to become better acquainted with our mining men and to see what progress we are making in the development of these resources. Visits of practical men to our country are the best method of advertising its resources. We trust the next time you visit this portion of Canada the progress you will see will just be as great as it has been since the last time you visited us here, in Nova Scotia, in 1886; and I may say that this great expansion in mineral and industrial development is not alone confined to this good old Province of Nova Scotia. In British Columbia, in the far off Yukon and North-West Territories, in Ontario, with its nickel, its iron, its copper and its gold, yes, even, in the old Province of Quebec, we have much still to show you of our progress in mining enterprise. A year or two ago the net value at the pit's mouth of our mineral output reached something like \$22,000,000, to-day it is over \$50,000,000, and this rate of progress, I make free to say, will be maintained for many years to come. While comparatively speaking, a youngster in years, our Canadian Mining Institute has done not a little towards promoting better mining legislation in Canada, and in bringing together the best elements of the mining profession in the various Provinces of the Dominion. Its meetings are well attended and it publishes annually a volume of proceedings, which will compare, I think, most favorably with any similar organization of its years and membership. I should be pleased to have applications for membership from any mining engineer who is not yet enrolled in our members. In conclusion I would move, Mr. Chairman, that this meeting of the members of the Canadian Mining Institute places on record our grateful appreciation of the hospitalities and courtesies which have been extended to ourselves and to our guests the American Institute of Mining Engineers on the present occasion. (Applause.)

DR. RAYMOND—I would like to second that motion on behalf of the American Institute of Mining Engineers which has certainly taken a large share of the entertainment and ought also to feel as it does a large share of the gratitude, and if gratitude be, as we have been told, a lively sense of favors yet to come then we ought to be doubly grateful in view of the week before us. (Applause.)

The motion was carried unanimously.

NEW MEMBERS.

The following having been recommended by the Council were elected members of the Canadian Mining Institute:—

- DR. E. GILPIN, jr., Mining Engineer,
Deputy Commissioner and Inspector of Mines, Halifax, N.S.
- PROF. CARR HARRIS, Civil Engineer,
Queen's University, Kingston, Ont.
- MR. WM. KOEHLER, Chemist and Metallurgist,
Dominion Copper and Nickel Co., Hamilton, Ont.
- MR. WILLIAM L. GRAMMER, Mining Engineer,
Dominion Iron and Steel Co., Bell Island, Newfoundland.
- MR. C. H. TOMPKINS, Mechanical Engineer,
American Diamond Rock Boring Co., New York.
- MR. E. P. JENNINGS, Mining Engineer,
Salt Lake City, Utah.
- MR. W. S. EDWARDS, Mining Engineer,
29 Broadway, New York.
- MR. A. E. NOBLE,
Anniston, Alabama.

MR. B. T. A. BELL—I would move that this meeting as a meeting of the Canadian Mining Institute do now adjourn, and as I understand the American Institute has some business to transact, perhaps the occasion would be appropriate for their meeting.

AMERICAN INSTITUTE MEETING.

Mr. BELL'S motion having been adopted, Dr. James Douglas, President of the American Institute, took the Chair.

Dr. RAYMOND—I have a list of some 30 papers to be presented at this meeting, but as I understand we are to have another meeting at Halifax, perhaps they had better be deferred until then.

Dr. DOUGLAS—I would like if some local members would give us some remarks on the resources of the locality.

EARLY COAL MINING IN CAPE BRETON.

Mr. JOHN S. McLENNAN—Mr. Chairman, what I know, from an experience of close on 20 years, which with the exception of one or two is more than any one here, is about the coal trade. Some 15 years ago the American Mining Institute came here on an excursion from the Halifax meeting. That was, I believe, the first meeting of the American Institute held in Canada. There were no railroads on Cape Breton connecting with the mainland at that time. There were two railways of ten miles connecting Sydney with the mines. There were five or six different companies operating collieries here, shipping from six to seven months from Sydney harbor. The output was so limited that we looked with anxious eyes at any schooner coming into the harbor to see whether she would come to us or to the rival colliery. (Laughter.) The output was some five, six or seven hundred thousand tons, and that was a rift in the clouds. The General Mining Association, which is represented here by Mr. Brown to-night, has an ancient history beginning early in the century, and there were one or two others which never had the unfortunate episode of a sale by the sheriff, but the other properties had to change hands several times, mostly by forced sale. There was, however, considerable development during the Reciprocity Treaty and times were prosperous, but this was followed by periods of depression during which for a time only one colliery, that of the General Mining Association, was running, and that was exclusively worked for local consumption. This was followed by a gradual development of interprovincial trade about 1879, when we began to send coal into the St. Lawrence. In the early nineties the mines now owned by the Dominion Coal Company had only reached an output of some 800,000 or 900,000 tons. There was not much to do in the winter, and we used to meet at each other's houses and talk over what we would do when the mythical American syndicate came along with many millions of dollars in their pockets. I remember one man who, least he should hand over too great a property to one of these mythical American syndicates to which his mine was under option, refrained for a year from putting a bathroom in his house. (Laughter.) However, there may be a moral connected with that, as he has now retired to ease and affluence, while others who put in bathrooms are still laboring in the coal trade. However, in 1893 Mr. Whitney became interested in the coal industry of Cape Breton, and the chief point of his interest was a thing which has marked all his enterprises, his faith in sound general principles. (Applause.) He felt that coal of a fair quality and suitable for the ordinary purposes for which coal is used, within easy reach of the seaboard all the year round, was bound to become valuable, and all the development which you see illustrates the point at which our president has made a success. (Applause.) This is an example of what Dr. Douglas has referred to. The capital invested in the Dominion Coal Company was largely American, but owing to its success under the able management of Mr. Whitney—the output in 1883-84 was 800,000 tons, and this year it will be 2,250,000 to 2,500,000 tons—when it came to forming the Dominion Iron and Steel Company, owing to the success of his previous enterprise, the great bulk of the capital which has gone into it is Canadian, and this capital was raised in Canada with the utmost ease. (Applause.) While we had the utmost confidence in the physical conditions we felt doubly assured with the benefit of Mr. Whitney's sagacity and ability. He is one of the comparatively few Americans interested. A few years before we had all been seeing the advantages of consolidation but had never been able to accomplish to. (Applause.)

THE CHAIRMAN called upon Mr. R. H. Brown, but that gentleman thought it was hardly fair to call upon him without warning. "All I can say," he continued, "is that the General Mining Association was formed about 1826. When my father came out to this country he took a lease of mines for the General Mining Association in England, and it exists there up to the present time. Mr. McLennan speaks of other companies as having fallen into the sheriff's hands. The General Mining Association has never done that. It is flourishing up to the present moment, except that just now they have sold the property out to another company which will manage it in their place. I have been managing it for the last 36 years." (Applause.)

THE CHAIRMAN—They have large interests both on the mainland and on the Island?

Mr. BROWN—They had all the lands in the Province. One of the English Kings gave it to the Duke of York, his brother. The General Mining Association was formed, and in 1857 they made an arrangement with the Province by which they handed over all but what they retained. First of all, they sold out the old Albion mines, subsequently the Springhill Company and the Victoria mine. They retained the Sydney mine.

THE CHAIRMAN—Long ago when I took my first examinations in surgery and anaesthetics it was a debatable question as to whether the operation should be performed immediately after the accident or wait until the effect of the shock had passed. I have often felt that that was still an open question, whether to call upon a gentleman suddenly to make remarks or to let him have the prolonged agony of thinking as to what he ought to say; therefore, out of fear we have not advised Mr. Poole that we are going to ask him to make any remarks.

Mr. HENRY S. POOLE—My recollections in connection with the coal trade make me feel disposed to look backward rather than forward. To illustrate the smallness of the trade, I may mention one man who went down one day and cut the coal; the next day he was endeavoring to draw it to the surface; the third day he was to ship it and put it on board. (Applause.) My experience was not quite as extensive as Mr. Brown, who, was the previous speaker, but still in my time I have played many parts. I was for a short period manager of the mine, and at the same time acted as consular agent, then as shipper, and then as health officer, requiring me to make out some 17 papers for the clearance of each vessel. There is one feature of this neighborhood that is of interest, and that is in connection with the vast area that once existed is now only in part available to the coal miner. When you take the map which has been shown on the programme and presented to each member, you will notice that all the seams of coal dip seaward. It has always been a matter of discussion as to how far they do now extend from the shore and how far they may be mined. There has been an erosion of something like three feet a year from the cliffs to the coal fields. That might be a basis of calculation as to how long this denudation has been going on. We know that there are seams of coal dipping seaward that many miles, many miles distant. Some speculators, anticipating the success of the mechanical engineer, have taken areas lying several miles seaward from shore, in anticipation of ultimately mining the coal contained in them.

THE CHAIRMAN—Is there any distinction between the Cape Breton and the Newfoundland coal?

Mr. POOLE—I understand it is supposed to be lower carboniferous, not quite the same as the Sydney coal.

Mr. BROWN—There seems to be no relation at all between the two coals of Newfoundland and Cape Breton.

THE CHAIRMAN—I know we have all been interested in what we have seen to-day. My particular interest is in copper metallurgy. We see that all the works from the crude article to the finished steel are going to be performed in the small compass of these works of to-day. Most steel works make their coke at a distance and import it to their works, and therefore the works which we have seen to-day seem to be unique. Perhaps Mr. Hinchman would give us some comparative remarks on what he has seen to-day.

AMERICAN OPINION ON THE STEEL PLANT.

Mr. C. HINCHMAN, of Philadelphia.—So far as the works we have seen to-day are concerned, they certainly seem to be laid out on the most modern and perfect plans that any engineer could devise, and will produce good results. So far as the works in the United States are concerned, their's has been a varied history. Some of them have been failures by reason of their being located too far from their raw materials or market. So far as mining in the State of Pennsylvania is concerned, we have had the largest development of the steel industry of any single State in the United States, although our Pennsylvania ores are generally better suited for foundry and mill iron than for Bessemer, and we have to draw our supplies from the Great Lakes. Most of the companies west of the Alleghenies draw their ore from the Lake Superior mines. The companies to the east of the Alleghenies draw their stuff largely from foreign sources, from Cuba, from the Mediterranean and from Spain, all of which furnish good Bessemer ore supplies. We who know what coal we have in Pennsylvania think there is hardly any coal to equal the coking coals of Western Pennsylvania for making Bessemer pig. Our coal makes such a quality of coke that it is carried as far west as Chicago and the Mississippi valley for steel making, and will stand considerable transportation. Those of us who are interested in Bessemer works feel that we can live in Pennsylvania after some other parts of the country will have to shut down. I know that the development of Bessemer ore on the Great Lakes is already great enough to supply all our works in the United States, and we are already exporting rails and bridges to China and into Egypt and Australia. Our present Minister to Russia built the first railroad between Duluth and the iron or Vermillion range, 75 miles back of Duluth, and is entitled to a great part of the credit for the development which followed on both the Vermillion and Mesaba iron ranges. I am glad to say that his reward came during his lifetime, as he doubled his fortune after he was 70 years of age. I hope Mr. Whitney and his associates may do the same. (Applause.) I have always believed that iron would be found here sufficient to supply all the wants of the eastern part of Canada and to export largely. We found some ore in the Bay of Fundy that analyzed very well, but the trouble was that we could not find enough of it. I never thought of going to Newfoundland, so then we began to look into New Jersey and Virginia for Bessemer ores, and we got very good ore there, but it was a small deposit and finally worked out. We then, in connection with the Bethlehem Iron Company, turned our attention to the development of Cuban ores, being too far east for Lake Superior ores. We developed the Iron Company and built a road from Santiago de Cuba thirty miles, and that has been for some years the source of the larger supply of the Pennsylvania and Bethlehem Steel Companies. I think that before long we will be exporting pig to England. I do not see why with the shorter distance of transport Nova Scotia should not develop a trade with England and Germany as well as her own. (Applause.) So far as the pig going into the United States is concerned, we should have to have reciprocity between Canada and the United States before that could be brought about, our high duty preventing the importation of any but special brands in small lots. Twenty years ago the well known iron master, Abraham S. Hewitt, favored reducing the duty upon pig from \$7.00 to \$3.50 per ton, but we were not ready for it at that time. Had that been adopted I believe we would have had a more stable business and fewer booms and depression than have occurred in the iron business due to undue stimulation and attraction of furnaces where they could not be profitable without a duty. (Hear, hear.) When our late lamented Alexander L. Holley was superintendent of the Pennsylvania Steel Works, we had a call from the general manager of the Cammell Company, the foremost steel makers of Sheffield, England, shortly after Mr. Holley had introduced the three shifts in the 24 hours, thereby increasing the product 50 per cent. over anything that had heretofore been done abroad. So far we have managed to export our surplus, and I think that both China and Japan are going to open up a very large market to the steel works of the world. It was my duty at that time to go with Mr. John Fritz and others to Russia and consider the plans for building steel works to supply the rails for the Pacific Trans-Caucasian system, a road since completed by the Russian Government to the Pacific. We found deposits of Bessemer ore, some of which have since been developed, at Krivoi Rog. The engineers reported that the coal examined was more broken up than we had expected to find it, all the veins in Southern Russia pitching at steeper angles than we were accustomed to in Pennsylvania, but the conclusion our gentlemen came was that with the application of the same amount of brains, money and energy would pay as well in our own country. The opening up of China, which we are now entering upon, is going to afford a great market for the surplus products of all the leading nations. In the next ten years I should not be surprised to see 10,000 miles of railway built in China. They need it. There are 400,000,000 of people there, and they will readily consent after they have seen the necessity and the advantages of it. (Applause.)

Dr. R. W. RAYMOND—Remembered when in 1873, as first president of this American Institute of Mining Engineers, he attended a meeting at Liege, in Belgium, he told them that if they came to America he would show them Bessemer converters making 25 tons a day where before they made 15. This iron master to whom Mr. Hinchman referred was afterwards going over the works of Edgar Thompson, jr., when he was told that he would not find an ingot in the works that was cool enough to sit on. That was the history of the Bessemer works in those times, and I think that Alex. Holley took the English industry by the scruff of the trousers, and when they were making 15 tons a day we were making 25; when they went up to 25 we were making 50 tons a day, and when they made 50 tons we went up to 100, and they sent a man to Bethlehem to remodel his works, and who made 100 when we were making 250. We forced the tail of the procession to march. (Applause.)

Mr. HINCHMAN—As an illustration of the growth of the industry, I may say that it was originally more trouble to furnish a railroad with ten tons of rails than it is now 100,000 tons. Mr. J. Edgar Thompson, the far-sighted president of the Pennsylvania road, has probably done more to establish the steel industry of this country than any other single railroad man, and most of them have followed in his footsteps, but the man who is chiefly entitled to credit for mechanical development was Mr. Alex. L. Holley, who brought the Bessemer patents to this country.

THE CHAIRMAN—I suppose we have been rather slow in discarding the beehive oven and adopting the coke oven, which saves the bi-products, and possibly the only place where coal is coked and made in pig iron and in basic steel is in Alabama. I would like to ask Mr. Fraser as to the probable source from which they expect to draw their ore and the probable amount in sight to run these works upon — to give us some statistics as to their source of supply and probable production.

MR. GRAHAM FRASER—Dr. Raymond said that these great works had sprung up suddenly. No doubt they have developed very suddenly at the end, but still some of us who were living in Nova Scotia thought that if we could only get clear of the sulphur in the coal here in Cape Breton we had one of the best places in America for making iron. If you take the map you will see that Sydney is very nearly the centre, is more than half way across the Atlantic from New Orleans and ports in the Gulf. The coal after being coked pretty cheap was found free enough from sulphur for making iron. Then came the question of limestone. Well, the country is full of it. Having the coal in abundance and the limestone, then came the question of ore. Well, the Bell Island mine with the development of which I had something to do is very good; that is, the ore can be mined very cheap and is all right for basic steel and foundry pig iron. Another point is this that this place being a very central point to make basic pig iron, it is possible to use Lake Superior ores right here. Since the canals have been deepened to 14 feet, coal can be sent up to the head of the lakes and ore sent down at a very low rate, under a dollar a ton. I doubt very much if Mr. Carnegie can get his ore to his furnaces as cheap as Mr. Whitney can get his ore here. Now there is this advantage for export, that while the lakes are frozen six months in the year, the harbor of Sydney is only frozen about four months, and Louisburg is open nearly all the year, and the Strait of Canso, only 70 miles away, is one of the best harbors in the world. The ore has got to be taken down from the head of the lakes to Cleveland or any of the lake ports in a short season, while here we have a long season. I think, therefore, that we stand in a very good position. Certainly the deposit in Newfoundland is a very cheap ore, but even going beyond that, the business would stand the Lake Superior ore altogether, and there have been some very large deposits developed lately on the Canadian side of Lake Superior. (Applause.)

THE CHAIRMAN—What you say is certainly extremely interesting. I could not help pointing out to the Congress in Paris to our European friends that if they would change their methods of transportation they would be in as good a position as the Americans. Take Northern Sweden, some 250 miles away, where there is 60 to 70 per cent of ore, and then there is a seaboard of 150 miles open all winter. They could do it just as well as Lake Superior if they would change their methods of transportation. I think down here you are certainly using the means at your disposal to very great advantage.

MR. FRASER—The ore in Conception Bay is very similar to the ore in Alabama, perhaps higher in iron and in phosphorus. The iron of that ore in Alabama will be something like \$1.00 a ton. I think we can make it cheaper here. With regard to the Lake Superior ores being the same as ore used in Pennsylvania, I think the iron could be made as cheap and probably cheaper here.

The meeting shortly afterwards adjourned.

WEDNESDAY—THE COLLIERIES OF THE DOMINION COAL CO., LTD.

Probably one of the most enjoyable visits of inspection made by the party during the entire excursion was this day spent in a visit by special train over the Sydney and Louisburg Railway to the extensive collieries of the Dominion Coal Company and to the historic old town of Louisburg. The company owns 160 square miles of coal leases, and the aggregate thickness of workable coal is 30 feet in known seams, together with water leases, making 3,000,000,000 tons of workable coal. Mr. John S. McLennan, treasurer; Mr. Hiram Donkin, resident manager, Mr. Thomas J. Brown, assistant to manager, and other officials who accompanied the party, left nothing undone to make the inspection both pleasant and profitable.

The following notes on the collieries visited will be of interest:—

DOMINION No. 1 COLLIERY.

Seam Phalen, 8 ft. thick, dip 1 in 14. *Mined*, pillar and room, with Puncher type mining machine, driven by compressed air. *Haulage*, endless rope 1 in. dia., engines (2) 18 x 36 in., speed 3 miles per hour. *Shaft*, 157 feet deep, 24 feet long, 10½ feet wide, 4 compartments. *Hoisting*, coal engine, 2-20 x 54 in., rope 1¼ in. dia. *Ventilation*, 2 fans, Murphy's, 12 ft. dia. and 8 ft. dia., engine, 11 x 16 in. *Compressors*, 3, Ingersoll's Coreless engine, compound m. steam 22 in. air, 22 and 36 in. steam by 42 in. stroke. *Bankhead and screens*, bankheads of steel fitted with screens of the shaking and knocking type and picking table. *Motive power*, 5 Babcock & Wilcox boilers of 212 h.p. units and 2 of 318 h.p. units, making 1,700 horse power in all.—Boilers operated by mechanical draft. Monthly output, 60,000 tons (2,240 lbs.).

