

CANADIAN MINING JOURNAL

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No. 14.

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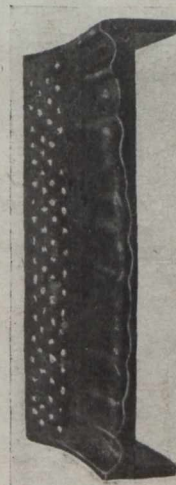
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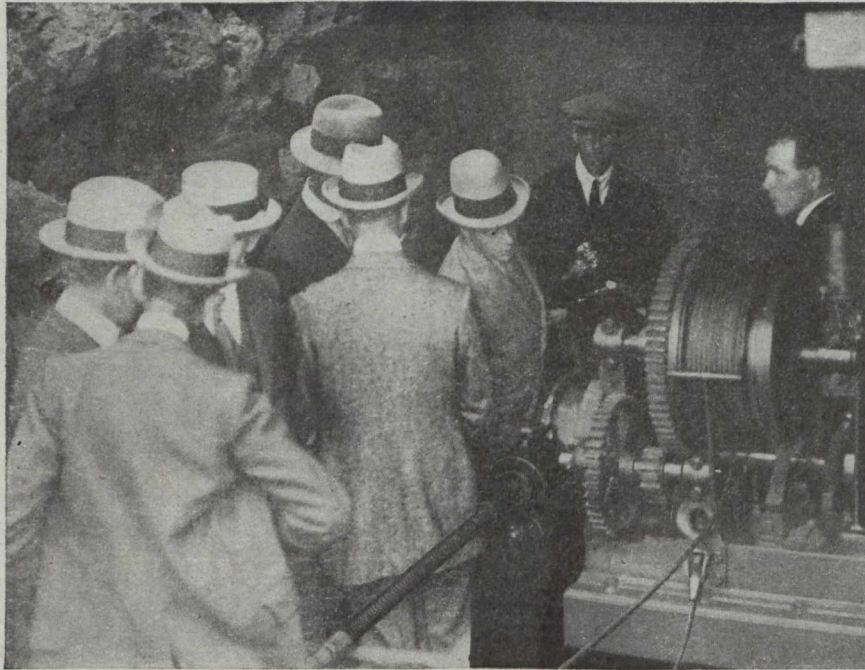
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The Prince of Wales visits his Sullivan Diamond Drill

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THE accompanying photograph was taken on the occasion of a visit of the Prince of Wales, who is also the Duke of Cornwall, to the Kit Hill Mine in June, 1919. The Western Morning News of June 11th says, "Because of the enterprise of the Duchy management in installing up-to-date machinery, these mines are providing valuable quantities of tin and wolfram, the supplies of the latter having proved of great national service during the war.

"The Prince showed a decided aptitude for making the most of his time, for he at once proceeded to view what is probably the most interesting feature of the mines, the new Sullivan Diamond Drill, which began its work of boring on May 28th. This drill bores out a core of rock about one inch in diameter, from which can be learnt the properties of the lode, the object of the drill being for prospecting. It has already bored about 120 feet, the average being about 12 feet per day (horizontal holes in single shifts), and its ultimate depth will be over 700 feet. * * * The Prince spent some time watching the drill at work and displayed a very keen interest, asking many questions relative to the working of the drill. Specimens of metal which had been extracted by the drill were also shown him."

The Prince is the man close to the swivel head, watching the machine work.

