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No. 19.

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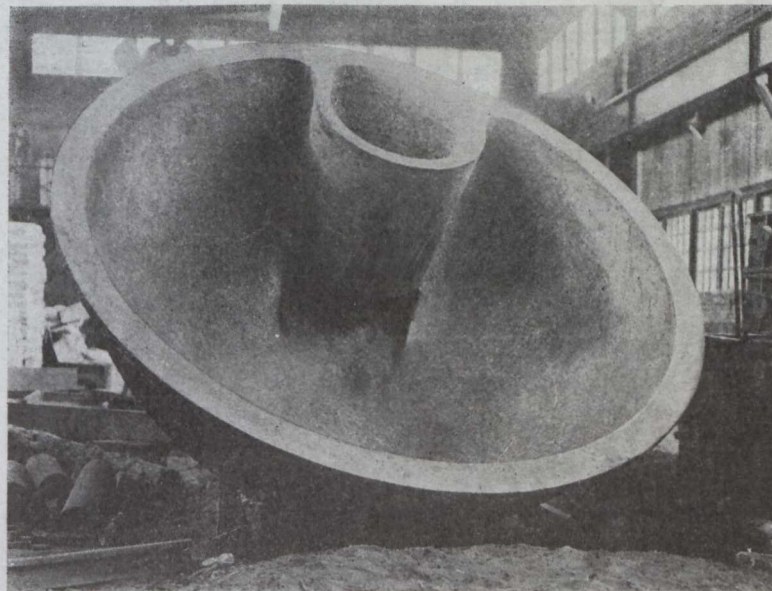
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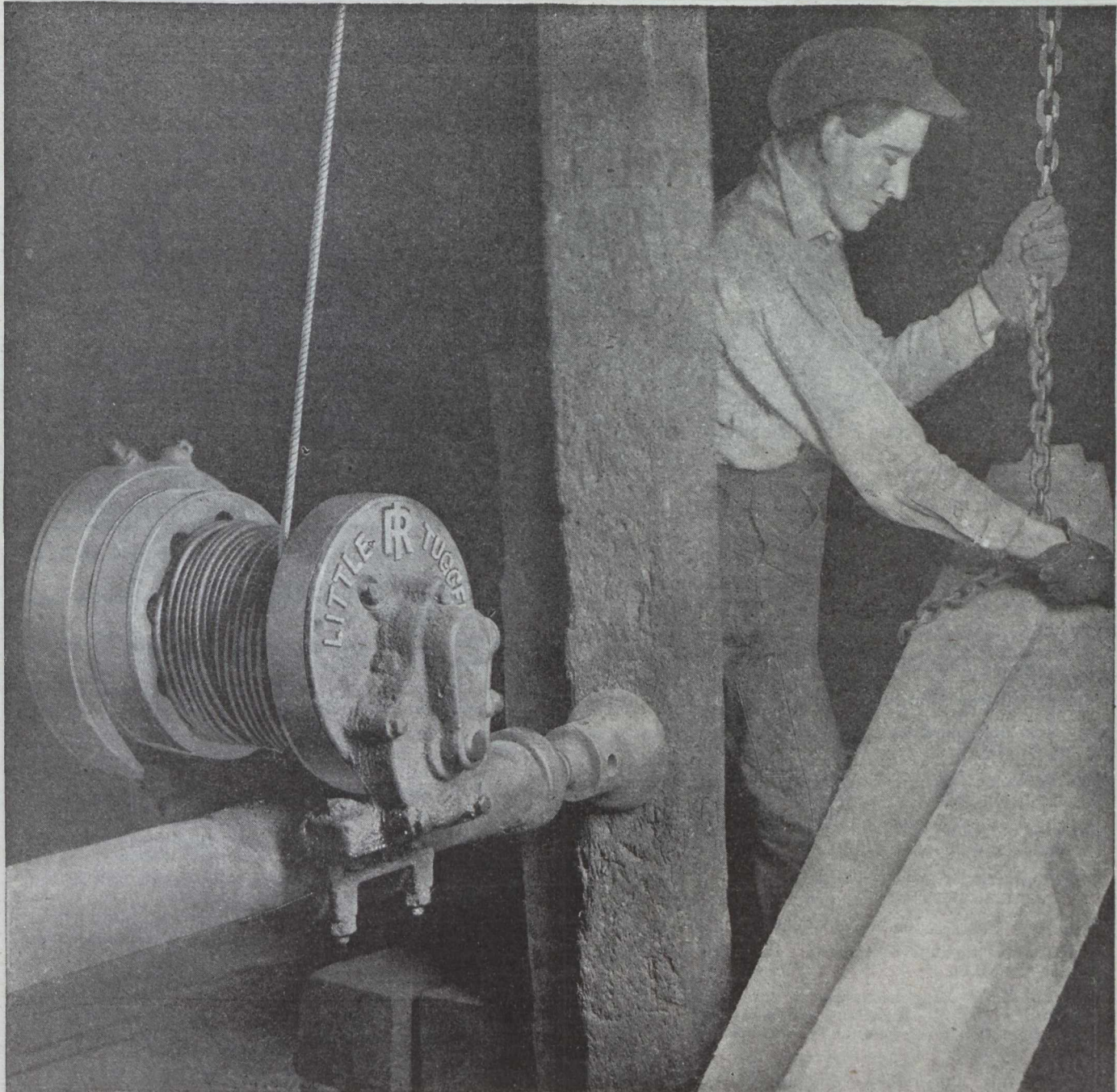
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Recent Publications

Iron Ore Occurrences in Canada, Vol. II. Compiled by E. Lindeman, M.E., and L. L. Bolton, M.A., B.Sc. Introductory by A. H. A. Robinson, B.A.Sc.

The Copper Smelting Industry of Canada. Report on, by A. W. G. Wilson, Ph.D.

Building and Ornamental Stones of Canada (British Columbia). Vol. V., by W. A. Parks, Ph.D.

Peat, Lignite and Coal; their value as fuels for the production of gas and power in the by-product, recovery producer. Report on, by B. F. Haanel, B.Sc.

Annual Mineral Production Reports, by J. McLeish, B.A.

The Coal-fields and Coal Industry of Eastern Canada, by F. W. Gray.

The Value of Peat Fuel for the Generation of Steam, by J. Blizard, B.Sc.

Analyses of Canadian Fuels. Parts I to V, by E. Stansfield, M.Sc., and J. H. H. Nicolls, M.Sc.

Clay Resources of Southern Saskatchewan, by N. B. Davis, M.A., B.Sc.

Summary Report of the Mines Branch, 1918.

The Mineral Springs of Canada. Part II., by R. T. Elworthy, B.Sc.

The Mines Branch maintains the following laboratories in which investigations are made with a view to assisting in the development of the general mining industries of Canada:—

Fuel Testing Laboratory.—Testing value of Canadian fuels for steam raising and production of power gas; analyses, and other chemical and physical examinations of solid, liquid and gaseous fuels are also made.

Ore-Dressing Laboratory.—Testing of Canadian ores and minerals, to ascertain most economical methods of treatment.

Chemical Laboratory.—Analysing and assaying of all mineral substances and their manufactured products. Copies of schedules of fees, which are slightly in excess of those charged by private practitioners, may be had on application.

Ceramic Laboratory.—Equipment is such that complete physical tests on clays and shale of the Dominion can be made, to determine their value from an economic standpoint.

Structural Materials Laboratory.—Experimental work on sands, cements and limes is also undertaken.

Applications for reports and particulars relative to having investigations made in the several laboratories should be addressed to The Director, Mines Branch, Department of Mines, Ottawa.

GEOLOGICAL SURVEY

Recent Publications

Summary Report. The annual Summary Report of the Geological Survey is now printed in parts. Applicants should therefore, state what particular geologist's report is required, or what subjects they are interested in.

Memoir 105. Amisk-Athapapuskow Lake district, by E. L. Bruce.

Memoir 108. The Mackenzie River basin, by Charles Camsell and Wyatt Malcolm.

Memoir 109. The Harricanaw-Turgeon basin, northern Quebec, by T. L. Tanton.

Memoir 110. Preliminary report on the economic geology of Hazelton district, British Columbia, by J. J. O'Neill.

Memoir 111. The Silurian geology and faunas of Ontario peninsula and Manitoulin and adjacent islands, by M. Y. Williams.

Memoir 112. Geology of the district belt of southwestern Alberta, by J. S. Stewart.

Memoir 113. Geology and mineral deposits on a part of Amherst township, Quebec, by M. E. Wilson.

Memoir 114. Road material surveys in the city and district of Montreal, Quebec, by Henri Gauthier.

Memoir 116. Investigations in the gas and oil fields of Alberta, Saskatchewan and Manitoba, by D. B. Dowling, S. E. Slipper and F. H. McLearn.

Museum Bulletin 30. Gabbros of East Sooke and Rocky Point, by H. C. Cooke.

Map 164A. St. John, New Brunswick. Topography.

Map 183A. Harricanaw-Turgeon basin; Abitibi, Timiskaming and Pontiac, Que. Geology.

Map 1585. Mackenzie River basin. Geology.

Map 1680. Portions of Grenville, Harrington, Chatham and Wentworth townships, Argenteuil county, Quebec. Geology.

Map 1708. Bridge river, Lillooet district, B.C. Topography.

Map 1712. Foothills of Southern Alberta, St. Mary river to Highwood river. Geology.

Map 1714. The Niagara peninsula, Ontario. Geology.

Map 1715. The Ontario peninsula. Geology.

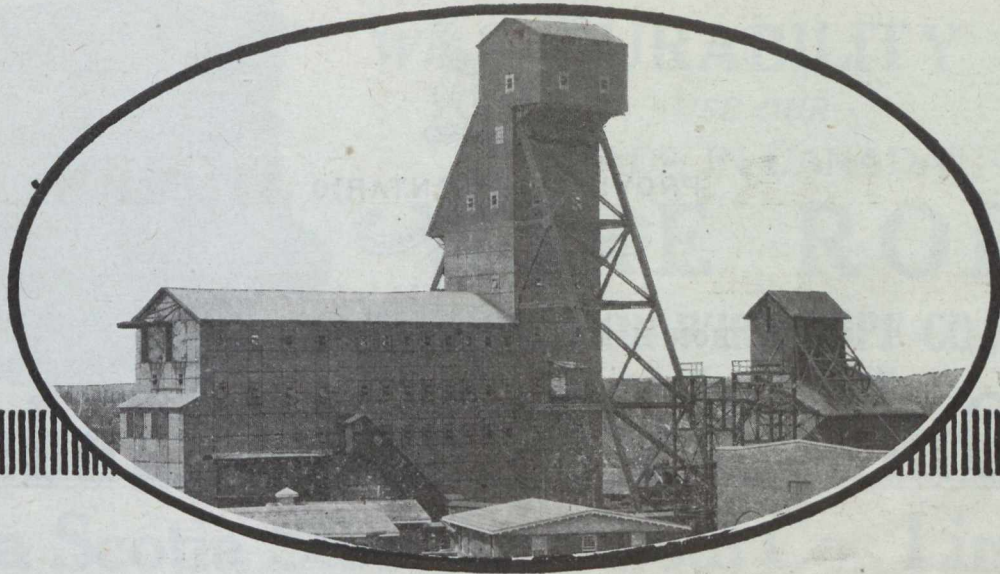
Map 1724. Sheep River, Alberta. Geology.

Map 1726. Athapapuskow Lake region. Geology.

Applicants for publications not listed above should mention the precise area concerning which information is desired.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon.

Communications should be addressed to The Director, Geological Survey, Ottawa.



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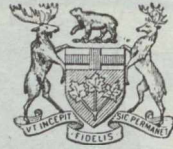
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Practically all economic minerals (with the exception of coal and tin) are found in Ontario:—actinolite, apatite, arsenic, asbestos, cobalt, corundum, feldspar, fluorspar, graphite, gypsum, iron pyrites, mica, molybdenite, natural gas, palladium, petroleum, platinum, quartz, salt and tale. This Province has the largest deposits on the continent of tale, feldspar, mica and graphite.

Building materials, such as ornamental marble, limestone sandstone, granite, trap, sand and gravel, meet every demand. Lime, Portland cement, brick and tile are manufactured within the Province.

Ontario in 1918 produced 45 per cent. of the total mineral output of Canada. Returns made to the Ontario Bureau of Mines show the output of the mines and metallurgical works of the Province for the year 1918 to be worth \$80,308,972 of which the metallic production was \$66,178,059.

Dividends and bonuses paid to the end of 1918 amounted to \$13,359,210 for gold mining companies, and \$74,810,521 for silver mining companies, or a total of \$88,169,733.

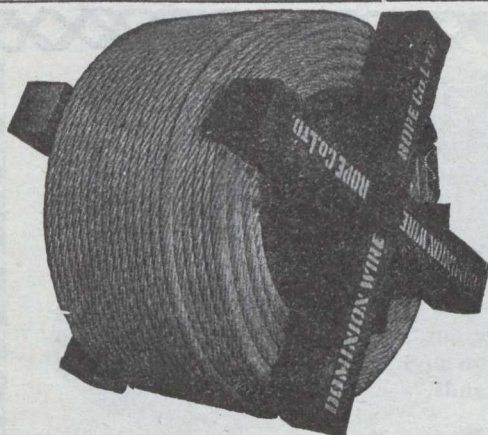
The prospector can go almost anywhere in the mineral regions in his canoe; the climate is invigorating and healthy, and there is plenty of wood and good water. Hydro-electric power is available in many parts of the Province, and many undeveloped water-powers remain to be harnessed. A miner's license costs \$5.00 per annum, and entitles the holder to stake out in any or every mining division three claims of 40 acres each. After performing 240 day's assessment work on a claim, patent may be obtained from the Crown on payment of \$2.50 or \$3.00 per acre, depending on location in surveyed or unsurveyed territory.

For list of publications, illustrated reports, geological maps and mining laws, apply to

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Coal Over six million tons of coal were produced in the province during 1916, making Nova Scotia by far the leader among the coal producing provinces of the Dominion.

Iron The province contains numerous districts in which occur various varieties of iron ore, practically at tide water and in touch with vast bodies of fluxes. Deposits of particularly high grade manganese ore occur at a number of different locations.

Gold Marked development has taken place in this industry the past several years. The gold fields of the province cover an area approximately 3,500 square miles. The gold is free milling and is from 870 to 970 fine.

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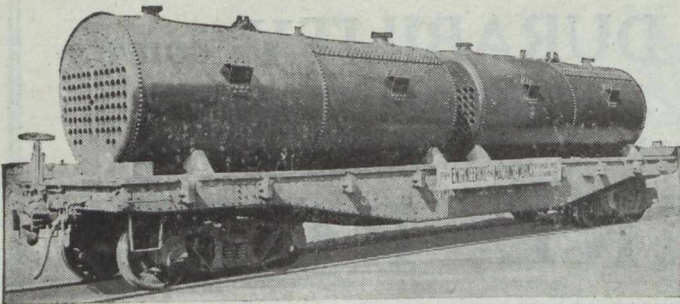
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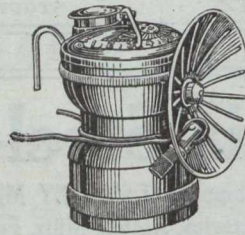
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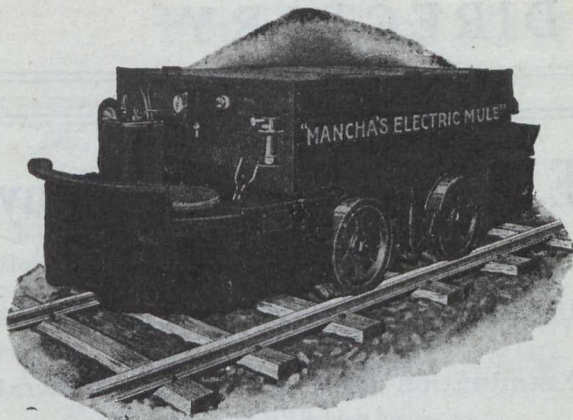
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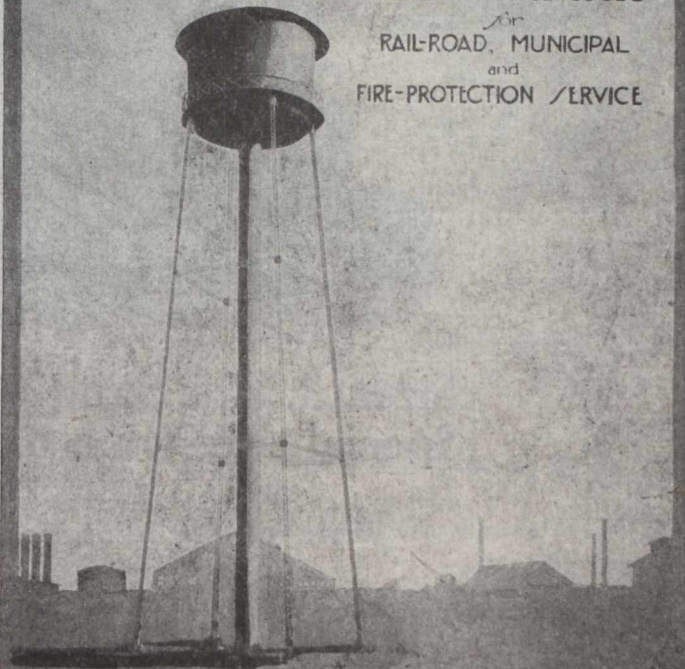
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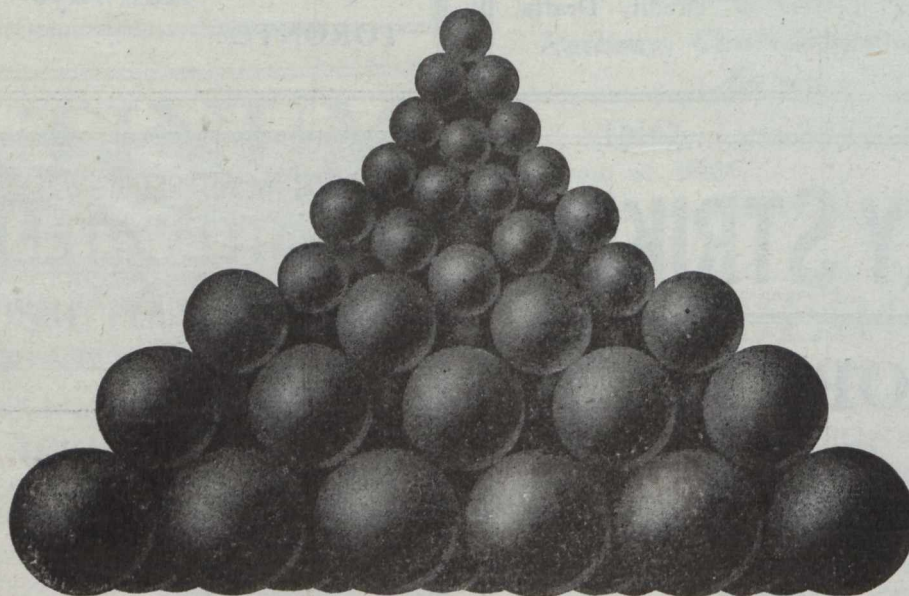
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CONTENTS

Pages 383 to 408.

THE TWENTY-EIGHTH ANNUAL MEETING OF THE MINING SOCIETY OF NOVA SCOTIA, Glace Bay, May 4th and 5th, 1920. (Reported by the Editor)	383
The Conservation and Drawing of Mine Timber By P. T. Prendergast. A paper read before the Mining Society of Nova Scotia	389
"Canadian Coal Men." Alexander S. McNeil . .	392
The Theory and Practice of Fighting Mine Fires, from Practical Experience Gained in Pictou County, N.S., by F. E. Notebaert. A paper read before the Mining Society of Nova Scotia	393
Coal Conservation Campaign. Engineers' & Fire- men's Year Book	398
Canada's Coal Bill. Cartoon from Racey in Mon- treal "Star"	398
Northern Ontario Letter	399
British Columbia Letter	401
Port Arthur Notes	403
Manitoba Notes	403
Fifteen Resignations from Geological Survey . .	404
Government Assistance Required for Ontario Iron Ore Mining, by J. J. O'Connor	404



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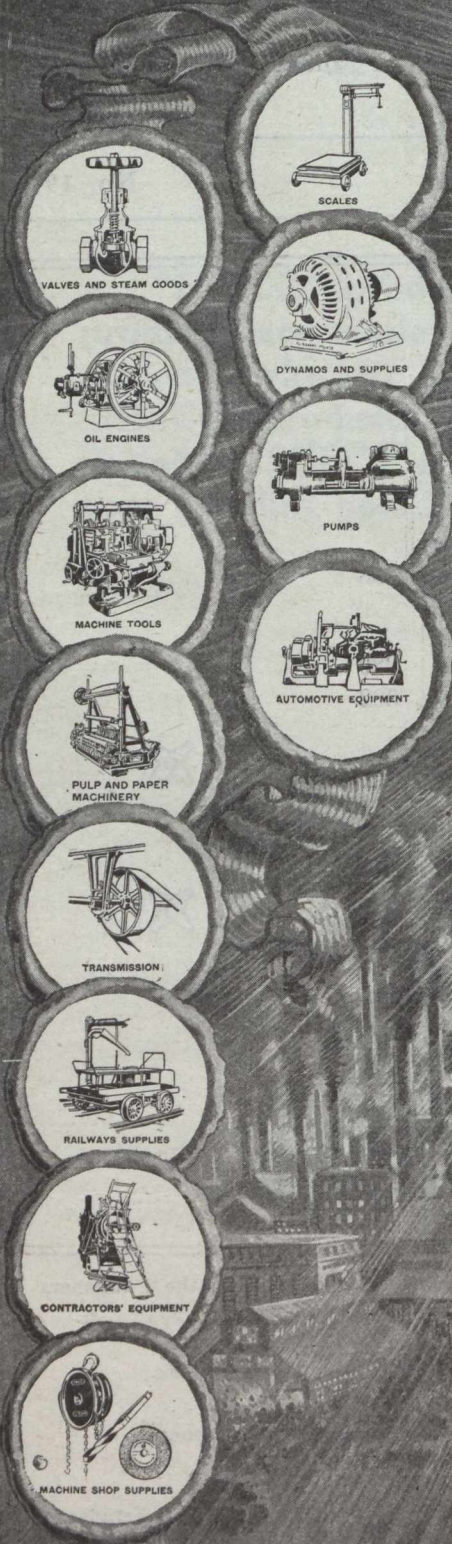
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The Mining Society of Nova Scotia.



Twenty- Eighth Annual Meeting

Glace Bay
May 4 and 5
1920

A Well Attended, Worth-While Meeting, with Conservation as its Key Note.

THE 28th Annual General Meeting of the Mining Society of Nova Scotia was, for the first time, held in Glace Bay, the centre of a mining district that has during its productive life added more wealth to Canada than any other mining district in the Dominion. In actual monetary value, according to current market prices, the Sydney coalfield has yielded a greater revenue, over a longer period of time, than any other mining operation in Canada, but the intrinsic value of the coal produced, regarded as a source of national energy, so far exceeds that of all other products of the mine as to make it proper and fitting that the Mining Society of Nova Scotia should meet in what its citizens are pleased to call "The Biggest Town," but unfortunately only known throughout the rest of Canada in inverse ratio to its real importance.

Not only has Glace Bay and its environs produced the major portion of the coal production of Canada, up to this date, but, until Alberta comes into its own as the greatest storehouse of Canadian coal, Glace Bay will continue to be the centre of the most important coal mining industry of our country. As the central point of access to the undersea coal areas, Glace Bay can never be lessened in importance until that day, far distant, and recessive in the ratio that human knowledge grows, when the extraction of the undersea coal will have grown too expensive to be profitable.