RESERVE COLLIERY.

Seam Phalen, 8 ft. thick, dip 1 in 12. *Mined*, room and pillar, partly by punching machines and partly by hand. *Haulage*, endless 1 in. rope, engines 22 x 42 in. *Slope*, French slope, 5,000 feet long; main slope, 5,600 feet long; south slope, 1,600 feet long. *Ventilation*, Chandler fan, 15 feet dia., engine 16 x 18 in. *Bankhead and screen*, wooden, with shaking and knocking screen and picking belts. *Motive power*, 2 Babcock & Wilcox boilers of 318 h.p., 2 B. & W. boilers of 212 h.p., and 2 ordinary tubular boilers. Output monthly, 65,000 tons (2,240 lbs.).

INTERNATIONAL COLLIERY.

Seam "Harbor," 6 feet thick, dip 1 in 12. *Mined* by hand picks, room and pillar. *Haulage*, endless rope, 1 in. dia., engine 1—18 x 36. *Shaft*, 90 feet deep, 14 feet long, 6 feet wide, 3 compartments. *Hoisting*, rope 1¼ in. dia., engine, 2—17 x 42 in. *Ventilation*, fan, Murphy, 8 feet dia., engine, 1—9 x 12 in. *Bankheads and screens*, wooden bankhead with transfer truck for mine cars and ordinary gradient screens. *Motive power*, 1—212 and 1—318 h.p., B. & W. boilers, 1 Lancashire 7 feet dia. x 30 feet. Monthly output, 25,000 (2,240 lbs.).

DOMINION NO. 2 COLLIERY.

NOW SINKING.

This shaft is in the course of sinking. Coal shaft 37 x 11—400 feet to the Harbor seam, and from that 21 x 11, 500 feet to the Phalen seam. Air, pumping and man shaft 34 x 11 feet, 900 feet to the Phalen seam. This coal shaft is to be divided into compartments, 2 compartments for each seam, and is to have an output of 6,000 tons (2,240 lbs.) per day. The mine tub is to carry 3 tons, and to be weighed and tipped in the pit bottom, the coal being raised in self-dumping coal tanks with a capacity of 6 tons each. The coal will be hauled to pit bottom by electric motors.

Bankheads of steel 125 feet high. All machinery to be of the most modern type. 4 boilers (being built) Babcock & Wilcox, 318 h.p. unit each. 2 hoisting engines (being built by Dickson, Scranton) 34 x 48 in. 1 fan and 2 single engines (being built by Dickson, Scranton) 24 feet fan and 20 x 42 in. engines. 2 compressors (being built by Walker in Wigan) duplex compound high pressure steam 31 in.; air 32 in.; low pressure steam 57 in., air 51 in. and 60 feet stroke.

CALEDONIA COLLIERY.

Seam Phalen, 8 feet, thick, dip 1 in 14. *Mined*, room and pillar, partly by hand and partly by puncher type of coal cutting machines. *Haulage*, 1 in. wire rope, endless system, engine 1—23 x 42, about 12 miles of wire rope on engine. *Shafts*, 182 feet deep, 17 feet long and 11 feet wide, 3 compartments. *Hoisting Coal*, rope 1¼ dia., engine 2—20 x 48 in., cages self-dumping. Rope 1¼ in. dia., engine 2—18 x 24 in. *Compressors*, Rand compound in steam and air, L. P. steam and air 48 in., h.p. steam and air 22 in. stroke 60 in., one small Ingersoll 20 x 20 x 30. *Ventilation*, 1 fan, Murphy, 12 feet dia., 1 fan, Dickson, 15 feet dia. *Bankhead and screens*, steel bankhead, shaking and knocking screen, picking tables. *Motive power*, 5 Babcock & Wilcox boilers of 212 h.p. units or 1,060 horse power. Monthly output, 58,000 tons (2,240 lbs.).

DOMINION NO. 4 COLLIERY.

IN COURSE OF SINKING.

Seam, Emery, 5 feet thick, dip 1 in 10. *Mined*, room and pillar, puncher coal cutting machine. *Haulage*, endless rope 1 in. dia., engines (1) 24 x 54 in. *Slope*, 1 in 12. *Motive power*, 2 B. & W. boilers, 624 h.p. mechanical draft. *Ventilation*, Champion fan, 8 feet dia. *Compressors*, 2 small Rands, 18 x 20 x 30. *Bankhead and Screening*, of wood, knocking screens, air tripplés and picking belts, driven with rope, driven by engine, 18 x 36.

DOMINION NO. 3 COLLIERY.

IN COURSE OF SINKING.

Seam Phalen, 8 feet thick, dip 1 in 14. *Mined*, room and pillar by puncher type of coal cutting machine, driven by compressed air. *Haulage*, 1 in. rope, engine 24 x 54, coal hauled by endless rope overground to Dominion No. 4 bankhead, a distance of 1 mile. *Slope*, 1 in 2. *Ventilation*, Murphy fan, 6 feet dia. *Compressor*, small Rand, 18 x 20 x 30; duplex compound compressors being built in Wigan, England, for this colliery. L. P. steam 57 in., air 51 in., h.p. steam 31 in., h.p. air 32 x 60 in. stroke.

COAL WASHING PLANT.

Coal Washing Plant consists of 2 Robinson Ramsay coal washers, with a combined capacity of 2,000 tons of washed coal per day, one built in 1897 and the other in 1900. The slack coal is brought from the mines in cars and dumped into bins under the track, having a storage capacity of 1,200 tons, and from which it is drawn by two cable conveyors to the centre of the bins. From here it is elevated to the top of the wash house, and divided between the two washers. An average of 41 per cent. of the contained ash and 28 per cent. of the sulphur is removed by this process. Coming from the washers the coal is carried over screens and the water drained into the sludge tanks, from where it is pumped by four pulsometers of 1,000 gals. per min. capacity each, back into the washer, and is used over and over again. After passing over the screens the coal falls into another elevator which takes it to the washed coal storage bin, holding 1,800 tons, and from here it is trapped back to the cars. Power is furnished by 4 return tubular boilers, 5 x 14 feet; water is piped from a lake, 3,000 feet from the plant.

LUNCHEON AT DOMINION NO. IV. COLLIERY.

After a very thorough inspection of the surface plants and a visit underground at Caledonia, the company was entertained to luncheon in the large dining room at Dominion No. IV. The tables were handsomely decorated, and the miniature Union Jacks, Stars and Stripes and Canadian flags greatly enhanced the pleasing effect. Mr. John S. McLennan, treasurer of the company, presided, and seated around him at the table of honor were Dr. Douglas, president of the American Institute; Mr. W. L. Libbey, president of the Mining Society of Nova Scotia; Mr. Charles Fergie, vice-president, and Mr. B. T. A. Bell, secretary, of the Canadian Mining Institute; Dr. Gilpin, inspector of mines; Mr. J. F. Lewis, and Mr. Hiram Donkin, resident manager of the company.

After the luncheon, at the request of Mr. McLennan, the resident manager, Mr. Donkin, delivered the following address of welcome;—

ADDRESS OF WELCOME.

To the Visiting Members of the American Institute of Mining Engineers, the Canadian Mining Institute, and the Mining Society of Nova Scotia:—

LADIES AND GENTLEMEN,—On behalf of the Dominion Coal Company, Limited, we its local officers extend to you a very cordial welcome. Such an opportunity as this seldom presents itself to an organization such as the Dominion Coal Company, and we find it hard to express in modest language our high appreciation of the visit of this body of representative and distinguished men, embracing as it does leading scientific mining men of both the United States and Canada. By to day's visit you will have seen for yourselves to what extent and with what success the Dominion Coal Company is mining coal in this locality, but to fully realize the situation and understand the progress being made it is only necessary to refer to the fact that this company was but inaugurated in 1893, the output of coal for that year being eight hundred thousand tons, and that in the last year of its operations the output had risen to one and three quarter million tons, and for the present year it will reach a total aggregate of two and one quarter millions, and when the new shaft known as Dominion No. 2 which you have just visited, and the new slopes near which we are now standing, shall have been developed, together with the improvements in progress at the older collieries, the output for the incoming year is expected to reach three and a half million tons. We are here situated on the Atlantic seaboard with harbors capacious and accessible within the limit of our operations, and you are now standing in the centre of a coal basin which is known to contain workable coal to the extent of three thousand million tons, the company's leases covering one hundred and sixty square miles. In the early history of this company its most serious problem was to furnish a market for its product, and consequently employment for its workmen all the year round. This great problem has been happily solved by the genius of its president, Mr. Whitney, who has changed the old condition of things of eight months labor and four months idleness to continuous work throughout the year;

and from having its product seek a market to having the market seek for its product. In conclusion we shall feel pleased if we have contributed even in a small way to the pleasure of your visit and take this opportunity of extending to one and all a cordial invitation to repeat your visit at no distant date. I am, Ladies and gentlemen, in behalf of the Dominion Coal Company (Limited), and its local officers, yours cordially.
HIRAM DONKIN.

MR. JOHN S. McLENNAN—On behalf of the President and Directors I wish to extend the same welcome, and to say what pleasure it gives to have you here, and to express Mr. Whitney's regret that he was unable to be with us. (Applause.)

DR. DOUGLAS—Mr. Chairman, ladies and gentlemen, I am perfectly sure that your welcome is just as warm as the high class of coal that you mine to generate heat. In thanking you as our hosts we have likewise to thank you as coal miners, for, after all, coal is the great unifier, and the coal miner is a far more potent politician than all the orators of all the representative bodies of the world put together. If you look across the line and consider what the United States was within our memory, you will recollect that we were too divided into sections. There was a manufacturing section in the east which made a tariff, and there was a cotton-bearing section in the west which reversed the tariff. Then we had a west which was supposed to be exclusively a food-raising section. Look at them to-day. There is no manufacturing section, there is no specifically cotton-raising section, there is no purely food-raising section. All that distinction between the manufacturing States and the food and cotton producing States has disappeared, and how? Simply through the agency of coal. Coal has brought about what all the politicians could never have effected, that is, a homogeneous unification of the country. Another grand influence of the coal industry has been the linking of one section to another by our wonderful railroad system, which would simply have been impossible without the agency of coal and that coal distributed far and wide throughout the land, and I think we can predict without being either prophets or sons of prophets that that very same influence which has brought about this result on the other side of the land will tend to unify the whole continent. For if you look at the situation as it is to-day, we have these magnificent coal resources here in the Lower Provinces. New England is bereft of that advantage. On one side of the lakes we have magnificent coal fields, on the other side of the lakes we have none. Naturally, therefore, the coal from the Lower Provinces should not cut off from Ontario the coal supply that nature intended her to use. It is not likely, therefore, that the perversity of man will long stand against nature, and I think, therefore, that those of us who are not soon to drop into the grave will see this unification brought about by that same potent force that is unifying the whole land to the south of us. Therefore, I think that I can congratulate you gentlemen not only on the noble work you are doing here as coal miners, but on the vastly greater work you are doing as true patriots and politicians. (Applause.)

MR. CHARLES FERGIE—Mr. Chairman, ladies and gentlemen, after the interesting remarks of Dr. Douglas I do not think there remains much for me to say. I am sure that you are all interested in watching the progress of the Dominion Coal Company and its development. I remember when the Whitney syndicate took over these properties with Mr. Donkin, there were some 800,000 tons being produced, and this year it is something like 2,250,000, and I think I will be safe in predicting that you will yet see an output of certainly five million tons at no very distant date. There is no possible reason why it should not be done. There is no doubt that coal can be worked cheaper in Cape Breton than in any other place. In Pictou county we are not so well placed, and although we looked upon the Whitney syndicate as going to wipe us all out I have no hesitation in telling you that we have been benefited. We will follow in their wake, and what is profit to them we will have a certain share of it. I am very pleased to have made the visit to-day, and on behalf of the Canadian Institute I thank you very much. (Applause.)

MR. W. L. LIBBEY—Mr. Chairman, ladies and gentlemen, I do not see that I can give you any statistical information that will be of benefit. I am a little different from the gentlemen associated with you, being a metalliferous man instead of a coal miner.

MR. FERGIE—That is where you have the advantage.

MR. LIBBEY—Distance lends enchantment to the view. The pleasure, however, that I have in this visit is almost without measure, and the hospitality that we have received is something that each individual member of the Mining Society of Nova Scotia appreciates. We appreciate also what personal cost to every individual officer of the Dominion Coal Company the entertainment means. It means an amount of personal labour that can hardly be estimated. We cannot help but think that every individual official has conferred a personal favour on every one of us. For the amount of labour we have to sincerely thank you. (Applause.)

EXCURSION TO LOUISBURG.

The remainder of the afternoon was spent in a delightful run over the Sydney & Louisburg Railway to Louisburg. A short inspection was made of the fine shipping pier of the Dominion Coal Company at this point. The Robins Belt Conveyor and Slack Pocket now being built here will increase the shipping capacity by at least 50 per cent. The party was next towed in a schooner over to the site of the old fort of Louisburg. Here under the guidance of Mr. John S. McLennan, the treasurer of the Dominion Coal Company, who explained the many points of interest and delighted the visitors with historical reminiscences of the stormy times around the old fort during the seventeenth century—a delightful hour was spent among the old ruins. On returning to the pier three rousing cheers were given for Mr. and Mrs. McLennan and for Mr. Donkin and the officers of the Dominion Coal Company. On the return journey a brief stop was made at the coal washing plant at Morien. Sydney was reached early in the evening.

THURSDAY—THE BRAS D'OR LAKES.

Through the courtesy of the Mayor and Corporation of the town of Sydney and the officers of the Dominion Iron and Steel Company, the visitors were entertained to an enjoyable sail on the steamer "L'awnee," past North Sydney into the Atlantic Ocean and down by Boulderderie Island into Little Bras d'Or Lake, passing the pretty little resort of Baddeck and the summer residence of Prof. Graham Bell, the inventor of the telephone, which is beautifully situated on a magnificent point in the lake facing Baddeck. A stop was made at his wharf for water, and the visitors went ashore and inspected the immediate surroundings. It was noted that even during his holiday seasons Prof. Bell must needs have a workshop fitted up for experimenting purposes. It had been intended to also go through the Great Bras d'Or Lake, and on through St. Peter's channel, Lennox Passage and the Strait of Canseau, joining the special train at Mugrave, but time would not permit, so that the party disembarked and joined the train which was held for them at Grand Narrows.

Previous to disembarking, Dr. Douglas, president of the American Institute, said: Ladies and gentlemen, I am sure we are all at one, whatever we may differ in opinion, in according our hearty and sincere thanks to the citizens and corporation of

Sydney who have placed this boat at our disposal, and the Dominion Iron and Steel Company who have supplied the inner man. I am almost beginning to fear for the stability of our institute. It was started as an institution for the discussion of purely scientific subjects, and it was therefore to be supposed that only those who would join who had no other motive in doing so but to advance science and art, but if this sort of thing continues I fear that we may deteriorate into a junketing party. We find wherever we go, to the east coast or to the west, to the north or to the south, the same open-handed hospitality, and I am afraid that people will join the Institute in the future, not because they are expert miners or metallurgists, but because they have a good time at other people's expense. (Cries of "No, No.") Certainly the hospitality which we have received does call for this thanks and on this occasion for three hearty cheers (Applause), and to all the gentlemen who have individually and collectively been kind to us we return our sincere thanks.

FRIDAY—PICTOU COUNTY.

At New Glasgow on Friday morning the party divided, a portion going to the Drummond Colliery at Westville, and another to the Acadia Coal Company's mine at Stellarton, while the ladies and others were driven by courtesy of the Citizens Committee over Fraser's Mountain and other points in the beautiful countryside of which Pictou County is so famous.

AT THE DRUMMOND COLLIERY.

A large party visited the Drummond Colliery of the Intercolonial Coal Company, Limited, at Westville, leaving by special train from New Glasgow about nine o'clock in the morning. They were accompanied by their genial host Mr. Charles Fergie, M.L., managing director of the company. At the Drummond Colliery the main and second seams are worked, the fourth being intact. The second seam is only in process of being opened up. The main seam is worked by slopes 12 x 18 feet, having an average dip of 16 degrees and are 5,400 feet long. The seam is worked on the longwall system: each lift is 450 feet; the levels are S.E. and N.W. 20 degrees; the dip is 24 degrees on the north and 19 degrees on the south side; counterbalance planes are driven every 300 to 400 feet. The main levels of every lift are driven out to the extreme boundary, and the coal is then worked by longwall retreating. No explosive is used, the coal being worked by naul and wedge. The coal is good for steam and household purposes and makes excellent coke. The annual output is about 250,000 tons. The plant is in every respect admirable and up to date, and in keeping with the sound mining practice for which Mr. Fergie is famous. After inspecting the surface and underground works of the company the party adjourned to the beautiful residence of Mr. and Mrs. Fergie where luncheon was served.

The visitors appreciation of Mr. and Mrs. Fergie's kindness was very neatly and appropriately expressed by Mr. J. Stevenson Brown, treasurer of the Canadian Mining Institute. Mr. Fergie having briefly acknowledged the vote of thanks, cheers were freely given for Mr., Mrs. and Master Fergie, and the party returned to New Glasgow.

THE ACADIA COLLIERY.

In the meantime a smaller party had gone over to the adjacent collieries at Stellarton, operated by the Acadia Coal Company, Limited, where they were received by Mr. Henry S. Poole, M.A., Assoc. R.S.M., the general manager, and by Mr. J. Geo. Rutherford, M.E., his able assistant. Mr. Poole, who is an eminent geologist, pointed out the many interesting features of the coal measures of the district and conducted the visitors over the principal surface works. At the Acadia a seam of 10 feet is worked by a slope 4,200 feet, the dip averaging 27 degrees. The method of working is in lifts of 300 feet, longwall with timber packs 5 feet square. The Albion colliery main seam is 38 feet thick; 148 feet lower deep seam 22 feet thick. The Poord pit shaft is 900 feet deep being sunk to the main seam. The output in 1899 was about 270,000 tons.

NOVA SCOTIA STEEL WORKS.