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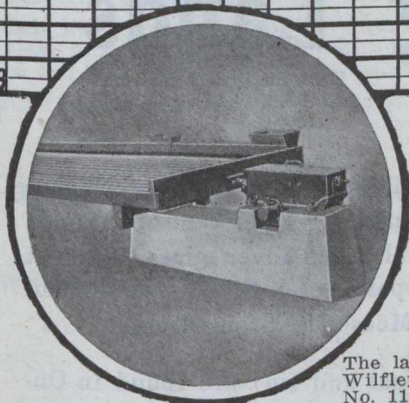
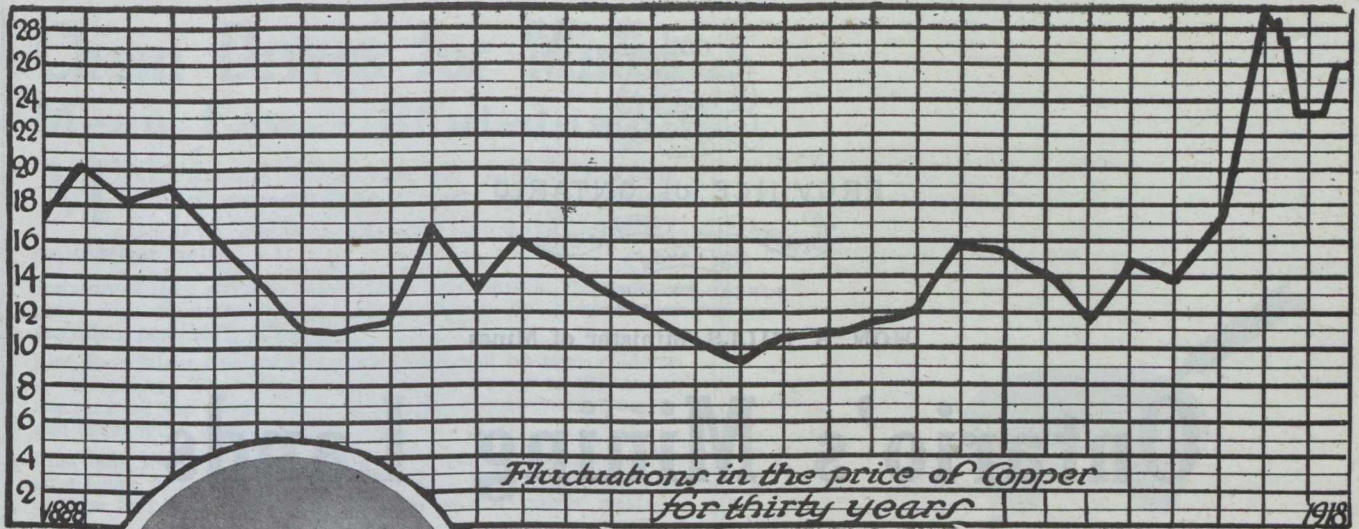
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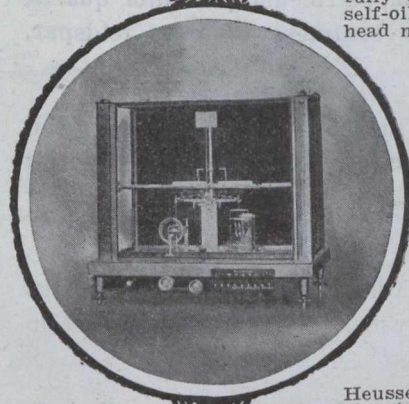
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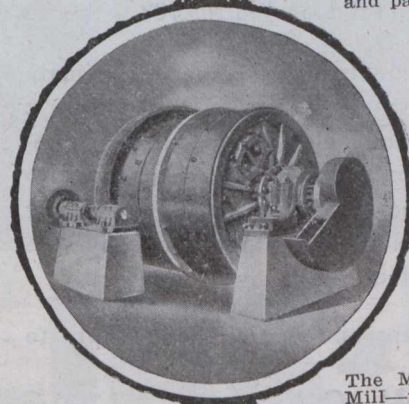
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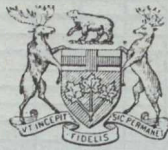
- Wilfley Concentrating Tables—single and double deck
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HON. H. MILLS, Minister of Mines.

Ontario's Mining Lands

Ontario, with its 407,262 square miles, contains many millions of acres in which the geological formations are favorable for the occurrence of minerals, 70 per cent of the area being underlain by rocks of pre-Cambrian age. The phenomenally rich silver mines of Cobalt occur in these rocks; so also do the far-famed nickel-copper deposits of Sudbury, the gold of Porcupine and Kirkland Lake, and the iron ore of Magpie and Moose Mountain Mines.