In the transactions of mining societies the name of Glace Bay will frequently recur in years that are to come, as the fascinating problem of profitably mining undersea coal seams develops new inventions, and as necessity compels novel methods of which the mining fraternity will be eager to learn. Some premonition of this enkindled the Glace Bay meeting, and the

dominant note in the papers and in the discussions was not that of things actually accomplished—although this note was not lacking—but dwelt upon things yet to come. There was a definite feeling that the coal mining practice of Nova Scotia was entering a new stage, that new difficulties would compel the adoption of new methods.

The keynote of the meeting was "Conservation," and, as will be seen from the papers that were read, in part reproduced in this issue, economies were suggested in regard to the supporting pillars in coal extraction, in connection with mine timber, waste heat and power economy, and in regard to labour turnover.

Thanks to the courtesy of the Dominion Coal Company, the new club-rooms of the company, recently provided for the staff, were put at the disposal of the Mining Society, thereby, in large part, making possible the unqualified success of the meeting.

About seventy members took part in the meeting, the interest of which was sustained from the opening. The President, Col. Thos. Cantley, who has had much experience of society meetings, remarked that he did not remember to have seen a larger attendance at the opening session.

The excellence of the attendance was matched by the quality of the papers, and the keenness of the discussions was a natural result of a gathering of men daily occupied and immersed in the problems dealt with by the papers. One eminent member of the profession deplored the sustained excellence of the papers as depriving him of all excuse for criticism.

Visitors from outside the immediate district of Glace Bay and the Sydneys included Mr. Hiram Donkin, the Deputy Commissioner of Mines, and Messrs. H. M. Wyld and H. C. Wright from Halifax, a re-

presentative deputation from Pictou County and Cumberland, and Mr. H. Y. Russel and the Editor from the Montreal Branch of the Institute.

The new President of the Mining Society is Mr. A. J. Tonge, the General Superintendent of the Dominion Coal Company at Glace Bay. Mr. Tonge was President of the Manchester Geological Society in 1910, succeeding Sir W. E. Garforth, and is a Councillor of the Canadian Mining Institute.* He is a mining engineer of large experience and of acknowledged eminence in his profession. The retiring President, Col. Thos. Cantley, is sufficiently well known throughout Canada to make recapitulation of his offices unnecessary. As President of the Mining Society of Nova Scotia he succeeded Mr. D. H. McDougall, the immediate past-President of the Institute. This is a presidential record of which the Mining Society of Nova Scotia may be justly proud. The Canadian Mining Institute was much strengthened when the older society decided to join forces, and, we think, it may be fairly stated from observation of the recent meeting, that added prestige and virility has resulted to the Mining Society of Nova Scotia from the union.

As a member, and as the Editor of the Mining Society, the writer is diffident in praising in these columns the doing of the "mother lodge," but in fairness to this eastern representative of the Canadian Mining Institute, it is necessary to say that at no metropolitan gathering at headquarters has the general excellence of papers and discussion been surpassed, and that a larger representation from headquarters would not only have been welcomed, but would have received good value as compensation for the long journey.—F. W. G.

PROCEEDINGS OF THE MEETING.

Business was opened at 10 a.m. May 4th, in the Club Rooms of the Dominion Coal Company at Glace Bay. The President, Col. Thos. Cantley, was in the Chair. After an address of welcome by the Mayor of Glace Bay, Mr. E. McKay Forbes, the members present, numbering about fifty, proceeded with routine business. The Secretary-Treasurer reported a balance on hand of \$1,265.

Mr. Hiram Donkin, the Deputy Commissioner of Mines, expressed the regret of the Hon. E. H. Armstrong, Minister of Mines, that he could not attend the meeting owing to his duties at Halifax, the Houses of Assembly being in session.

The Report of the Council, among other matters, referred to a Resolution which had been forwarded to Ottawa deploring the numerous resignations from the Geological Survey. (See issue of 16th April, 1920, page 305, and March 5th, page 184.) The President briefly emphasised the gravity of the situation, and said he was unable to say whether remedial action was proposed by the Government or not.

* See Journal, Nov, 26, 1919,

Change of Date of Meeting.

A resolution, of which notice of motion had been given, was unanimously adopted to change the date of the meeting to "a date chosen by the Council between the 1st of January and the 1st of July."

Change of Name of Society.

Notice of motion had been given to change the name of the Society to the "Nova Scotia Mining & Metallurgical Society." This proposal did not meet with unanimous favor, and after discussion, it was moved that the recommendation of the Council to change the name of the Society be adopted, and that a letter ballot should be prepared by the Council, and submitted to the vote of the members, and that upon this vote action should be taken by the next Annual General Meeting.

Presidential Address.

Col. Cantley gave the Presidential Address on "The Importance of Cheap Power to the Industrial Life of Nova Scotia. A vote of thanks was moved by Mr. C. M. Odell and seconded by Mr. Hiram Donkin, who said it was reassuring to those who had given thought to power problems to note that men who filled important positions on the Canadian National Railways Board, as did Col. Cantley, were abreast of the latest developments in sources of motive power.

In replying, Col. Cantley said there was no doubt but that the Diesel engine was the most economical prime mover of today, but the drawback was that not sufficient oil is being produced to supply current demand, and that in comparatively few years it was unlikely that oil would be available in anything like the quantity in which it is being produced today.

The Application of Hydraulic Stowing to Undersea Coal Workings with Special Reference to the Sydney Coal Fields.

Mr. Walter Herd, the Mining Engineer of the Dominion Coal Company, read a paper on the possible application of hydraulic stowing to the undersea conditions of the Sydney Field.*

A vote of thanks to Mr. Herd was moved by F. W. Gray and seconded by Mr. T. J. Brown, both congratulating the author. Mr. Brown said that the paper had been written with especial reference to the application of hydraulic stowing to undersea areas, and had not laid much stress on its usefulness in the extraction of pillars on land, particularly under towns.

Mr. Alexander McEachern (Asst. Supt. Dominion Coal Company) said that Mr. Herd's paper was an intimation that new methods were becoming necessary to meet new conditions.

Mr. J. J. McDougall (Mining Engineer, Acadia Coal Co.) suggested the application of the system to the conditions of Pictou County.

Mr. Hiram Donkin said that the subject of hydraulic stowing was one to which he had not given the detailed thought that was necessary to enable comment, but he thought the deciding factor in its use would be that of cost, as there was no physical impossibility involved in its application. He suggested that the un-

* See also issue of Jan. 23rd, 1920, page 56, "Primary Considerations in Hydraulic Stowing," by C. A. J. Hendry.

dersea mining problem would be largely one of transportation, and that perhaps not enough attention had been paid to the civil engineering side of mining. He humorously applied the story of a Chinaman upon first seeing a trolley-car, who, after some study, expressed himself by saying: "No pushee, no pullee, go like hellee allee samee! He congratulated Colonel Cantley upon the successful solving of the transportation problem in the Wabana Slopes, where great speed had been obtained by spending thought on the special nature of the haulage required to meet the special conditions. In this connection, readers of the "Journal" are referred to the article on the Wabana Slopes, in our issue of March 26th last (see page 241), in which Mr. R. E. Chambers remarked that this type of haulage was significant "inasmuch as it points to a solution of the haulage problems arising from the moving of submarine deposits of coal at increasing distances as the working faces recede from the shore."

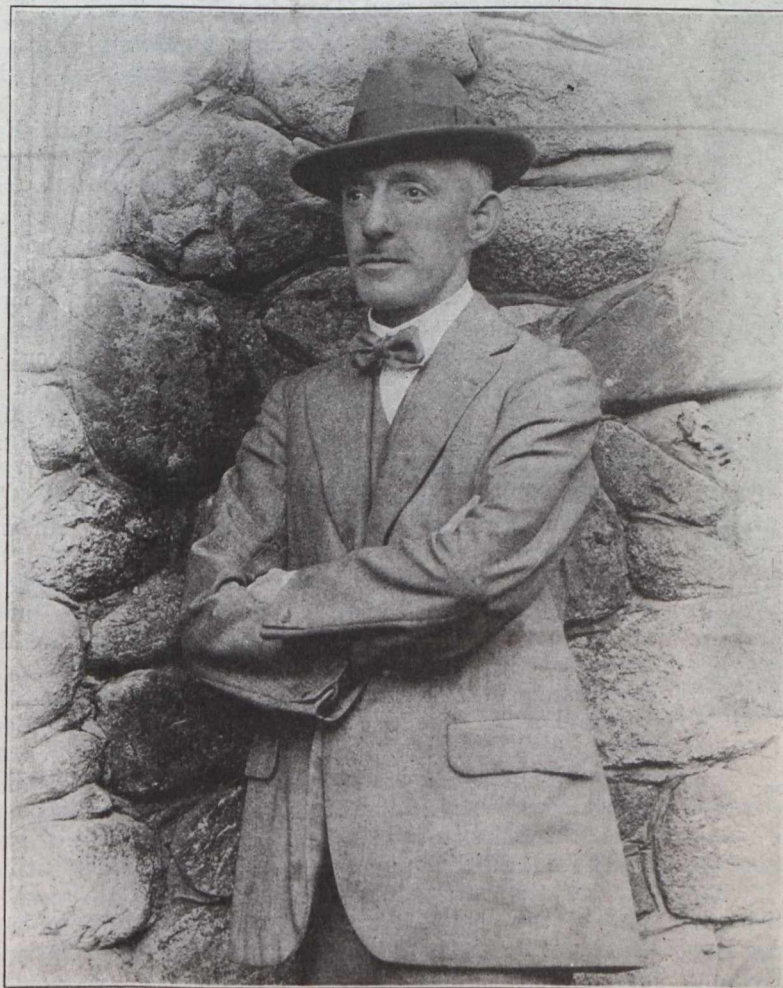
Mr. Tonge, in congratulating the author, said the paper would be one that all could look back upon when the day came, as he believed it would, when the practical problems of hydraulic stowing would be a matter of everyday routine in the Sydney field. He mentioned that he was looking into the practice of water flushing as practised in Belgium when the war broke out, and that conditions had since prevented further consideration of such matters. Mr. Tonge referred to the practice in the Scranton field, and to the excellent Bulletin on this which was published by the U.S. Bureau of Mines. Mr. Herd has prepared his paper with special reference to coal lying between the 200 and the 800 foot cover line. There are no other

means by which the coal can be all extracted in this area except by some such system as water flushing with solid materials. Speaking generally, about 50 per cent of the coal had been taken out, which means that if some such method of supporting the roof so as to enable the pillars to be extracted is not adopted, fifty per cent of the coal will be entirely lost. The application of the method to pillar areas under towns promised well. Mr. Tonge referred to the troubled conditions occasioned by the war which had prevented mining engineers from developing the scientific side of mining practice as they would have liked.

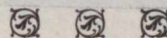
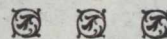
Mr. Neil Nicholson (Inspector of Mines) expressed his belief in a panel system of retreating longwall combined with hydraulic stowing.

In presenting the vote of thanks, the Chairman referred to the use of crushed slag in hydraulic stowing in the Ruhr District of Westfalia. He also suggested that the problem of getting workmen to face, more particularly in the iron-ore mines at Wabana, would in time become so great that consideration might be paid to providing temporary underground residences for workmen.

Mr. Herd replied at length to the questions raised in the discussion. With regard to the super-imposed undersea seams down to 800 ft. of cover he would advise stowing one seam solid, and then it would be a question for deliberation as to what percentage of the other seams should be stowed. It might not be necessary to stow the whole area; perhaps half-stowing of the goaf might suffice, which would represent the percentage of pillar support now left.



MR. ALFRED J. TONGE,
President, Mining Society of Nova Scotia

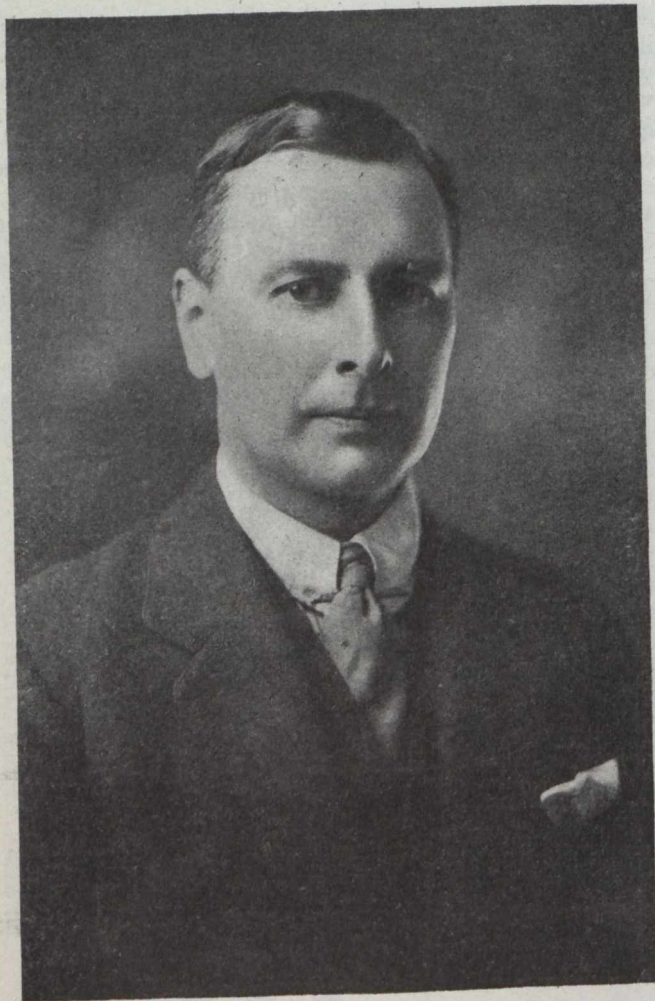


In the matter of cost the additional cost of hydraulic stowing over and above the present practice was not so important—relatively—as it had been in the past.

In reply to a remark by the President that the Germans, in using hydraulic stowing, had developed an idea which they did not originate, a characteristic national trait, Mr. Herd said that the system of hydraulic flushing pursued at Scranton had been originally conceived by an English engineer, who could not get his own countrymen to consider his plans, and had been listened to in the United States, but that it was really in Germany that the system had been perfected.

Mr. Herd's paper will be published in a following issue of the "Journal."

As the whole of the afternoon had been taken up, other papers purposed to be read on the first day were deferred until the following morning.



MR. WALTER HERD,
Dominion Coal Company, who read a Paper on
"Hydraulic Stowing."

THE SMOKER

During the evening a smoker took place, which was—well, it was a "Smoker," and fully up to the Penhale standard, with—oh yes, just a dash of Holland.

SESSION OF WEDNESDAY, MAY 5th.

Mr. E. G. Mackay, Superintendent of the Open Hearth and Blast Furnace Departments of the Nova Scotia Steel and Coal Company, read a paper on "Generating Steam by Use of Open-Hearth Furnace Waste Gas." The paper was a description of a waste-heat boiler attached to one of the open-hearth furnaces at Sydney Mines, and, as was pointed out by the President, showed a saving of 91 cents per ton on steel manufacture by the interception of the heat of the waste gases. On the production of pig-iron in Cape Breton, such provision, if applied to the existing open-hearths, would amount to a possible saving of \$400,000 per annum.

Mr. H. C. Wright (Canadian General Electric Co.) pointed out that Cape Breton was much interested in saving of waste coal-heat, because the Island had no water powers, and coal was the only source of power. The Province of Nova Scotia was definitely committed to a policy of developing its hydro-electric powers.

Mr. J. S. Whyte (Acadia Coal Company) said many possibilities were yet untouched in the salvage of waste heat, which Mr. Mackay's paper barely opened up.

Mr. Tonge recommended the extended use of recording apparatus in steam plants. Mr. Mackay, replying to questions, said the boiler he described gave between 50 to 75 per cent efficiency, and he emphasised that it was merely an interceptor of waste heat, and did not use gas as fuel, the gases utilised being exhausted and non-combustible waste products of the open-hearth furnace.

"Conservation, and Drawing Mine Timbers."

Mr. P. T. Prendergast Manager of Dominion No. 2 Colliery, read a paper, published in this issue, with the foregoing title.

Mr. Herd, who was an officer in the Canadian Forestry Corps during the war, referred to the great destruction of growing timber in the woods, and the tremendous depletion of the forests by pulp mills. As to quality, pine was best, followed by spruce, and the much inferior balsam fir. Nothing was growing today in Cape Breton suitable for pit timber, but second-growth balsam fir. It had not the lasting qualities of spruce, and as Mr. Prendergast rightly pointed out, it should be treated for preservation. He referred to the necessity of barking timber used for mine support. Elaborate treatment, such as creosoting was not advisable for such poor timber. Boiling in a saturated solution of common salt with the admixture of a little alum was a simple and successful practice. He suggested sorting timber into separate piles, so that the timber best suited for certain underground purposes could be readily selected. Props are sometimes tapered so that they will not break readily in the middle, and used timbers can thus be made of further service by cutting into shorter lengths for thinner seams.

Mr. D. H. MacLean (Manager, Princess Colliery, N. S. S. & Coal Co.) said in the deeper mines the weight played havoc with the timber, and it lasted so short a while that treating would be wasted expenditure. Mr. MacLean's description of the effect of roof-weight in deep mining suggests that possibly utilisation of the roof-pressure to break down the coal by use of the longwall method would be preferable to endeavoring to hold up the roof at great depths of cover.

Pit-Timber Supply of Eastern Canada has Life of Ten Years.

Mr. J. W. Revere (Purchasing Agent of the Dominion Coal Company), whose knowledge of the pit-timber situation in Nova Scotia is more complete than that of any other person, expressed himself as satisfied that the present growth of timber in Nova Scotia was not making up for what was being used, and that in ten years the pit timber supply of Eastern Canada would be exhausted. The pulp mills in Cape Breton were offering \$12.00 a cord for pulpwood.

Mr. J. J. McDougall commended the practice recommended by Mr. Prendergast of chucking the high side and thus shortening the length of the timber required, which was the practice in Pictou County. In regard to preserving timber, creosoting could not be used in the Pictou collieries because it had been found that the odor of the creosote underground was indistinguishable from the "fire-stink" which the miners relied upon to give warning of underground fires.

Mr. Neil Nicholson pointed out that the system of mining largely decided the amount of timber that was required, and he advocated retreating longwall wherever possible to obviate the use of timber for support.

Some discussion took place on barking timber. It was stated the use of the "barker" of the pulp-mill men would not suit for pit-timber as it also took off about twenty per cent of the wood. Mr. Herd mentioned that in South Wales men would not accept barked timber. They liked wet timber, timber that would "talk" when the weight came on, and give warning to the miner. Timber in South Wales was sold by weight, the wetter it was the better in the miner's opinion. He referred also to the effect of heavy roof pressure in South Welsh collieries, where in the course of two years, in one instance, the intake road, originally driven in the coal on the same level as the return, was raised to a level thirteen feet above the return.

Mr. Revere said a machine existed by which timbers were rotated in a cylinder with an admixture of water and gravel, which removed the bark satisfactorily.

The President, in presenting the vote of thanks to Mr. Prendergast, said that timber was becoming so scarce that the use of reinforced concrete in large quantities for underground support was likely in the near future.

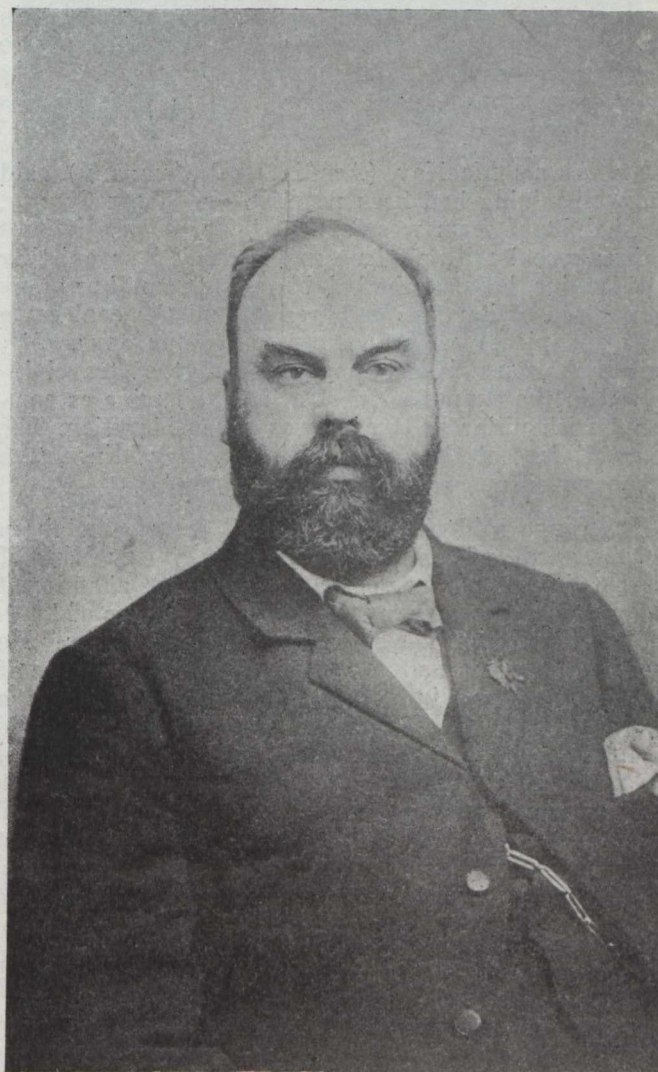
In the unavoidable absence of Mr. W. H. Graham (Superintendent of Construction, Dominion Iron & Steel Co.) a paper on the Plate Mill of the Dominion Iron & Steel Company, bearing particularly on the construction work, and prepared for the Toronto Meeting of the C. M. Institute was taken as read.

The "Turn-Over of Labor."

Mr. Angus W. MacDonald (Employment Agent, and Welfare Superintendent, Dominion Steel Corporation) read a paper on "Labor Turnover in Industrial Plants and what can be done to minimize it." Mr. George D. Macdougall (General Superintendent, N. S. S. & Coal Co.), in moving a vote of thanks, said that the available supply of labor did not promise improvement, and that time and thought devoted to conservation of labor would be well repaid. Mr. F. W. Gray seconded, remarking that labor—reduced to its lowest denominator—was a marketable commodity, but was

also the commodity of greatest value dealt in by corporate organizations. It was therefore worthy of at least as much study as the duties of the purchasing agent who dealt only in materials. Prof. Sexton warned against the regarding of the laborer as a commodity, and he deplored the system which had developed the motion-study and stop-watch man, and had speeded-up production without proper regard to the physical and mental needs of the worker. Mr. Tonge said the author had touched upon the question of safety, and that conservation of life was not to be regarded as the least of the subjects drawn to the attention of the meeting.

The President said he would place the cost of educating new men at a figure greater than Mr. MacDonald had mentioned. He would put it at \$150 per man. With regard to the effect on safety, accidents



MR. HIRAM DONKIN,
Deputy Commissioner of Mines, who urged greater attention
to the "Civil Engineering" side of Coal Mining

occurred at two distinct periods, namely, the first week of employment, when men were becoming accustomed to their surroundings, and later, when familiarity had bred contempt. In the middle period there was comparative immunity. The first stage of employment was, however, the one that yielded most accidents.

Longwall Mining and Conservation.

Mr. J. H. Cunningham (recently Superintendent of Mines, N. S. S. & Coal Co.) read a paper on the theory and practice of longwall mining which was one of the clearest expositions of a difficult subject for description we remember to have heard. Mr. Cunningham's paper will be published in a following issue of the "Journal."