Shortly after noon the whole party were hauled by rail over to the works of the Nova Scotia Steel Company, Limited, where they were received by Mr. Graham Fraser, vice-president; Mr. Harvey Graham, secretary; Mr. Thomas Cantley, and several other officers and directors of the company by whom they were conducted over the extensive works. The plant here comprises four Siemens melting furnaces, ranging from twenty-five to fifty tons capacity, three gas reheating furnaces, reversing cogging mill with live rolls and hydraulic ingot manipulators, hot bloom shears with live rolls, one 20-in. plate mill, one 16-in. bar mill, one 12-in. bar mill, one 9-in. guide mill, twelve pairs of shears, forty tons and smaller, one five ton hammer with fifteen ton hydraulic crane, four steam hammers of smaller size. Machine shop 175 x 75 feet, with thirty-ton travelling cranes, commanding the whole shop. The machine shop is equipped with 30-in. slotter, 9 ft. radial drill, twelve laths of various sizes, the largest taking 50-in. over the carriages, with a gap of 8 x 10 feet and 37 feet between centres. Power for the entire plant is supplied by some seventy steam and fifteen hydraulic cylinders. The entire plant is lighted by an electric plant installed at the works. The output consists of upwards of one hundred and fifty steel ingots per day, all of which are worked up into bars, sheets, axles and forgings. The company also operates a blast furnace plant of modern design, at Ferrona, and also mines of red and brown hematite on the East River, some thirteen miles distant from the furnaces. The output from these mines is from 4,000 to 5,000 tons per month. It also owns and operates one half of the great red hematite deposit at Bell Island, Conception Bay, Newfoundland (described later on). The coal washing plant of the company is situated near the furnaces at Ferrona. About 50 per cent. of the ash in the coal is removed, besides about 60 per cent. of the sulphur. The capacity of the coal washing plant is about 900 tons of washed coal per day. The coking plant, also at Ferrona, consists of 54 retort coke ovens of the Bernard types. During 1899 the company made 31,100 tons of pig iron, 23,000 tons of steel, and 3,500 tons of forgings. In this production were used:—140,000 tons of coal, 24,300 tons of Canadian ore, 32,900 tons of Newfoundland ore, 1,100 tons of Cuban ore, 45,000 tons of coke, 24,000 tons of limestone. It employed 750 persons and paid out over \$300,000 in wages. The profits during that period amounted to \$819,945.19. During the present year the company acquired the valuable coal mining property at North Sydney, operated for a great many years by the General Mining Association, Limited.

EXCURSION ON PICTOU HARBOUR.

The inspection of the works completed, the visitors, accompanied by a large party of invited guests from New Glasgow and the surrounding neighbourhood, were entertained to a most delightful sail in the steamer "Princess," which had been chartered by the Nova Scotia Steel Company for the occasion.

Among others who accompanied the party were Mr. D. C. Fraser, the genial and large hearted M. P. for Guysborough; Mr. L. L. Macdonald, M. L. A.; Mr. Graham Fraser, Mr. Henry Graham, Mr. Thos. Cantley, Mr. J. D. MacGregor, Mr. W. G. Matheson, and these gentlemen were unremitting in their efforts to make things pleasant for everybody. Nor while memory lasts can we ever forget the galaxy of bonnie lassies from Pictou and New Glasgow, and their splendid impromptu concert of Scottish song, sung with a vigor and heartiness and expression which would be hard to beat. Another feature of the afternoon was the Westville band whose selections added in no small measure to the pleasure of the company. Altogether that afternoon in the bright sunshine off Pictou harbour will linger long and pleasantly in the memories of all who were privileged to be the guests of the Nova Scotia Steel Company.

Previous to reaching the wharf, Dr. Douglas, president of the American Institute, stepped to the front and said: Now that our pleasant little trip around this beautiful harbor is drawing to a close, we of the American Institute of Mining Engineers feel it a pleasure to return our sincerest thanks for the unbounded hospitality that you have shown us. I believe to day that we owe the pleasure of this trip to the Nova Scotia Steel Company, the Acadia Coal Company, the Intercolonial Coal Mining Company and Messrs. J. Matheson & Co. Limited, of New Glasgow. To these gentlemen more particularly, therefore, we wish to return thanks. It is fortunate that we are not called upon to fill our glasses and empty them to all those who have been so kind to us or we might have all been under the table before we got here. The mention of Pictou recalls to me early memories. I am a Quebec man, and in my boyhood days Pictou loomed large before us, for it was the port through which our mails to Europe always went. Most of you perhaps forget the incident when Captain Walter Douglas, the commodore of the Cunard line in 1842, two months before the regular line was established, brought over the SS. Unicorn from Boston. It came round to the gulf and was established as a branch line of the Cunard Company, and for five years the mails went from Pictou to Quebec, whence they were transferred by land to Halifax and picked up by the regular steamer to Boston. Capt. Walter Douglas was sailing master of the *Gulnare* under Capt. Bayfield when he made his survey of the St. Lawrence, and on that account he was selected by the other company for their commodore and commander of the Unicorn in the St. Lawrence. The week before last, old Mr. Huntington was marching with elastic step about Wall street, New York, when he was asked by some one how it was that he came down in such hot weather and could be as cheerful and chirpy as he was. "Oh, well," he replied, "I take life as it comes; I never regret yesterday and I never look forward to tomorrow." I do not think these principles actuated him all through life. Had he done so he would never have looked ahead and become the proprietor of the Southern Pacific Railroad. I do not think it is wise to follow that precedent, but we should rather look forward with hope and assurance. I am not an extremely old man, and I do not wish to consider myself such, but I was born the same year as the city of Chicago. I saw as a baby the city of Chicago as an incorporated village in 1837. About that time there were a number of little blast furnaces making about as much as one of the Duquesne or even the South Chicago furnaces make today. Now, then, I do not think that we can look forward to Pictou a life hence as likely to rival Chicago, although Pictou has advantages that Chicago did not possess, although she has labored under disadvantages that Chicago did not. There is no spot on this continent within county limits where you have coal, malleable iron ore and shipping ports all within county limits. These advantages give Pictou, therefore, a prospect for the future, which although they may not rival Chicago undoubtedly should lead everybody in Pictou to do his best and make the most of these marvellous resources. And therefore in bidding you good-bye we do so with the hope and with the assurance that, having the resources that you have and being peopled with the people who inhabit it, the prospects of Pictou in the past will be more than rivalled by Pictou in the future, and that Pictou county will become one of the notable spots on the North American continent. Now, gentlemen, I for my part bid you good-bye with the most hearty wishes for your future. As I said before, I am an old Quebecer and feel very proud of my birthplace and my country. The next Douglas that I hope you will greet will be Admiral Douglas, my cousin, when he will be placed in charge of the North American squadron. Today he is the second Lord of the Admiralty, and I hope that when he becomes a vice admiral we will see him out here in that conspicuous position. (Applause.)

Dr. R. W. RAYMOND—Mr. Chairman, ladies and gentlemen, a little while ago I thought it would be a great privilege to follow my friend, Dr. Douglas, and express some of the sentiments which fill the hearts of all the citizens of the United States. I can give Dr. Douglas a simple reason why we are not all under the table. We were told in Sydney the other day that it was somewhere between New Orleans and Liverpool, and therefore if we were half seas over what was the need of going any further. (Laughter.) Dr. Douglas has also told you that he was born the same year as the city of Chicago. Well, we all love him very much, and we all hope that his career will not parallel that of the city of Chicago which was burned up a few years ago and we trust that his conflagration will never, never arrive. (Laughter.) Without giving any special acknowledgement to any of the innumerable friends and corporations that have done so much to make our stay in the Province of Nova Scotia delightful and profitable, I must express the thrill of delight with which we have come into the atmosphere of this old and ancient province which brings us into touch with the old Breton fishermen and with the old covenanters, this province which with all the air of enterprise carries still the reminiscences of the past, and the beauty and the heroism and the ancient memories of undying hopes, the most splendid hopes of the noblest souls. We have shaken hands at Quebec with the sons of New France, and today the songs of old Scotland have been sung in our ears. As the sons of New France and the sons of New Scotland, New England greets them both to-day, and joins with them in the hand clasp of eternal friendship. (Applause.)

Mr. GRAHAM FRASER being called upon, said:—I do not make speeches. I am a practical man; but I have a small sized boy that I have brought with me for making speeches, and I am going to call upon Mr. D. C. Fraser, M. P.

Mr. D. C. FRASER, M. P.—Mr. Chairman, ladies and gentlemen, I have heard of a man travelling with a private chaplain, but never with a private speech-maker. But I wish to say something, and I wish it to appear as if he were not here, and it is this, that I wish my United States friends who are here to know that there is not in Canada or anywhere else a better man than that same Graham Fraser. (Hear, hear.) With him silence is silverine and speech is golden, but he is of the metal which makes a great nation of this Canada of ours. I do not wish to make a speech, but I would like to say that while I want you all to carry away the best impression of this country of ours, lest there should linger in your minds that sentiment that sometimes finds place in the United States, I wish to add that while our attachments are with you as brothers across the line, we in this country of ours are perfectly able, as we think, to get along ourselves. (Hear, hear.) Let not one single man living in the United States think that there is a man, woman, or child in Canada—because we teach our children so—who thinks there is any need now or at

any future time for any attachment except the friendly rivalry that makes for the progress and welfare of any great nation. (Applause.) Our population is a small one, but we think we possess resources equal to anything they can show, and we think we have all the riches in this Canada of ours sufficient to make a nation and fit ourselves to dwell in amity and goodwill with them and with all the world. (Loud applause.) We love them in that higher and better sense; if there is any young man who longs for that which makes life happy, if you want the chosen of the earth, look about you. (Applause.) There was no nation ever great that did not live in northern latitudes. We can produce just as fine a people as exist, there are no finer than ours. I want also to say that when Mr. Bell moved in this matter I joined in it with all my heart and soul, because I know of no better way of having the people of Canada and the people of the United States understand one another than having just such people come to this country. We are not afraid in the slightest degree, because we have got something to show them. Just look at the bloom of health about you. (Hear, hear.) Speaking of poetry and art, if you wish to wander amid Acadian bowers and arcades where lovers can enjoy all the luxuries of present happiness and anticipation of eternal joys with the loveliest women you ever saw on this or any other continent, you could not do better than to come and see us. (Hear, hear.) We are not able to go in such large numbers as you, nor have our men engaged here the opportunity, but none such as we have here today will ever come to Nova Scotia without the warmest welcome. We receive you as people of the same tie and united by blood, and notwithstanding the attempts made some of the people of your country who tried to step over and take us, and which was prevented by the march of British sons who are ever in the forefront in support of all that tends to liberty, civilization, and commerce and friendly intercourse. Let each work out their own destiny, and we shall feel, as you feel, the all-mastering power of the British flag. (Loud applause.)

Mr. FERGIE—I will not detain you, ladies and gentlemen, but I simply want to endorse what has already been said, that we welcome our American friends with the utmost cordiality, and we know that if we go to visit on the other side of the line we will get as warm a welcome there.

Before disembarking, on the motion of Mr. B. T. A. Bell, three hearty cheers were given for the ladies, after which "Auld Lang Syne," "Our Country," "tis of Thee," and the "National Anthem," were sung by the company. At New Glasgow the special train was again taken and after a smart run Halifax was reached shortly before midnight.

SATURDAY, HALIFAX.

The headquarters of the visitors was the Halifax Hotel, where the Mining Society has a comfortable room equipped with technical literature.

By courtesy of the officers and members of the Society, the party were driven, in the morning, to various points of interest, a pleasant half hour being spent in the beautiful public gardens for which the city is noted. In the afternoon, by the courtesy of Mr. Mat. Morrow, they were entertained to a delightful sail on the ss. Coban, one of the boats of the Dominion Coal Co. In the evening they were guests at an exceedingly bright performance given by amateurs at the Academy of Music.

Sunday morning parties visited the Citadel and the various church parades. In the afternoon they were taken out in a steamer to H. M. S. Crescent, and through the courtesy of Lieut. and Acting Com. order Gillett they were shown the many interesting features of this fine cruiser. Lieut. Gillett having entertained the party to cake and wine in the gun room everybody left the ship greatly pleased with what they had seen, with the uniform courtesy of the officers and men, and particularly with a lively sense of appreciation of Lieut. Gillett's kindness.

MONDAY—MEETING OF THE AMERICAN INSTITUTE.

A meeting of the American Institute of Mining Engineers was held at the Halifax Hotel at ten o'clock, at which the Secretary, Dr. R. W. Raymond, presided and submitted the following papers by title:—

- "Signal Device for Mines," by Chas. S. Herwig, Virginia, Minn.
- "The Oil Bearing Shales of the Coast of Brazil," by Prof. J. C. Branner, Stanford University, California.
- "A Mining Survey," by J. F. Wilkinson, San Francisco, Cal.
- "The Red Ash Colliery Explosion," by William N. Page, Ansted, West Virginia.
- "The Hartville (Wyoming) Iron Ore Mine," by Dr. H. M. Chance, Philadelphia, Pa.
- "The Ballarat Indicator," by T. A. Rickard, Denver, Col.
- "The Properties of Brass made from Copper containing sub-oxide, with observations of the effect," by Erwin S. Sperry, Bridgeport, Conn.
- "The Telluride Ores of Cripple Creek and Kalgoorlie," by T. A. Rickard, Denver, Col.
- "The Method for obtaining the Volume of Small Drifts and Working Places where it is not possible to use the Transit," by Charles S. Herzig, Virginia, Minn.
- "The Influence of Silica on the Condition of Carbon in Cast Iron, with Other Notes on Cast Iron," by Prof. H. M. Howe, New York City.
- "Biographical Notes of H. B. C. Nitze," by H. A. J. Wilkins, New York City.
- "Deep Level Shafts on the Rand and a Method of Working the Greatest Amount of Deep Level Mines with the Fewest Possible Shafts," by Thomas H. Leggett, Cape Town, South Africa.
- "Pyritic Smelting in the Black Hills," by Prof. Franklin R. Carpenter, Denver, Col.
- "Investigations on Magnetic Fields, with reference to Magnetic Ore Concentration," by Walter R. Crane, Litchfield, Conn.
- "International Specifications and Methods of Testing Iron and Steel from an American Engineer's Standpoint," by William R. Webster, Philadelphia, Pa.
- "The Micro-Structure and Physical Properties of Cast Iron as affected by Heat Treatment," by A. T. Child, Perth Amboy, N. J.
- "Experiments regarding the Influence of Silica on the Loss of Silver in Scorification," by Lester Strass New York City.
- "The Testing of Winding Ropes in the Province of Anhalt, Germany, by Frank H. Probert, Anhalt, Germany.
- "Notes on the Compressed Haulage Plant at No. 6 Colliery of the Susquehanna Coal Company, Glen Lyon, Pennsylvania," by J. H. Bowden, Wilkesbarre, Pa.
- "Notes on the Methods for Setting Out the Astronomical Meridian in connection with Surveying Operations," by H. D. Hoshold, Buenos Ayres, South America.
- "Some Points in the Evolution of Mine Surveying Instruments," by Benjamin Smith Lyman, Philadelphia, Pa.
- "The Colorimetric Assay of Copper," by J. Audley Smith, Clifton, Arizona.
- "The Protection of Blast Furnace Linings," by S. S. Hartrauf, Buffalo, N. Y.
- "Coal Outcrops," by Charles Catlett, Staunton, Va.

"Notes on the Geology of Cochis County, Arizona," by E. T. Dumble, Houston, Texas.

DEEP LEVEL SHAFTS ON THE RAND.

Dr. RAYMOND presented a brief summary of the nature of several of the papers. In connection with Mr. Leggett's paper on "Deep Level Shafts on the Rand and a Method of Working the Greatest Amount of Deep Level Mines with the fewest possible Shafts," Dr. Raymond said that there has been on the Rand a very remarkable development of deep vertical shafts; in fact, there was no mining country in the world so young in its development which has produced such a number of deep shafts. In his paper Mr. Leggett outlined a plan to reach gold bearing deposits to a depth of from three to five thousand feet. The deepest shaft yet sunk in the Rand was 4,464 feet, and Dr. Raymond did not suppose it was any deeper because the Boers did not do any of that kind of work. However, he did not think that we have ever had before any miners starting a shaft and going down nearly 4,500 feet throughout barren rock on the expectation of striking a mine. The general grade of the ore of the Rand and South Africa was low grade, and that was why it took American engineers who understood this kind of work to go in and work these mines. Give an American engineer a large mass of low grade material and he will take a small margin of profit and make money. He also remarked that there was only one bed on the Rand of three or four parallel zones carrying gold. Dr. Raymond added: "You may have noticed in June in the papers of South Africa that President Kruger had brought into the Volksraad a proposition to sell the Government deep-mining rights. It was probably a proposition to have all these outside properties put up for sale by auction. There was a tremendous row in the Volksraad, and he was accused of wanting to put the property up at auction so as to have it sold to a member of his own family. President Kruger said they wanted money, but he was asked how it was that he before stated that he had plenty of money to carry on the war. However, the proposal was thrown out and the Volksraad adjourned. President Kruger then issued advertisements offering the properties at auction, and the sale was set for July, but the British were dangerously near, and it was postponed until August, and now likely indefinitely."

METHODS OF TESTING CAST IRON.

In connection with Mr. Webster's paper on International Specifications and methods of testing cast iron, Dr. RAYMOND said: "I hope we shall be able to contribute, as the Institute did before, a good deal to the discussion on the methods of testing. The committee of the International Association have taken up special lines and prepared special specifications. This interests you gentlemen in Canada just as much as it does us in the United States. The whole continent is going to be called on to export iron and steel, and I hope not only crude iron or ingot steel, but manufactured iron and steel in structural forms and in castings, and we have got to be ready to meet the specifications of other countries, or we may find ourselves crowded out and our specifications thrown out, although we may have the better article. The object of the Congress which has just finished in Paris is to try and negotiate with the structural engineers of both continents, with a view of getting a uniformity of specifications. We are the ones that stand to win with such a form as that, because while we may adopt some of theirs, we believe that they will come very nearly to our specifications as the best. We will command the English market by reason of our raw material and abundant production and native skill. But the radical point is that we are not going to get the foreign market unless we begin to manufacture by metric scales, and the sooner our manufacturers find out that the dimensions in use by us should be to some extent adapted to the measures in use throughout the world the better. That one thing will prevent the chance of selling a machine. The greatest invention of modern times—the one that has the greatest effect upon the commercial development of the world—was not the telephone, the steam engine or the utilization of electrical power, but the idea of making replicate parts. Only the other day I had an experience where a friend of mine went over to take charge of a bankrupt concern in Germany. They had everything in their favor, and they had every reason to succeed, and I wondered at the failure. I asked my friend what ailed it, and he replied that there was only one thing that ailed their engineer, he wanted to manufacture improvements. They sent one of their electric trolleys and electric motors down to South America, and they had to couple these to other machinery, and in order to do so they had to make new patterns in order to get out the pieces. The mere lack of uniformity killed that industry. He did not know that it was better to go on and manufacture an old type than to make improvements which put on the side track all the machines he had made."

Regarding Mr. Bowden's paper on Compressed Air Haulage on No. 6 Colliery of the Susquehanna Coal Company, Dr. RAYMOND said: "There has been a great controversy going on between electrical power and compressed air. The question is not going to be answered in a hurry, and it will be well for both parties to keep well up. There is a great deal to be said in favor of electricity as being cheaper. We saw at Sherbrooke the other day a crane run by compressed air. Mr. Lewis was running everything by compressed air and he being interested in compressed air would not have electricity around his place. You cannot get around the fact that electricity is dangerous, and a fellow sleeps better nights without it, but we would sacrifice our sleep better if it could be proved that electricity is cheaper. We have some excellent reports on electrical haulage, and now we have one on compressed air haulage which shows remarkable controversy."

TESTING WIRE ROPES.

There was an informal discussion on Mr. Frank H. Probert's paper on the testing of winding ropes in Germany, particularly as concerned the fact developed by frequent tests of such ropes by the author of the paper, that they always lost tensile strength at the first period of use and subsequently increased in strength, a phenomena which was considered very interesting and very difficult to explain.