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

Thos. W. Gibson,

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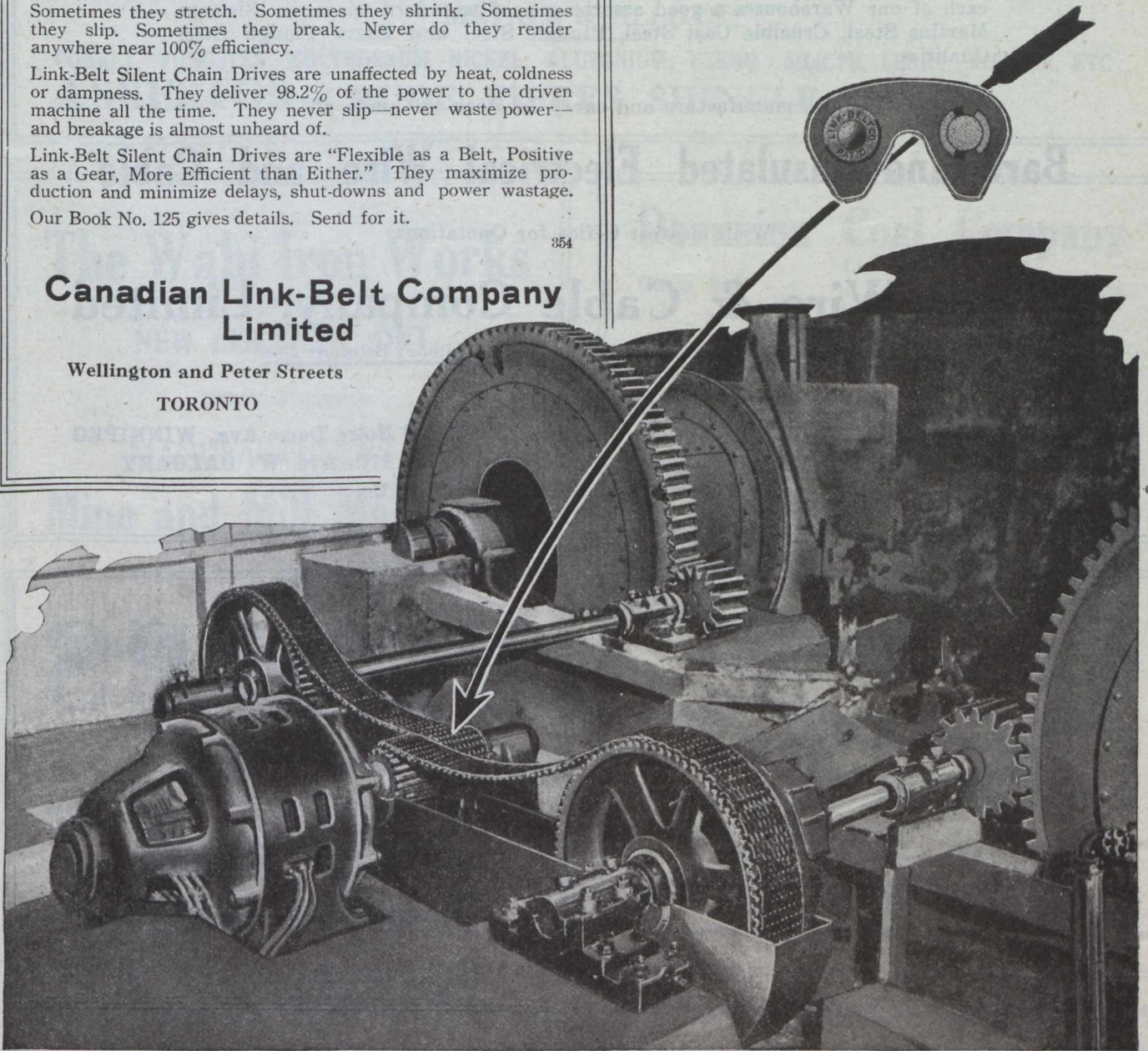
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