Mr. Herd congratulated the writer upon his interesting and able account of longwall mining. He referred to the mining of the Torbane Hill mineral, (sometimes known as "Torbanite") in Scotland, which was originally two feet thick and was extracted by the longwall method, and thinning out, had been followed down to a thickness of four inches, this being possible because of the valuable character of the mineral. There was really no limit to the thickness of the seam that could be worked longwall, as it is common practice to work thick coal by longwall faces in layers. He did not think there was any necessity to blast coal after it had fallen from a longwall face. It could be broken up with wedges, unless the area was too confined.

Mr. Angus MacKay (Acadia Coal Company) said longwall mining had been practised in Pictou County. The height of seam was 3 ft. 11 ins. It was difficult to break coal with wedges under conditions existing in this mine, because the height was too small to allow proper use of hammer and wedge, and the coal came down in pieces weighing three to four tons. Mr. Neil Nicholson said the smaller amount of travel involved in the examination of a longwall mine as compared with pillar and room was a consideration. The longwall face at the Jubilee Mine Sydney Mines, was a successful operation.

Mr. Tonge said that the longwall system had been in successful and extensive use at the Emery Mine of the Dominion Coal Company, but had been abandoned in favor of pillar and room because of the loss of longwall miners, chiefly Belgians, during the war. He thought longwall had not been successful because it had been tackled in a half-hearted fashion, or in a partial manner. Sufficient space had not been allowed for full play of the bending action of the roof, and too many pillars had been left. He had himself worked longwall faces a mile long and in all heights from 1 ft. 6 ins. to 7 feet thick, and had never thought of working coal any other way. Once longwall had been decided upon, it did not matter whether it was used under sea or under land. Mr. Tonge said he did not know when he had heard a clearer description of longwall practice than had been given by Mr. Cunningham.

One speaker mentioned what is probably the true explanation of the non-success of longwall mining namely, that the local miners do not favor it.

Mr. F. W. Gray mentioned that there was in the Joggins Field, at the collieries of the Maritime Coal & Iron & Railway Company, a unique longwall operation, inasmuch as a thin seam was being completely extracted from under the sea by the longwall method. In view of the number of thin seams which exist in the Sydney field, and proceed under the sea, none of which have as yet been touched, the Joggins Mines operation was of some significance. He suggested that if it were possible to obtain a description for the next meeting of the Society, this should be done.

Fighting Mine Fires in Pictou Field.

A paper was read by Mr. Angus MacKay—in the absence of the author, Mr. F. E. Notebaert, Acting General Manager of the Acadia Coal Company—on "The Theory and Practice of Fighting Mine Fires from Practical Experience gained in Pictou County." Mr. Notebaert's valuable and historical paper is published in this issue of the "Journal."

Mr. F. W. Gray stated that he was glad to note Mr. Notebaert stated his belief in the existence of the McCulloch fault, and his opinion "that the Westville seams are only the regular continuation of the series of Stellarton seams, thus adding an enormous tonnage of coal to that already known to exist in the Stellarton district." He had himself come to the conclusion four or five years ago, after studying maps loaned by Mr. Notebaert, that the "existence and size of the McCulloch fault seems to have been presumed from surface indications and from a belief that the "Main" or Ford seam of the Albion area was identical with the "Main" or Acadia seam of the Westville area, worked at the Drummond and Acadia Collieries." No proof of the identity of the two seams had however been furnished.



HON. E. H. ARMSTRONG,
Commissioner of P. W. and Mines, Nova Scotia.

The reading of Mr. Notebaert's paper concluded the morning session, and there was not time to hear Mr. H. Y. Russel's talk on the manufacture of explosives, or to deal with the papers on "Transportation of Coal" by Mr. M. A. McInnis, and that on "Canada's Coal Supply" by Mr. F. W. Gray, read at the Toronto Meeting of the Institute, and placed on the programme of the Glace Bay Meeting for discussion.

At noon-hour the Society was the guest of the Dominion Coal Company at luncheon.

In the afternoon, a meeting was held in the Savoy Theatre, to which the public were invited, at which there was displayed a series of moving pictures, lent by the U. S. Bureau of Mines, showing the manufacture of coke and by-products, and modern colliery power

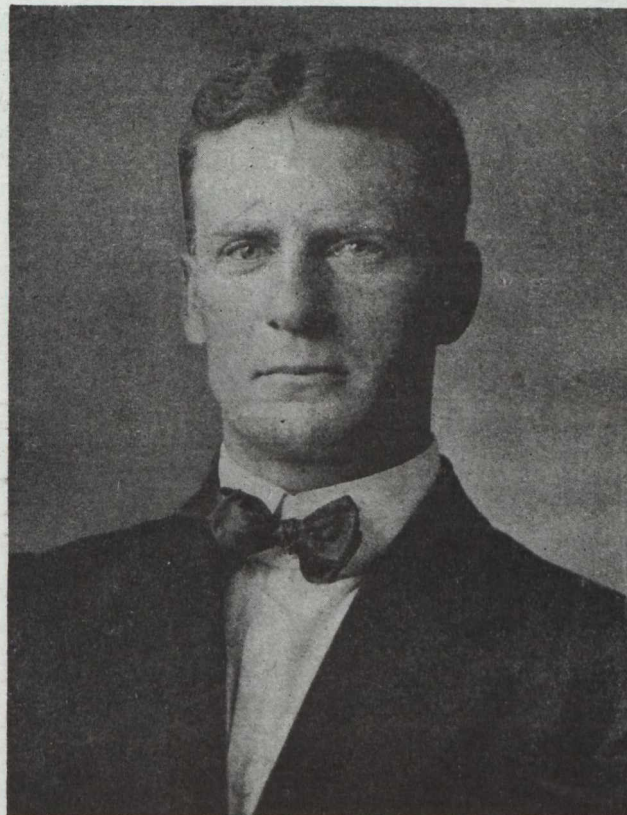
plants. Prof. F. H. Sexton spoke on "Vocational re-training of Workers in Industry" and illustrated his remarks with lantern slides. Prof. Sexton's enthusiasm and successful work in this connection are well known and much appreciated. Mr. W. S. Wilson, of the Economy Engineer's Department of the Dominion Steel Corporation, read a paper on "Conservation in Colliery Power Plants."

The newly elected officers of the Society were announced these being as follows:—President, Mr. A. J. Tonge; Vice-President, Mr. Geo. D. MacDougall; 2nd Vice-President, Mr. C. M. Odell; Secretary-Treasurer, Mr. E. C. Hanrahan.

The new President was suitably installed by the retiring President, and this closed the proceedings.



PROF. F. H. SEXTON,
who spoke on "Vocational Re-Training of Workers in Industry."



MR. F. E. LUCAS,
Economy Engineer, Dominion Steel Corporation, whose work on the Committee was largely responsible for the successful meeting.

The Conservation and Drawing of Mine Timber

A paper read before the Mining Society of Nova Scotia, Glace Bay, April 5th 1920.

By P. T. PRENDERGAST.

When asked to read at this meeting a paper on the conservation and drawing of mine timber, it was with a full realization of the fact that this subject had already been discussed before you on different occasions, that I reluctantly consented.

This matter has heretofore been discussed from the theoretical point of view; and while, no doubt, much valuable knowledge is obtained from a discussion of this nature, it is proposed in a few remarks to deal with the subject from the view point of practical experience; by which is intended my own personal experience, as acquired during years of connection with mines and mining in Cape Breton.

Conservation of raw materials has so taken hold of the public mind, and is regarded of such vital importance by those of us who realize our responsibility

to those who are to come after us, that it behooves all to use every available means to prevent wastage of timber in and around the mines. In recent years the item of mine timber has entered so largely into the cost of coal production, that any measures which we can take towards the economical use of our available timber supply will prove a great investment in the years to come.

When the Dominion Coal Company was organized in the year 1893, the cost of the regulation 9 ft. prop was from 54 to 50 cents per dozen laid down at the pit mouth, and the specifications followed at that time required that they were all to be of black spruce and six inches in diameter at the small end. This was in the days when the mines were working under comparatively shallow covers. Today the only avail-

able supply of timber is of balsam fir, with a small proportion of spruce, and the cost has reached four and a half times as much.

Mining under greater depths with an interior wood to support the roof means that more timber will be required, and the manner of use of our present supply will have to be dealt with more energetically in the future. The drawing of mine timber and the use of preservatives are two ways of assisting towards this end.

We are each successive year going deeper and deeper into the earth in order to obtain the coal to keep our industrial plants in operation, and furnish our homes with warmth. This means that each successive year much greater weight of strata has to be contended with. It will be found where mining operations are carried on at any great depth, that even an increase



MR. GEO. D. MACDOUGALL,
Vice-President of the Mining Society of Nova Scotia.

in the size of pillars will not prevent the breakage of timber.

Where great weight of strata has to be reckoned with and where lateral pressures are troublesome, we find that on our roadways the roof is forced down on the timber causing them to lag and finally break. To overcome this breakage is one way of assisting in the great cause of conservation, as all broken timber must be replaced by new ones, and the writer submits that a great deal of over-head timber destroyed in this way might be saved by shortening the span between the supports. It may not be good policy to

recommend the placing of props too close to the haulage roads, but the shortening of the span of overhead booms could be done in a great many cases with increased safety to employees, and at a saving in expensive timber, if certain methods are adopted, with the idea of conserving timber supply.

Take the case of landings and turnouts where long booms are required, and where, on account of the length of the span and the area to be supported, extra heavy timbers are required, it will be found that even these timber very often break, and it becomes necessary to replace them. Also, the thin end of the pillar here is continually breaking away, necessitating more timber and labor, adding greatly to the cost of production. This, you will all agree, is an unpardonable wastage, as it not only means an unnecessary use of new timber, but also very often results in a decreased output of coal, both of which could have been avoided had the work been properly done in the first instance.

The building of neat packs in the "V" of the road, on which would rest one end of the overhead timber, thus shortening the span, would result in a great saving of timber. This would not only be a safer method, which is in itself sufficient to justify its use, but would result in a great saving in cost, as much shorter and cheaper timber could be used. It would also serve the purpose of preserving the ends of the pillars which are continually splitting off. These packs could be built of broken and discarded timber of which every mine has a fairly good supply. The only cost would be that of labor.

Not only would such packs tend to conserve our timber supply, by lessening the amount of broken timber and protecting the weak end of pillars, but it would be a satisfaction to the mine official to have this work done properly along roadways and landings. To have long booms carrying a heavy load is by no means a nerve-soothing condition.

I might give here a few figures showing the cost and quantity of timber used today as compared with, say eight years ago, in some of the coal mines. In one mine there were 64,000 more pit props used in the year 1919 than were used in 1911, and the cost of props increased in that period 100 per cent. In 1911 there were four tons produced per prop, and in 1919 only 2.4 tons. This difference may be attributed partly to different conditions, but principally to the deeper workings, and the maintaining of longer roadways and airways. The replacing of broken props along roadways is a heavy drain on our timber supply.

In the deeper local mines, where the edges of pillars can not be depended upon as a safe support for booms, and where all booms must be supported by props or packs, such props are very often subjected to more stress by the heaving of the bottom than by the weight of the roof. Props are thus forced up until they cut through the overhead roof, thus weakening the roof support, and new timber must be put in. This heaving of the bottom is generally from one of two causes, (a) Where pillars are not left sufficiently large, (b) Where the strata below the coal is of a weak and broken nature. The first of these causes suggests its own remedy, while the second presents a problem which is somewhat more difficult to grapple with.

Since heaving of the bottom results in a great wastage of timber through breaking, one might suggest that the most easily applied remedy to overcome

this wastage would be to use a better quality of timber. With this statement no doubt you will all agree provided it did not materially increase the cost of coal per ton. However, looking at this question from the view point of conservation of valuable timber resources, and bearing in mind the fact that future mining developments must be carried on at a much greater depth than that of the present day, it might be the proper thing to conserve for future generations the more valuable woods, while the cheaper and faster growing woods might be drawn on in quantities to meet present requirements.

While still dealing with the question of conservation of mine timber, there is another phase of it which is worthy of attention. At present the wood that is to be used as timber in our mines is cut and handled in large quantities during the winter months, and while the hauling is good, it is hustled out of the woods and piled along the railway and highway. Some of this will not be used in the mines for a year and in many cases for a much longer time. During all this time it is laying in close piles and deteriorating from disease and decay, and when it is finally placed in the hands of the miner, its strength and life in many cases, is reduced at least fifty per cent. In timber that is closely piled, thus preventing a free circulation of air, and on which the bark is continually moist, we have the most favorable conditions for fungoid growth.

A great deal has been done and said by mining men with regard to curing timber before putting it into the mine, and much good has been accomplished in this way to lengthen the life of mine timber, but to apply remedies to wood that is already well advanced in decay is so much energy wasted. The proper time to apply the remedy, if wood curing is to be done with a sufficient degree of satisfaction, is when the timber is green from the woods, and before the parasites have had an opportunity to get in their work, and not after they have had many months start.

The drawing of mine timber from finished places is a question that has been given a great deal of thought by those interested in coal mining. It has been contended on many occasions that timber cannot be drawn profitably in our Cape Breton mines, as such work cannot be done by common labor. I agree with this statement in so far as it applies to inexperienced labor. Experienced men must be employed at such work, and labor of this kind must be paid a fairly high rate. The timber must then be carried to the roadways, from whence it can be again hauled to the working places.

In this country, where mine timber is principally of balsam fir, a large percentage after being drawn is not worth resetting. I have had this work done myself with a fair degree of profit by having men take only such timber as could be drawn without too much labor and make good timber for resetting.

I do not know to what extent these ideas will meet with your approval, but I believe that, having in mind only the cost of coal per ton without regard to the conservation of timber, the drawing of timber in this way will be found most profitable. In places where the bottom is fairly strong, and does not heave sufficiently to break the timber, and where the roof is not too heavy, it will be found that a great many timbers can be drawn which will be fit for resetting. Probably from 50 to 75 per cent, particularly where such timber is of spruce.

I have also used broken timber in the making of road ties in the mine, and find that these can be made at about the same cost as new ties, but it requires a man who has had some experience at this kind of work to make it come out even. It might be suggested that this work could be done better on the surface, if the wood was brought there; but the extra handling would increase the cost, and probably result in the lessening of the output, by interfering with the free handling of the coal.

Where booms have of necessity to be removed, because of their being broken, either through deterioration of the wood, or through some other cause, and where either end of such boom is of sufficient length to make a prop, they may well be used for that purpose; and even when the fibre becomes brittle through



MR. H. M. WYLDE, Halifax,
A Charter Member of the Society.

deterioration, and the stick is of no further use as a boom, it can be used as a prop with fairly good results.

Rafted timber, or in other words, timber that has been soaked in water for some time until it sheds the bark, will stand underground conditions much better than wood sent into the mine with the bark on. I might also say that timber which is cut from areas that have been swept by forest fires, and are cut after they dry on the stump, have much better lasting qualities than wood cut in the sap. It follows then, that it might be better to have timber peeled when cut, and piled so as to give it a chance to dry out. This would of course add materially to the cost.

It might be argued that the additional cost would not be justified from the fact that the life of much of the timber used in the mine is of short duration owing to conditions already mentioned. However, it might be recommended that a certain percentage of the timber be prepared in this way, so that the mine official could use them in travelling ways and airways, and such other places as are to be maintained for a longer period.

In the timbering of mine roads, where it was necessary to maintain such roadways for a number of years, and where such timbering must of necessity be of a more or less permanent nature, imported timber of a quality superior to our native wood is sometimes used. This is generally yellow hard pine. This wood, if it is in good condition when put into the mine, and has not too much resin extracted from it, does not seem to be affected by underground conditions.

Steel girders are sometimes used where support of a permanent nature is required. The initial expenditure is fairly large, but allowing for the cost, and having due regard to the permanency desired, any reasonable expenditure is justifiable, as it will ultimately prove much cheaper than if ordinary timber had been used.

It has been proven conclusively that main roads can be supported as cheaply, particularly where double tracks are repaired by using steel rails that have been condemned for ordinary railway use, as with round spruce timber. This is for the reason that many more spruce booms would have to be set for a given

distance; and as for durability, the life of the steel boom, as compared with the spruce, might well be placed at 20 to 1, and the difference may be much greater than this. This refers to the ordinary 80 lb. steel rail.

Portions of haulage road boomed with these rails, say six feet apart, supported on cured spruce props, and having sufficient overhead lagging, would require, if spruce booms were used instead, three spruce booms to every rail so used, and would entail three times the labor in getting.

It is generally supposed that when steel is used instead of wood for timbering, that the first cost is much greater, but in the cases referred to it does not work out that way. For instance, we take a case where roof conditions will require a steel boom every three feet, then at least two spruce booms must be placed in the same space. The average cost of a steel boom 14 feet long is \$5.00. Supported on two special spruce timber at 30 cents each, the cost of putting up would be about \$2.40, making a total cost per boom of \$8.00. The cost of two spruce booms 14 feet long is \$2.00, with four props for supports \$1.20, and \$4.80 for setting, makes also a total of \$8.00. Where it becomes necessary to set steel booms a distance less than three feet apart owing to the weight of the roof, I would not take any chance with spruce even if set skin to skin, unless propped in the centre, and centre props on haulage ways are always a source of annoyance and delays.



ALEXANDER S. McNEIL,
Supt. of Mines, Nova Scotia Steel and Coal Company,
Sydney Mines.

CANADIAN COAL MEN.

Alexander S. McNeil.

Alexander S. McNeil, the Superintendent of Mines of the Nova Scotia Steel & Coal Company at Sydney Mines is another of the native sons of Scotch Highland descent that are the moving spirits in the coal mining activities of Cape Breton Island. Mr. McNeil was appointed Overman at Dominion No. 1 Colliery in 1899, and after holding various official positions was appointed manager of No. 8 Colliery in 1908. He filled successively the position of manager at No. 9 and No. 2 Collieries, and was in 1916 appointed District Superintendent, having charge of Collieries Nos. 2, 7 and 9, and later of Nos. 1, 5 and 10 in addition. In 1919, Mr. McNeil joined the staff of the Nova Scotia Steel Company as Superintendent of Mines.

Like so many other men in official positions in Nova Scotia, whom it has been our privilege to know, Mr. McNeil has risen from a junior position underground by dint and personal merit, and studious nights, to the superintendency of a group of collieries producing 600,000 tons annually. His long experience in connection with the submarine collieries of the Dominion Coal Company, namely, Nos. 1, 2 and 9, and 7, and his charge of the Princess Colliery at Sydney Mines, has given him a unique knowledge of undersea coal-mining at long distances from shore, and with heavy cover.—F.W.G.

The Theory and Practice of Fighting Mine Fires from Practical Experience Gained in Pictou County

Paper Read Before the Mining Society of Nova Scotia April 5th 1920, Glace Bay.

By F. E. NOTEBAERT.*

A large portion of the Pictou County Coal Field is composed of very thick seams. Amongst these are seams that have been known for years past, namely:

The Foord Seam—40 feet thick;

The Cage Pit Seam—18 feet thick;

The Third Seam—14 to 17 feet thick;

The McGregor—The thickness of which at certain places reaches over 22 feet.

These four seams are the old seams known as the seams of the Stellarton district, and have been worked, some of them for over a century.

To these seams a series of thirteen new seams underlying the four first ones mentioned, were added—when in the winter of 1915 a borehole drilled by the Acadia Coal Company, made this discovery.

As in the upper seams, the heavy thickness of these new seams seems to have prevailed, and we have to record:

One—21 foot seam;

One—28½ foot seam;

One—20'4" seam;

One—24'2" seam;

One—23'0" seam.

These seams were found intermingled with thinner seams, such as: 3 ft. 6 in.; 5 ft.; 6 ft. 2 in.; 4ft. 11 in.

McCulloch Fault Considered Non-Existent.

Undoubtedly had the borehole been extended further down, other seams would have been discovered, and eventually the borehole extended still further down, would have entered the Westville coal measures. These very often have been considered as being the same seams as those of the Stellarton district, but thrown in a south-westerly direction by a fault of great amplitude known as the "McCulloch Fault," the existence of which has never been proved. Without certainty, although without much doubt, we are fairly safe to abandon the old conception of the so much talked of "McCulloch Fault" and to accept that the Westville seams are only the regular continuation of the series of Stellarton seams, thus adding an enormous tonnage of coal to that already known to exist in the Stellarton district.

Having so outlined what may be properly now called the main coal field of Pictou County, we will enumerate the main features of this field.

The angle of dip may be called steep in comparison with the great majority of the Cape Breton fields. At the southern end of the field, the seams outcrop with an angle of 21° to 23°, dipping northerly until they reach a basin line, then they rise up in a northerly direction at various inclinations, varying from the true level up to 90° and in certain disturbed sections of the northern portion of this field, the seams are completely reversed, the foot wall resting on top and the hanging wall lying underneath.

The angle of the dip, the thickness of the seam, the fact that the space left open by the working out of the seam is not flushed nor filled, implies almost

necessarily a method of working by "Bord and Pillars," retreating from the limit of the field towards the main slope, leaving only a crush behind the working faces.

The Cause of "Gob" Fires in Pictou County.

The immediate consequence of such a system is the unavoidable abandonment of a more or less important tonnage of coal in the gob. This coal being subjected to the heavy pressure of the roof, is crushed, and provided that the oxygen of the air is allowed to get in contact long enough with this "loose coal" great heat is bound to be generated, which ultimately will provoke a "gob fire."

These gob fires are naturally frequent in the seams of the Stellarton district, or more correctly, would be quite frequent if special precautions were not taken. These precautions are of three different natures, namely:

1. Reduce the quantity of combustible matter left crushed in the gob, the presence of which is the original cause of the fire.
2. Reduce the prolonged contact of air (oxygen) and crushed coal in the gob.
3. Emergency measures, consisting of heavy stoppings which allow us to isolate and to seal off any sections or part of section whenever this section is threatened or affected by fire.

These emergency measures are naturally very expensive, but our experience has proven to us that they may be, after all, the cheapest and safest method to prevent gob fires, or to fight them.

Hydraulic Filling Advocated as Gob Fire Preventative.

The amount of combustible matter left in the gob, when attempting to work out such thick seams, can only be reduced to an unimportant quantity by the adoption of the "flushing system," also called "hydraulic filling," but at this date of the coal industry in Nova Scotia, it is very questionable if in long slopes with an abnormally high cost of labour as compared with the selling price of the coal the time has yet come when "hydraulic gob-flushing" can be introduced in Nova Scotia mines with financial profit. Although, as we have just stated in the case of the Pictou County mines, the "flushing system" is and will be the only system by which all the coal being recovered, the gob fires may be completely suppressed. Let us also incidentally mention that with the hydraulic flushing, dust explosion will be a thing of the past.

Gob Areas Should Be Air Tight as Possible.

To reduce the prolonged contact of air (oxygen) with the crushed coal left behind in the gob, the most efficient disposition is to advance the working faces as rapidly as possible, so as to bring the roof down; also to avoid any filtration of air through the gob. This can best be done by retreating towards the slope, also by ascensional ventilation, the air being allowed in at the bottom of the pillar section and being exhausted at the upper end of the section in a direction opposite to the gob.

To reduce a prolonged contact of the air with the gob, implies also that the gob resulting from the work-

* Acting General Manager, Acadia Coal Company, Stellarton, Nova Scotia.

ing out of a pillar section be properly and completely sealed off, so as to avoid as much as possible filtration of air through the gob and oxidation of the crushed coal left therein.

These are roughly speaking, the general points that should always be kept in mind in the extraction of pillars in a thick seam dipping at a steep angle, without having recourse to the "flushing system," if an earnest attempt to avoid gob fire is made.