Mr. HORACE SEE: We have none of the conditions that exist on the winding drum. Our wire rope is put out over the rigging where it always remains a straight pull. One thing suggests itself to me in the matter before us, and that is that the test pieces were taken from one end of the rope, so that the question arises whether the same phenomena would present itself if the pieces were cut at the ends where the vibrations would be most intense and have a tendency to affect the material most seriously. It occurs to me, and I think this is shown in fact, that the strength will improve with each succeeding test piece, the last being furthest removed from the end which sustained the final pull. As far as our experience is concerned I cannot say very much about the action on a winding drum, but I would like to know something about testing a rope where the pull is straight one. We have had on shipboard a wire rope which is affected from the outside, and we are frequently called upon by captains who say that its state is dangerous because it has been in a certain time. All that we can judge by is the outside appearance.

Mr. WILLIAM KELLY: This shows that this paper is exceedingly important and interesting, because it presents new features of appliances to which we daily trust our lives and the lives of others. There are two points mentioned in the resume which I hope may be put in the paper: One is the question of the comparative advantages of ropes of different materials as crucible steel ropes, and the question occurred to me that the tests for these different kinds of rope would have to be of a different nature, and the test that would be suitable for the crucible steel rope might condemn the plough steel rope. The other is in regard to the method of attaching the rope to the cage. There are two principal systems in use in our mining regions, one by socket and one by clamp. The practice varies in different localities, and I have never seen any test of those points, and we have been obliged to adopt one or the other as its advantages have appeared to us from general considerations, but it would be exceedingly valuable if we could have some tests upon which we could base our reasons for adoption.

Dr. RAYMOND: The paper intimates that the method there used is spliced. Our experience shows that our wire ropes do not fail for the loss of tensile strength in the strand, but they fail because in bending on the drum the wires in the strand seesaw, and it breaks because the ends turn up. There is no question but that we have lots of rope lying around our mines and collieries that ought to be thrown out on account of defects of that kind, the breaking of a single strand. Mr. Probert says that they have made separate tests of each strand and of each wire requisite, because they found that in a great many ropes which, in the aggregate, stood the tensile test as a whole got that strength out of special strands in the rope that were especially strong, and that other strands were weak. Of course that will not do, and that is the reason of the testing of the special strands. Has anybody come across such a phenomena as that of a rope in use recovering strength, losing it and then recovering it, and if so, what theory would he suggest? Mr. Gee's suggestion is that the phenomena did not occur in the middle of the rope. I would like to know what became of the end?

Dr. GILPIN: We never had any experience in testing the strands or the rope as a whole. In fact, the ropes have been made by the most improved makers and then discarded as soon as the rope gave way, or became weakened. They gave an average life for the rope, and then when it was used so many months it was thrown aside. I would imagine that the experiment would be most interesting if made on the rope next the cage. So far as I know, no such test has been made here. The principal causes of the destruction of our ropes here are rust and acid water. We have instances of the latter.

Dr. RAYMOND: Have there been any Lang Lay ropes, or the Elliott Lay ropes used, and how do they stand?

Dr. GILPIN: Sometimes there have been complaints of their being a little inclined to twist.

Dr. RAYMOND: We never found that.

Dr. GILPIN: With these ropes it has been found that if a wire broke it makes a much worse tangle than the other kind.

Dr. RAYMOND—You believe the Lang Lay the best?

Dr. GILPIN—Yes.

Dr. RAYMOND—The Elliott rope is different. It is steel to the centre.

Mr. SEE—It has a steel centre?

Dr. RAYMOND—Principally steel. The breaking of a strain does not let the rope out but only weakens it to that section, that is all. A rope that is steel to the centre will stand a much larger strain than the mere hemp centre.

Dr. GILPIN—These ropes have been used here, and after being used for some time they apparently diminish, the effect being as if the wire were elastic.

THE DEPOSITION OF ORES.

Dr. RAYMOND—I have with me some copies of a very important paper by Prof. R. C. Van Hise, of Madison, Wis., on "Some Principles Controlling the Deposition of Ores," and which is published by permission of the Director of the United States Geological Survey, and if any of you desire a copy I shall be glad to provide you with it. This paper is going to make a noise around the world, and it comes nearer to furnishing a satisfactory general theory on that subject than anything I am acquainted with in the literature of ore deposits. Together with several other papers on branches of the same subject read at the Washington meeting in February, it will throw a great deal of light upon a subject that has never been furnished by scientific studies, and we propose to publish them in a separate volume outside of our Transactions, so that it can be made available to persons who are not members. It will probably be a volume of several hundred pages, containing the famous treatises of the late Prof. Posepny, this paper of Prof. Van Hise's, of the University of Wisconsin, and papers by S. F. Emmens, Walter H. Weed, and Waldemar Lindgren, of the United States Geological Survey.

GOLD MINING IN NOVA SCOTIA.

Mr. GEORGE W. STUART, Mining Engineer, of Truro, was then introduced, and requested to address the meeting on gold mining in Nova Scotia. He said that perhaps the lack of cultivation of their wonderful resources was due to their own lethargy; that while the other Canadian provinces were not slow in booming their resources, no such charge against the Provincial Government of Nova Scotia could be sustained, as they concealed with a quiet modesty such information for publication of geological and productive facts as would without embellishment ensure an influx of knowledge and capital to their shores that would reap a reward for such essentials as would equal that of any other part of the world. Mr. Stuart then went into a brief history of gold mining in Nova Scotia from its inception in 1860 to the present day, during which he said there were in the vicinity of 5,000 square miles of auriferous formation in the country, after deducting the intrusive and sterile rocks. Mr. Stuart dwelt to some extent in a scientific manner on the structural formation of the gold measures, showing a most intimate knowledge of the wonderful and rather unique formation containing the gold bearing leads in this section of the country. He made certain comparisons with the district of Bendigo, Australia, showing conclusively a more permanent formation in Nova Scotia. He stated that while the small veins from a few inches to 30 inches in thickness yielded marvellously rich ore, in some cases as high as \$4,000 per ton, yet notwithstanding such marvellous richness, the inordinate search for these small veins had, in his opinion, done much towards injuring the mining interests of the country, because of the fact that much low grade ore had been frequently overlooked and abandoned, of which there were many yielding from \$1 to \$7 per ton, and could be worked under favorable circumstances not to exceed \$1.20 per ton. He gave several instances of practical results on such belts now being worked with reasonable capital and modern machinery, showing profits as high as 50 per cent. to 90 per cent. per annum on the total capital. Several instances were given of the present operations in the province, of

mines that had been abandoned for many years because of the fact that poor zones of insignificant extent had been encountered by the old operators, and which now, after lying idle for 15 or 20 years, had been taken up by capitalists and were being operated with most satisfactory profits. Among others the barrel or quartz mine of East Waverley, ten miles from the city of Halifax, was referred to, and as they were going to visit this mine on the following day, he would say for their information that this lead was one of a series of saddle reefs proved to exist to great depth by the use of diamond drill. The lead, which has at present some 150,000 tons of ore in sight ready for stopping, is perhaps one of the most interesting quartz veins known. In order to show the confidence of the present owners—an American company—have in this mine, it may be mentioned that a plant is now about completed comprising a 60-stamp mill, with all the other necessary appliances, including a 16-drill air compressor. The plant, apart from that of the Brookfield Mining Company's plant in the County of Queens, is perhaps the most perfect and extensive in the province. This mine and mill are operated by water power, and Mr. Stuart explained that almost all the mines in the province could be operated by water power, either direct or by electricity generated by steam. There were some forty odd districts in the province where more or less gold mining had been done. Mr. Stuart also gave a list of the best known districts, and also the cost of fuel, labor and supplies, including machinery. The labor, which was the best that was procurable in any country, ranged from \$1.20 to \$1.50 per day of ten hours. Timber, both milled and round, ranged from \$6.00 to \$11.00 per thousand, and the price of machinery of all kinds, which was now manufactured in the province, was as cheap if not cheaper than could be procured in any other part of the world.

Dr. RAYMOND: The indications which Mr. Stuart has given of a revival of gold mining in this province and to a greater depth is parallel with what has been occurring in California, where with energy and modern appliances they are treating rock that was formerly thrown away. I remember a couple of years ago enquiring as to the cost of mining and milling in California, and I found they were able to extract ore from the hard quartz vein 2,509 feet from the surface, and take it up to the surface and treat the concentrates for about \$2.60 per ton, of which \$1.25 went for mining. There, as in this case, they had the advantage of water power, and I am sure that the abundance of water power will be an enormous factor in the prosperity of a mining region located as is this Province of Nova Scotia.

Dr. GILPIN: I do not know that I can add very much to what Mr. Stuart has said, nor would I like to attempt any criticism of his paper without having gone over it first. There is one point which he neglected to refer to which is of some little interest. He spoke of the action following upon the completion of the quartz veins. As a matter of fact, the quartz or auriferous formation and the Devonian were broken into by the granite, which is an obtrusive rock at the end of the Devonian or the beginning of the carboniferous. The effects of the denudation as seen to-day are due not only to the recent glacial action but also to the geological. I noticed that Dr. Raymond referred to the water power as one item in the lowness of the expense of gold mining in Nova Scotia, but as a matter of fact all the properties which Mr. Stuart referred to as giving examples of cost of mining are driven by steam.

Mr. STUART: Yes.

Dr. RAYMOND: Is not the Waverly run by water power?

Dr. GILPIN: That is water power, but that mine is not in a position to afford a statement as to the cost.

Mr. STUART: No.

Dr. RAYMOND: With steam at \$1.50 a cord for wood.

Dr. GILPIN: I think Mr. Stuart will have to pay more for his coal.

Mr. STUART: \$1.70 at the wharf, run of the mine.

Dr. GILPIN: We paid more than that.

Mr. STUART: I would be glad to be corrected.

Dr. GILPIN: The gold mining industry of Nova Scotia has in the past consisted almost entirely of operations in the small gold-bearing veins. Many of these small veins were not suitable for the operation of companies when they were suitable for small local syndicates, because it was found that after \$150,000 or \$200,000 had been taken out the pay-streak ceased, but there have been veins of moderate size which have been worked very profitably by companies for a long time. I think the best results are to be looked for in the low grade belts. They are undoubtedly the most certain, and it is along these lines, I think, that the greatest development is to be made. Our mining facilities are very good. We have no snow or frost or heat that interferences with mining, winter or summer. Of course, we cannot prospect in winter, because the ground is frozen, but all our mining is carried on in winter as in the summer.

Dr. RAYMOND: Has the recent glacial denudation taken place before or after the completion of the veins?

Dr. GILPIN: After.

Dr. RAYMOND: Then in that case you began the work in this province for a thousand feet below the original surface when the range was formed?

Dr. GILPIN: Yes, but as a matter of fact, we have mines that have been opened on the entire thickness forming the original gold-bearing horizon.

Dr. RAYMOND: How deep have your high exposures been worked? And what is the aggregate height above the sea that the gold veins are exposed?

Dr. GILPIN: Mount Uniacke is about 600 feet above the sea, and veins have been worked there to a depth of 350 feet.

Dr. RAYMOND: I only wish to bring out this point to emphasize what Vancouver said. It is absurd to talk about veins giving out when they were originally five or six thousand feet higher than they are to-day. You start five or six thousand feet below and then you wonder whether it is going to give out. For instance, in California, the mother lode runs with it, and it is crossed by innumerable canyons. We run across the vein on the top of the mountain, and then run across the same vein a thousand feet further down. The veins in the canyon were poor and on the high mountains rich, and that made prospectors feel that they gave out. It is only within the last few years that we have found bed-rock at a depth of a thousand feet, and now they mine at a depth of 5,000 feet.

Dr. GILPIN—I notice that in some of the districts Mr. Stuart mentioned only mispickel mineral accompanying the gold, but I presume that that was the principal.

Mr. STEWART—Yes.

Mr. WILLIAM S. EDWARDS—In California the experience of our miners had been that after going down five or six hundred feet there did occur a barren zone and that continued 400 or 600 feet further down, and when that barren zone was reached the men of the mine ceased work. But latterly they have tried it again and they have struck pay ore still further down and that is what they are working on now, and as far as I know they have not reached the bottom of that pay zone yet. They have reached down some 2,000 feet, and they have 1,200 feet of continuous pay ore in depth.

Dr. RAYMOND—In older times when they went down to \$5.00 a ton they could not work it at such a depth.

Mr. EDWARDS—They can take it out from \$2.00 to \$3.00 a ton.

Dr. RAYMOND—I suppose they take out \$3.00 stuff rather than none.

Mr. EDWARDS—There was one man out our way who only got 69 cents for years and years and still they worked it.

Mr. KELLY—I would like to ask whether the developments in the gold mines here lead them most to resemble the deposits of Bendigo in Australia or those of South Africa. The illustrations in the paper rather suggested South Africa, and yet I think it is more generally supposed that they resemble Bendigo.

Mr. STUART—The mines I referred to compare with Bendigo rather than South Africa.

Dr. RAYMOND—It is at Bendigo where saddle reefs occur and these are saddle reefs.

Mr. STUART—The saddle reefs in Bendigo are rather numerous. There are over a dozen now in 3,000 feet, the saddles occurring every 100 feet or so, but the legs grow narrower as depth is attained, while here the legs grow thicker in depth.

Mr. KELLY—It is the same kind of deposit as at Johannesburg. The only resemblance to Bendigo is in the seams being bent over an anticlinal. The fact that there are two or three or more deposits that have been pierced by going down across the strata is the same as Dr. Raymond mentioned at Johannesburg. The only thing that suggests Bendigo is this anticlinal fold at the other end, a description going to show that the seam is continuous.

Dr. RAYMOND—There is a radical difference between this and South Africa from the fact that that is a conglomerate rock and this is an intrusive granite. However, I do not feel that the analogy is perfect with Bendigo, and I agree with Mr. Kelly on that one point. The very nature of the Bendigo saddle reefs requires that it should peter out and this does not.

Dr. RAYMOND then announced that the next meeting would probably be held in Richmond, Va., and the meeting after that in Mexico, where they had intended going last year, but owing to the outbreak of the war had decided not to do so.

The session then adjourned.

MONDAY AFTERNOON—HARBOUR EXCURSION.

On Monday afternoon, by the courtesy of the Mining Society of Nova Scotia, the members were entertained to an excursion in Halifax harbour, on board the commodious steamer "Chebucto," and as the party proceeded down the harbour it was seen that both islands and mainland actually bristled with forts and guns, prominent among which was the York Redoubt, which occupies a lofty eminence and is one of the strongest forts in the world. The splendid view of the fort from the steamer was of particular interest to the American visitors. Ports of miner importance could be seen on McNab's Island, where is situated the military rifle ranges, on St. George's Island and on the Dartmouth shore, and the citadel directly overlooking the city of Halifax must not be forgotten. The many pretty coves and the scenery along the shore, were the delight of the man with the camera, and as the steamer entered the beautiful North-West Arm, the American visitors were in ecstasies at the panorama spread before them. The picturesque shores on either side make an ideal spot for residential purposes, and on the shore nearest to the city are to be seen many of the beautiful residences of Halifax's prominent business and professional men. From the North-West Arm the steamer took the party through the Eastern Passage and then around the charming Bedford Basin. Luncheon was served on board the steamer. The visitors were accompanied on this trip by a large number of the leading citizens of Halifax, including her public, business and professional men, many of whom were accompanied by their ladies. Just before landing the whole party were assembled on the upper deck when several addresses were delivered.

Mr. B. T. A. BELL, Secretary of the Canadian Mining Institute, addressing the gathering, said—Some of us have thought this an opportune moment to have our friend the Premier, Mr. Murray, address a few words of welcome to our guests the members of the American Institute who are with us today. I will therefore, with your permission, call upon Mr. Libbey, President of our Mining Society, to convene this informal gathering.

Mr. W. L. LIBBEY—Ladies and gentlemen, it is with feelings of pleasure that I reflect on the auspicious character of this gathering. In the first place the inception of the whole happy programme of to-day and of the last ten days was entirely due to Mr. Bell. Since then, under the general auspices of the Canadian Mining Institute and the Mining Society of Nova Scotia we have had the pleasure of entertaining as our guests the members of the American Institute of Mining Engineers, and, characterising them by their title, I think that the definition of the word American should be fully comprehended. It is not the Mining Institute of the United States, but it is the Mining Institute of America. America commences in the frozen icebergs of the North and it extends to where Cape Horn whirls into sleety storms over the meeting waters of the Atlantic and the Pacific, and from the foaming cascades of Newfoundland in the East where the salmon leap and play to the shining sands of the golden gate in the West. But the field of usefulness of this organisation is the world. (Applause). Its work is the building up and making to bloom of the desert places of the earth. (Applause). It is changing the financial and political policy and the racial characteristics of empires. In fact, the work of mining engineers almost redeems the mistakes of missionaries. (Applause). I am here in behalf of the Mining Society of Nova Scotia to say that I believe the results of the introduction of these men of brains, ability, and tireless energy will be written by a man yet unborn. They are the forerunners, the advance agents, of capital. We have shown them resources that they did not dream of. I am with you all in believing that Nova Scotia has the wealth, the natural mineral wealth, to invite the attention of any and all capitalists, and it is a most auspicious occasion for Nova Scotia that this Society is here without any schemes or deceptions. We can entertain them as guests, and they can go away with a full knowledge of what we have been doing. I will now ask the Hon. George Murray, Premier of Nova Scotia, to address you. (Applause.)

HON. MR. MURRAY was greeted with the singing of "For he's a jolly good fellow," as he rose to speak. He said—Mr. President, ladies and gentlemen, I am almost inclined to think that there is one thing upon which we are all agreed this evening, and that is that it is being too pleasantly spent for speech-making. However, I am pleased to say that when it was first announced that the American Institute of Mining Engineers was to visit us, we all felt in this Province that a very great honour was put upon us. I watched with interest the arrangements that were being made, and in that respect I was assisted by the very excellent programme that was prepared, and I want to say right here that that production was very creditable indeed. (Applause). When Mr. Bell undertakes to do anything, he does not do it in any half-hearted way—perhaps you have discovered it. (Applause). I have sometimes thought that Nova Scotians were all boastful, but we think we have some

reason to be proud of the Province of Nova Scotia. Perhaps as you gentlemen had opportunities of seeing our coal and our iron there is very little left for me to say any way. I believe that every good mining engineer believes in seeing rather than hearing, and you have had a splendid opportunity of seeing something of the coal and iron interests of the Province of Nova Scotia. We have confidence in the Nova Scotia Mining Society, and I was very glad to see that the Society had our distinguished visitors in charge. I simply want to say that I was glad to see the statement of the programme published by Mr. Bell that he thought the mining legislation of Nova Scotia was fairly reasonable. (Hear, hear.) You know, mining men criticize legislation, but assisted in the past by the Society we have been enabled to put upon our statute book of this Province such legislation as to make everybody feel, whether English or American, that every dollar of American money is just as safe in the Province of Nova Scotia as a dollar of English money. (Loud applause.) I want to make that statement. Now I hope you are pleased with the entertainment. (Applause.) You have probably a million of our Canadian native born people in your country. I think they have made fairly good citizens. If we cannot get any exchange in any other way for a very large portion of our population we are willing to take your money to develop our mineral resources. You are indebted to us in the past, and I trust this meeting will bring the natural resources of the Province of Nova Scotia more to your attention than in the past. I thank you for this visit, and I hope you will be sufficiently pleased with it, so that in a few years we may expect a return of this visit. (Applause.)