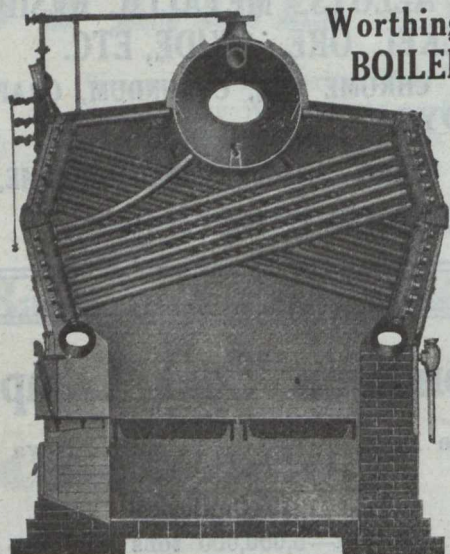
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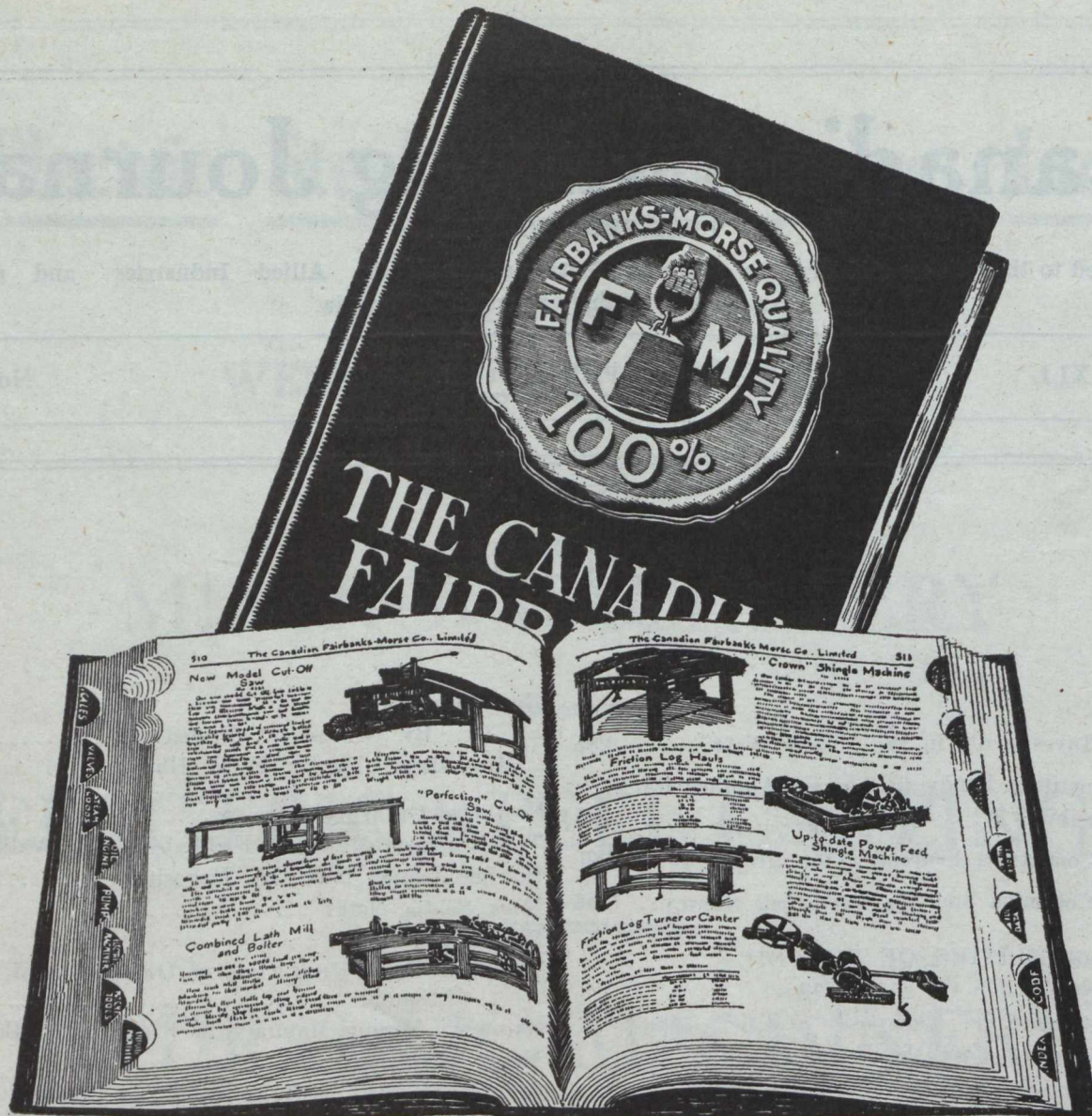
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EDITORIAL