We have mentioned the nature of the seams and of their dispositions, and we believe it might be interesting to point out that although commonly qualified as "very apt to spontaneous combustion" the coal seams of Pictou County and especially of the Stellarton district are the least subject to spontaneous combustion; this being due to their very low percentage of sulphur, which in most cases does not exceed 1 per cent.

The Progress of a Gob Fire.

But even when all precautions are taken, gob fires are apt to take place. Usually the first indication of fire is only a very slight odor of distillation of coal. According to the nature of the seam, and to the general dispositions which are causing the fire, the odor will persist for hours or for days, and we know of cases where it has persisted for weeks without showing any increase of temperature, or any sign of smoke, which are the next indications of a gob fire.

At this stage when smoke appears, conditions are always very serious, because even if the seam does not liberate explosive gases, the distillation of coal with a restricted amount of air will generate carbon monoxide, which is highly explosive. It is at this stage that good judgment must be used and a quick decision arrived at.

When smoke has made its appearance, the tendency is usually to continue carrying out the dispositions which had been adopted in the earlier stages when the only indication of the gob fire was the odor of distillation.

In many cases this may have resulted in apparent success, but very often the fire has already been allowed to smoulder too long, heat has increased and flames have made their appearance. Conditions then may be termed as highly dangerous, and alarming, since all the elements required to provoke an explosion are present. If conditions have unfortunately been allowed to develop this far, there remain very few remedies to be depended upon, and any one of these remedies is entirely affected by a very great factor of "chance." The natural remedy against flames is water, applied by sprinkling or by flooding. The flooding of the section will usually take a great time, during which the fire will continue to progress, kept alive by the suction of the fan. Besides, flooding against fire can only be adopted as a very extreme measure. As a matter of fact, it is almost always worse than the complete and forced abandonment, except if the flooding may be restricted to a small area, because without controlling the fire quickly, you add to the damage and risk of the fire the destruction from the flood.

As regards the sprinkling, it will generally not be very efficient and will almost in every case amount to failure, since the water will only reach the outside manifestation of the gob fire (the flames) without reaching the real seat of the fire, which is away inside in the gob. We have known of flaming fire being successfully extinguished by sprinkling of water,

and the officials who were supervising the fight are today still wondering why it was that the water put the fire out. A closer study might have shown that the steam generated by the water on a very hot fire and carbon dioxide were the decisive factors. The fire will in most cases, continue to gain in violence and make its appearance at other places in the district, until conditions are so alarming that the mine has to be abandoned. This abandonment means the stopping of the fan. The natural ventilation, which will likely be reinforced by the heat of the fire zone, will carry a current of air through the mine and in the vicinity of the fire. The next available step is to seal off the mine at the main intake and main return, and to wait developments. The moment is naturally a very serious and anxious one, since the conditions and the elements are all present to cause a very serious and destructive explosion, which even on the surface may cause loss of life.

It is an order to avoid this alarming situation that we recommend never to wait to face these desperate conditions, and instead of being guided by "luck and chance" to control the conditions whenever the first smoke has made its appearance. Even then conditions are dangerous, but in our opinion, it is at this stage, that radical decision should be taken without waiting and without hesitation, and that the mine should be sealed off as tight as possible at the main intake and return. The purpose is total suppression of oxygen, not only in the fire district, but in the whole mine, and its replacement by a high percentage of other gases, explosive or not, the mixture of which will after a short time be in explosive, due to its lack of oxygen.

As an illustration, are given some analyses of mine gases taken at a slope mouth of one of our mines, after it had been closed for only a few days, as follows:—

	Per cent
Carbon dioxide	7.2
Carbon monoxide	0.0
Oxygen	3.1
C. H. 4	31.4
Nitrogen	58.4

and a few days later, the percentage of oxygen had fallen to .86 and .42.

The mine referred to here, is the Albion Mine of the Acadia Coal Company. This mine, ever since its opening away back in 1881, has been affected by numerous very serious fires, almost always due to one of the causes mentioned hereabove. In this particular case, (the fire which took place in 1917-1918) an old abandoned section in the Third Seam, had been entirely isolated by a line of very substantial concrete stoppings, which unfortunately, due to a special disposition of the ventilation circuit, were subjected to a heavy water gauge, that except for the stoppings themselves, would have allowed a short circuit of the ventilation through the old section.

Workings in an underlying seam, having disturbed the stoppings in the Third Seam, odor of distillation of coal, was first perceived at almost every stopping, showing conclusively that most of the section was affected by heat: This heat was generated by the oxidation of the coal, occasioned by the filtration of the air through some defective stoppings and also through the coal itself, as we show later on.

The first step taken was naturally a general reinforcement of every concrete stopping, followed by further reinforcements of weaker stoppings. The odor of distillation would disappear for a few days or even

weeks, to suddenly reappear at some other place; until finally after about eight weeks of special watch, a slight vapor of smoke made its appearance in one of the bottom stoppings which was being reinforced.

The section which was affected had an area of 1,410,000 sq. ft. in which a considerable body of crushed coal had been left. Following the policy herein advocated we decided without any hesitation, at the very moment smoke was seen, to suspend any further reinforcements of the stoppings isolating this section, and to surround this body of smouldering heat slowly but undoubtedly developing into a flaming fire, with an atmosphere entirely deprived of oxygen.

We have given above, the analysis of the mine atmosphere, and will only recall that after a very short time, the percentage of oxygen in the mine was less than 1 per cent, that the percentage of CH₄ was about 36 per cent and the percentage of carbon dioxide between 7 per cent and 8 per cent. Such a mixture made the extension or even the existence of any fire impossible.

But this mixture, efficient as it was to suspend the fire and prevent its expansion, could not kill the heat which had been generated by the first stage of the coal oxydation, in the time estimated. The extent and importance of this heat we did not know and could not have known, since at the first appearance of light smoke we had decided to seal off the mine for the reasons already explained.

We had considered that the fire zone was of small extent, in that after the previous reinforcement of the other stoppings, the warm points could be located only very near the stopping where we had noticed the first smoke. Therefore, basing our decision on similar experience in the past, we had decided that the mine being closed for over thirty-six days, the temperature of any heated point should have been equalized by the natural and much lower temperature of the strata and of the whole atmosphere of the mine. But apparently the area of the zone which had been affected by heat was far more important than we had estimated as will be seen from a brief relation of the stages of the method of re-entering a mine, abandoned on account of a gob fire and subsequently entirely filled up with mine gases that we recommend.

During the last six years, underground conditions in the Pictou County coal field have faced us five times with reopening of mines, abandoned either on account of fires getting beyond control, or because of explosions creating fires compelling the temporary abandonment of the mine.

Natural Ventilation Currents from Fire Areas.

In all our re-entering of mine workings, under similar conditions, we have never made use of the fan. The mine having several outlets all sealed up as tight as possible, with the exception of one, (the one intended to be used to re-enter the mine) a current of air or of gas is bound to be set up, notwithstanding the fact that there is only one opening. The slightest leakage in the stoppings of the return airways, if the intake is open, or of the intake if the return is open, will cause the heavy cold fresh air to drive out the light warm gas included in the mine.

Supposing that all the openings could be kept theoretically absolutely tight, with the exception of the one through which the re-entering of the mine is going to be made, a current will be set-up. The cold air will travel down on the pavement of the slope chasing the warmer gas which will escape by following the roof of the slope.

As a matter of fact, during the reopening of the mine which we are going to describe, we made an experiment. We reinforced all the surface stoppings, covering them with sand and clay, even covering certain portions of the surface with sand and clay, and then opened the main return-air slope, lying alongside the main air-shaft.

The first effect was a large quantity of gas coming out of the full section of the slope and after a very short while a regular current was noticed, going in at the foot wall of the slope and coming out at the roof.

After several hours of this experiment, the cold air gradually found its way down the mine, the whole section of the slope becoming an intake. In order to counteract this motion, a wooden stopping was built below the connection which existed between the slope and the air shaft in the main return slope. This had the effect of reducing the amount of fresh air going down, but did not stop the current.

In order to still further counteract this tendency, an opening of 16 square feet was made in the fan shaft, in the expectation that the air, instead of keeping down towards the mine, would return up the fan shaft. Of a total quantity of 8400 cubic feet of air the greatest part was going straight in the mine, and barefaced men could reach the stopping which we had built in the main return slope.

Finally, as a last effort to prevent the air from going down, the steam fan was started at 14 R.P.M. in order to draw the air up the fan shaft. Of a total quantity of 5148 cubic feet of air at the slope mouth, 4500 cubic feet was rushing in the mine at a point 25 feet below the crosscut between the main slope and the main air-shaft.

This experiment ought to show the effect of natural ventilation, especially on pitching seams. At first sight it should be evident that a state of equilibrium does not exist when placing in contact light warm gases, and cold heavy air. The quantities involved being very large, with considerable difference in temperature and density, heavy exchange setting up currents or natural ventilation are bound to take place and to persist for a very long time.

Therefore, in every reopening of mines, the question of natural ventilation will have to be taken very seriously into consideration, especially in cases where it is important that fresh air does not get away ahead at places where fire may exist, because under these circumstances fires may be apt to start again suddenly. In such cases, it will be most important to direct the natural current by short circuit or new circuit away from any point where the oxygen of the air could and would cause damage.

As an illustration, at the time of re-entering the Albion Mine on January 1918 the first inrush of air, entirely due to natural ventilation, was 50,000 cubic ft. of air per minute, both fans being standing, every opening being closed, with the exception of the main slope (through which the re-entering of the mine was made) and a few boards taken off the fan shaft.

In order to prevent this flow passing anywhere near the seat of the heated section, this amount of air must be deflected before it gets near the fire zone by short circuiting the main intake and the main return. In our case, this had been done when closing down the slope at the time of the temporary abandonment of the mine. The short circuit of the air current was established at a distance of 1,300 feet from the seat of the fire. Only a short distance below this point we

had a blanket of gas through which no living person could pass without the use of breathing apparatus.

The mine was then allowed during three or four hours to clear, the great bulk of the gas lying on the circuit which had been established at a point 1,300 feet above the fire zone. The ventilation being then considerably reduced, due to the cooling effect of the circuit, and also due to dilution of the gas in the return, the short circuit at this point was suppressed and established further down, closer to the fire zone at a distance of only 460 feet from the fire.

Our men following the air circuit reached the point where the light smoke had been seen at the time of the closing of the mine. At this point, a strong odor of distillation was detected and soon after was followed by a smell of coal smoke. This discovery was most disappointing because it did not leave us any doubt that the smouldering gob fire which had been surrounded by an atmosphere less than 1 per cent of oxygen during thirty-six days, had not been extinguished.

A few hours after, smoke again made its appearance, and for the same reasons as before, we decided to close down the mine and to let it fill again with gas.

The mine had been opened for only 18 hours and all the different phases of the re-entering had been carried out as scheduled. As stated, this attempt was somewhat disappointing, coming after four other successful reopenings carried on exactly under the same theory. In each of these cases, one month had been considered as being fully sufficient, not only to extinguish the fire, but also to cool down the surrounding coal and strata. In some cases less than one month had been the waiting period.

This apparent failure caused hesitation in the mind of many an official, and every supposition was considered; namely, the possibility of the section being connected with some workings of upper seams which were on fire, or connections through subsidence which might have taken place between this seam and the underlying seam and so on.

Finally, after new consideration and study of the situation, it was decided to proceed according to the same method as that adopted previously, but to keep a closer control of the natural ventilation. Since our first attempt had shown us that thirty-six days had not been sufficient to cool down the fire zone, the new attempt was made almost three months after the first one, and contrary to what had been done in this case, the new attempt was going to be made in different stages.

The first one included the establishment of a ventilation circuit to No. 4 level 1,900 feet, and from there upwards towards the surface in a separate ventilation slope, the idea being to keep the ventilation as far away as possible from the fire zone. Instead of starting with as heavy a quantity of air as during the first attempt, the air current given by the natural ventilation at the start was only 10,000 cubic feet of air per minute, which ultimately was increased to 21,000. The composition of the mine atmosphere at the time of this start was:

	Per cent
Carbon dioxide	9.98
Carbon monoxide	0.89
Oxygen	1.00
Methane	42.6
Nitrogen	45.9

in other words, highly favorable.

The rest of the program of this first day included the

opening of a door on No. 5 level at 260 feet away from the seat of the fire. This door having been previously left closed by mistake, meant that any ventilation passing below No 4 level would pass on the fire zone. This part of our programme meant that in order to avoid sending the ventilation past No. 4 level, as this part of the mine had to be kept under gas, the door had to be opened first by a Draeger team. The distance down the slope from the air station to the door was 940 ft. Our men went down to the door but found that a fall which had taken place, prevented its opening. At this stage, a sample of gas taken on the slope at No. 5 level, 2,800 feet, was analysed, and showed 17 per cent of oxygen. The mine having been opened for almost 10 hours, dilution of the gas in the air current was taking place. It was decided to end there this first stage of the operations and to let the mine fill up again with gas for a few days. This was done, and after a very short while, a gas sample taken through the pipe at the slope mouth gave us:

	Per cent
Carbon dioxide	10.9
Carbon monoxide	0.42
Oxygen	0.62
Methane	30.00
Nitrogen	59.00

A few days later we proceeded with the second part of the programme, which consisted in levelling off the fall which prevented the opening of the door at No. 5, also the closing by a temporary wood partition of a small ventilation head next to the fire stopping. 20,000 cubic feet of fresh air forced in the mine through natural ventilation was admitted in the slope, but only down to No. 4 level. From this point the work which we had planned to do was done by our Draegermen, in an atmosphere including only a small per cent of oxygen, and working at 940 feet from No. 4 level which was our air station. This was practically all that was done that day. At the end of the day, our Draegermen had levelled off the fall, opened the door referred to and closed up the ventilation head. They also took a sample of gas almost against the fire stopping; this sample was most reassuring since it included carbon dioxide, 5.5 per cent—oxygen 10 per cent, methane 24.5 per cent, after the mine had been opened up for almost almost twelve hours.

A Proper Use of the Breathing Apparatus

The value of this information alone would fully justify the use that can be made of a well-trained and well organized corps of Draegermen. This valuable information meant that all our previous work had been successful in keeping away from the fire zone an explosive mixture; also that it was possible to work with a restricted ventilation in the close vicinity of the fire stopping for about 12 hours, without allowing the diffusion of the air and of the methane to constitute an explosive mixture.

Men Wearing Breathing Apparatus as "Scouts."

Further valuable information brought back by our Draegermen was that nowhere close to the fire section could they feel any indication of heat. We had therefore every reason to believe that the period of three months of rest which we had given to the mine, during which the percentage of oxygen had been less than one per cent, had been sufficient to equalize the temperature of the smouldering fire to the surrounding temperature of the mine. In other words, not only had the combustion been suspended, but the surrounding temperature was low enough to avoid excessive avidity of hot combustible matter for oxygen.

At this stage, it would have been quite possible to complete our programme, which included the building of a temporary stopping outside the one where on two different occasions we had noticed smoke; but before proceeding to this last stage, the whole mine was once more allowed to fill up with gas.

Mr. Notebaert's Method Justified.

Finally the last day came. Through the same proceeding, the air was allowed in the mine, and this time allowed to pass No. 4 Level, travelling down towards No. 5. Barefaced men started, followed the air and built the temporary stopping mentioned above. The old stopping and all its surroundings were found to be perfectly cool, giving no indication of heat and no odor of distillation. The building of the temporary stopping was rapidly completed, and right after the permanent concrete stopping was started. We had been successful, and once more our mine officials felt that their confidence in this system of fighting fire was well justified.

In order to remedy the real cause of the fire, namely

filtration of air through the coal surrounding the stoppings sealing off the lower part of the section, a system of pipes connected to a natural supply keeps a head of a few feet of water all over the bottom part of the section. The overflow taking place through the coal itself is the best proof that the air cannot again enter to feed the gob with oxygen.

All this took place late in the year 1917 and early in 1918.

This time as before, we had found out that it was not only possible to suspend a gob fire by curtailing its oxygen supply, but also that it was possible, if time were liberally granted, to equalize the temperature of the smouldering fire with the rest of the temperature of the mine by means of a restricted natural ventilation.

Our faith in this logical, safe and efficient system of stopping an underground fire, passing rapidly beyond control, had once more been fully rapid, adding another mining experience to many other anxious ones of the Pictou County Coal Field.



COL. THOS. CANTLEY.
Retiring President, Mining Society of Nova Scotia.

COAL CONSERVATION CAMPAIGN.**Engineers' and Firemen's Year Book.**

We have received a copy of the "Engineers' and Firemen's Year Book", issued under the patronage and with the co-operation of the Fuel Administrations of Canada and the Provinces, the Railway Association of Canada, Mr. J. K. L. Ross and Mr. R. M. Wolvin, supported by the large railways of Canada and a number of leading banks and manufacturers.

The volume contains some striking reproductions of crayon sketches by Hal. Ross Perrigard, showing the part played by coal in our national life.

The text of the volume is an extract from the Final Report of the Fuel Controller of Canada. We congratulate those who conceived the idea of giving this Report such an attractive dress, and a wider opportunity for perusal by Canadians. Mr. Magrath's studied conclusions on the Canadian fuel problem deserve the widest publicity, much wider publicity than they have obtained. The Canadian public is extraordinarily apathetic about the fuel problem, and we are coming to the conclusion that the men who really know are afraid to face it. It is the skeleton in the Canadian closet, and too many people prefer to forget it. It is therefore encouraging to come across a volume that is deliberately designed to haul this skeleton into the daylight for public inspection.

The foreword to the volume, is as follows, and in quoting it, we would remark that it is an epitome of the view that the "Canadian Mining Journal" has preached regarding our domestic coal supply since it commenced publication in 1907.

"The most immediate, if not the greatest, experience of Canada from the war has been the absolute necessity for our country to produce more Coal and to conserve it more than we have done in the past.

"We are starving for coal today as we have done in the worst days of the war and whether the blame should rest upon industrial unrest here or in the United States, or upon any other cause, we are confronted with the fact that we have very little coal to burn and that a few days could see us reduced to the straits in which Germany and Austria find themselves today.

"Every body is agreed upon the necessity for an increased production of coal in Canada; this takes time however and two to four years will be required as a minimum before our coal production is increased to such a level as would relieve us from the coal shortage from which we are suffering today and would also enable us to secure that most desirable of results: the establishment of a foreign market for our surplus coal production. Meanwhile we must save coal and save it more than we have done during the last two years if we want to live, to prosper and to develop.

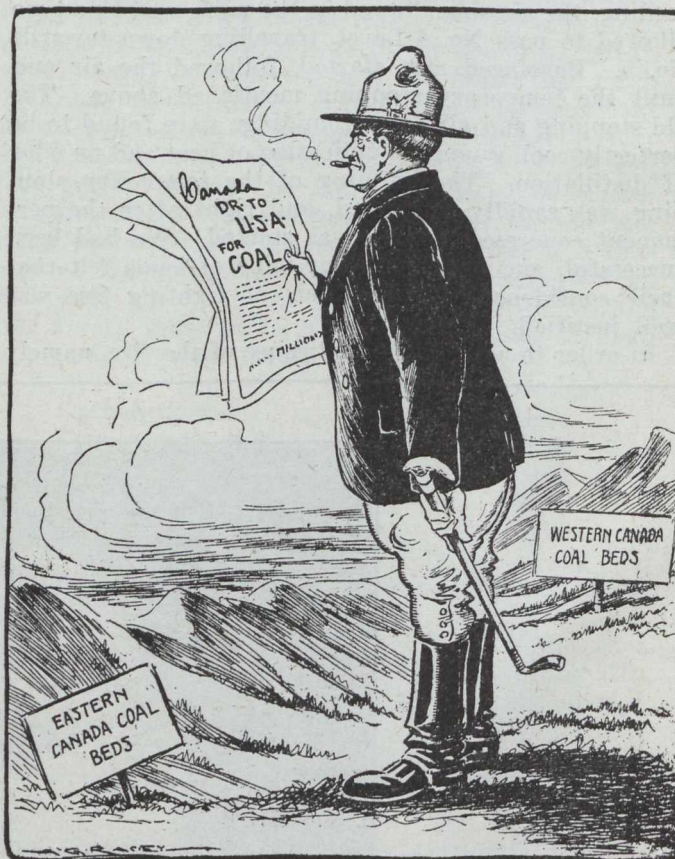
"We have preached and spread the doctrine of Coal Conservation in and out of season; our reception has been in directly inverse ratio to the weather: warm in winter, cold in summer. Who worries about coal in July and August?

"This is precisely the point we wish to emphasize; coal is just as vital in the hottest day of summer as in the bleakest day of winter—we must keep in mind that the year is short

and that the seasons revolve quickly. Uppermost before us at all times should remain the fact that we must work untiringly: 1.—TO SAVE MORE COAL. 2.—TO PRODUCE MORE COAL."

A NATURAL QUESTION.

?



Racey, in Montreal "Star."

"Canada (disgusted and worried at the constantly increasing size of its coal bill). "Why in thunder should I be at his mercy and be forced to pay these millions annually when I have sixteen per cent of the world's supply right under my feet?"

Note:—Canada has greater coal reserves than any other nation, with the lone exception of the United States.—Ed.

SAWARD'S ANNUAL—1920. A CORRECTION.

We regret that, through a printer's error in the "Journal" of last week, we were made to refer to Mr. Saward's publication as a "well-known 'complication' of data." The unfortunate wording might in some instances contain sufficient truth to prove embarrassing, but it can hardly affect the reputation of Mr. Saward's handbook, which is unexcelled in the fullness and accuracy of its information regarding all phases of the coal trade in North America.

Mr. F. A. Combe who was, until recently, Chief Engineer for Canada for Babcock and Wilcox Limited has opened an office at 603 Southam Building, Montreal to practice as a consulting combustion and steam engineer. Mr. Combe will specialize in power plant design and operation and the utilization of waste head and steam.

Northern Ontario Letter

The Silver Mines.

Quotations for silver during the first week in May continued to decline. Big silver producers in Cobalt which have been hoarding their output since the price began to fall below \$1.25 an ounce, now find their vaults fairly bulging with bullion and with quotations having dropped to \$1.05 an ounce at the time of writing. It is obvious that the recession in the price of the metal was quite unexpected, and was due to influence which may not be altogether visible even to the most astute metal authorities. While the decline has caused some disappointment, yet the current quotations are still higher than the fixed price which ruled during the closing years of the late war, when the mines were exceedingly prosperous.

An outstanding feature in connection with the silver situation is that while a decline of a further 25 per cent in price would cause curtailment of work in many of the silver mines throughout the world, it would still leave a big margin of profit for the leading producers in the Cobalt field. It is a noteworthy fact that the entire silver production of Cobalt is maintained at an average cost of under 60 cents an ounce. The Nipissing has the lowest cost, each ounce being produced at about 35 cents an ounce. Such mines as the Coniagas and Kerr Lake produce their silver at less than 45 cents an ounce.

The Beaver Consolidated Company having succeeded in leasing the adjoining Prince claim, is now making arrangements to also get control of the Badger property which corners the Beaver on the north west and lies adjacent to the Prince claim. Lateral work is being carried from the Beaver onto the Prince on a vein opened up on the Beaver at the 1,400-ft. level and which has been found to run over the boundary to the Prince. It is proposed work through the latter claim to the Badger.

It is stated that the Dominion Reduction Company has agreed to treat the old tailings pile of the Peterson Lake Company for one-third of the proceeds. The slimes are estimated at over 300,000 tons and while the exact average silver content is still undetermined, yet it is known to be such as to leave room for a substantial margin of net profit.

The appeal in the previous decision on the dispute between the O'Brien Mine and the La Rose is scheduled for an early date. It has to do with the determination of the exact location for the boundary between the Violet property of the La Rose and the O'Brien Mine of the M. J. O'Brien, Limited.