DR. R. W. RAYMOND—Mr. President, ladies and gentlemen, as Secretary of the American Institute of Mining Engineers, and as representing that Society because of the absence of our beloved president, Dr. Douglas. I am glad he is not here because he was born in Canada, and he could not say with the same force as it could be said by one who was born south of the line what I propose to say now—I am sure that I speak the sentiment of every member of the American Institute when I express the delight with which we have visited this fair province, which we are so soon and so regretfully to leave. To those of us who were here a dozen years ago, there is a great perceptible change. There is a spirit of energy and activity, all stimulated by prosperity, a golden future and active present, which we could not then have seen. It is due not only to the natural progress which this noble continent has undergone, but to what I humbly believe to be the fact, to such societies as ours, both in Canada and the United States, in welding together the professions of mining engineering and metallurgy, and the bringing to bear upon all our mineral resources the scientific theory and business ability which they require. But it is due also to the intelligent and fostering care of the government, not only of the Dominion but of this province, during the last dozen years. If you will allow me to say a word right here that will be no news at all to Canada, but may be information to our own members, that when this series of British Colonies was welded into the Dominion of Canada, and when Nova Scotia gave up its independence and became a sovereign state in that confederacy, this province was stripped of its sources of income and in return for it received an annual grant of \$400,000—that used to be a large amount but it is so no longer—and within that very limited period, and if I am not mistaken without any other recourse except direct taxation, which none of us like and which has not been resorted to as yet—with regard to that direct taxation, as a theoretical proposition is perfect, but put into practice every mother's son of us kicks—this province has tried to do what could be done, and it has not been measured with what could be done with limited means or unlimited advertising and brag and swindling, but what could be done by honest labor and economy in developing its mineral resources. I for one believe it has been done wisely and well, and I am very happy to see that in the list of measures which the government of this province has favored and has undertaken, there has been not only a liberal and just mining law, but also a very intelligent and wise forecast concerning that great element of success, viz., scientific and technical training. (Applause.) Already there has been established in connection with the Truro Normal School a course of scientific training as an evidence of what the government hope to do. And I am informed that the governments of the Lower Provinces are already consulting earnestly with a view of establishing somewhere in this region such an institution to include mining engineers and metallurgists, as Sir William Macdonald's great beneficence to McGill University has enabled them to also, and what we have done during the last 25 or 30 years in the States, to establish thorough schools, so that our sons are no longer obliged to go abroad to learn what they could learn at home. We shall be exporting professors to Europe before long. (Hear, hear.) I am not one to disparage such interchanges as these, for the more of the world a man has seen the better citizen he makes at home; nevertheless the shame no longer rests upon us that there are things learned abroad that cannot be learned at home has been removed from us. And it is being done in Nova Scotia, and the time will come when they will no longer require to go abroad and learn in foreign schools. I make this cordial acknowledgment therefore of what the government of Nova Scotia has done with energy, patriotism and liberality. I do not understand the difference between a liberal Conservative and a conservative Liberal. (Laughter.) I read Sir Charles Tupper's speech on the other side, and I thought it was a great speech, but after all it seems very clear on this side of the line that both political parties have at heart the welfare of their country, but they do not go further than that. When it comes to the question of the prosperity of Canada they join hands—the free traders do not insist on killing industry, and the protectionists do not throttle importation. (Applause.) We are very much delighted to see this harbor of Halifax. This is the best fortified city on the coast of this continent, and it seems to me a very interesting fact that this city has been so well fortified that no gun was ever fired in anger over the waters in this harbor. Annapolis has been taken I don't know how many times, but you fortify Halifax and there has been peace always. I would that all the fortifications of the world would have the same effect. (Applause.) We are fortifying now and trying to keep up even with Halifax, and I hope when our fortifications are built that the grass will grow over them as it does on yours, and that the strongest of our batteries will be, as the strongest of yours, those where the guns are entirely invisible. (Applause.) But, ladies and gentlemen, I cannot sit down without mentioning one other reason which draws us closely together to-night—I mean the prayer I heard yesterday morning in your garrison church, with which I joined with all my heart, "God Save the Queen." (Loud applause.) That dear and venerable lady in whose firm and wise and tender hand more than any other mortal hand this day rests the fate of civilization and Christianity. (Renewed applause.) God bless her. (Loud applause.) If she had her way there would not be a drop of blood flowing this day, nor a tear falling from the orphan or widow in all the world. God bless her again, because she knew that there were things worse than blood or tears; that national honor had to be maintained; that the nation's sons had to be protected; that in South Africa or in North Asia, and in common with the other powers of the world, it was her place and the place of her great empire to stand foremost in the hour and in the place of peril. (Applause.) Oh, my friends, none of us from the United States are going to forget this day, nor any day to come, how our sons and your sons have stood shoulder to shoulder, hand

to hand, heart to heart, and upheld by that blood which is thicker than water, the standards of both our realms. I do not want the United States to annex Canada, but I won't let Canada annex the United States. There is a union that is better than that. We want no union that wipes out either of these glorious flags. Our colors are the same—red, white and blue—our national anthem is the same, if we sing them as you do, so that no fellow can find out what the words are—

My country 'tis of her,
Long may she reign.

(Laughter.) But in these greater aims and higher developments and nobler achievements in which we are at one, there is no need to talk of annexation. Annexation is putting two things together and trying to make them stick. Fusion brings them together—we are fused already. (Loud applause.)

MR. B. T. A. BELL: Mr. President, ladies and gentlemen: After the characteristically brilliant speech of our friend, Dr. Raymond, any crude and ill-digested observations of mine are superfluous, but as an officer of the Canadian Mining Institute, an organization representing very thoroughly all classes of the mining profession in Canada, I would be remiss to my duty did I not express, on behalf of the members, our great appreciation of the courtesies and kindnesses which have been showered upon us, and upon our guests, the members of the American Institute, since we entered this glorious old Province of Nova Scotia. We trust this visit of our American confreres will enable them to appreciate more correctly the great resources and possibilities of this section of the Dominion. They have met in Canada several times, and we trust before very long we shall have the pleasure of seeing them with us again. It is just by such practical meetings as this that we can best promote the development of our resources.

On behalf of our Institute, I desire to express to the President and members of the Mining Society, and in this connection more particularly to my friend, Mr. Harry Wykle, the Secretary—who has been indefatigable in his exertions on our behalf—our sincere and grateful acknowledgment of what has been done for us and for our guests. (Applause.)

The whole party returned to the city thoroughly delighted with their outing in Halifax Harbor.

TUESDAY—WAVERLEY GOLD MINES.

The last function of the visit at Halifax was the visit to the gold mines of Waverley, on Tuesday. The party left by special train shortly after breakfast. The property visited was that of the Waverley Gold Mining Company, known locally as the "Tunnel" mine. The company, which by the way included the Hon. W. S. Fielding, M.P., the Finance Minister, was escorted to the works by Mr. D. C. Hood, the Secretary, and Mr. J. G. McNulty, the manager. As we did not go to the mine, and the officers of the company have refused to give us any information for publication concerning its organization or equipment, we must be content with reproducing our stenographer's notes of the visit. At two o'clock, after inspecting the mine and mill, which we understand is water driven, 40 stamps in place, with accommodation for 70 more, the visitor: were entertained to a sumptuous luncheon, served in a large tent which had been erected on the beautiful lake shore at the foot of Laidlaw's hill, where the mine is operated.

At the request of Mr. D. C. Hood, Mr. James F. Lewis, of Sherbrooke, a member of the Council of the Canadian Mining Institute, and at one time an officer of the American Institute, presided.

The toasts of "The Queen" and "The President of the United States" having been loyally honored, the chairman called upon Dr. Douglas, President of the American Institute.

DR. DOUGLAS: Mr. Chairman, ladies and gentlemen, no words can express our thanks, and therefore you must accept my assurance that it is absolutely the case. I am glad to see that Mr. Bell had on the last page of the handsome Souvenir Programme, of which we have all received a copy, two flags—on one side the flag of the Union, and on the other the flag of Great Britain. I cannot help thinking that such meetings as this, which is drawing to a close, does tend to draw into one the American continent. In that respect we are all heartily in favor of the Munroe doctrine. The American Institute goes a little further than that, and is willing to embrace Mexico within its arms. Before very long we expect to meet you south of the United States, and to express there that very feeling of co-fraternity—we cannot call it consanguinity—that the American Institute expresses to you. There is this in our mining and our milling, that no possible jar can possibly mar the enjoyment of these visits. Whatever other differences there may be in matters of politics or in matters of religion, we are one in this. We are all solid and still bent upon developing the natural resources, not only of our own continent, but as far as nations will follow us, the resources of the world; and in that aim and object we have no limited liability company with watered and unwatered stock. It must be admitted that occasionally we are inclined to be a little watered in our stock, and inclined to go beyond strictly scientific facts, but at the same time science is science, and science is open to the world, and every scientist is willing to tell and to teach all he knows, and to indicate freely and thoroughly all his experience to those who will gather to hear him, and these meetings of ours, which take in one section after another of the continent, undoubtedly do bind us together with the closest ties of friendship verging almost into love. It is really with more than feelings of kindness towards you—I will call myself in the meantime American—that we Americans wish you good-bye, and wish you God-speed in the work you are carrying on in this Province, and which will have such a magnificent end. It is no mere hap-hazard that you have taken us last to the first industry, gold, and first of all to your newest great industry in iron and steel, because it is this last which always seemed first, and it is the science which iron and steel require which I think has stimulated you to put your gold industry on a more scientific basis than it formerly was. We cannot any of us doubt that the gold interest of Nova Scotia will make more progress in the future than it has ever done in the past. In its early days it was a very hap-hazard interest. No one tried to dip down into the causes of things. Here on this hill there were a great many little companies stripping off the quartz, and they believed that when they had stripped it they had taken the very roots out of the hill. To-day one company is working it with science and skill, and with capital behind it, and bringing about the results which you have seen—results which will not only redound to the prosperity of Nova Scotia, but it will likewise fill the treasury and the pockets of those interested in the company with the gold which they are extracting. It is only of late, in fact, whether here or elsewhere, that these problems are being studied with anything like scientific accuracy, and what you see to-day—the revival of an almost extinct industry—has occurred elsewhere. Last year we visited the mother lode in California. There we saw the marvellous ore deposit which in the early days enriched California, and which had fallen into decadence, mines closed and everything gone to wreck and ruin, the mother lode supposed to have been exhausted. But better machinery, more skill and

higher metallurgical science was brought to bear upon it, and the prosperity of the mother lode was never more assured than it is to-day. Exactly the same thing has happened with you. Thirty or forty years ago these hills were in a crude state yielding much gold; the rich surface ores were exhausted, and with their exhaustion were supposed to be exhausted all they contained; but science has been brought to bear upon it, and the peculiar character of your ore deposit and the geology of the district has been studied, and the result is what we see to-day. Very often we hear on both sides of the line that our geological surveys do not sufficiently deal with purely technical subjects; that they are content to view only the scientific side, instead of the practical side of their work. I think that the geological surveys are right, and I think that here we have proof of it. Had it not been for the careful study of the geological formation of this part of the country such work as we see upon this vast antefinal would never have been undertaken. It is only by the Geological Survey of Canada combining together and correlating facts that their officers, by their wide experience, are able to draw conclusions by which you practical people have been able to work a 40-stamp battery, where formerly a 5-stamp battery would have sufficed, and project a mill of 80-stamps. I say this because I feel that many of the criticisms that have been made on both sides of the line of the work of our geological surveys are not correct, and such institutions as we see to-day is a confirmation of the course they have pursued. I am drifting far away from what I intended to say, and that is to reiterate the hearty thanks of the American Institute to the societies of which we primarily are the guests, and to every lady and gentleman, and every institution which has labored so heartily to make our visit not only pleasant in the highest degree, but profitable to a still higher one. (Applause.)

THE CHAIRMAN. There is one thing that I think we have fully demonstrated during our trip, and that is our capacity for a jolly good time, for great eating and drinking. We have listened to some talk also, but only by a few of our members, and it is generally understood that when Dr. Douglas talks and Dr. Raymond talks that they have been studying for it, and now I want to hear from three or four others. I am going to call upon a gentleman largely connected with railroads in Pennsylvania to tell us what he thinks of the Dominion of Canada. I will now ask Mr. George F. Baer to address you.

MR. BAER.—Mr. Chairman, ladies and gentlemen, there is an unwritten law in the American Institute of Mining Engineers whereby we are required to elect orators to office so that those of the rank and file shall never be called upon to make a speech, and I assure you that if I were not in a strange land and under orders from a superior I would hesitate to undertake to speak, in view of the fact that it is contrary to the custom of the American Institute, but I feel that I would be wanting in full respect to you and do violence to my own sense of obligation if I hesitated to add a few words to the many that have been spoken in favor of the impression, the agreeable impression, that has been upon all of our visit to your very fine country. Very many of us know very little of Nova Scotia and of Canada. It is true we have read from time to time of the grand resources of the Canadian settlements, and of the siege of Louisburg, and the stories of cowboys as told by our own Longfellow, and we have read novels that tell us of the Seats of the Mighty, we have heard of the fine fish stories told us by Americans returning from the Dominion, so that our impression of Canada has been an agreeable one, but still it was an impression that was made upon us from afar off. We had no adequate conception that we would meet up here a generous, whole-souled people so thoroughly American and so like ourselves, and from the time we left our homes we have never known when we crossed the line, nor have we been able to distinguish the Celt, the Gaelic, the Anglo-Saxon, the Teuton or the Canadian from the true-hearted American. (Applause.) Now we have visited some portions of your land and we have seen with what earnestness you have entered upon the development of your material resources. I sometimes think that that old command given at the beginning of man, that he must subdue the earth, has been misinterpreted for centuries, and that it consisted in an attempt to subdue his fellowman, and it is only in modern times that the subjugation of the earth means the bringing of all its hidden forces under subjugation. This we are accomplishing in our own age; through heat and electricity and all the countless powers that man has developed we are subduing the earth. Deep down in the mines we take our power and compel it to unearth her hidden treasures, so that to-day more than ever on land and sea man is asserting his true dominion and carrying out his original command that we should subdue the earth and replenish it. This peaceful subjugation you are undertaking, and we can only hope, as we have no doubt, that it will be successful in every way. May I not say that the great progress that has been made in the earth in the last century has been made by men of our race. I do not mean to use that common phrase, the Anglo-Saxon, which to me is misleading, because I am of pure Teutonic blood, but I mean that Irish, Scotch, German and English, combining together and mingling together on this continent, have developed a system of government that is just and true, that has made itself felt all over the earth, not merely a government in name, but republics, for we have long since learned to know that the form of things is nothing, it is the substance that tells, and here in Canada under your own system of small States with a Queen as your central power you are as free as we are under a system of small republics under one great republic with a President to rule over us. (Applause.) So that the outward form of things is nothing. Wherever there is a pure government secured to men in their life and property and in the pursuit of happiness, there you have the true system, call it by what name you please. I have sometimes thought that the suggestion of Max Muller was true that it was not race, but it was language which unite a people. Philologists tell us that centuries and centuries ago upon the high table lands of Asia there dwelt a people speaking a common language and that in the course of years they wandered westward and southward and created the great commonwealth of Greece and the great Empires of Rome, and gave a high order of civilization to the world, and that in the course of years and years they forgot the common language, so that when they met they could not understand each other. I have sometimes thought that here on the American continent were to be reunited all the scattering and wandering tribes, and that here men coming from every race and speaking every tongue under the heavens as in the beginning before the dispersing they were united, and that the common tongue they would speak would be English, so that the English-speaking people would be the typical race for all time to come. (Applause.)

THE CHAIRMAN.—We have a gentleman from Michigan, and he has also been studying the mines in this section of country as we have, and I am going to call upon Mr. William Kelly, of Vulcan, Mich., to say a few words to us.

MR. KELLY.—Mr. Chairman, ladies and gentlemen, I did not know that sitting alongside Mr. Lewis necessitated the making of a speech or I would certainly have got here earlier and chosen one in the far corner. However, being called upon, it seems that the duty is imposed upon me of expressing my thanks—which is undoubtedly the sentiment of all the members of the American Institute of Mining Engineers—for the courtesies that have been extended to us since we joined the party at Quebec, especially to those societies who planned the programme, and to those friends who have so kindly lent their aid. It seemed as if it was almost becoming a

contest between the hospitalities that were being extended to us and the physical capacity we had to receive them, but our capacity to appreciate has not reached its limit, and we are carrying away memories that will live forever. (Applause.)

THE CHAIRMAN.—The gentleman whom I am now about to call upon is a member of the Canadian Mining Institute, yet he has taken to-day his first initiation in mining, and he has during his daily life so much figuring with finances and that sort of thing that I am going to ask him to talk about plain every day matters, especially his experience in the first lesson he has taken in mining.

HON. W. S. FIELDING, Minister of Finance.—Mr. Chairman, ladies and gentlemen, I count myself fortunate in being able, even at this eleventh hour, to participate in a small degree—small only by reason of time—in an excursion which I know has been exceedingly pleasant, and which I would gladly have enjoyed from the beginning had I been able. Our friend across the table thought he was in a strange land. I think if I could suppose myself in a community of Hottentots, but surrounded for a moment by the members of the Institute of Mining Engineers, I should not have imagined myself in a strange land. It has been my good fortune on many occasions to meet the members of the mining societies, both provincial and federal, and share with them—

“That communion of heart and that parley of soul,
Which have lengthened our night and illumined our bowl.”

In Halifax, in Sydney and in Montreal many things happened which our friends do not always tell you of. I can recall occasions in the Mining Society of Nova Scotia and the Federated Canadian Mining Institute when I had the opportunity of meeting some of the friends. On the important occasion when the American Mining Institute paid a visit to Canada, I remember the night that we climbed Montreal mountain with an escort of snowshoers, and that when we got to the top of the mountain the President of the Association and myself found that there were higher latitudes, which we occupied for a very few moments (laughter). I do not mind confessing that it was with regret that I saw you go away from Quebec, but I had just returned from Europe, and a stern sense of duty prevented me from joining you just as you turned down to the land of the Blue Nose. A friend of mine once told me never to neglect any fun for the sake of business, and I had that feeling at the time I saw you go away. However, I went up to Ottawa to attend to a little business, and yesterday I caught up with you. You have, I am sure, been welcomed by my friend, the Premier of Nova Scotia, who has spoken on behalf of his Government; if you had arrived at Quebec a little earlier I would have been glad to welcome you on behalf of the Government of the Dominion. I suppose it is a little gratification to know that you have as your president a Canadian. We are a little proud of that. In this connection I am reminded of Pinareff—

“For he might have been a Russian,
A Frenchman, Turk or Prussian,
Or perhaps an A-mer-i-can;
But in spite of all temptation
To belong to another nation,
He remains Can-a-d-i-an.”