Mining Investments in the Middle West

In the editorial pages of this Journal in recent issues there has been under discussion the very pertinent question of the relationship of investors to operating mining companies and to the owners of prospects. We had intended to discuss some phases of this subject at the recent annual meeting of the Institute. It is an unfortunate fact that financial and business men in Manitoba and Saskatchewan look askance at investments in mining fields. In many cases, indeed, when investments are made, secrecy is enjoined in order that the standing of our financial men be not impaired by the knowledge of the fact that they are interested in mining ventures. This is a situation so serious that we cannot avoid facing it and discussing the methods that may be adopted to change the present state of affairs.

In Manitoba, and probably in Saskatchewan, the mining industry in the precious metals will only be placed on a secure footing as far as the confidence of mining men is concerned, when a real industry is established. The fact that the Flin Flon property is now being operated and the probability that a deal will be made which will ensure an industry of large proportions, is of paramount importance. The gold industry, necessarily of a speculative nature, will secure confidence in financial circles when it is seen that a real industry has been established in mining through the copper properties. For that reason the future of the Flin Flon property has been the crux of the situation in connection with the recognition of mining among the industries of the Middle West.

It has been felt by mining men that irresponsible publicity in connection with gold prospects, more particularly in relation to advertising matter, has done a great deal to undermine the confidence of the men whose confidence it is important to secure. Advertisements of gold prospects appearing in the daily press are ostensibly written, as a rule, not for business men or for mining corporations, but for the small investor. The point of view is a mistaken one, and, like a boomerang, recoils on the districts connected therewith. It will be gradually conceded that legislative restrictions will not finally cure this situation; such restrictions, however, may do much to check misstatements and keep the situation under control. Certain enactments which have been passed by the Manitoba Legislature during the recent session provide that prospectuses

be filed with the Public Utility Commissioner, whose duty it is to administer the Sale of Shares Act, and that such prospectuses give full details with reference to properties and the methods of organization of the companies applying for permission to sell stock. It is also provided that all advertising matter conform to the facts set forth in the prospectus. It is not to be expected that such provisions will inaugurate a new era; they indicate, however, the temper of the representatives of the people in this regard and such indication may mean much for the future.

There is a duty, however, which the mining men of Canada, more particularly through the Institute which represents them, should perform in order to assist the Middle West at the present time. Local branches may do much to assist the mining industry. The Institute as a whole, however, can do much more. There is no doubt that the western meeting was fruitful of good results, particularly in British Columbia. The suggestion should be carried out that the next western meeting should hold at least one session in the City of Winnipeg in order that the prominent mining men of Canada may discuss with the business men of Winnipeg the whole mining situation, more particularly in its western aspects and thereby establish confidence in the circles where confidence will mean much in an industry which, while it will not vie with agriculture, will yet be of great importance to the provinces of the Middle West.—R.C.W.

IS THE INSTITUTE READY TO ASSUME ANOTHER RESPONSIBILITY?

That the mine operators will find, in the services which the Secretary can render the industry, adequate compensation for the financial assistance which it is proposed to ask of them in putting the Institute on a better business basis may be assumed. At present the Institute is recognized by the Government as an organization that contributes to the welfare of the country and the Government helps to defray the Institute's expenses. The government grant, like the government officials on the Council, is recognized as a source of weakness when deputations from the Institute wait on governments. The Institute will be stronger if it can carry on without the assistance of a government grant. It is proposed that the operating companies should properly be requested to make this

possible by subscribing in proportion to their investment in the industry towards the cost of the Institute's work. It is proposed further to ask for subscriptions to pay for increased work by Institute officers.

There can be little doubt that the willingness of past governments to give financial support to the Institute resulted not from the organization's work on behalf of established industries, but from its useful work in connection with the establishment of new industries. The Institute has, owing to the early stage of development of our country, given much attention to development of mineral areas and has been a big factor in supplying useful information about mineral deposits and methods of mining and treating ores. If this part of the Institute's work is to continue and expand, there must be recognition of the fact that government officials and others not in responsible charge of mining operations have been the chief contributors. Men who represent money are asked to take the responsibility of putting the Institute on a better business basis. They should accept with this responsibility the duty of seeing to it that the educational part of the Institute's work is not allowed to sink too far into the background. There are many members of the Institute who have contributed something more valuable than money to the industry. Their contributions become more valuable when discussed by experienced operators; but care should be taken to insure that the contributions continue and that the demand for better business methods does not result in too little appreciation of the necessity of the encouraging of the pioneers and of the help given pioneers in the industry by men who do not represent money invested in the industry.—R.E.H.