Official announcement is made this week that the Canadian Light Railways Construction Company has already engaged one engineer and a small force of men to scout out the most suitable location for a roadbed, and that actual work of construction is held in abeyance only pending the bill for the charter receiving the Lieutenant-Governor's assent. It is also announced that not only will work commence on the Gowganda line, but it is also planned to proceed with the line from Swastika to Kirkland Lake. Following is the official statement in part as submitted to the correspondent of the Journal:

"We intend to overcome every obstacle and to make a great success of our transportation scheme and hope to have all our lines constructed and in operation before the end of the year. Our bill has passed the committee and received its second reading in the

House. We now have an engineer and force of men on the job at Elk Lake and as soon the as our Bill receives the Lieutenant-Governor's assent, we will go ahead with a large force not only on the Elk Lake-Gowganda line, but also in the Kirkland Lake district.

"As soon as we have reached Gowganda, it is our intention to continue right into Shiningtree and Fort Matachewan."

It is stated at Elk Lake that the Coniagas Company of Cobalt has secured a working option on the Gamble-Thompson properties in the Gowganda district, and that the terms governing the deal are moderate. The vendors are stated to have demonstrated their faith in their property by granting fairly easy terms, with an ultimate large price provided the property makes good.

According to official advice to the "Journal", the Aladdin-Cobalt and the Tough-Oakes Company's have completed all details in connection with consolidation, and that arrangements have been made to commence work on the Tough-Oakes about May 20th. It is also stated that following a meeting to be held this week, the Burnside will also be included in the merger. Concerning the outlook for the consolidated properties, the physical condition of the Tough-Oakes and the Burnside is dealt with under "Gold Mines."

Ex-Governor Smith of Vermont, holder of an option on the Kells Silver Property in the township of Corkhill in the Gowganda Mining Division has made application for an extension of time to make the large cash payments which shortly fell due. In the meantime, an order has been issued to close down this week. The attitude the vendors will take is problematical, but the belief of local men is that they may consider the application favorably. This opinion is based on the fact that it is quite difficult to interest capital in such outlying properties, a condition with which the vendors are fully familiar.

It is expected that a shipment of ore may be made early in June by the Bailey Silver Mines, the company in control of the old Bailey-Cobalt Mine. In the meantime, preparations are being made to commence making regular shipments of medium grade ore to the Bailey Mill, formerly known as the Northern Customs Concentrator.

According to a despatch from New York, the Nipissing Mining Company has brought in three or four small oil wells on its oil lease in Kansas, with indications of the venture being a profitable one. At the same time deeper drilling is being carried on in Texas on the 1000-acre lease held by the company there. This new speculative aspect attracts added interests to the Nipissing. As regards the mine itself, the first four months of the year have been marked by a production of around \$375,000 monthly, the highest record so far in its history.

Ore and Bullion Shipments.

During the week ended May 7th, six Cobalt companies shipped an aggregate of eight cars containing approximately 576,364 pounds of ore. The Mining Corporation with three cars was the heaviest shipper, as shown in the following summary:—

Shippers	Cars	Pounds
Mining Corporation	3	196,873
Northern Customs	1	88,000
La Rose	1	87,211
McKinley-Darragh	1	84,280

Coniagas	1	60,000
Dominion Reduction	1	60,000
<hr/>		
Totals	8	576,364

During the corresponding period, the Mining Corporation was the only bullion shipper, sending out 99 bars on May 4th, containing 99,987.25 fine ounces.

The Gold Mines.

Net profits being realized by the leading gold producing mines of Northern Ontario continue satisfactory, with indications of continuance. Present conditions justify a fairly general belief that the Hollinger may decide not to increase its present rate of one per cent every eight weeks, that the McIntyre will continue to disburse 5 per cent at intervals of about every four weeks, and that the Dome and the Lake Shore will each probably pay 2½ per cent quarterly. A departure from these rates would be brought about only by a change in the labor situation. With more men available, it would be possible to increase net earnings but, as at present, with no assurance of more than about 75 per cent of the required number of men, the mines are strengthening their position as much as possible. Shareholders in close touch with the situation express confidence in the sound policy generally adopted which carries with it promise of greater longevity and increased dividends in due course.

Considerable importance attaches to the meeting of the shareholders of the Porcupine V. N. T. called for May 27th in Toronto. Obligations incurred by Sir Henry Pellatt in connection with stock underwritten some years ago by him are believed as likely to be dealt with. The meeting is also expected to reveal some idea of the cause of the friction between the English and the American directors. It is believed that all differences may be disposed of, and a decision may be reached to resume work.

Unofficial reports that the Schumacher would resume work at an early date have been current in Porcupine. Among other things, it is reported that provided work should be resumed this summer, the main shaft will be carried from its present depth of 700 ft. to the 1000-ft. level. The treasury of the company is in fair shape, there also being upwards of 100,000 treasury shares as yet unissued, and which the directors have authorized the sale of at 45 cents each. The location of the Schumacher and the nature of its gold ore deposits lends a high degree of importance to the property. It corners in between the Hollinger and the McIntyre, and is located on the contact of the porphyry and the greenstone formations under similar conditions.

To the visitor the Kirkland Lake district now present a busier appearance than ever before. To those in touch with all phases of the industry, the field promises to experience further rapid growth, and within a year or so to see as many miners engaged in work there as the total employed in Cobalt. By this, the importance of the area may be gauged.

At the 300-ft. level of the Kirkland Lake mine of the Beaver Company, some remarkably rich ore has recently been opened up. Stopping operations are being carried on at that depth. It is also learned that

in addition to the usual developments, the main shaft will be continued from the present depth of 700 ft. to a depth of 900 ft.

With reference to the Tough-Oakes and the Burnside properties, the merging of which is being completed this week, and the operation of which will commence May 20th, an official of the company stated to the "Journal" that ore actually in sight amounts to between 17,000 and 18,000 tons, and that the average gold content is from about \$12 to \$15 to the ton, or in all amounting to close to a quarter of a million dollars. The reason for the comparatively small amount of ore in sight is said to be on account of the development work having fallen far behind production during the few months prior to closing down. With work again under way at full blast, it is believed the reserve can be greatly increased in about six weeks by which time the mill will be set in operation.

A deal has been closed in connection with the Hutton-Kirkland, whereby M. Porteous and his associates have agreed to place funds in the treasury of the company so as to finance the installation of a mining plant and an extensive plan of development work. In return for this necessary money, treasury shares are to be issued. It is learned, however, that the control of the company will not be changed. Work has already commenced, and orders for machinery have been placed. It is proposed to contract for electric power from the Northern Ontario Light and Power Company and to at once build a transmission line to the property.

It is announced that the Fidelity Mining Company has let a big contract for work on its property in Teck township. The work of sinking the main shaft to the 300-ft. level has already commenced and the contract calls for an additional two thousand feet of lateral work at a depth of 300 feet.

According to official advice, the Bidgood Company, operating property at Mud Lake in the township of Lebel has raised adequate finances to assure the completion of preliminary work, which consists of 300 feet of sinking now under way, as well as over one-third of a mile of drifting and cross-cutting at the latter depth.

At the Argonaut Gold Mines at Beaverhouse Lake, about twelve miles east from Kirkland Lake, a shoot of ore 190 feet long has been passed through at the 200-ft. level. Official figures show the average gold content of the ore to be high. It is stated that 100 feet in length and seven feet wide contains average values of \$11 to the ton, while an additional 90 feet in length and five feet in width shows average gold values of \$17 to the ton. The information is entirely reliable, coming from John W. Morrison, who is charge of the operation. Mr. Morrison obtained a good reputation as the result of the work in opening up the Lake Shore Mine and bringing it to a producing basis.

It is unofficially reported that the Boston Creek Gold Mines may be re-opened within the next few weeks, and that the interest of John K. Pappas makes has been purchased. Among those interested in the property are Messrs. Bickell, Symmes, Richardson and Albright.

W. H. Seaman has been appointed manager of the Fort Matachewan Gold Mines, to succeed T. J. Flynn who has managed the work since the company was formed.

British Columbia Letter

Stewart, B.C.

That recent development on the L. L. and H. group of Mineral Claims, situated on Bitter Creek, Bear River Valley, has exposed an ore bearing body twenty-seven feet in width is the statement of C. N. Tubman, of Victoria, B.C., who, with E. M. Molander, of Everett, Wn., one of the original stakers of Mount Sicker, Vancouver Island properties, bonded this group last February from J. S. Hartley, one of the first stakers. The ore carries values in copper, silver, lead and gold. When Messrs. Tubman and Molander went to work on the 14th of last March they found two tunnels had been driven one for forty feet on the upper or galena ledge and the other for two hundred feet on the lower or arsenical ledge. The former crosscut the ledge and the latter had struck the vein and had been carried forward in ore for a distance of seventeen feet. Mr. Tubman and his partner continued the latter work and, the former states, have gone forward another ten feet in ore. They, therefore, now have exposed a body 27 feet in width which, assays have demonstrated, gives encouraging returns in the minerals named. The L. L. H. is about sixteen miles from Stewart and it is the intention to carry on development throughout the season now opening.

Alice Arm

Miners employed by the Taylor Mining Co., at the Dolly Varden Mine left their work on the 22nd of April and, as far as could be learned on the date of writing (3rd May), still are on strike. Negotiations, however, then were reported to be underway which, it was hoped would result in the resumption of operations. As matters stand both the actual mining and the railroad, which furnishes transportation between tidewater and the mine, are tied up. The men's demands for a raise in wages from a minimum of \$5 a day to \$6, single cot bunks, scrubbing of camps, and free blankets and sheets. The Company's rate of board was to remain at \$1.25 a day. This ultimatum was presented to the management on Monday, it being specified that three days, or until the next Wednesday night, would be allowed for the announcement of a decision. The decision was that under no circumstances could what was asked for be allowed and that rather than submit the whole work would be permitted to cease. This is what happened and as stated no word has yet been received indicating a settlement.

Anyox, B.C.

The Granby Co. Two and Three, consisting of sixteen mineral claims situated in the Hidden Creek District and adjacent to the property of the Granby Consolidated Mining & Smelting Co., are reported to have been bonded by P. Oleson. The owners are William Hanna, Charles Flood and associates. Mr. Oleson also has bonded the Ptarmigan, Rex, and Monty Groups in the same section. Development work is to start on the first mentioned claims next June, it being the intention to use three diamond drill outfits.

Nelson, B.C.

Samples of mineral taken from the upper workings of the Utica Mine are being shown in Nelson District which because of their exceptional quality have attracted special attention. They are from a showing

between five and six feet wide and represent a rich stringer in the showing two feet wide, the latter being of grey copper with ruby and native silver, running it is estimated from \$100 to \$1,000 a ton. The average of the whole showing of five and a half feet of ore will be 500 to 600 ounces of silver per ton.

Cranbrook, B.C.

A. J. Palmquist, manager of the Wild Horse Creek Mining Company, who has been spending the winter in Texas, has returned to British Columbia and is making preparations for the resumption of placer mining operations on Perry Creek. The company did a lot of work last season in the shape of repairs to flumes and other plant. Washing operations, therefore, should be started in the course of a month.

Vancouver, B.C.

Dr. E. T. Hodge, for several years professor of mining in the University of British Columbia and in that time prominently active in outside mining circles, has resigned to accept a professorship in the Department of Mining, Geology, and Petroleum in the University of Oregon at Portland. Dr. Hodge states that, while he is leaving the university of this Province, he will not entirely cut off his association with the mining industry and the mining fraternity of Western Canada. As his new duties will not necessitate the spending of his entire time at Portland he has agreed to become the executive head of a group of engineers organized with the object of assisting in the development of the natural resources of the Pacific Northwest.

Revelstoke, B.C.

Recent development on the Lanark Mine, an old and well-known British Columbia property situated near the City of Revelstoke, appears to confirm the faith and judgment of the present owners, Fred. C. Elliott and William Dornberg. At a depth of 1,000 feet on their vein they have opened up a body of ore containing a high grade streak from two to four feet in width, with about six feet of milling ore. The high grade averages 90 oz. silver and 65 per cent lead. The vein has been drifted on for 30 feet and holds its width and values. In addition it is asserted that a vein of high grade copper has been exposed on which little work has been done. During the winter considerable work has been done in blocking out ore and the Lanark now is practically ready to commence production. Since Messrs Elliott and Dornberg have acquired control they have installed a modern hydro-electric plant and a concentrator.

Victoria, B.C.

A total reduction of 318,101 tons of ore and concentrate by the properties of the Consolidated Mining & Smelting Co. for the 15 months ending December 31st, 1919, is shown in the report of W. M. Archibald, manager of the British Columbia mines of that corporation.

J. Warren, the president reported in part as follows:—

"The ore reserves have been largely increased, the developments in the Sullivan Mine being most satisfactory.

"Owing to the strike the prosecution of the power Company's line to Copper Mountain was seriously interrupted. It should be completed early in the coming summer. As usual your Company was the large consumer of the power company's output.

"For many years your directors have been ambitious to make your company a large producer of copper. Originally the Rossland Mines promised to contribute considerable quantities of this metal, but latterly the copper content is almost negligible, the gold values being the important ones.

"With the acquisition of the controlling interest in the Coast Copper Company (Quatsino) and the Sunlock Mines (Jordan River) both properties being situated on Vancouver Island the ambition referred to seems about to be realized.

Outside of the remarkable advancements in the Sullivan Mine, the outstanding occurrence of the period was the demonstration of a satisfactory process of treating the lower grade ores of the Rossland Camp—a problem that it has taken over 20 years to solve. This followed months of operating a large sized experimental mill. As a result many years have been added to the life of the Rossland Mines.

Another important incident of the period was the improved practice brought about in the concentrating mill at the Flourspar property, in consequence of which a product of the highest grade can be turned out, and also the lower grades can be produced more uniformly and economically.

The copper refinery is being enlarged to a capacity of 50 tons per day. A rod mill of the same capacity is being installed.

These extensions are necessary to take care of the concentrates of the Canada Copper Corporation, shipments of which will begin in the coming summer. Three Dwight & Lloyd sintering machines are being provided to treat these concentrates prior to the main smelting operations.

S. G. Blaylock, general manager, in a more detailed report makes the following statement:

Copper Plant: The main source of supply for this plant is the company's Rossland property. Owing to the very high cost of operation and the small available tonnage of ore sufficiently high in grade to offset this cost, it was not considered advisable to mine a large tonnage at Rossland. Mining operations, therefore, were conducted on a very small scale and only one copper furnace, was operated at the smelter. While the tonnage was so small that both mining and smelting costs were high, the metallurgical recoveries were the best that have ever been obtained in the smelter, and tonnage considered the costs were very low.

Lead Plant: Most of the ore treated came from the Sullivan Mine and consisted of crude ore or zinc plant tailings, but there was an insufficient supply of ore, a condition that will be remedied when the new Sullivan concentrators have reached the point where they can provide the required lead tonnage. There has been much improvement in the class of customs ore received, shippers taking more care to eliminate the zinc from their lead concentrates. The metallurgical work of the lead plant has been much improved, this year's work, considering the analyses of the ore treated, being better metallurgically than that of any of the last 10 years.

Zinc Plant: Owing to the delayed completion of the magnetic concentrator through non-delivery of machinery, the cost of production in this plant did not decline as had been expected. The cost was increased too through the raw ore dropping in grade owing mainly to the shortage of labor at the mine. The magnetic concentrator is now completed, so that much lower costs and higher production should prevail.

Copper Refinery: Improved methods have been introduced and better practice prevails. The product is now admitted to be thoroughly high grade and most suitable to the trade. The present capacity (20 tons of refined copper per day) is being increased 50 tons of refined copper per day, to take care of the production of the Canada Copper Corporation under a contract with that company.

Lead Refinery: This plant has continued to turn out its uniformly high grade product, and has shown marked improvement in costs, which are now well below the costs of a Parkes' Process Plant operating on the same tonnage.

Gold and Silver Refinery: The gold and silver refinery has been practically rebuilt, and is now thoroughly up-to-date.

Zinc Lead Ores: A floatation mill of 200 tons daily capacity was run for several months on the low grade Rossland ore. This mill proved beyond a doubt that the Rossland ores can be concentrated at reasonable cost and with good recoveries. Plans are well underway for a concentrator to handle 1,500 tons of Rossland ore daily.

Research Department: This department is a very important factor in the development of new processes and improving old methods, and has done much good work during the period under review.

Mining costs have been affected by the low tonnage produced in the same manner as the reduction plants. While the developments in the Coast Copper and Sunloch properties have been very satisfactory, probably the most gratifying thing has been the actual opening up of the ore bodies on the lower tunnel level of the Sullivan Mine. The ore opened up here while slightly different in character, is richer and larger than anyone expected, and assures even greater tonnage in this tremendous ore deposit. The tonnage developed at this mine easily justifies the building of a concentrator of from 2,000 to 3,000 tons of ore per day. The erection of such a plant at the mine will make great savings in freight, besides which the operation on such a large scale will greatly lower the cost of production. Another advantage derived from a mill of this size will be that it will insure a sufficient supply of lead concentrates to make a very substantial lead production.

Flourspar: The opening of the Rock Candy Mine and the building of a concentrator at that mine has added a new industry to the list. The company are now able to supply practically any grade of flourspar required in the trades.

THE COLLIERIES

The production of British Columbia collieries for the month of March follows:

CROWS NEST PASS

	Tons
Crow' Nest Pass Coal Co., Coal Creek	27,090
Crow's Nest Pass Coal Coal Creek	
Crow's Nest Pass Coal Co., Michel	21,529
Corbin Coal & Coke Co., Corbin	10,116
Total	58,735

NICOLA-PRINCETON

Fleming Coal Co., Merritt	3,344
Coalmont Collieries, Coalmont	81
Princeton Coal Co., Princeton	993
Total	4,418

VANCOUVER ISLAND.

Canadian Western Fuel Co., Nanaimo	55,769
Canadian Collieries (D) Ltd., Comox	32,587
Canadian Collieries (D) Ltd., Extension	19,277
Canadian Collieries (D) Ltd., South Wellington	7,219
Pacific Coast Coal Mines Ltd., Wellington	10,338
Nanoose Collieries, Nanoose Bay	1,849
Granby Consolidated Mining & Smelting Co., Cassidy	17,566
Total	144,595

NORTHERN BRITISH COLUMBIA

Telkwa Collieries, near Prince Rupert	200
---	-----

Coal deposits situated on the North Thompson River near Kamloops City are being developed. Drilling is to be undertaken and those interested state that the necessary capital is available to open up a mine and put it on a producing basis. This is to be done as soon as the preliminary work now underway is complete. Chu Chua Coal, as it is termed has been tested out for efficiency as against the product of the Province of Alberta and the terms given indicate that it is of first class quality. A good market is looked for in Kamloops and among the different metal mines of the district.

The Settlers' Rights Act of 1920, passed at the last session of the Provincial Legislature, is not likely to receive the sanction of the Lieut. Governor, who has re-

fused his signature to the measure. This, it is presumed, he has done on advice of the Dominion Government authorities. The result is that settlers within the E. and N. Railway Belt, Vancouver Island, will not be permitted further time in which to make application and receive provincial title to the coal under their lands on proving the validity of their claims. This is the third time that the federal administration has refused to assent to like legislation passed by the Legislative Assembly of British Columbia.

GEOLOGICAL SURVEY PLANS EXTENSIVE FIELD WORK IN BRITISH COLUMBIA DURING SUMMER.

Despite the reduced condition of the personnel of the staff of the Canadian Geological Survey Branch, Dominion Department of Mines, there will be more parties in the field in British Columbia this summer than for years past. Charles Camsell, in charge of the Geological Station of this Province, who returned from Ottawa a few days ago, has made this announcement. While the proposed distribution of the work planned has not yet been formally approved, it is confidentially expected that parties will be sent out as indicated below:

Portland Canal District, with particular reference to the Salmon River section, of which so much has been heard of late.

Eutsuk Lake Country.

Taseko (Whitewater) region. Here discoveries have been made of Hematite and Limonite ore on which W. M. Brewer, provincial mining engineer, has reported favorably. If Mr. Brewer's findings are confirmed it is figured that the deposits will have an important bearing on the question of the establishment of an Iron and Steel Industry in British Columbia.

West Coast of Vancouver Island.

Coquitalla Valley, from Hope to the Summit.

Lardeau and Windermere Districts. This examination, it is stated, has not been definitely decided upon but is under consideration.

Fraser River Delta Country.

In addition to these two parties are going into the field which do not come under the jurisdiction of the British Columbia Geological Station, one into the Peace River District from Hudson's Hope to Mount Selywn and the other into the Elk Region, the latter's object being the investigation of coal deposits.

Topographic parties are slated for the districts of Alice Arm, Eutsuk Lake, Cariboo and Barkerville, Teseko District, and Vancouver and Fraser Delta.

It is assumed that the attention this Province is to receive is the result of the keen interest taken in the work of exploration in the Canadian West by Mr. Camsell as well as the fact that Hon. Wm. Sloan, Minister of Mines, at the last session of the Provincial Legislature made a fervid plea for the maintenance of the high standard of service set by the Canadian Geological Survey.

PORT ARTHUR NOTES.

J. J. O'Connor.

A party of men left May 6th for Silver Islet, in charge of R. C. Jamison of Duluth, Minn. and J. D. Lamont, of Virginia, Minn. with mining supplies and equipment, including a large smokestack, and material for the erection on the Islet of a bunkhouse for the men.

Such of the old buildings as are still available will be put in repair for use in the new operations. One

structure, built of logs in 1870, is still intact, with walls in good condition. Very little will have to be done to the shaft house to put it in condition for use.

The work of unwatering the mine, will begin soon as the necessary surface preparations can be completed.

The Silver Islet Syndicate have under option, and are now carrying on operations on the following old properties in the Port Arthur district; East End Silver Mountain (Shuniah Weachu), West End Silver Mountain, Badger, Porcupine, Porcupine Jr. and Rabbit Mountain mines. The option requires the expenditure of a fixed sum per month, on this group of mines. The expenditure so far, has met the option requirements, up to June 15th next.

The Prince Location Syndicate, composed of Montreal and Boston gentlemen, are about to undertake a careful exploration of the "Prince Location", comprising 6400 acres situated in the township of Blake, on the shore of Thunder Bay. This was the first mining location staked and patented on the Canadian shore of Lake Superior. A Crown patent was issued to the late Colonel Prince, for this location in 1846. It was located for copper, and was operated during a part of 1845, and the whole of 1846. Men and supplies were brought from Montreal by batteaux, up the Ottawa and French Rivers, the Sault River and Lake Superior. Three men left in charge of the property during the winter of 1846-47 were never afterwards heard of. In the spring of 1847, a body was found on what is now known as Deadman's Island, and was supposed to be the remains of one of the party. From this incident the Island was named.

MANITOBA LETTER

Experiments are being made between Winnipeg and Selkirk with wireless telephony. These are being carried out under the supervision of Prof. R. C. Wallace, and with a view to installation of necessary equipments chiefly between Winnipeg and the Rice Lake District, and between Le Pas and the Northern Manitoba mine areas which at present have no method of quick intercourse, and, at this season of the year, are absolutely cut off from all means of rapid communication. Just now, and for a few weeks to come the lakes will be frozen and the trails fit for neither winter or summer travel.

Prof. Wallace is conducting these experiments with the object also of having any installations controlled and operated by the Government. In the abstract, this is all right—but from a matter of fact point of view, it has this objection, i.e., the Provincial Government does not own its natural resources, and therefore has little incentive to go in for much expenditure even though the enterprise would be largely commercial. So we cannot look for rapid action along this line, and it is understood that no assistance would be given to corporations to install privately controlled commercial plants.