(Applause.) It is greatly to his credit, but there is something that is a great deal more to your credit. You have by your President proved that you have no nationality in science, because that science is world-wide, and that you are prepared to recognise merit wherever you find it. We are glad to have you come into Canada. You came to Quebec, so full of beauty for the artist and so full of interest to the student of history, and you came down the St. Lawrence into Nova Scotia and Cape Breton. You have seen some of the natural beauty of our country, and I hope you have been most hospitably entertained wherever you went; but if you will not tell anyone I will let you into a little secret, and that is, that we have an eye to business all the same. Was it not your own Mark Twain who said that when his uncle got a big pork contract from his Government he was glad to know that while he served his suffering country he made a nice thing out of it. (Laughter.) So we hope that some of you, after you investigate the resources of the country, will come back again and leave some of your money behind you. Some of you have already found permanent investments for your money in the Dominion. We are glad to be able to say that the mineral development of Canada, principally of Nova Scotia, has been largely carried on by our enterprising friends from the United States, and the great industrial enterprise which is being built up in Cape Breton today is, first of all, the handiwork of a great and enterprising American who led the way. We hope and trust that this intermingling of men and women from the two countries will always be productive of good results. Living side by side as neighbors we ought to see more of each other. We ought to be good neighbours, and I can imagine nothing more likely to assist us in being so than such visits as these. I trust that your visit to Canada has been productive of both pleasure and profit, and that the knowledge that you have obtained in regard to the resources of Canada may induce many of you to again visit us whenever the opportunity occurs. (Applause.)

THE CHAIRMAN: There is one more toast—and we have toasted everybody from Quebec to Glace Bay and back—and that is “The Ladies,” who have helped to make our stay so pleasant wherever we have been. I ask you to drink most heartily to the dearest creatures on earth, and will ask Dr. Raymond to reply for them. (Applause.)

DR. RAYMOND: Mr. Chairman, ladies and gentlemen, I think that I have got at last the speech I have been fishing for ever since we came into this fisherman's country. Mr. Lewis said that I have studied a speech. I present the ripe conclusions of about 40 years' study, to say nothing of the earlier years that I find it convenient to forget, and I feel it quite appropriate, as an official representative of the American Institute of Mining Engineers to reply to the toast to the ladies, because it was the one technical society on this continent or of the world, for all I know, which was the first to give a place in the sessions and excursions to the ladies (applause), the first to strike a mortal blow to that surviving monster of barbarism, the stag party. You remember, some of you, the night of that first banquet when we paralyzed the town of Pittsburg 21 years ago by inviting the ladies, and when we found it pleasant, not to drink too much and get under the table, but to enjoy rather the society of the ladies opposite. And we were well repaid, and there never was any cause of complaint. Every man in the American Institute is either a married man, or means to be, or wishes he were; but, on the other hand, let me warn you a little against some of these alleged bachelors who have left their wives at home. Do not be deceived by these gay Lotharios. Our beloved Alexander Holley stood up that night at Pittsburg and spoke the words that rang in our hearts, and spoke about the queens of whom we were the soldiers; how he described the mining engineer ranging through all the earth, facing the dangers of the wild beasts and hostile tribes, facing the tunnel through the mountain, bridging the stream, delving into the earth, risking all, daring all, achieving all; and now, he said, if you follow up this man you will find that the ambition of his life and the secret of his firmness is that at the end of that silver cord somewhere there is a little woman into whose lap he pours all his wealth, at whose feet he lays all his ambition, in whose eyes he seeks all his love, and

from whose lips he takes all his reward. Yes, we are the soldiers of the queen; yes, we do work for those whom we love, and we understand how to take health and strength from them, and they know how to work with and for us. (Applause.) We have got two or three ladies members of the Institute. One of the best mining engineers in California is a woman, and one of the best chemists in Missouri, Miss Rich, of Boston, is a woman, but it is not among these that they show their glory. I for one, having been in orders for the period of a silver wedding, and not very far from a golden one, think it is the happiest condition a man can be in, and I—counting myself one of this Society, one of its founders, and in which I may claim to have exercised some influence as almost continuously holding office in it—am glad that it has put itself so firmly on record on the side of the higher joy, the union and companionship with the daughters of the far and the fair daughters of this fair land add to its charms of sea and sky such unspeakable attractions of a cordial delicate welcome, these sisters of ours known since yesterday only, to be forgotten never, may take from us the assurance that we shall hold them always in our hearts with gratitude and friendship. Yes, gentlemen, I give you the old toast—men's sisters, sweethearts, and I will not say wives, for our true wives are our sweethearts evermore (applause).

The party then returned to Halifax, and in the evening, at the invitation of the Garden Commissioners, attended a patriotic concert in the Public Gardens at which an address was presented to the brave boys of Halifax who had returned from the seat of war in South Africa, and at which Sir Charles Tupper, Bart., also delivered a patriotic address.

WEDNESDAY—RETURN TO LEVIS.

On Wednesday morning at ten o'clock the special train left Halifax for Levis, Quebec, amid salvos of cheers and the greatest enthusiasm. The train arrived at Levis at six o'clock on Thursday morning, breaking the record for that run, and after the visiting engineers had spent a portion of the day in Quebec city, they left in the afternoon for their several homes, the American party leaving by special train over the Quebec Central Railway. Thus concluded one of the most successful summer meetings which it has ever been the good fortune of the Canadian Mining Institute to hold.

EN ROUTE FOR NEWFOUNDLAND.

The following members visited Newfoundland: Mr. Walter Wood, Prof. Ladd, Mr. C. S. Hinchman, Dr. Drown, Mr. J. W. Dougherty, Mr. E. L. Wiles, Mr. and Mrs. Wethey, Mr. and Mrs. E. P. Jennings, Mr. and Mrs. Sherrerd, Mr. and Mrs. H. J. Seaman, Mr. and Mrs. Tompkins, Mr. and Mrs. Edwards, Mr. and Mrs. Guildford Smith, Mr. and Mrs. Bonner, Mr. R. B. Ross, Mr. Levi Holbrook, Mr. W. S. Hinchman and two daughters, the Misses Brown, Dr. C. H. Jouet, Mr. Theo. D. Rand, Mr. and Mrs. B. T. A. Bell. A small party of these visited Newfoundland direct from Sydney, rejoining the main party at Halifax before returning to Levis, and the others, numbering close upon forty, left the special train at Truro on their way up. On arrival at North Sydney this party received and accepted an invitation to visit the old Sydney mines on Thursday, as the guests of Mr. R. H. Brown, the manager, and his two charming daughters.

AT OLD SYDNEY MINES OF THE N. S. STEEL CO.

The party drove over from North Sydney to Mr. Brown's delightful residence, about eleven o'clock in the forenoon, being received by the Misses Brown. The ladies spent a delightful morning in Mr. Brown's beautiful gardens, while the men inspected the plant at the colliery. This property has for a great many years been successfully worked by an English company, the General Mining Association, Limited, registered in 1825, but recently it has been sold out, and is now being worked by the Nova Scotia Steel Company, Limited, being part of this company's comprehensive scheme to establish a large steel works on similar lines to that of the Dominion Iron and Steel Company. The main seam, at present worked, is 5 ft. 4 in. thick, dip averaging 1 in 12, opened by shaft 13 ft. diameter by 690 ft. The system of working is by bord and pillar, the bords being 17 ft. wide. In 1899 the management began working by long wall in one district of the mine, also commenced working the pillars under the ocean, where there is 1,000 ft. of cover overhead. A feature that excited the interest of the party was the substantial hoisting and pumping plant. The hoisting engines have two horizontal cylinders, each 36 in. diameter by 5 ft. stroke; drum 18 ft. diameter, drawing two tubs of coal in a cage at once, and hoisting 126 tons per hour. The pumping plant comprises one Cornish pump, vertical, 68 in. diameter by 9 ft. stroke, raising about 550 imperial gallons per minute and working 9 hours per day. Pumps are in two lifts, each 20 in. diameter by 336 ft. in height. One forcing set, steam cylinder, horizontal, 30 in. diameter by 4 ft. stroke, pumps about 42 gallons per minute, in one column of pumps, which are 8 in. diameter by 360 ft. in height. The water from the faces of the workings at the dip is pumped to the shaft bottom by two duplex pumps; one Northey 4½ x 2½ x 4 in. forces the water to a distance of 2,960 ft. back from the working faces and to a vertical height of 280 ft.; the other, a Northey, 7½ x 4½ x 10 in., forces the water thence to the pit bottom, a distance of 3,194 ft. and to a vertical height of 209 ft. 9 in. These two pumps are actuated by compressed air produced on the surface and carried to the pumps in malleable iron pipes. The plant altogether is very complete and efficient. The average output of the colliery for the past three years has been about 270,000 tons per annum. The colliery has returned satisfactory dividends to the shareholders for a great many years.

On returning to Mr. Brown's house the whole party were entertained to luncheon, and the remainder of the afternoon was spent basking in the sunshine and in wandering about the beautiful gardens. Before parting Mr. Theo. D. Rand, Treasurer of the American Institute, expressed in a few graceful sentences the cordial appreciation of the courtesies which Mr. and the Misses Brown had shown them. Three hearty cheers were then given for their delightful hosts, and the party drove back to North Sydney greatly pleased with their delightful outing.

ARRIVAL IN NEWFOUNDLAND.

In the evening the party boarded the finely appointed little steamer *Bruce*, which Mr. Reid, the proprietor of the Newfoundland Railway, had generously placed at their disposal. The rugged and picturesque harbor of Port aux Basques was reached early next morning, and connection was immediately made with the regular train for St. Johns, which was found in waiting at the pier. The run through Newfoundland by daylight was a source of intense enjoyment to everyone, the rich variety and great natural beauty of the route being a subject of general remark. St. Johns was reached at mid-day where the Crosby House was made headquarters.

A MEMORABLE MORNING.

On Sunday morning those who proposed inspecting Bell Island left St. Johns for Killegrew's on a special train which Mr. Reid had again courteously placed at their

disposal. The morning was cold and windy and wet, and when the party arrived at Killegrew's the prospect was cheerless in the extreme. The driving gale had raised an ugly looking sea, rendering it impossible for the tug to make the wharf; she lay, therefore, rocking and tossing some distance outside. It was, therefore, necessary to go through the surf in a small boat. Mr. R. E. Chambers, M.E., manager of the mines of the Nova Scotia Steel Company, accompanied by Mr. W. L. Grammer, manager of the Dominion Iron and Steel Company, together with a party of other officers from these companies, had just landed from the tug, and in making the shore had a very close call from being swamped.

We found them on the beach drenched to the skin, and blue with the cold, none of them presenting that cheerful cast of countenance characteristic of these genial good fellows. The outlook was so bad that many were in favour of postponing the trip. However, while this was being discussed a fishing cobbler was rapidly made seaworthy by a crew of sturdy fishermen, and in it about half the party made the tug in safety, while the others, disheartened by the inclemency of the weather and the prospect of *mal de mer* or a ducking, took the train home again.

AT THE BELL ISLAND IRON MINES.

Those of us who ventured our precious carcasses in that rickety looking old cobbler are very far from regretting the memorable experience; neither will we ever forget the great kindness that everyone showed us, nor the exceedingly delightful day we spent visiting these great iron beds on the beautiful shores of Bell Island. After a stormy trip across, and a long, wet, but not very muddy climb over the tram-line, Mr. Chambers and his staff received us at his house and entertained us most hospitably to lunch. After noon the skies cleared, the wind fell, and Old Sol smiled genially upon us as we wandered over the mines. So much interest has been excited in these unique deposits that we may, perhaps, be excused for reproducing here a description of them, by Mr. Chambers, which appeared in the *Review* some time ago.

Mr. Chambers says—

"In Conception Bay, Newfoundland, about mid-way between its entrance and its head is situated Bell Island.

This island is eight miles long by two wide, and is about 35 miles by water from St. John's. Upon its northern shore are stratified beds of hematite, which, on account of accessibility, quality, and ease of mining, are likely to come into prominence during the next few years.

The measures containing these beds consist of shales and hard sandstones, and are said by the Government Geologists of Newfoundland to be of Silurian age. The underlying measures are seen on Little Bell Island, Kelley's Island, and upon the shore of the bay at Topsail, where the lowest beds consist of limestones reposing at a high angle upon the Huronian and Laurentian formations of a long Peninsula.

The beds containing the iron ore are even and unbroken, and lie at an easy dip to the northward.

Beneath is a great thickness of white sandstone, while in the immediate neighbourhood of the ore are several thick shaly bands of dark color. There are in all five beds of ore exposed in the cliffs upon the northern side of Bell Island. Three of these extend over so small an area and are so thin that they are not of commercial value, and for this reason will not be here again referred to. The two lower beds are of larger size, and extend over wider areas.

The outcrop of this bed is seen in the cliffs on the north side of the island, its western extremity being at Ochre Cove and its eastern near Gull Island Head.

It is first met upon the tramway at a distance of 8,600 feet from the pier. From this point the distance is one mile to the eastern end of the outcrop, and two and one-half miles to the western end. At the open cut near the tramway the section shows ten feet of clean ore. At Gull Island head the bed is eight feet thick, and at Ochre Cove seven feet, the average of the whole bed being probably eight feet.

At the western end the dip is N. 19° E. 70°. This increases a few degrees going east, and the dip changes towards the north. Along this outcrop of 3½ miles not any dislocation of the strata has been found, and the ore is exposed over most of its extent. This gives unusual facilities for open-cut working. There is little doubt but that 200 feet of this outcrop can be mined open-cut over the greater part of this distance, giving 2,000,000 to 3,000,000 tons of ore. When this is worked out many times that amount can be mined underground with natural drainage.

From about 100 analyses made during the past year the composition of this ore is found to be:—

	Per cent.	Per cent.
Metallic iron.....	54.000	to 59.000
Silica	5.000	" 12.000
Alumina.....	2.000	" 4.000
Phosphorous500	" .700
Sulphur.....	Trace	" .012
Carbonate of lime	3.000	" 5.000
Oxide of manganese.....	Trace	" .400

THE UPPER BED.

At Station 101 on the tramway the outcrop of another bed of ore appears, overlying the first in stratification and six feet in thickness, the ore is fully equal to the lower bed, the average of eleven analyses from widely separate points giving 57 per cent. in metallic iron. While not extending over so large an area as the lower bed its boundaries are equally well defined, leaving no doubt as to the quantity of ore it contains. The exposure in the cliffs is quite regular at both the east and west ends, and the ore has been test-pitted along the outcrop between.

Over a great part of its extent this bed is denuded of the over-lying strata making it accessible over large areas for open-cut mining.

QUANTITY OF ORE.

The area of the lower bed upon Bell Island is 817½ acres. Counting 10 cubic feet of ore to the ton and considering the bed 8 feet thick which is a fair average.

$$\frac{817.5 \times 43560 \times 8}{10} = 28,488,240 \text{ tons.}$$

The area of the upper bed is 240 acres and its thickness 6 feet.

$$\frac{240 \times 43560 \times 6}{10} = 6,272,640 \text{ tons.}$$

This gives a total upon the island of 34,760,880 tons. The outcrop inland and the exposures in the cliffs give access to the beds from all sides.

SHIPPING FACILITIES.

Conception Bay, to the north east of Bell Island open gradually towards its mouth into the Atlantic Ocean, so that with northerly winds the side of the islands on which the ore is situated could not be used for shipping purposes, consequently shipping has to be done on the south side. A small beach near the east end and the situation of the island itself form a perfect shelter from northerly winds, and the mainland being close to hand on the south and east no ocean swell is to be feared from that direction, consequently the pier is so situated as to be perfectly safe from the wind from almost any quarter of the compass.

The waters of the bay are deep and free from rocks and shoals, the bottom being mud near the pier affords admirable anchorage.

Near the island the admiralty charts show from 8 to 14 fathoms of water on the southern, and from 6 to 20 fathoms on the northern shore. The bay is navigable from 8 to 9 months in the year.

METHOD OF WORKING.

The ore being obtained by open cut work from the outcrop an elaborate mining plant is not necessary. Two systems are employed for excavation. In the first the cars are run by gravity along a track of 2 ft. gauge to the working face, whence after being loaded they run, still by gravity, to the main tramway. This is made possible by a switch for empties being at the top while the switch for loaded cars is at the foot of a 10 per cent. grade. The track is shifted laterally to keep within loading distance of the receding face.

Another part of the outcrop is worked by a double travelling cable hoist of 300 ft. span. One span is used for stripping the surface, the other for excavating the ore. The towers with boilers and double drum engines are upon rollers capable of being moved in a direction parallel to the strike as the excavation proceeds. As before the empties are switched from the main tramway at the top of a grade and dropped by gravity beneath the cable. They are then conveyed by the cable carriage to any part of the working face, whence after loading they are again hoisted and placed in the full track leading to the main tramway. Upon any part of the ore being excavated the whole plant is moved upon the supporting tracks to new ground.

TRAMWAY.

From the mine the ore is conveyed over a double track tramway of 2 ft. gauge and two miles in length to the shipping pier; this is operated by an endless steel cable, $\frac{1}{2}$ in. in diameter, four miles in length. The alignment is perfectly straight. The cable is supported by wooden rollers 25 ft. apart, while at the apices of the grades iron pulleys 2 ft. in diameter are placed. The cable is kept in proper tension by counter-balance weights. The power house contains two upright tubular boilers and a double cylinder stationary engine geared 1 to 20 to two 6 ft. 6 in. bull wheels. One of these operates the cable for the line now working, the other is spare, for any road it may be found necessary to construct.

HAULAGE PLANT.

1st. The original plant was erected in 1895 with the idea of supplying ore to the Ferrona Furnace of the Nova Scotia Steel Company. This called for an output of only 200 tons per day, with a possible increase to 500 tons.

This plant consisted of a hopper pier of 2,000 tons storage capacity, and an endless rope tramway connecting the pier with the mine. The haulage engine was at the mine. The mining being simply quarry work, did not require an elaborate outfit.

2nd. All demands for ore were easily met by this arrangement until the summer of 1898, when the possibility of shipping ore to the European markets called for an increase. The experience of the previous two years had shown the necessity of increased storage capacity at the pier in order to give quicker despatch to steamers. It was estimated that an extension of the system of pier hoppers would cost over \$100,000 for an increased capacity of 10,000 tons, whereas the excavation of pockets in the rock ashore would give a capacity of 20,000 tons for an outlay of \$40,000. The latter plan was adopted, the contemplated output being 2,000 tons per day. To carry the ore from bins to steamer, a distance of 550 feet, a horizontal conveyor was put in. This was designed and made by the Nova Scotia Steel Company, and contemplated a capacity of 600 tons per hour at a speed of 100 feet per minute. In operation, however, by increasing the speed, it has easily hauled 1,100 tons per hour, including stops for shifting the ship, so that the actual working capacity has probably reached 1,400 tons per hour.

To supply the additional ore for this output tramways were built along the crop of the lower bed of ore 2,600 feet east and 6,500 feet west. Quarries were opened at the end of each line. These branch lines were operated by endless cables driven by bull wheels at the central station which received their motion from a shaft driven by a bull wheel on the main cable. To minimize the handling of coal, a new haulage engine was placed at the pier. It is a compound condensing engine with cylinders 13 in. and 26 in. diameter by 4 ft. stroke, and receives steam from three vertical tubular boilers.

During the season of 1899, this plant easily met the requirements. There were sixty-nine steamers loaded of an average carrying capacity of 4,500 tons each, the total shipments for the year being 302,000 tons. The record for quickest loading was on Sept. 28th, when the *Claudius* was loaded with 6,000 tons in five hours and fifty minutes, or over 1,000 tons per hour.