The Rice Lake district has been added to the territory over which Prof. R. C. Wallace acts as Government Commissioner. This is good news as the Professor is not only conversant with his new territory, but entertains a kindly interest for it as a prospectively rich part of the new mining areas which have recently attracted so much attention in and to Manitoba as being other than a strictly agricultural Province.

Comparatively little news is available of activities at the various mines East of Lake Winnipeg. Travel in or out is at a standstill. Navigation on Lake Winnipeg itself will not be earlier than the first week in June, as the ice is extraordinarily thick this year—being from 5 to 6 ft. in most places. The late spring, with the steady northerly winds of the last month has resulted in keeping the ice very firm.

While the summer trip to Rice Lake will, this year and from now on, be comparatively easy, those contemplating the journey this summer will be well advised to arrange for canoes before reaching Hole River. It is almost impossible, at the present time, to secure the proper kind of canoe in Winnipeg, and all canoe manufacturers seem to be well sold out of freight canoes far in advance. In all probability the Gabrielle Mines, Ltd., will arrange this summer to have a small launch on the upper Hole River which will be available for a limited freighting service. With the new Government wagon road complete it will not be a difficult matter to take in two or three tons of supplies on one trip, as the matter of portaging will very soon be eliminated.

An effort is being made in Winnipeg to offset any further attempts at "brokers" mining booms and the wildcatting of mining stocks. Just recently the management of the Winnipeg Stock Exchange decided to allow the members of the exchange to trade in several of the Rice Lake and Le Pas mining companies' stocks. These will be quoted in the unlisted section. To date development stock of the following Manitoba mining companies can be quoted:—Gabrielle, Northern Manitoba Mining & Development, Bruce Consolidated, Northern Copper and Nickel, Boulder, Pan Extension, Gold Pan (8 p.c. pref.), Marigold and Golden Vein. No activities as yet have been evident as far as exchange trading is concerned, as most of the companies still have development stock available from treasury sales, but it is expected that, in the near future mining stocks will be quite active as progress reports are forthcoming from the camps, and the Winnipeg Stock Exchange taking hold of the situation in time may prove a most desirable feature in mining speculations and investments.

FIFTEEN RESIGNATIONS FROM GEOLOGICAL SURVEY.

The staff of the Geological Survey Branch of the Canadian Mines Department faces the season of 1920 very much thinned, and no doubt to a large extent disorganized, because of the failure of the Dominion Government to provide in the year's estimates for increases necessary to bring the salaries of these technically qualified civil servants to an acceptable standard. Many did not wait to learn what the authorities intended to do during the Season now in progress but took advantage of offers from private companies for service in various parts of the world. Those who did hold their positions expecting consideration are reported to be far from satisfied and some have since given clear evidence of their feeling by submitting their resignations. A list of those who have left the Canadian Geological Survey recently follows:

Name and place of Geological Work	Approximate length of Service Years
S. J. Schofield, British Columbia	15
L. Reinecke, B. C. and Quebec	13

J. J. O'Neill, B. C. and Arctic	12
H. C. Cooke, Quebec	16
M. Y. Williams, Ontario	14
B. Rose, B. C. and Arctic	12
O. A. Hayes, Eastern Canada	12
E. L. Bruce, Manitoba and B. C.	12
B. R. McKay, B. C. and Ontario	12
W. Wright, Eastern Canada	13
F. Alcock, Manitoba	10
V. Dolmage, B. C.	8
J. Stewart	10
W. E. Cockfield, Yukon	8
M. F. Bancroft, B. C.	10

GOVERNMENT ASSISTANCE REQUIRED FOR ONTARIO IRON-ORE MINING

By J. J. O'CONNOR

To prevent the iron ore situation becoming as acute as the fuel problem is today, Canada should take immediate steps to provide against such a contingency. A leaf should be taken from the book of experience now being written on the richest iron ore range in the world, the Mesabi range in Minnesota. On this range, and on the contiguous ranges of Vermilion and Cuyuna, there are many millions of tons of the highest grades of iron ore, ready at hand, susceptible of being mined by the cheap steam shovel method, yet millions of dollars are being expended in the erection and equipment of beneficiating plants, for the treatment of their low grade ores.

The experienced operators of the Minnesota ranges are quite well aware, that with an annual consumption of sixty million tons, the high grade ores must necessarily be exhausted within a comparatively short time, and, therefore, are preparing for the time when their low grade ores must be drawn upon for the nation's supply.

The percentage of treated ore being shipped from the United States Lake Superior mines, is increasing annually. Washing plants, crushing plants, and concentrating plants are being installed at many of the mines, for the conservation of ores, that a few years ago were not considered merchantable.

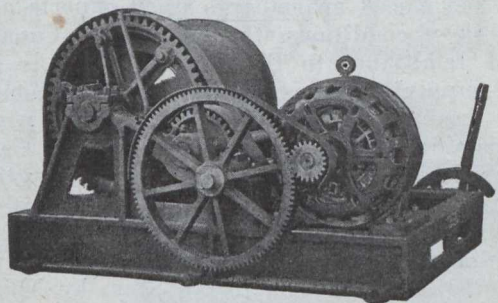
The huge plant now being erected at Babbitt, (formerly Argo) Minnesota, by the Mesabi Iron Co., is the most outstanding example of what is being done in this direction. This company have expended \$750,000 in the operation of a testing plant at Duluth, and in the acquiring of iron lands on the eastern Mesabi. The operation of their pilot plant at Duluth, has amply demonstrated to them, the commercial feasibility of the undertaking, and has cleared away all doubts of the success of the enterprise. They are now erecting at Babbitt, a concentrating and sintering plant, the first unit of which, is to cost \$3,000,000. This plant, will have a capacity for handling from 3,000 to 4,000 tons per day. The operations of the Mesabi Iron Co., are under the immediate direction of Mr. Dwight E. Woodbridge, M.E., of Duluth, Minn., a gentleman of long experience in the mining, handling and treatment of iron ore, on the Minnesota ranges. This company is not rushing into this vast expenditure, without having proved their theory of beneficiating the low grade magnetites of the eastern Mesabi.

The knowledge gained by these experienced operators, in the treatment of low grade ores, should be an object lesson, as to what may be done with our own

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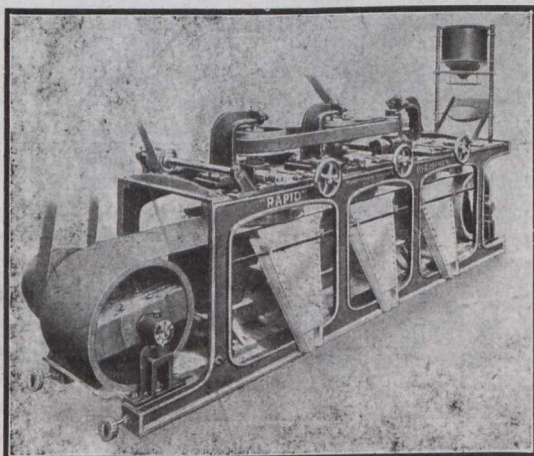
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ores. It shows that it only needs capital and enterprise to make of our iron deposits, real nation builders.

The chief disadvantage our own ores are under is the easy accessibility of United States Lake Superior ores, so long as these ores can be imported free of duty, and at low freight rates, just so long will our own ores be neglected. Added to this ease of import, is the fact that practically all Ontario ores must go through some form of treatment. If the cost of this latter handicap were overcome, it would be plain sailing for Canadian ores. Capital would be induced to invest in the development of our iron deposits, and make Canada independent of imported ore.

Already retaliatory legislation has been asked for at Washington, in the matter of news print. If the retaliation should take the form of an embargo on the export of United States iron ore, where would Canada be? This matter is so serious, that it invites the immediate attention of the Federal Cabinet, Members of Parliament, and all public bodies, to the end that the present situation may be remedied, and Canada made independent of foreign ore.

The remedy may be found in governmental aid to iron ore operators, to the extent of the cost of treatment necessary to place our low grade ores on a parity with United States ores. There can be no division of interests in this form of assistance, the benefits would be widespread and beneficial to the whole people. The iron industry is just as basic as agriculture, just as necessary in the building up of a great country, as the latter. No word of criticism has ever been heard, in or out of parliament, against the government aid given to agriculture. No class in the community would benefit more largely, through government aid to the iron ore industry, than the agriculturists, through increased markets, better prices, and cheapened implements.

The shipbuilding industry, so necessary to an exporting country, would be very largely benefitted, and enabled to compete successfully with foreign yards. Canada is, and must be, an exporting country, therefore, to reap the full benefits of our exports, we must have ships, whether privately or government owned. We are as much a maritime country as Great Britain, and relatively, just as much interested in shipping, anything that will encourage ship-building, to the extent that government aid to iron ore would do, should have the support of every Canadian, whether he be a resident of the prairies, the metallic fields of northern Ontario, or any of our commercial centres.

THE CANADIAN EXCHANGE PROBLEM.

By GEORGE E. ROBERTS, Vice-President National City Bank.

(From an address before the Merchants' Club of Boston.)

The exchange problem is usually more or less obscure to any one who is not intimate with it, but the principles are very simple. I might illustrate them by the situation between this country and Canada. If the payments both ways were equal, the drafts drawn in each country on the other would meet in the clearing houses and offset and cancel each other. But this country sold to Canada last year nearly \$300,000,000 worth of products in excess of Canada's sales to us. Canada must pay this balance. There is a balance in favor of Canada in her trade with Great Britain, and ordinarily Canadian bankers would draw

on London and sell the drafts in New York to settle the account with the United States, but part of Canadian exports to England were for credit and did not provide a cash balance.

In normal times, when the balance is first one way and then the other, bankers might ship gold from their reserves to make the settlements, but the total gold reserves of Canada are less than \$200,000,000, and under present conditions they might be all drained away, taking the foundation from under the whole banking credit situation. And so the Canadian government has placed an embargo upon exports of gold.

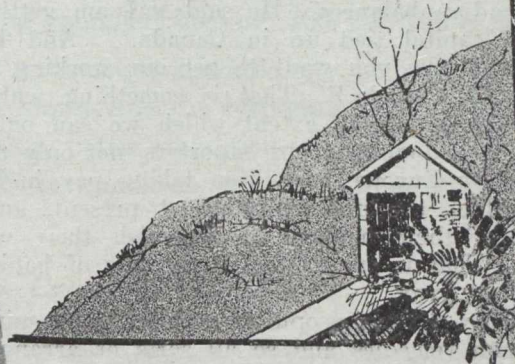
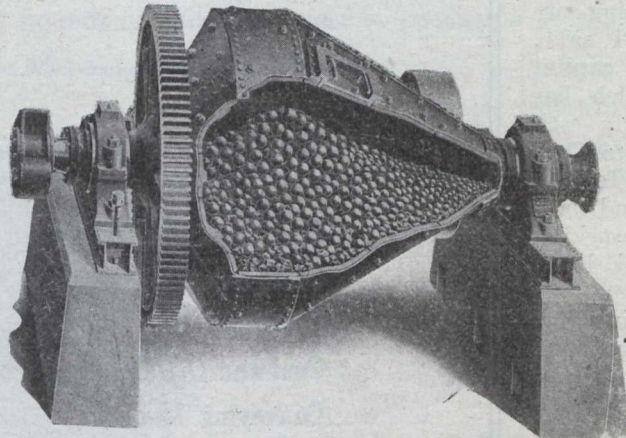
Under these conditions, the demand in Canada for means of remittance to the United States is greater than the supply, and this results in competition which has sent credits in the United States to a premium. From this side of the situation, we say that Canadian exchange is at a discount; in Canada they say that exchange on the United States is at a premium.

In the fall of 1918 the premium on American drafts in Canadian cities was about 2 per cent. In the spring of 1919 it was about 3 per cent; by November, 6 per cent, and now it is about 15 per cent. That premium amounts to an open public offer for any one to come forward and provide funds in the United States. It is an inducement to those who have the means of creating credits here to do so. A resident of Canada who owns American securities, or any securities that have a market in this country, may sell them on this side of the line and realize a premium of 15 per cent above the selling price by selling his New York draft in the Canadian market, and the same is true of the Canadian producer of any kind of goods which are saleable in the United States. The exporters of pulp and paper from Canada to this country are making handsome additions to their profits by means of the premium on exchange.

It is not a situation created by bankers or that can be cured by bankers. It is due to the one-sided state of trade. It is not a reflection upon the credit of Canada or upon the money of Canada. I read the other day of an interview with a prominent public man in Canada, a parliamentary leader, who spoke rather bitterly about the discount on Canadian exchange. He said that he would not buy anything from a country which did not accept Canadian money at its face value. That was a rather ill-considered remark. We recognize and continue to accept the Canadian gold dollar as an own brother to our dollar, but the Canadian paper money was never intended to circulate in this country. We cannot use it here. We cannot pay wages with it. We cannot pay taxes with it, and that is one of the principal uses of money nowadays. We cannot pay debts with it. The banks cannot use it in their reserves or pay it out, and merchants cannot have it. We have to ask them to settle with something we can use, and it is the competition among themselves for means of payment which makes the premium upon exchange. Moreover, it would not be desirable to have paper money issued in Canada enter into free circulation here. It would not be sound from the Canadian standpoint, for it might lead to undue inflation of the currency.

The situation is not pleasing or advantageous to us, for it is a barrier to our trade. It makes American goods cost more in Canada. We hear daily from our customers who are having trouble in holding their Canadian trade. Some of them say they cannot hold it; some of them are dividing the cost of exchange with their Canadian customers; some of them have

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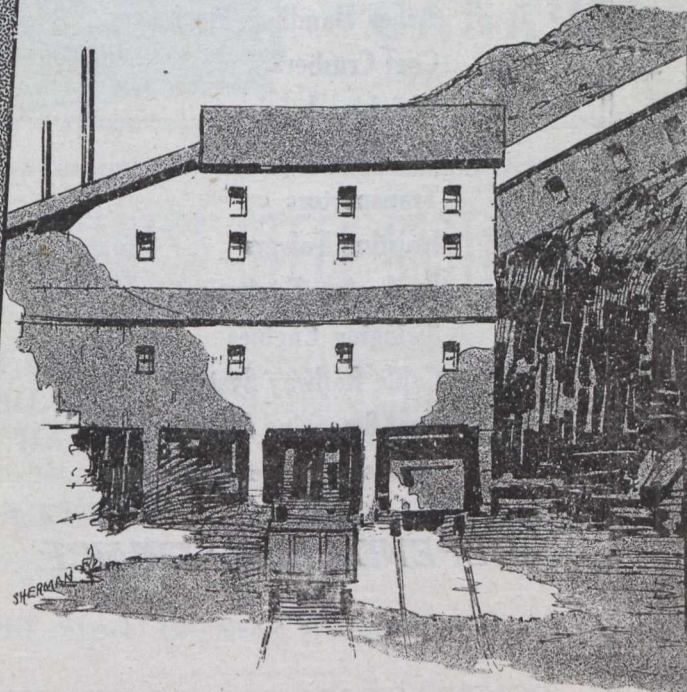
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been taking their pay in Canadian funds; that is, checks on Canadian banks, and some have been converting their funds into Canadian investments, which is all right if they are able to spare the capital from their business. I had a talk a couple of months ago with the treasurer of an important corporation, who said that he had \$2,000,000 in Canadian banks. He said: "We did not want to bring it home last spring when the discount was 3 per cent, we did not want to bring it home when it was 6 per cent, and we do not want to bring it home when the discount is 10 per cent." I suspect it does not feel any better with the discount at 15 per cent. He wanted to borrow against his Canadian balances. He said: "I am getting my working capital tied up in Canada." And I said: "Yes, and now you want to get our working capital tied up in Canada." That is something which has been going on to an extent which we can only estimate, but undoubtedly our exporters, not only to Canada, but to Europe, have been taking pay in foreign funds which are not realizable at present, and borrowing of their bankers to replenish their working capital. That is one factor in the rise of bank loans in the last year.

There are always people at such a time coming forward with remedies and so all sorts of arrangements are proposed now. An international currency, an international clearing house, an international gold pool and a foreign exchange bank all have been suggested, but all these people overlook the fact that in the long run trade must be brought into balance, and these high exchanges are a powerful influence to bring it into balance. The influence is to reduce exports from the United States to Canada, and to increase exports from Canada to the United States, and that is the only real remedy for the situation.

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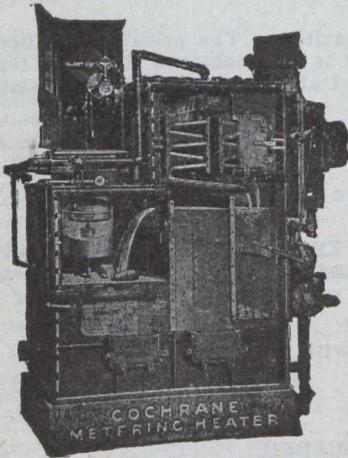
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Department of Colonization, Mines and Fisheries

The chief minerals of the Province of Quebec are Asbestos, Chromite, Copper, Iron, Gold, Molybdenite, Phosphate, Mica, Graphite, Ornamental and Building Stone, Clays, etc.

The Mining Law gives absolute security of Title and is very favourable to the Prospector.

MINERS' CERTIFICATES. First of all, obtain a miner's certificate, from the Department in Quebec or from the nearest agent. The price of this certificate is \$10.00, and it is valid until the first of January following. This certificate gives the right to prospect on public lands and on private lands, on which the mineral rights belong to the Crown.

The holder of the certificate may stake mining claims to the extent of 200 acres.

WORKING CONDITIONS. During the first six months following the staking of the claim, work on it must be performed to the extent of at least twenty-five days of eight hours.

SIX MONTHS AFTER STAKING. At the expiration of six months from the date of the staking, the prospector, to retain his rights, must take out a mining license.

MINING LICENSE. The mining license may cover 40 to 200 acres in unsurveyed territory. The price of this license is Fifty Cents an acre per year, and a fee of \$10.00 on issue. It is valid for one year and is renewable on the same terms, on producing an affidavit that during the year work has been performed to the extent of at least twenty-five days labour on each forty acres.

MINING CONCESSION. Notwithstanding the above, a mining concession may be acquired at any time at the rate of \$5 an acre for SUPERIOR METALS, and \$3 an acre for INFERIOR MINERALS

The attention of prospectors is specially called to the territory in the North-Western part of the Province of Quebec, north of the height of land, where important mineralized belts are known to exist.

PROVINCIAL LABORATORY. Special arrangements have been made with POLYTECHNIC SCHOOL of LAVAL UNIVERSITY, 228 ST. DENIS STREET, MONTREAL, for the determination, assays and analysis of minerals at very reduced rates for the benefit of miners and prospectors in the Province of Quebec. The well equipped laboratories of this institution and its trained chemists ensure results of undoubted integrity and reliability.

The Bureau of Mines at Quebec will give all the information desired in connection with the mines and mineral resources of the Province, on application addressed to

HONOURABLE J. E. PERRAULT,
MINISTER OF COLONIZATION, MINES AND FISHERIES, QUEBEC.

BRITISH COLUMBIA

The Mineral Province of Western Canada

Has produced Minerals valued as follows: Placer Gold, \$75,436,103; Lode Gold, \$97,121,786; Silver, \$46,839,631; Lead, \$42,294,251; Copper, \$145,741,069; Other Metals (Zinc, Iron, etc.), \$13,278,058; Coal and Coke, \$187,147,652; Building Stone, Brick, Cement, etc., \$28,843,272; Miscellaneous Minerals, \$651,759; making its mineral production to the end of 1918 show an

Aggregate Value of \$637,353,581

The substantial progress of the Mining Industry of this Province is strikingly exhibited in the following figures, which show the value of production for successive five-year periods: For all years to 1895, inclusive, \$94,547,241; for five years, 1896-1900, \$57,605,967; for five years, 1901-1905, \$96,509,968; for five years, 1906-1910, \$125,534,474; for five years, 1911-1915, \$142,072,603; for the year 1916, \$42,290,462; for the year 1917, \$37,010,392; for the year 1918, \$41,782,474.

Production During last ten years, \$313,976,022

Lode-mining has only been in progress for about twenty years, and not 20 per cent. of the Province has been even prospected; 300,000 square miles of unexplored mineral bearing land are open for prospecting.

The Mining Laws of this Province are more liberal and the fees lower than those of any other Province in the Dominion, or any Colony in the British Empire.

Mineral locations are granted to discoverers for nominal fees.

Absolute Titles are obtained by developing such properties, the security of which is guaranteed by Crown Grants.

Full information, together with Mining Reports and Maps, may be obtained gratis by addressing

THE HON. THE MINISTER OF MINES
VICTORIA, British Columbia

The Canadian Miners' Buying Directory.

Acetylene Gas:

Canada Carbide Company, Ltd.
Canadian Fairbanks-Morse.
Prest-O-Lite Co. of Canada, Ltd.

A.C. Units:

MacGovern & Co.

Agitators:

The Dorr Co.

Air Hoists:

Canadian Ingersoll-Rand Co., Ltd.
Mussens, Limited.

Alloy and Carbon Tool Steel:

H. A. Drury Co., Ltd.
International High Speed Steel Co., Rockaway, N.J.

Alternators:

MacGovern & Co.

Spielman Agencies, Regd.

Aluminium:**Amalgamators:**

Northern Canada Supply Co.
Mine and Smelter Supply Co.
Wabi Iron Works.

Antimony:

Canada Metal Co.

Antimonial Lead:

Pennsylvania Smelting Co.

Arrester, Locomotive Spark:

Hendrick Manufacturing Co.

Arsenic White Lead:

Coniagas Reduction Co.

Assayers' and Chemists' Supplies:

Dominion Engineering & Inspection Co
Lymans, Limited
Mine & Smelter Supply Co.
Pennsylvania Smelting Co.
Stanley, W. F. & Co., Ltd.

Ash Conveyors:

Canadian Link-Belt Company

Ashes Handling Machinery:

Canadian Mead-Morrison Co., Limited

Assayers and Chemists:

Milton L. Hersey Co., Ltd.
Campbell & Deyell
Ledoux & Co.
Thos. Heys & Son
C. L. Constant Co.

Asbestos:

Everitt & Co.

Balls:

Canadian Foundries and Forgings, Ltd
Canadian Steel Foundries, Ltd.
Hull Iron & Steel Foundries, Ltd.
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
The Wabi Iron Works.
The Hardinge Conical Mill Co.

Ball Mills:

Hardinge Conical Mill Co.
Hull Iron & Steel Foundries, Ltd.
Mine and Smelter Supply Co.
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
The Wabi Iron Works.

Balances—Heusser:

Canadian Fairbanks-Morse Co., Ltd.
Mine and Smelter Supply Co.

Babbit Metals:

Canada Metal Co.
Canadian Fairbanks-Morse Co., Ltd.
Hoyt Metal Co.

Ball Mill Feeders:

Fraser & Chalmers of Canada, Ltd.
Hardinge Conical Mill Co.
Hull Iron & Steel Foundries, Ltd.

Ball Mill Linings:

Hardinge Conical Mill Co.

Hull Iron & Steel Foundries, Ltd.

Belting—Leather, Rubber and Cotton:

Canadian Fairbanks-Morse Co., Ltd.
Link Belt Co.
The Mine & Smelter Supply Co.
Northern Canada Supply Co.
Jones & Glasco.

Belting:

R. T. Gilman & Co.

Belting (Transmission):

Goodyear Tire & Rubber Co.

Belting (Elevator):

Goodyear Tire & Rubber Co.

Belting (Conveyor):

Goodyear Tire & Rubber Co.

Blasting Batteries and Supplies:

Canadian Ingersoll-Rand Co., Ltd.
Mussens, Ltd.
Northern Canada Supply Co.
Canadian Explosives, Ltd.
Giant Powder Co. of Canada, Ltd.

Bluestone:

The Consolidated Mining & Smelting Co.

Blowers:

Canadian Fairbanks-Morse Co., Ltd.
MacGovern & Co., Inc.
Northern Canada Supply Co.
Fraser & Chalmers of Canada, Ltd.

Boilers:

Northern Canada Supply Co.
Canadian Ingersoll-Rand Co., Ltd.
Marsh Engineering Works
MacGovern & Co., Inc.
R. T. Gilman & Co.
Fraser & Chalmers of Canada, Ltd.
The John Inglis Company
Wabi Iron Works.

Blue Vitriol (Coniagas Bed):

Canadian Fairbanks-Morse Co., Ltd.

Bortz and Carbons:

Diamond Drill Carbon Co.

Boxes, Cable Junction:

Standard Underground Cable Co. of Canada, Ltd.
Northern Electric Co., Ltd.

Brazilian Rough Diamonds:

Diamond Drill Carbon Co.

Brazilian Mica:

Diamond Drill Carbon Co.

Buggies, Mine Car (Steel)

Hendrick Manufacturing Co.

Brazilian Ballas:

Diamond Drill Carbon Co.

Brazilian Rock Crystal:

Diamond Drill Carbon Co.

Brazilian Tourmalines:

Diamond Drill Carbon Co.

Brazilian Aquamarines:

Diamond Drill Carbon Co.

Bridges—Man Trolley and Rope Operated—Material Handling:

Canadian Mead-Morrison Co., Limited

Bronze, Manganese, Perforated and Plain:

Hendrick Manufacturing Co.

Buckets:

Canadian Ingersoll-Rand Co., Ltd.
Canadian Mead-Morrison Co., Limited
The Electric Steel & Metals Co.
R. T. Gilman & Co.
Hendrick Manufacturing Co.
Link-Belt Co.
Marsh Engineering Works
Mussens, Ltd.
MacKinnon Steel Co., Ltd.
Northern Canada Supply Co.
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works

Buckets, Elevator:

Hendrick Mfg. Co.

Cable—Aerial and Underground:

Northern Canada Supply Co.
Standard Underground Cable Co. of Canada, Ltd.

Cableways:

Canadian Mead-Morrison Co., Limited
Fraser & Chalmers of Canada, Ltd.
Mussens, Ltd.
The Wabi Iron Works
R. T. Gilman & Co.

Cages:

Canadian Ingersoll-Rand Co., Ltd., Montreal, Que.
Northern Canada Supply Co.
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
The Mine & Smelter Supply Co.
Mussens, Ltd.
The Wabi Iron Works

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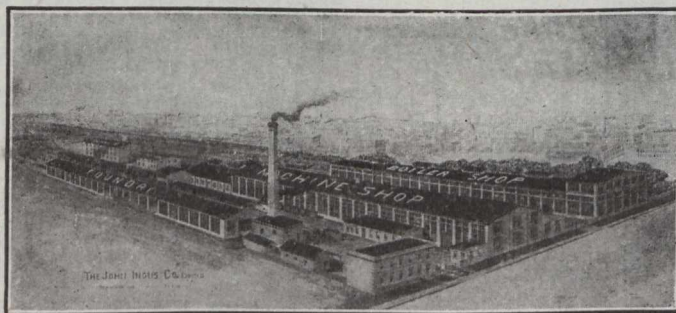
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Canadian Miners' Buying Directory.—(Continued)

Cables—Wire:

Standard Underground Cable Co. of Canada, Ltd.
Canada Wire & Cable Co.
Fraser & Chalmers of Canada, Ltd.
Northern Electric Co., Ltd.
Osborn, Sam'l (Canada) Limited.
R. T. Gilman & Co.

Cable Railway Systems:

Canadian Mead-Morrison Co., Limited.

Cam Shafts:

Canada Foundries & Forgings, Ltd.
Hull Iron & Steel Foundries, Ltd.

Car Dumps:

Sullivan Machinery Co.
R. T. Gilman & Co.
Canadian Fairbanks-Morse Co., Ltd.
Canadian Mead-Morrison Co., Limited.

Carbide of Calcium:

Canada Carbide Company, Ltd.

Cars:

Canadian Foundries and Forgings, Ltd.
Canadian Ingersoll-Rand Co., Ltd.
Canadian Fairbanks-Morse Co., Ltd.
Canadian Mead-Morrison Co., Limited.
John J. Gartshore
MacKinnon Steel Co., Ltd.
The Electric Steel & Metals Co.
Northern Canada Supply Co.
Osborn, Sam'l (Canada) Limited.
Marsh Engineering Works
Mine and Smelter Supply Co.
Fraser & Chalmers of Canada, Ltd.
Mussens, Limited
R. T. Gilman & Co.
The Wabi Iron Works

Car Wheels and Axles:

Canadian Car Foundry Co., Ltd.
Burnett & Crampton
Hull Iron & Steel Foundries, Ltd.
John J. Gartshore
Marsh Engineering Works, Ltd.
Osborn, Sam'l (Canada) Limited.
The Electric Steel & Metals Co.
The Wabi Iron Works

Carriers (Gravity):

Jones & Glassco

Castings—Brass

The Canada Metal Co., Ltd.

Castings (Iron and Steel)

Burnett & Crampton
Canadian Steel Foundries, Ltd.
Hull Iron & Steel Foundries, Ltd.
Osborn, Sam'l (Canada) Limited.
The Electric Steel & Metals Co.
The Wabi Iron Works

Cement and Concrete Waterproofing:

Spielman Agencies, Regd.

Cement Machinery:

Northern Canada Supply Co.
Hadfields, Limited
Hull Iron & Steel Foundries, Ltd.
Osborn, Sam'l (Canada) Limited.
Fraser & Chalmers of Canada, Ltd.
Canadian Fairbanks-Morse Co., Ltd.
The Electric Steel & Metals Co.
R. T. Gilman & Co.
Burnett & Crampton

Chains:

Jones & Glassco
Northern Canada Supply Co.
Canadian Fairbanks-Morse Co., Ltd.
Link-Belt Co.
Greening, B., Wire Co., Ltd.

Chain Drives:

Jones & Glassco
Mine and Smelter Supply Co.

Chemists:

Canadian Laboratories
Campbell & Deyell
Thos. Heyes & Sons
Milton Hersey Co.
Ledoux & Co.
Constant, C. L. Company

Chrome Ore:

The Electric Steel & Metals Co.
Everett & Co.

Classifiers:

Mine and Smelter Supply Co.
Mussens, Limited
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works
R. T. Gilman & Co.
The Dorr Company

Coal:

Dominoion Coal Co.
Nova Scotia Steel & Coal Co.

Coal Cutters:

Osborn, Sam'l (Canada) Limited.
Sullivan Machinery Co.
Canadian Ingersoll-Rand Co., Ltd.

Coal Crushers:

Canadian Mead-Morrison Co., Limited

Coal Mining Explosives:

Canadian Explosives Ltd.
Giant Powder Company of Canada, Ltd.

Coal Mining Machinery:

Canadian Rock Drill Co.
Denver Rock Drill Mfg Co., Ltd.
Osborn, Sam'l (Canada) Limited.

Canadian Ingersoll-Rand Co., Ltd.

Sullivan Machinery Co.
Marsh Engineering Works
Hadfields, Ltd.
Hendrick Mfg. Co.
Fraser & Chalmers of Canada, Limited
Mussens, Limited
R. T. Gilman & Co.

Coal and Coke Handling Machinery

Canadian Mead-Morrison Co., Limited.
Link-Belt Co.

Coal Pockets:

Canadian Mead-Morrison Co., Limited.

Coal Pick Machines:

Sullivan Machinery Co.

Coal Screening Plants:

Canadian Mead-Morrison Co., Limited.

Cobalt Oxide:

Conlagas Reduction Co.
Everitt & Co.

Compressors—Air:

Canadian Fairbanks-Morse Co., Ltd.
Smart-Turner Machine Co.
Canadian Ingersoll-Rand Co., Ltd.
Northern Canada Supply Co.
MacGovern & Co., Inc.
R. T. Gilman & Co.
Fraser & Chalmers of Canada, Ltd.
Mussens, Limited
The Mine & Smelter Supply Co.

Concrete Mixers:

Canadian Fairbanks-Morse Co., Ltd.
Northern Canada Supply Co.
Gould, Shapley & Muir Co., Ltd.
MacGovern & Co., Inc.
Mussens, Limited
R. T. Gilman & Co.

Condensers:

Canadian Fairbanks-Morse Co., Ltd.
Smart-Turner Machine Co.
Northern Canada Supply Co.
MacGovern & Co., Inc.

Concentrating Tables:

The Mine & Smelter Supply Co.
Deister Concentrator Co.
The Wabi Iron Works

Converters:

Northern Canada Supply Co.
MacGovern & Co., Inc.

Conveyors—McCaslin Gravity Bucket:

Canadian Mead-Morrison Co., Limited.

Contractors' Supplies:

Canadian Fairbanks-Morse Co., Ltd.

Consulters and Engineers:

Hersey Milton Co., Ltd.

Conveyors:

The Mine & Smelter Supply Co.

Conveyor Flights:

Hendrick Mfg. Co., Ltd.

Conveyor—Trough—Belt:

Canadian Fairbanks-Morse Co., Ltd.
Link-Belt Co.
Hendrick Mfg. Co.
Mussens, Limited
Jones & Glassco (Roller, Belt and Chain)
Hendrick Mfg. Co.
The Wabi Iron Works

Conical Mills:

Hardinge Conical Mill Co.

Copper:

The Canada Metal Co., Ltd.
Consolidated Mining & Smelting Co.

Cranes:

Canadian Fairbanks-Morse Co., Ltd.
Canadian Mead-Morrison Co., Limited.
Canadian Link-Belt Company
R. T. Gilman & Co.
Smart-Turner Machine Co.

Crane Ropes:

Allan Whyte & Co.
Greening, B., Wire Co., Ltd.

Crucibles:

Canadian Fairbanks-Morse Co., Ltd.
The Mine & Smelter Supply Co.

Crusher Balls:

Canada Foundries & Forgings, Ltd.
Hull Iron & Steel Foundries, Limited, Hull, Que.
Osborn, Sam'l (Canada) Limited.

Crude Oil Engines:

Swedish Steel & Importing Co., Ltd.

Crushers:

Canadian Fairbanks-Morse Co., Ltd.
Canadian Steel Foundries, Ltd.
Hull Iron & Steel Foundries, Ltd.
Hardinge Conical Mill Co.
Osborn, Sam'l (Canada) Limited.
The Electric Steel & Metals Co., Ltd.
R. T. Gilman & Co.
Lyman, Ltd.
Mussens, Limited
The Mine & Smelter Supply Co.
Hadfields, Limited
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works

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Canadian Miners' Buying Directory.—(Continued)

- Cyanide:**
American Cyanamid Company.
- Cyanide Plant Equipment:**
The Dorr Co.
The Mine & Smelter Supply Co.
- D. C. Units:**
MacGovern Co.
- Derricks:**
Smart-Turner Machine Co.
Canadian Mead-Morrison Co., Limited.
Marsh Engineering Works
R. T. Gilman & Co.
Canadian Fairbanks-Morse Co., Ltd.
Mussens, Limited
- Diamond Drill Contractors:**
Diamond Drill Contracting Co.
E. J. Longyear Company
Smith & Travers
Sullivan Machinery Co.
- Diamond Tools:**
Diamond Drill Carbon Co.
- Diamond Importers:**
Diamond Drill Carbon Co.
- Digesters:**
Canadian Chicago Bridge and Iron Works
- Dies:**
Canada Foundries & Forgings, Ltd.
Hull Iron & Steel Foundries, Ltd.
- Dredger Pins:**
Canadian Steel Foundries, Ltd.
Hull Iron & Steel Foundries, Ltd.
The Electric Steel & Metals Co.
Hadfields, Limited
- Dredging Machinery:**
Canadian Steel Foundries, Ltd.
Canadian Mead-Morrison Co., Limited.
Hadfields, Limited
Hull Iron & Steel Foundries, Ltd.
R. T. Gilman & Co.
- Dredging Ropes:**
Allan, Whyte & Co.
Greening, B., Wire Co., Ltd.
R. T. Gilman & Co.
- Drills, Air and Hammer:**
Canadian Ingersoll-Rand Co., Ltd.
Canadian Rock Drill Co.
Denver Rock Drill Mfg. Co., Ltd.
Sullivan Machinery Co.
Northern Canada Supply Co.
Osborn, Sam'l (Canada) Limited.
The Mine & Smelter Supply Co.
Mussens, Limited
- Drills—Core:**
Canadian Ingersoll-Rand Co., Ltd.
E. J. Longyear Company
Standard Diamond Drill Co.
Sullivan Machinery Co.
- Drills—Diamond:**
Sullivan Machinery Co.
Northern Canada Supply Co.
E. J. Longyear Company
- Drill Steel—Mining:**
H. A. Drury Co., Ltd.
Hadfields, Limited
International High Speed Steel Co., Rockaway.
Osborn, Sam'l (Canada) Limited.
Mussens, Limited
Swedish Steel & Importing Co., Ltd.
- Drill Steel Sharpeners:**
Canadian Ingersoll-Rand Co., Ltd.
Canadian Rock Drill Co.
Denver Rock Drill Mfg. Co., Ltd.
Northern Canada Supply Co.
Sullivan Machinery Co.
Osborn, Sam'l (Canada) Limited.
The Wabi Iron Works
- Drills—Electric:**
Canadian Fairbanks-Morse Co., Ltd.
Sullivan Machinery Co.
Northern Electric Co., Ltd.
- Drills—High Speed and Carbon:**
Canadian Fairbanks-Morse Co., Ltd.
Osborn, Sam'l (Canada) Limited.
H. A. Drury Co., Ltd.
Hadfields, Limited
- Dynamite:**
Canadian Explosives
Giant Powder Company of Canada, Ltd.
Northern Canada Supply Co.
- Dynamics:**
Canadian Fairbanks-Morse Co., Ltd.
MacGovern & Company
- Ejectors:**
Canadian Fairbanks-Morse Co., Ltd.
Canadian Ingersoll-Rand Co., Ltd.
Northern Canada Supply Co.
- Elevators:**
Canadian Mead-Morrison Co., Limited.
Sullivan Machinery Co.
Northern Canada Supply Co.
Hadfields, Limited
Fraser & Chalmers of Canada, Ltd.
Mussens, Limited
The Wabi Iron Works
- Engineering Instruments:**
C. L. Berger & Sons
- Engines—Automatic:**
Canadian Fairbanks-Morse Co., Ltd.
Canadian Mead-Morrison Co., Limited.
Fraser & Chalmers of Canada, Ltd.
- Engines—Gas and Gasoline:**
Canadian Fairbanks-Morse Co., Ltd.
Alex. Fleck
Fraser & Chalmers of Canada, Ltd.
Osborn, Sam'l (Canada) Limited.
Sullivan Machinery Co.
Gould, Shapley & Muir Co., Ltd.
MacGovern & Co., Inc.
The Mine & Smelter Supply Co.
- Engines—Haulage:**
Canadian Ingersoll-Rand Co., Ltd., Montreal, Q.
Canadian Mead-Morrison Co., Limited.
Marsh Engineering Works
Fraser & Chalmers of Canada, Ltd.
- Engines—Marine:**
Canadian Fairbanks-Morse Co., Ltd.
MacGovern & Co., Inc.
Swedish Steel & Importing Co., Ltd.
- Engines—Steam:**
Canadian Fairbanks-Morse Co., Ltd.
Canadian Mead-Morrison Co., Limited.
R. T. Gilman & Co.
MacGovern & Co., Inc.
Fraser & Chalmers of Canada, Ltd.
- Engines—Stationary:**
Swedish Steel & Importing Co., Ltd.
- Engineers:**
The Dorr Co.
- Ferro-Alloys (all Classes):**
Everitt & Co.
- Feed Water Heaters:**
MacGovern & Co.
- Flashlights—Electric:**
Spielman Agencies, Regd.
- Flood Lamps:**
Northern Electric Co., Ltd.
- Flourspax:**
The Consolidated Mining & Smelting Co.
Everitt & Co.
- Forges:**
Canadian Fairbanks-Morse Co., Ltd.
Northern Canada Supply Co.
- Forging:**
Canadian Mead-Morrison Co., Limited.
Canadian Foundries and Forgings, Ltd.
Hull Iron & Steel Foundries, Ltd.
Smart-Turner Machine Co.
Hadfields, Limited
Fraser & Chalmers of Canada, Ltd.
- Frogs:**
Canadian Steel Foundries, Ltd.
Hull Iron & Steel Foundries, Ltd.
John J. Gartshore
- Frequency Changers:**
MacGovern & Co., Inc.
- Furnaces—Assay:**
Canadian Fairbanks-Morse Co., Ltd.
Lymans, Limited
Mine & Smelter Supply Co.
- Fuse:**
Canadian Explosives
Giant Powder Company of Canada, Ltd.
Northern Canada Supply Co.
- Gears (Cast):**
Hull Iron & Steel Foundries, Ltd.
The Link-Belt Co.
- Gears, Machine Cut:**
Canadian Fairbanks-Morse Co., Ltd.
Canadian Steel Foundries, Ltd.
The Electric Steel & Metals Co.
The Hamilton Gear & Machine Co.
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works
- Granulators:**
Hardinge Conical Mill Co.
- Grinding Wheels:**
Canadian Fairbanks-Morse Co., Ltd.
- Gold Refiners**
Goldsmith Bros

Canadian Miners' Buying Directory.—(Continued)

- Gold Trays:**
Canada Chicago Bridge & Iron Works
- Hose (Air Drill):**
Goodyear Tire & Rubber Co.
- Hose (Fire):**
Goodyear Tire & Rubber Co.
- Hose (Packings)**
Goodyear Tire & Rubber Co.
- Hose (Suction):**
Goodyear Tire & Rubber Co.
- Hose (Steam):**
Goodyear Tire & Rubber Co.
- Hose (Water):**
Goodyear Tire & Rubber Co.
- Hammer Rock Drills:**
Canadian Rock Drill Co.
Denver Rock Drill Mfg. Co., Ltd.
Osborn, Sam'l (Canada) Limited.
Mussens, Limited
The Mine & Smelter Supply Co.
- Hangers and Cable:**
Standard Underground Cable Co. of Canada, Ltd.
- High Speed Steel:**
Canadian Fairbanks-Morse Co. Ltd.
H. A. Drury Co., Ltd.
Osborn, Sam'l (Canada) Limited.
Hadfields, Limited
International High Speed Steel Co., Rockaway, N.J.
- High Speed Steel Twist Drills:**
Canadian Fairbanks-Morse Co., Ltd.
H. A. Drury Co., Ltd.
Northern Canada Supply Co.
Osborn, Sam'l (Canada) Limited.
- Hoists—Air, Electric and Steam:**
Canadian Ingersoll-Rand Co., Ltd.
Canadian Fairbanks-Morse Co., Ltd.
Canadian Rock Drill Co.
Denver Rock Drill Mfg. Co., Ltd.
Jones & Glassco
Canadian Mead-Morrison Co., Limited.
Marsh Engineering Works
Northern Canada Supply Co.
Mine & Smelter Supply Co.
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
The Wabi Iron Works
R. T. Gilman & Co.
Mussens, Limited
Link-Belt Co.
- Hoisting Engines:**
Canadian Fairbanks-Morse Co., Ltd.
Canadian Rock Drill Co.
Denver Rock Drill Mfg. Co., Ltd.
The Electric Steel & Metals Co.
Mussens, Limited
Sullivan Machinery Co.
Canadian Ingersoll-Rand Co., Ltd.
Canadian Mead-Morrison Co., Limited.
Marsh Engineering Works
Fraser & Chalmers of Canada, Ltd.
The Mine & Smelter Supply Co.
- Hoisting Towers:**
Canadian Mead-Morrison Co., Limited.
- Hose:**
Canadian Fairbanks-Morse Co., Ltd.
Northern Canada Supply Co.
- Hydraulic Machinery:**
Canadian Fairbanks-Morse Co., Ltd.
Hadfields, Limited
MacGovern & Co., Inc.
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works
- Industrial Chemists:**
Hersey, M. & Co., Ltd.
- Ingot Copper:**
Canada Metal Co., Ltd.
Hoyt Metal Co.
- Insulating Compounds:**
Standard Underground Cable Co. of Canada, Ltd.
- Inspection and Testing:**
Dominion Engineering & Inspection Co.
- Inspectors:**
Hersey, M. & Co., Ltd.
- Jacks:**
Canadian Fairbanks-Morse Co., Ltd.
Can. Brakeshoe Co., Ltd.
Northern Canada Supply Co.
R. T. Gilman & Co.
Mussens, Limited
- Jack Screws:**
Canadian Foundries and Forgings, Ltd.
- Laboratory Machinery:**
Mine & Smelter Supply Co.
- Lamps—Acetylene:**
Dewar Manufacturing Co., Inc.
- Lamps—Carbide:**
Dewar Manufacturing Co., Inc.
- Lamps—Miners:**
Canada Carbide Company, Limited
Canadian Fairbanks-Morse Co., Ltd.
Dewar Manufacturing Co., Inc.
Northern Electric Co., Ltd.
Mussens, Limited
- Lamps:**
Dewar Manufacturing Co., Inc.
- Lanterns—Electric:**
Spielman Agencies, Regd.
- Lead (Pig):**
The Canada Metal Co., Ltd.
Consolidated Mining & Smelting Co.
- Levels:**
C. L. Berger & Sons
- Locomotives (Steam, Compressed Air and Storage Steam):**
Canadian Fairbanks-Morse Co., Ltd.
H. K. Porter Company
R. T. Gilman & Co.
Fraser & Chalmers of Canada, Ltd.
Mussens, Limited
- Link Belt**
Canadian Fairbanks-Morse Co. Ltd.
Northern Canada Supply Co.
Jones & Glassco
- Machinists:**
Burnett & Crampton
- Machinery—Repair Shop:**
Canadian Fairbanks-Morse Co., Ltd.
- Machine Shop Supplies:**
Canadian Fairbanks-Morse Co., Ltd.
- Magnesium Metal:**
Everitt & Co.
Hull Iron & Steel Foundries, Ltd.
- Manganese Steel:**
Canadian Steel Foundries, Ltd.
The Electric Steel & Metals Co.
Hadfields, Limited
Osborn, Sam'l (Canada) Limited.
Hull Iron & Steel Foundries, Ltd.
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works
- Metal Marking Machinery:**
Canadian Fairbanks-Morse Co., Ltd.
- Metal Merchants:**
Henry Bath & Son
Geo. G. Blackwell, Sons & Co.
Comigas Reduction Co.
Consolidated Mining & Smelting Co. of Canada
Canada Metal Co.
C. L. Constant Co.
Everitt & Co.
- Metallurgical Engineers:**
The Dorr Co.
- Metallurgical Machinery:**
The Dorr Co.
The Mine & Smelter Supply Co.
- Metal Work, Heavy Plates:**
Canada Chicago Bridge & Iron Works
- Mica:**
Everitt & Co.
Diamond Drill Carbon Co.
- Mining Engineers:**
Hersey, M. Co., Ltd.
- Mining Drill Steel:**
H. A. Drury Co., Ltd.
Osborn, Sam'l (Canada) Limited.
International High Speed Steel Co., Rockaway, N.J.
- Mining Requisites:**
Canadian Steel Foundries, Ltd.
Dominion Wire Rope Co., Ltd.
Hadfields, Limited
Osborn, Sam'l (Canada) Limited.
Hull Iron & Steel Foundries, Ltd.
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
The Wabi Iron Works
- Mining Ropes:**
Dominion Wire Rope Co., Ltd.
- Mine Surveying Instruments:**
C. L. Berger & Sons
- Molybdenite:**
Everitt & Co.
- Monel Metal (Wire, Rod, Sheet and Foundry Metal):**
International Nickel Co.
- Motors:**
Canadian Fairbanks-Morse Co., Ltd.
R. T. Gilman & Co.
MacGovern & Co.
The Mine & Smelter Supply Co.
The Wabi Iron Works

Canadian Miners' Buying Directory.—(Continued)

Motor Generator Sets—A.C. and D.C.
MacGovern & Co.