3rd. The sale of a part of these ore deposits to the Dominion Iron and Steel Co. took place in the summer of 1899 and comprised the lower of two parallel beds of ore, together with the equipment. This company contemplates a consumption of 800,000 tons of ore per year in its furnaces at Sydney. This, taking into account the length of the working season at Wabana, means an output of 5,000 tons per day. To meet this increase, a tramway has been built direct to the west mine from the pier, and additional haulage machinery installed to operate it.

Several new openings along the tramways running east and west from the old central station have been made. These will deliver their ore over the old system, while all the ore from the West Mine, where the facilities for working are unusually good, will come over the tramway just built. These lines can be operated separately and independently of each other.

To the west of West Mine is an outcrop on the lower bed of one and a half miles along which it is the intention to construct a tramway operated by cable. On completion of this line every part of the outcrop of both beds will be reached.

To meet their sales for 1900 the Nova Scotia Steel Company have constructed a new pier half a mile to the west of the old one and fitted up a tramway connecting with their new mines on the upper seam of ore. The water at the pier has a depth of over 27 ft. at low tide. A conveyer is erected, similar in type to the first one, but with larger buckets, which should give it a somewhat larger capacity. This conveyer

will bring ore from pockets in the rock having a capacity of 40,000 tons. To construct these pockets, advantage was taken of a natural gulch on the shore, giving a large capacity without an excessive amount of excavation.

The tramway has branches extending east 3,600 feet and west 4,100 feet along the crop of the upper bed.

Instead of separate cables for the side lines, in this system one rope operates the main line and branches. It is six and three-quarter miles long, of one inch diameter plough steel, Lang's lay. Travelling at a speed of 240 feet a minute with cars spaced eighty feet apart, it should haul 300 tons an hour, or with a very large reduction in stops, should easily handle 2,500 tons per day.

The mining from the upper bed, as from the lower, consists simply of quarry work. There are in it from 1,500,000 to 2,000,000 tons which can be won by open cut.

Underground mining has not yet been commenced in the district. The situation of the beds, however, is unusually favorable for its prosecution. The character of the ore in the two beds is very similar with one or two per cent. of metallic iron in favour of the contents of upper bed.

The Newfoundland party left St. John's on Tuesday, September 4th, by the s.s. Bonavista, which Mr. Whitney had kindly placed at their disposal for the trip to Sydney.

The sail across was delightful, the genial Captain Fraser being assiduous in his attention to the comfort and pleasure of the whole party. Sydney was reached on Thursday in time to make connections with the Intercolonial Lewis express. This terminated a memorable outing, brimful of interest and enjoyment.

SOME VALUABLE OPINIONS.

The following statements made by some of the leading members of The American Institute of Mining Engineers and others—and which were endorsed by all—serve to show how greatly they appreciated the generous hospitality accorded them everywhere, and what a high opinion they have formed of the outlook for the future development of the mining and industrial interests of Nova Scotia:—

DR. JAMES DOUGLAS, president of the American Institute of Mining Engineers, said:—There is no question whatever that the conditions existing in Pictou County and in Cape Breton offer the iron industry more favorable advantages than anywhere upon this continent, as coal, iron and limestone co-exist on navigable ocean harbors. As to the ultimate extent of the industry, that of course will depend upon the accessibility and availability of iron ores in sufficient quantity to satisfy such demands as iron and steel works of modern dimensions will require. The only debatable questions at Cape Breton are probably the possibility of so washing the coal as to reduce the sulphur to a percentage applicable to the manufacture of steel, and making the mixture of iron ores in the large proportion to the very cheap Bell Island ore low enough in phosphorus for steel manufacture. If these two problems can be satisfactorily solved, it seems practically certain that a steel industry of almost world-wide importance will be built up, but in any case it is certain that pig-iron will be made at a figure that will compete with that of almost any other of the iron regions of either continent. Of course the works at Sydney, as planned and so far executed, are of the very highest standard of modern requirements.

DR. RAYMOND, secretary of the American Institute of Mining Engineers, stated that this was the fifth meeting which the Institute had held held in Canada. The first meeting in Canada was in 1879 in Montreal, the second in 1885 in Halifax (on which occasion different parties made excursions into a portion of Cape Breton), the third was in 1889 in Ottawa, the fourth in 1893 in Montreal, and now the fifth this year in Sydney, Cape Breton. Dr. Raymond added that he had always enjoyed coming to Canada, and that on this occasion they had been most hospitably entertained; in fact, everything in a social way was carried out in the most perfect manner. Speaking of the works of the Dominion Iron and Steel Company, Dr. Raymond said: It is a very large enterprise, and there is no reason why they should not make for themselves a splendid position in the iron and steel world. They have a magnificent ore supply, fuel at hand, and limestone close by, and the ultimate result will be, so far as I can see, to make iron and steel cheaper. The plant is certainly a first-rate one.

MR. C. S. HINCHMAN, of Pennsylvania: I have been to Quebec before, but that town is one that is unique in our history, and in the history of this continent, and with the history of the French intercolonial war scenes around it, it will always be an attractive spot to tourists, and especially to those who have any drawing towards historical points. And then that splendid hotel, the Chateau Frontenac, is run in a way that will always attract people of refined tastes. I met several of my friends who had been there for a week, and one, a former officer of the Pennsylvania Railroad, was simply in ecstasies over the view to be obtained from the Dufferin Terrace and the Citadel. From the time we entered Canadian Territory down to Sydney and back we have been more than hospitably welcomed; we have been received with open arms everywhere. The Dominion Coal Company's mines which we visited at Sydney and vicinity and the iron and

steel works being erected there were almost a revelation to us, all being much better than we had expected to see. I believe the Dominion Coal Company has a great future before it. The ore that we saw from Bell Island will make a good iron; there is no doubt about that, for pipe and foundry purposes. The layout of the steel works is according to the most modern practice, and I think they will handle all the material at a minimum of cost. Sydney is very well situated with respect to the coal and ore being close together, and both the ore and limestone supplies for the furnaces and the export and delivery can be made by water, which will always give them low rates, as railways will have to make corresponding rates in order to secure the trade. It is by far the nearest point to England and the Continent of any large producing iron district on this side of the water, and in that respect they will have the advantage in distance and time over the other iron districts of North America. Among the largest works of their kind in the Eastern States are The Steelton Works, three miles from Harrisburg on the main line of the Pennsylvania Railway, and the Maryland Steel Company at Sparrow's Point, Baltimore, where they make both architectural steel bridges and ships. They use the Cornwall ores of the Lebanon Valley and the Juragua Iron Company's ores from Santiago de Cuba, but the Cape Breton works are bound to stand the best show for exporting pig to England, both from the low cost and from the shorter distance which they have to transport it to England. There is no question in my mind but that Nova Scotia is going to attract a good class of settlers, and that there is room for doubling up her population at the present demand for coal miners. The special large demand for labor will be for coal and iron. Mr. Hinchman is prominently connected with the leading railroad systems of Pennsylvania, and he added that the Intercolonial Railway was in a much better shape, and the improvement of the line was very noticeable. There was good railway administration, and the trains were on time. Considering the conditions of the country and the trade, he thought the road was fully up to all modern requirements of railway travel.

MR. WILLIAM KELLY, of Vulcan, Mich.: I think the Dominion Iron and Steel Company at Sydney has a splendid future before it. The works appear to be laid out in a systematic and business-like way. The great point about the works is the nearness of the coal, and it looks as if they could most successfully compete in the English market. The physical characteristics of the iron ore is very good. I have been delighted with the way we have been entertained. The arrangements have been simply perfect from the time we left Levis until our return. We cannot imagine it possible for any more to have been done, and it is one of the most delightful meetings it has ever been my privilege to attend.

MR. GEORGE F. BARR is connected with the active management of the Reading Railway, and president of the iron department, and also a director of the coal company. He said: I am more than delighted with the general appearance of the country and with the great kindness and hospitality of the people. They are earnestly at work determined to develop their natural resources, and the progress being made marks one of the new developments in America. No money has been spared to thoroughly equip the plant, and under the intelligent management of the men now in charge I have no doubt that satisfactory results will be obtained.

MR. HORACE SEE, naval architect and consulting engineer, of New York: The development of coal and the production of steel in the Dominion of Canada presents great possibilities for the development of modern ship building. It will add greatly to the wealth of the Dominion, and will furnish an opening for the use of the coal and steel produced. We are greatly indebted for the hospitality that has been extended to us, together with the opportunity of seeing what has been done and what is contemplated for the development of the mining industries of the provinces. The proximity of the coal, iron and limestone will be great factors in this development.

MR. W. J. WRIGHTSON, of Darlington, Eng., and who is connected with the Cranington Colliery, of Northumberland, Eng., said: By the courtesy of the American Mining Institute I was allowed to join them in their visit to Nova Scotia. The hospitality that I have received, not only from them, but also the Canadian Mining Institute and the Dominion Coal Company—in fact every place we visited—has been unlimited. The resources of coal in Cape Breton are enormous, and as yet practically untouched, the Dominion Company having a royalty of 160 square miles. The mining plant they have put up and are putting up is of the most labor-saving type. The cost of production of coal is very much below that of England, chiefly from the size of seam and use of coal cutting machinery, and the handling of coal in large quantities. With regard to hand picking, several letters have appeared in various papers saying the English coal

miner's average output per day, viz., 3½ tons, is very much below other countries. This is hardly a fair comparison. The Canadian miner undercuts his coal only, and a loader shoots and fills it, and he gets 6 tons a day. The English miner undercuts his coal, shoots it down and fills it himself. I am sure it would pay any colliery mining engineer to visit these mines, especially when the new shafts are completed.

Dr. W. I. GOODWIN, of the School of Mines, Kingston, Ont., said—The Dominion Iron and Steel Company's Works at Sydney strike one as being very large and very solid, and they seem to have all the factors for the development of the most important industries with coal and iron as a basis and under the most favourable circumstances. They are able to assemble their raw materials by water transport without excessive handling, and they have shipping facilities which can hardly be paralleled. The supply of Bell Island ore seems to be very large, but it is said that the quality is not suitable for Bessemer steel. This, however, does not debar its use for a basic process. The factor of ore is one which might possibly be considered an uncertain one, but it is stated that coal can be carried to Lake Superior and return with a freight of ore brought down at a cost which will enable the Company to produce iron from Lake Superior ores at a cost not exceeding that of the Pennsylvania companies. If this can be done another result will follow. If coal can be laid down in Ontario at such rates as to enable the Ontario iron producers to compete with all comers in so far as local demand is concerned, irrespective of artificial restrictions; given a favourable outcome from the trial of the quality of the coal and the problem of the ore, the companies in Cape Breton should be able to compete in the world's markets under the most favourable conditions, and there seems to be no limit to the development that may follow. Coal in the first place, and iron in the second place, are the basis of all great manufactures, and it will naturally follow that Cape Breton, and indeed the whole of Nova Scotia will in process of time become a land of manufactories. In fact, we can only compare the outlook here with the industrial development of Great Britain. The present output of coal, estimated at 1,500,000 tons, is indeed small when compared with that of some of the great Pennsylvania producers, but what we saw in Cape Breton convinces us that this output can be increased to almost any extent when the circumstances of the trade and manufactures warrant it. For example, Liverpool and other ports of the Old World can be reached by a very much shorter course than from any ports in the United States. The arrangements for the excursion have been conceived and carried out from first to last with the most pleasant and profitable results. Almost without a hitch we have been carried through a great variety of country, and have been comfortably housed and fed. With regard to the transportation, not the slightest fault could be found. The officers of the Intercolonial Railway have been with us at every point, and one who has watched carefully is able to testify that quietly and unobtrusively they have been looking after us and seeing that our trip went on smoothly and pleasantly. As to our reception at the different points visited, here our thanks are almost too full for utterance. The heartiness and desire to please have been very evident. We have had luncheons and band music and hand shaking, and a general hurrah all along the line, so that our spirits have never had an opportunity to flag. All this good fellowship and making acquaintances must result in a better understanding between the men of the different Provinces, and also between Canadians and the mining men of the United States. It will doubtless have its material results in an increased overflow of capital into Nova Scotia, because we are confident that increased knowledge of the country will inevitably be increased confidence on the part of those who have money to invest in it.

MR. WALTER WOOD, of Philadelphia, went with a party of six to Newfoundland on Thursday, August 23rd. Besides Mr. Wood the party was composed of Dr. Drown, President of the Lehigh University; Dr. Ladd, President of the School of Mines for the State of Missouri; Mr. Walter Hinchman, Treasurer of the Denver & Rio Grande Railroad; Mr. J. W. Dougherty, Assistant Superintendent of the International Tube Works, of Wheeling, Va. Upon his rejoining the excursion party Mr. Wood made the following statement:—The general impression we received was of an island section of country that has heretofore been given over entirely to the one industry of fishing, and in which agriculture, except for dairy interests, has been almost entirely neglected. The possibilities of the extension of agriculture through Newfoundland will depend upon their getting a hardy race of farmers who have been accustomed to the restricted opportunities of Europe, or from the mainland close by, to whom the conditions of opening up a new country, and in a cold climate, will not be forbidding. The interior of the Island, on account of its previous history, has, up to the pre-

sent time, been so largely neglected that there are scarcely any inhabitants, and so completely so that the natural game of the country is almost untouched. It is impossible to judge of its lumber resources from what one sees from the railroad, but the water courses and lakes that exist will make the handling of whatever is off the line of transportation cheap and easy. The western coast gives the best promise for farming operations, as in the centre of the Island there are extensive and large peat bogs, and it is also considerably covered by very heavy glacial deposits and large gravel. The proprietors of the railroad and steamships, having received the right to locate an extensive acreage at their pleasure at any unoccupied portion of the Island, are engaged in systematically and energetically prospecting for minerals. They have already located what appears to be good prospects for copper, iron, asbestos and chrome ore. How far this will march into extensive enterprise it is impossible to determine at the present time, though one or two large operations at present exist. The iron ore on Bell Island is well defined in two parallel veins which occupy the northern side of the Island, which rises boldly out of the water. A large portion of this ore can be mined by stripping, but probably the greater portion must be gotten out by underground workings, all, however, above sea level. The quality of the ore, where it goes below the water level, has, so far as we heard, not been carefully and thoroughly prospected, but it is hoped and anticipated that some mines will be found to be workable under the ocean and beyond the shores of the Island. Each of the veins vary from three to thirteen feet in thickness of an ore running 40 to 50 per cent. in quality, and rather high in phosphorous. The handling of the ore for shipment is done most economically by rope haulage over the surface, by which it is carried to the south of the Island and discharged into large natural bins built into the cavities of the cliffs. There are two shipping piers, the bins at which can hold about 15,000 tons of ore. The height of the cliffs is such that they can be discharged from their bottom into a carrier which conveys the ore to a steamship where the loading is done by gravity. About 1,000 to 1,300 tons of ore can be handled by these conveyors per hour. The whole system of mining and deliverage to vessel is thus done most cheaply. The owners of the upper seam claim to have sold a large tonnage during 1899 for delivery at Rotterdam at \$3.15 per ton, the cost of delivery being eight shillings per ton. They claim that the remainder, viz., \$1.25 per ton, left them abundant and satisfactory profits. The general impression of the party, so far as I could gather, of the operations in Sydney, was that they had been legitimately undertaken and are based upon the low cost of the raw materials. The iron that it is proposed to make, being high in phosphorous, will chiefly have to be used for the manufacture of open hearth steel, which will find a ready market. Every appliance for the economical handling of raw materials seems to have been adopted, so that the cost of the finished product ought to compare most favorably, when distance of market is considered, with the most favorable costs in any other locality. Everyone has been agreeably surprised with the courtesies and hospitalities that have been extended to the party, and the ample and thorough opportunities of

investigating all the mineral resources of Nova Scotia, Cape Breton and Newfoundland. No pains have been spared to make the excursion entirely successful, so that we all go home feeling a strong interest in that progress and development that is in the future assured to the country.

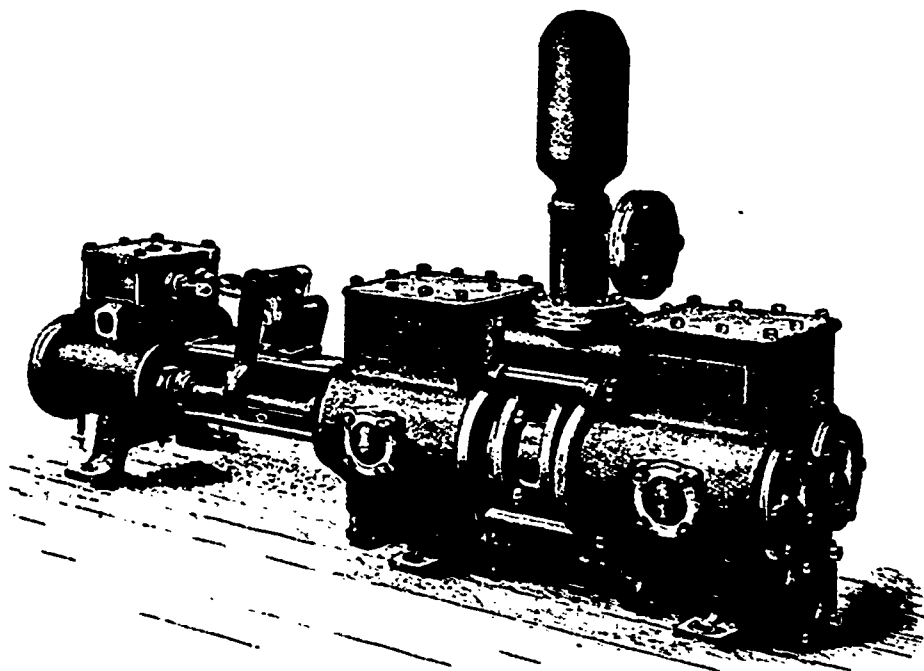
MR. W. S. EDWARDS, Mining Engineer, New York, a gentleman of large experience in working mines in Arizona, and other parts of the Western States, said:—I can see no reason why a successful shipbuilding industry should not be established within a very few years on Sydney Harbour.

MR. B. T. A. BRILL, Secretary of the Canadian Mining Institute:—I have of course been acquainted with these developments in Cape Breton, but the extent of the plant at present under construction of the Dominion Iron & Steel has been a revelation to me. These works will be an everlasting monument not only to the pluck and enterprise of Mr. Whitney, but also to the foresight and sagacity of the Hon. Mr. Fielding and his associates in the Nova Scotia administration.

ELECTRIC BLASTING CARTRIDGE.—An Italian electrician has invented an electric cartridge, which he offers as a substitute for dynamite and smokeless powder, for mines, rock-blasting, and heavy ordnance. The composition used in the cartridge is made up of carbonates of potash and chloride of ammonia, the proportion varying according as it is to be used for blasting effects in rock work or powder effects in ordnance. The discharge is effected by an electric current or spark, which produces instantaneous electrolytic effects upon the chemicals, which are contained in separated compartments of the cartridge. The inventor claims that the cartridges, until subjected to the effect of electricity, are entirely inoffensive and perfectly safe, so that there will be no necessity for isolating the magazines where they are stored.

PYRITES MINING AT CAPELTON, QUE.—During the year 1899, the Capelton copper mines were worked regularly by the Eustis Mining Company and the Nichols Chemical Company. Some work was also done on the Ascot Mine. The total output was 38,928 gross tons of the low grade ore in the environs of Sherbrooke, of a value at the mine of \$157,062, of which 23,728 tons were shipped to the United States, while the remainder was used on the spot.

NEW WEDGE FOR COAL GETTING.—The new wedge introduced by Hay and Voiseux consists mainly of a conical steel screw fitted with a handle for turning and a split nut. The sectional drawings, given in the "Colliery Guardian," show the relative positions of screw and nut in different stages of advancement. If when the screw has been driven up to its thickest part the coal refuses to split, the screw and nut can be withdrawn, and the latter replaced by a thicker split nut, and thus a greater pressure is brought to bear on the walls of the bore-hole. To set the wedge ready for use the split nut is placed on the small edge of the tapering screw, the two together being then inserted in the bore-hole, which the nut should just about fit.



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The screw is next screwed up by hand as far as it will go, a wrench or some other form of leverage being employed to drive it home, the effect being to drive the two halves of the split nut apart. The latter in this way act the part of a wedge, and rive the coal. As their outward movement is only gradual, the nature of the fissure produced is under control, since the slower the pressure is exerted the fewer and more extensive are the cracks formed; consequently it is said that the coal can be split off in large blocks with a minimum of smalls.

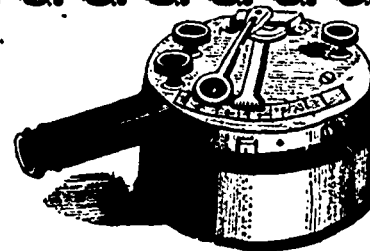
This is a powerful wedge, simple, and of few parts; the only objection we see in its construction is that the screw in the split nut must be cut to suit the largest diameter of the screw. It must be worked, however, a great deal with smaller diameters. This being the case the nut will become worn most along the middle at top and bottom. That is merely a matter of durability; it does not affect its efficiency as a wedge.

AN ORE UNLOADER.—To facilitate the transfer of ore from vessels to the cars, an unloader has been designed in the United States which is said to accomplish more in the same time than any other machine of its kind now in use. It is known as the Hulet automatic unloader, and has removed cargo at the rate of 300 tons an hour. An excellent illustration of the machine is given in the "Engineer" of March 30th. Mounted on a rail-road track, it is moved along the dock to a point opposite the hatchway of the steamer or barge. On the frame of the machine is a trolley, which carries a cylinder that moves the trolley to and from the boat. Pivoted to this trolley is a walking-beam, which is operated by a cylinder secured to the same for raising and lowering the outer end over the boat. Pivoted to the outer end of the walking beam is a depending mast or leg; this leg being mounted on rollers, swings a complete circle. At the lower end of this leg is a shoe, and secured to the shoe is a "clam shell" bucket holding ten tons of ore. This bucket is worked by hydraulic cylinders. By turning the mast the bucket has a reach of 20 feet, and can be filled under the deck of a boat. About 25 horse-power is utilised in moving the unloader up and down the track, and the same boiler is used in working a steam accumulator giving hydraulic pressure which is also communicated to the cylinders of the superstructure. In removing the cargoes of vessels carrying 4,000 and 5,000 tons, i. is intended to employ an unloader at each hatch, transferring the ore, coal, or other freight from the hold to the shore at the rate of 1,000 to 1,200 tons an hour.

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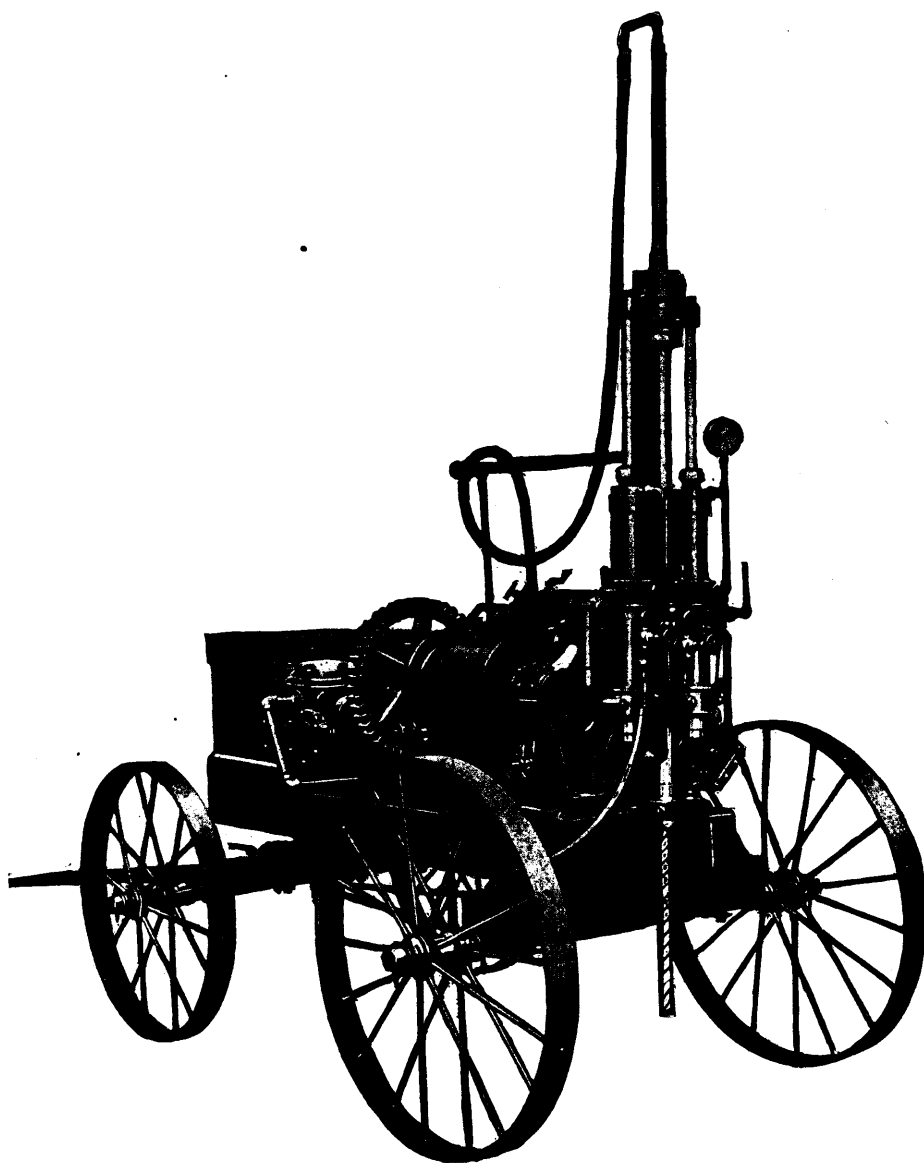
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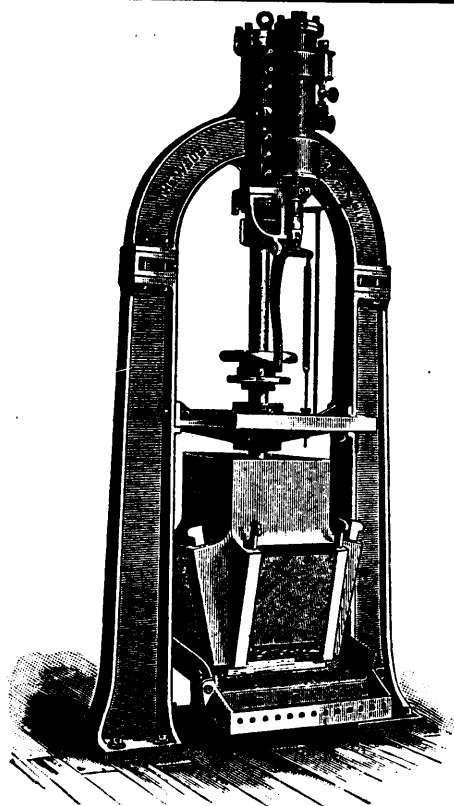
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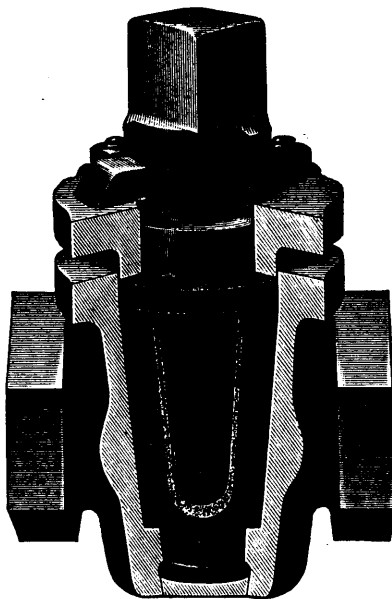
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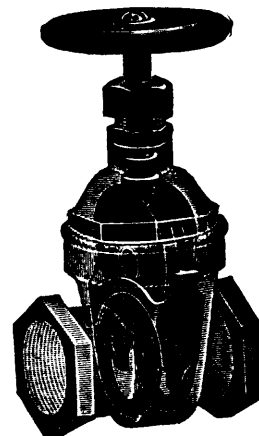
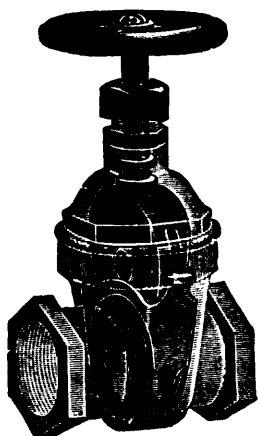
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Licenses to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department for a nominal fee, and provision is made for lessees and licensees whereby they can acquire promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are: Copper, four cents on every unit; Lead, two cents upon every unit; Iron, five cents on every ton; Tin and Precious Stones; five per cent.; Coal, 10 cents on every ton sold.

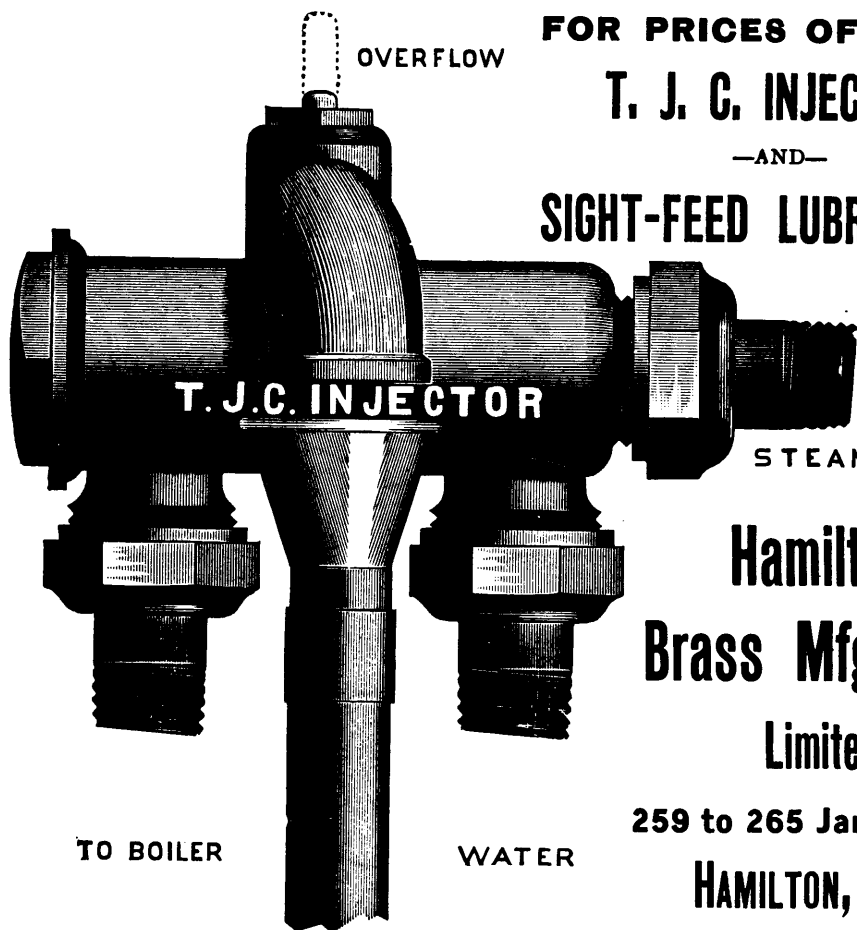
The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

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Commissioner Public Works and Mines,

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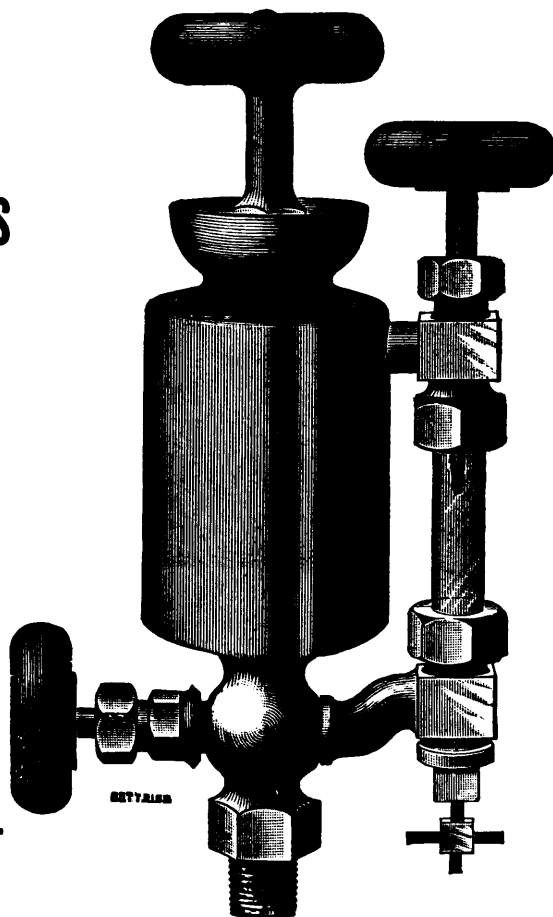


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It has been a pleasure year by year to welcome the successive issues of this valuable work, and to express our recognition and appreciation of its increasing interest and value. The *Canadian Mining Manual and Mining Companies Year Book* is the best volume of its kind published either in the Canadian Dominion or elsewhere. To all those, whether resident in Canada and immediately interested in the mineral resources and works, or resident elsewhere, but likely to have a personal and direct association with Industrial Canada, the book is simply invaluable. We know no other man so competent as our friend, Mr. B. T. A. Bell; and we do not think that even he has ever given better proof of his industrial Editorial talents than in this particular publication. We shall have further opportunities of placing before our readers some of the fascinating information of which the book is full; we content ourselves at present with saying that the present issue excels all its predecessors, and is a magnificent four dollars worth.—Dr. C. M. Percy in the *Science and Art of Mining*.

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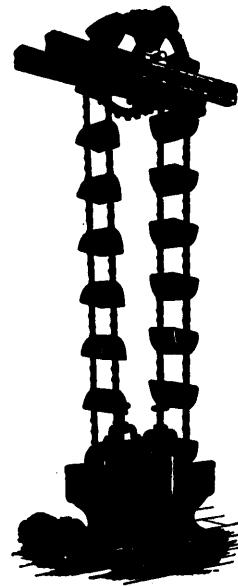
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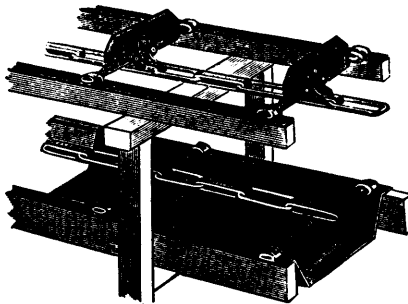


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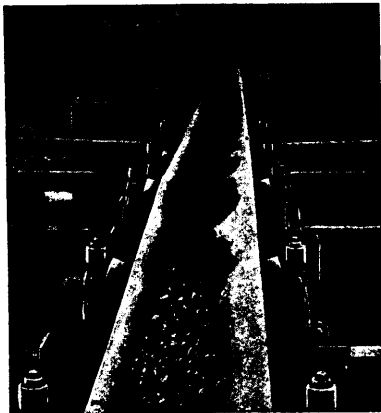
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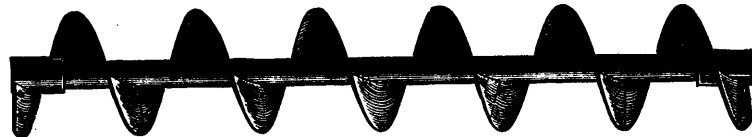
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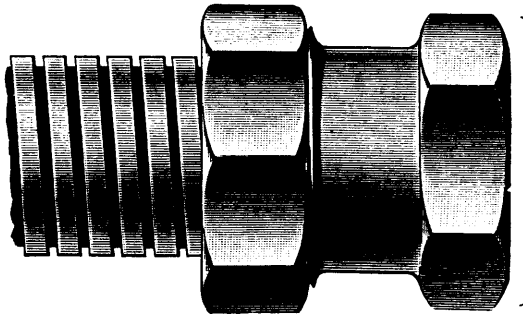
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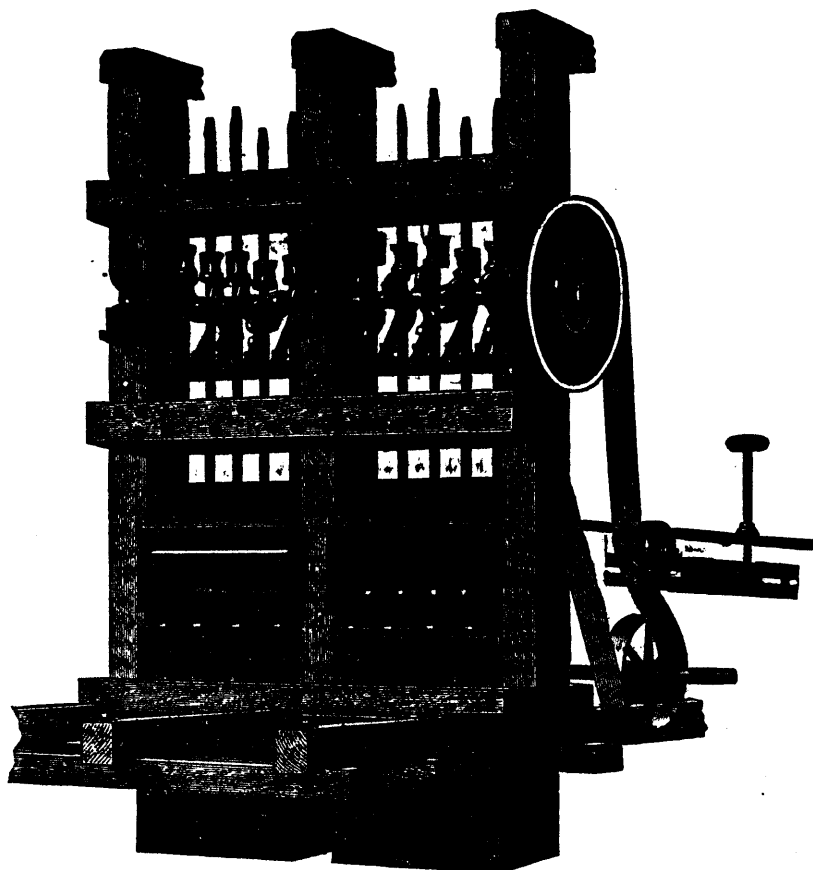
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