Nails:
Canada Metal Co.

Nickel:
International Nickel Co.
Coniagas Reduction Co.
The Mond Nickel Co., Ltd.

Nickel Anodes:
The Mond Nickel Co., Ltd.

Nickel Salts:
The Mond Nickel Co., Ltd.

Nickel Sheets:
The International Nickel Co. of Canada
The Mond Nickel Co., Ltd.

Nickel Wire:
The Mond Nickel Co., Ltd.
The International Nickel Co. of Canada

Oil Analysts:
Constant, C. L. Co.

Ore Handling Equipment:
Canadian Mead-Morrison Co., Limited.

Ore Sacks:
Northern Canada Supply Co.

Ore Testing Works:
Ledoux & Co.
Can. Laboratories
Milton Hersey Co.
Campbell & Deyell
Hoyt Metal Co.

Ores and Metals—Buyers and Sellers of:
C. L. Constant Co.
Geo. G. Blackwell
Consolidated Mining and Smelting Co. of Canada
Oxford Copper Co.
Canada Metal Co.
Hoyt Metal Co.
Everitt & Co.
Pennsylvania Smelting Co.

Packing:
Canadian Fairbanks-Morse Co., Ltd.

Paints—Special:
Spielman Agencies, Regd.

Perforated Metals:
Northern Canada Supply Co.
Hendrick Mfg. Co.
Canada Wire and Iron Goods Company.
Greening, B., Wire Co.

Permissible Explosives:
Giant Powder Company of Canada, Ltd.

Pig Tin:
Canada Metal Co., Ltd.
Hoyt Metal Co.

Pig Lead:
Canada Metal Co., Ltd.
Hoyt Metal Co.
Pennsylvania Manufacturing Co.

Pillow Blocks:
Canadian Link-Belt Company

Pipes:
Canadian Fairbanks-Morse Co., Ltd.
Canada Metal Co., Ltd.
Consolidated M. & S. Co.
Northern Canada Supply Co.
R. T. Gilman & Co.

Pipe Fittings:
Canadian Fairbanks-Morse Co., Ltd.

Pipe—Wood Stave:
Pacific Coast Pipe Co.
Mine & Smelter Supply Co.

Piston Rock Drills:
Mussens, Limited
Mine & Smelter Supply Co.

Plate Works:
John Inglis Co., Ltd.
Hendrick Mfg. Co.
The Wabi Iron Works
MacKinnon Steel Co., Ltd.

Platinum Refiners:
Goldsmith Bros.

Pneumatic Tools:
Canadian Ingersoll-Rand Co., Ltd.
Jones & Glasco
R. T. Gilman & Co.

Powder:
Giant Powder Company of Canada, Ltd.

Prospecting Mills and Machinery:
The Electric Steel & Metals Co.
E. J. Longyear Company
Standard Diamond Drill Co.
Mine & Smelter Supply Co.
Fraser & Chalmers of Canada, L.
The Wabi Iron Works

Pumps—Pneumatic:
Canadian Fairbanks-Morse Co., Ltd.
Smart-Turner Machine Co.
Sullivan Machinery Co.

Pumps—Steam:
Canadian Fairbanks-Morse Co., Ltd.
Canadian Ingersoll-Rand Co., Ltd.
The Electric Steel & Metals Co.
The Mine & Smelter Supply Co.
Mussens, Limited
Northern Canada Supply Co.
Smart-Turner Machine Co.
R. T. Gilman & Co.
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works

Pumps—Turbine:
Canadian Fairbanks-Morse Co., Ltd.
Smart-Turner Machine Co.
Canadian Ingersoll-Rand Co., Ltd.
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works

Pumps—Vacuum:
Canadian Fairbanks-Morse Co., Ltd.
Smart-Turner Machine Co.
The Wabi Iron Works

Pumps—Valves:
Canadian Fairbanks-Morse Co., Ltd.

Pulleys, Shaftings and Hangings:
Northern Canada Supply Co.
Canadian Fairbanks-Morse Co., Ltd.
The Wabi Iron Works

Pulverizers—Laboratory:
Mine & Smelter Supply Co.
The Wabi Iron Works
Hardinge Conical Mill Co.

Pumps—Boiler Feed:
Smart-Turner Machine Co.
Northern Canada Supply Co.
Canadian Fairbanks-Morse Co., Ltd.
Fraser & Chalmers of Canada, Ltd.
Mussens, Limited
Mine & Smelter Supply Co.

Pumps—Centrifugal:
Canadian Fairbanks-Morse Co., Ltd.
The Electric Steel & Metals Co.
Smart-Turner Machine Co.
Canadian Mead-Morrison Co., Limited.
Canadian Ingersoll-Rand Co., Ltd.
Mine & Smelter Supply Co.
Fraser & Chalmers of Canada, Ltd.
The Wabi Iron Works

Pumps—Diaphragm
The Dorr Company

Pumps—Electric
Canadian Fairbanks-Morse Co., Ltd.
Fraser & Chalmers of Canada, Ltd.
Mussens, Limited
Smart-Turner Machine Co.

Pumps—Sand and Slime:
Canadian Fairbanks-Morse Co., Ltd.
Fraser & Chalmers of Canada, Ltd.
Mine & Smelter Supply Co.
The Electric Steel & Metals Co.
The Wabi Iron Works
Smart-Turner Machine Co.

Quarrying Machinery:
Canadian Rock Drill Co.
Denver Rock Drill Mfg. Co., Ltd.
Sullivan Machinery Co.
Canadian Ingersoll-Rand Co., Ltd.
Hadfields, Limited
Mussens, Limited
R. T. Gilman Co.

Rails:
Hadfields, Limited
John J. Gartshore
R. T. Gilman & Co.
Mussens, Limited

Railway Supplies:
Canadian Fairbanks-Morse Co., Ltd.

Refiners:
Goldsmith Bros.

Riddles:
Hendrick Mfg. Co.

Roofing:
Canadian Fairbanks-Morse Co., Ltd.
Northern Canada Supply Co.

Rope—Manilla:
Osborn, Sam'l (Canada) Limited.
Mussens, Limited

Rope—Manilla and Jute:
Jones & Glasco
Northern Canada Supply Co.
Osborn, Sam'l (Canada) Limited.
Allan, Whyte & Co.

Canadian Miners' Buying Directory.—(Continued)

- Rope—Wire:**
Allan, Whyte & Co.
Dominion Wire Rope Co., Ltd.
Greening, B. Wire Co.
Northern Canada Supply Co.
Mussens, Limited
- Rolls—Crushing**
Canadian Steel Foundries, Ltd.
Fraser & Chalmers of Canada, Ltd.
Hull Iron & Steel Foundries, Ltd.
Osborn, Sam'l (Canada) Limited.
Hadfields, Limited
The Electric Steel & Metals Co.
Mussens, Limited
The Wabi Iron Works
- Samplers:**
Fraser & Chalmers of Canada, Ltd.
C. L. Constant Co.
Ledoux & Co.
Milton Hersey Co.
Thos. Heyes & Son
Mine & Smelter Supply Co.
Mussens, Limited
- Scales—(all kinds):**
Canadian Fairbanks-Morse Co., Ltd.
- Screens:**
Greening, B. Wire Co.
Hendrick Mfg. Co.
Mine & Smelter Supply Co.
Canada Wire and Iron Goods Company.
Link-Belt Co.
- Screens—Cross Patent Flanged Lip:**
Hendrick Mfg. Co.
- Screens—Perforated Metal:**
Hendrick Mfg. Co.
- Screens—Shaking:**
Hendrick Mfg. Co.
- Screens—Revolving:**
Hendrick Mfg. Co.
- Scheelite:**
Everitt & Co.
- Separators:**
Canadian Fairbanks-Morse Co., Ltd.
Smart-Turner Machine Co.
Mine & Smelter Supply Co.
- Shaft Contractors:**
Hendrick Mfg. Co.
- Sheet Metal Work:**
Hendrick Mfg. Co.
- Sheets—Genuine Manganese Bronze:**
Hendrick Mfg. Co.
- Shoes and Dies:**
Canadian Foundries and Forgings, Ltd.
H. A. Drury Co., Ltd.
Fraser & Chalmers of Canada, Ltd.
Hull Iron & Steel Foundries, Ltd.
The Electric Steel & Metals Co.
The Wabi Iron Works
- Shovels—Steam:**
Canadian Foundries and Forgings, Ltd.
Canadian Mead-Morrison Co., Limited.
Osborn, Sam'l (Canada) Limited.
R. T. Gilman & Co.
- Ship Bunkering Equipment:**
Canadian Mead-Morrison Co., Limited.
- Silice:**
Coniagas Reduction Co.
- Saline Refiners:**
Goldsmith Bros.
- Smelters:**
Goldsmith Bros.
- Sledges:**
Canada Foundries & Forgings, Ltd.
- Smoke Stacks:**
Hendrick Mfg. Co.
MacKinnon Steel Co., Ltd.
Marsh Engineering Works
The Wabi Iron Works
- Special Machinery:**
John Inglis Co., Ltd.
- Spelter:**
The Canada Metal Co., Ltd.
Consolidated Mining & Smelting Co.
- Sprockets:**
Link-Belt Co.
- Spring Coil and Clips Electric:**
Canadian Steel Foundries, Ltd.
- Steel Barrels:**
Smart-Turner Machine Co.
Fraser & Chalmers of Canada, Ltd.
- Stamp Forgings:**
Canada Foundries & Forgings, Ltd.
Hull Iron & Steel Foundries, Ltd.
- Steel Castings:**
Canadian Brakeshoe Co., Ltd.
Canadian Steel Foundries, Ltd.
Fraser & Chalmers of Canada, Ltd.
Osborn, Sam'l (Canada) Limited.
Hull Iron & Steel Foundries, Ltd.
The Electric Steel & Metals Co.
Hadfields, Limited
The Wabi Iron Works
- Steel Drills:**
Canadian Fairbanks-Morse Co., Ltd.
Canadian Rock Drill Co.
Denver Rock Drill Mfg. Co., Ltd.
Sullivan Machinery Co.
Northern Canada Supply Co.
The Electric Steel & Metals Co.
Osborn, Sam'l (Canada) Limited.
Canadian Ingersoll-Rand Co., Ltd.
Mussens, Limited
Swedish Steel & Importing Co., Ltd.
- Steel Drums:**
Smart-Turner Machine Co.
- Steel—Tool:**
Canadian Fairbanks-Morse Co., Ltd.
H. A. Drury Co., Ltd.
N. S. Steel & Coal Co.
Osborn, Sam'l (Canada) Limited.
Hadfields, Limited
Swedish Steel & Importing Co., Ltd.
- Structural Steel Work (Light):**
Hendrick Mfg. Co.
- Stone Breakers:**
Hadfields, Limited
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
Osborn, Sam'l (Canada) Limited.
Mussens, Limited
R. T. Gilman & Co.
The Wabi Iron Works
- Sulphate of Copper:**
The Mond Nickel Co., Ltd.
Coniagas Reduction Co.
- Sulphate of Nickel:**
The Mond Nickel Co., Ltd.
- Surveying Instruments:**
C. L. Berger
- Switches and Switch Stand:**
Canadian Steel Foundries, Ltd.
Mussens, Limited.
- Switches and Turntables:**
John J. Gartshore
- Tables—Concentrating:**
Mine & Smelter Supply Co.
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
- Tanks:**
R. T. Gilman & Co.
- Tanks—Acid:**
Canadian Chicago Bridge & Iron Works
The Mine & Smelter Supply Co.
- Tanks (Wooden):**
Canadian Fairbanks-Morse Co., Ltd.
Gould, Shapley & Muir Co., Ltd.
Pacific Coast Pipe Co., Ltd.
Mine & Smelter Supply Co.
The Wabi Iron Works
- Tanks—Cyanide, Etc.:**
Hendrick Mfg. Co.
Pacific Coast Pipe Co.
MacKinnon Steel Co.
Fraser & Chalmers of Canada, Ltd.
Mine & Smelter Supply Co.
The Wabi Iron Works
- Tanks—Steel:**
Canadian Fairbanks-Morse Co., Ltd.
Canadian Ingersoll-Rand Co., Ltd.
Canadian Chicago Bridge & Iron Works
Marsh Engineering Works
Osborn, Sam'l (Canada) Limited.
MacKinnon Steel Co.
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
Hendrick Mfg. Co.
The Wabi Iron Works
- Tanks—Oil Storage:**
Canadian Chicago Bridge & Iron Works
The Mine & Smelter Supply Co.
- Tanks (water) and Steel Towers:**
Canadian Fairbanks-Morse Co., Ltd.
Canadian Chicago Bridge & Iron Works
Gould, Shapley & Muir Co., Ltd.
MacKinnon Steel Co.
Mine & Smelter Supply Co.
The Wabi Iron Works

Canadian Miners' Buying Directory.—(Continued)

Tramway Points and Crossings:
Canadian Steel Foundries, Ltd.
Hadfields, Limited

Transits:
C. L. Berger & Sons

Transformers:
Canadian Fairbanks-Morse Co., Ltd.
R. T. Gilman & Co.
Northern Electric Co., Ltd.

Transmission Apparatus:
Jones & Glassco

Troughs (Conveyor):
Hendrick Manufacturing Co.

Trucks—Electric:
Canadian Fairbanks-Morse Co., Ltd.

Trucks—Hand:
Canadian Fairbanks-Morse Co., Ltd.

Trucks:
Canadian Fairbanks-Morse Co., Ltd.

Tubs:
Hadfields, Limited

Tube Mills:
The Electric Steel & Metals Co.
Fraser & Chalmers of Canada, Ltd.
Hardinge Conical Mill Co.

Tube Mill Balls:
Canada Foundries & Forgings, Ltd.
Fraser & Chalmers of Canada, Ltd.
Hull Iron & Steel Foundries, Ltd.

Tube Mill Liners:
Burnett & Crampton
Fraser & Chalmers of Canada, Ltd.
Hull Iron & Steel Foundries, Ltd.

Turbines—Water Wheel:
MacGovern & Co.

Turbines—Steam:
Fraser & Chalmers of Canada, Ltd.
MacGovern & Co.

Twincones:
Canada Foundries & Forgings, Ltd.

Uranium:
Everitt & Co.

Weighing Larries:
Canadian Mead-Morrison Co., Limited.

Welding—Rod and Flux:
Prest-O-Lite Co. of Canada, Ltd.
Imperial Brass Mfg. Co.

Welding and Cutting—Oxy-Acetylene:
Prest-O-Lite Co. of Canada, Ltd.
Canadian Fairbanks-Morse Co., Ltd.
Imperial Brass Mfg. Co.

Wheels and Axles:
Canadian Steel Foundries, Ltd.
Hadfields, Limited
The Electric Steel & Metals Co.
The Wabi Iron Works

Winches—Power Driven:
Canadian Mead-Morrison Co., Limited.

Winding Engines—Steam and Electric:
Canadian Fairbanks-Morse Co., Ltd.
Canadian Ingersoll-Rand Co., Ltd.
Marsh Engineering Works
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
Mussens, Limited
R. T. Gilman & Co.
The Wabi Iron Works

Wire:
Canada Wire & Cable Co., Ltd.
Greening, B. Wire Co.

Wire Rope:
R. T. Gilman & Co.
Canada Wire and Iron Goods Company.
Dominion Wire Rope Co., Ltd.

Wire Rope Fittings:
Canada Wire and Iron Goods Company.

Wire Cloth:
Northern Canada Supply Co.
Greening, B. Wire Co.
Canada Wire & Iron Goods Company

Wire (Bars and Insulated):
Standard Underground Cable Co. of Canada, Ltd.
Northern Electric Co., Ltd.

Wolfram Ore:
Everitt & Co.

Woodworking Machinery:
Canadian Fairbanks-Morse Co., Ltd.

Zincium:
Everitt & Co.

Zinc:
The Canada Metal Co., Ltd.
Consolidated Mining & Smelting Co.

Zinc Spelter:
Canada Metal Co., Ltd.
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THE CANADIAN MINING JOURNAL
ALPHABETICAL INDEX TO ADVERTISERS

A		B		M	
Allan Whyte & Co., Ltd.		Electric Steel & Engineering, Ltd.	1	Manitoba, Province of	
American Cyanamid Co.		Electric Steel & Metal Co.	1	McDonald, M. P.	11
American Zinc Lead & Smelting Co.		Engineering & Machine Works of Canada	8	MacGovern & Co., Inc.	
B		Everitt & Co., Ltd.		MacKinnon Steel Co., Ltd.	
Balbach Smelting & Refining Co.	49	F		Marsh Engineering Works	35
B. C. Prospector's Protective Association, The		Fleck, Alex.		McEvoy, Jas.	11
Bell, J. M.	10	Ferrier, W. F.	11	Mine & Smelter Supply Co.	
Blackwell, G. G. Sons & Company	12	Fasken, Robertson, Chadwick & Sedgewick	10	Mond Nickel Co.	
Berger, C. L. & Sons	12	Fraser & Chalmers of Canada, Ltd.		Mussens, Ltd.	
Brigstocke, R. W.	11	G		N	
British Columbia, Province of	40	Gartshore, John J.	12	Northern Canada Supply Co.	
Burns, L. P., Ltd.		General Engineering Co.	12	Northern Electric Co., Ltd.	
C		Giant Powder Company		Nova Scotia Government	7
Canadian Allis-Chalmers	39	Goldie & McCulloch		Nova Scotia Steel & Coal Co.	7
Can. Chicago Bridge & Iron Works	13	Goldsmith Bros., Smelting & Refining Co., Ltd.	12	O	
Canadian Explosives, Ltd.	44	Goodyear Tire & Rubber Co. of Can- ada, Ltd.		Ontario, Province of	6
Canadian Fairbanks-Morse Co., Ltd.	16	Greening, B. Wire Co., Ltd.		Osborn, Sam'l Co., Ltd.	2
Canadian Mead-Morrison Co., Ltd.	38	Grover & Grover	10	P	
Canadian Milk Products, Ltd.	38	Gutta Percha & Rubber, Ltd.		Pacific Coast Pipe Co.	
Canadian National Railways	13	H		Peacock Bros., Ltd.	52
Canadian Ingersoll-Rand Co., Ltd.	3	Hardinge Company	37	Powley & Townsley	9
Canadian Link-Belt Co., Ltd.		Hadfields, Ltd.	52	Prest-O-Lite Co. of Canada	
Canadian Laboratories, Ltd.	10	Hamilton Gear & Machine Co.	12	Q	
Canada Foundries & Forgings, Ltd.	49	Hassan A. A.	11	Quebec, Province of	40
Canada Wire & Iron Goods Co.	9	Hendrick Mfg. Co.	12	R	
Canada Wire & Cable Co.		Hersey, Milton Co., Ltd.	11	Rapid Magnetting Machine Co., Ltd.	35
Canadian Rock Drill Co.	51	Heys, Thomas & Son	11	Ridout & Maybee	12
Canadian Steel Foundries, Ltd.		Hull Iron & Steel Foundries, Ltd.	14	Rogers John C.	11
Canada Metal Co.	9	Hore, Reginald E.	12	Rogers, Geo. R.	11
Canadian Brakeshoe Co.	39	Hoyt Metal Co.	52	Reddaway, F. & Co.	
Canadian Sirocco Co.		I		S	
Capper Pass & Son, Ltd.	10	Imperial Bank of Canada	13	Smart-Turner Machine Co.	
Consolidated Mining & Smelting Co.	39	Imperial Trading Co.		Smith & Travers Company, Ltd.	10
Coniagas Reduction Co.	42	International Business Machines		Standard Underground Cable Co. of Canada, Ltd.	
Constant, C. L. & Co.	49	International Nickel Co. of Canada, Ltd.	5	Stewart, Robert H.	11
D		Inglis, J. & Co.	42	Spielman Agencies, Regd.	
Denver Rock Drill Mfg. Co.	51	International Nickel Company		Sudbury Diamond Drilling Co., Ltd.	10
Deloro Smelting & Refining Co.	39	J		Sullivan Machinery Co.	
Dewar Mfg. Co.	8	Johnston, Matthey & Co.	10	Swedish Steel & Importing Co.	
Department of Mines, Canada	4	Jones & Glassco (Regd.)		T	
Diamond Drill Carbon Co.	50	L		Toronto Iron Works	
Diamond Drill Contracting Co.	12	Laurie & Lamb		Tyrrell, J. B.	11
Drury, H. A. Company	8	Ledoux & Co.	10	U	
Dominion Coal Co., Ltd.		Lindsey, G. G. S.	11	University of Toronto	9
Dominion Oxygen Co., Ltd.		Longyear, E. J. Company	10	W	
Donald, J. T. & Co.	10	Lyman, Ltd.	13	Whitman, Alfred R.	11
Dorr Co.	11				
Dresser, John A.	11				
Dominion Wire Rope Co., Ltd.	7				
Dwight & Lloyd Sintering Co., Inc	10				
Dominion Engineering & Inspection Co.	11				

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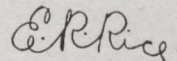
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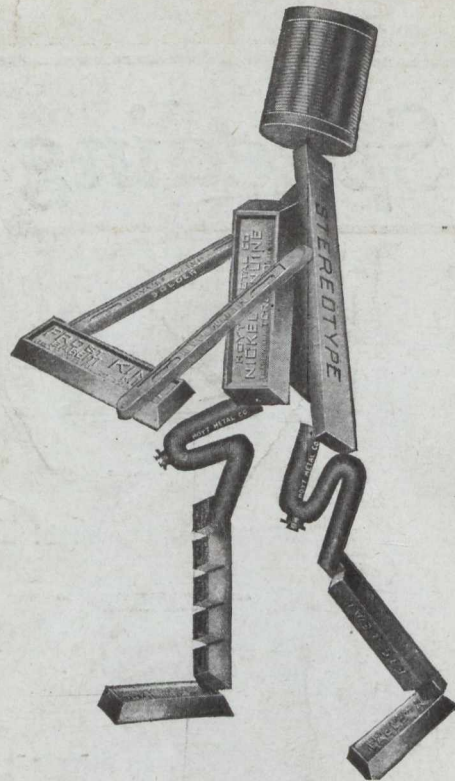
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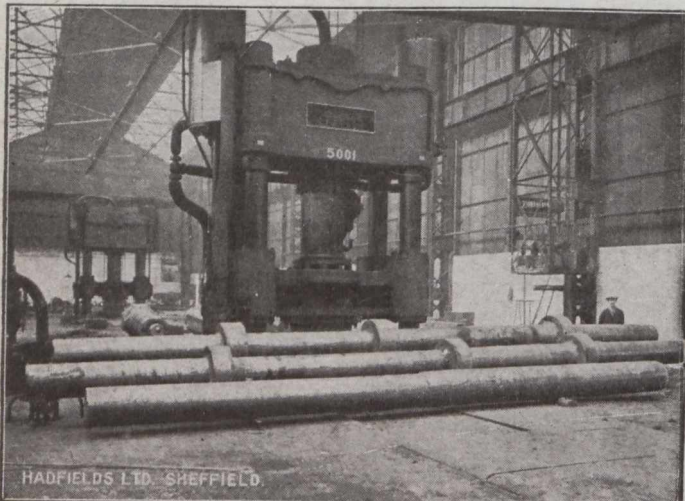
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