MINING COMPANIES SEARCHING FOR PROPERTIES.

During the past few years several of the mining companies operating in Ontario have given much attention to the search for new properties. Some of the operators of silver mines at Cobalt have been particularly active. Company scouts have visited and examined hundreds of prospects, not only in Ontario, but also in far distant mineral districts. Some of the companies have undertaken exploratory work on many properties. Occasionally a company has committed itself to a large expenditure on property held with the option to purchase. In a few instances terms and results of exploration have proven satisfactory and the mining company has become the owner and operator of a new property. In other cases a controlling interest has been purchased and the responsibility of operation taken on. Up to date there are not many mines in Ontario that have been developed by com-

panies in this way; but it is reasonable to expect that the existing organizations will be taken fuller advantage of in the future and that our mining companies will give more and more attention to the search for new properties that can be made productive.

An obvious advantage in favor of the mining company in this search is its staff of experienced men and its facilities for making assays and tests and for obtaining necessary men and supplies to carry on development work. An obvious disadvantage is the variation in opinions among shareholders when expenditures on a very speculative enterprise are to be undertaken. The original shareholders whose success came from a highly speculative enterprise may themselves be satisfied to hold what they have instead of venturing again. If they are willing, they have then to consider the many newer shareholders who did not invest when there was danger of failure and who may not be willing to venture now. If the shareholders are willing to speculate on development of new properties, they can well do so through their company's officers and staff, for they will thus have the benefit of a strong organization. The risk to be run, however, despite the best of guidance, is in most cases such that directors hesitate to act for their companies as they would for themselves, and mining companies are not making the progress in new development that some might expect.—R. E. H.

BRITISH COLUMBIA AND THE GEOLOGICAL SURVEY.

In this issue is published the text of a speech made by the Minister of Mines of British Columbia with reference to the resignations of members of the Geological Survey. The "Journal" welcomes Mr. Sloan's whole hearted and convincing endorsement of a point of view that has been urged with perhaps tiresome iteration in these columns. In setting forth his point of view Mr. Sloan has written a history of the Geological Survey of Canada that eloquently sets forth the proud and worthy traditions of what we venture to name the "Look Out" of Canada, which we believe our readers will find not only interesting, but inspiring. Mr. Sloan goes very far when he says that the Geological Survey "is the one branch of the Dominion Civil Service that has any direct bearing on our future". Yet, when that statement is pondered over, little exception can be taken to its accuracy. If other executive officers of provincial mine departments were as clear and as outspoken on the importance of the Geological Survey and its unimpaired maintenance there would be some chance of dissipating the ambiguity that characterises official attitude towards the Survey.

The Possibilities of the Oil Resources of Canada

By D. B. DOWLING*

The mobility of the liquid fuel introduces into the question of a survey of oil resources many problems quite foreign to the study of the coal measures. Certain formations indicate the probable presence of either of these resources, and generally the formations carrying oil precede in time of formation those carrying coal. The influence of earth movements and the introduction of compressive strains generally harden and consolidate the coal, but have the effect on the semi-fluid matter of increasing its fluidity and so hastening its segregation into pools, or even of facilitating the long period through which they have since been the porous beds to natural outlets. The survey of these resources must, in addition to the superficial mapping of the areas, also include studies of the physical condition of the beds presumed to be oil-bearing. As already suggested excessive fracturing and disturbance indicate a possible waste, whereas gently flexed beds may provide many structures favorable for the retention and collection of the oil.

The study of our probable fields must consequently include the outlining of the deposits, in which the oil has been found in other parts of the continent, a careful study of the general structure with the view of eventually eliminating those portions from which the reserves may be deemed to have been drained, and selecting for prospecting of those parts which give some promise of success. The term prospecting is not applied here in the same sense in which it is used when referring to the search for other minerals, but generally involves the actual drilling of wells to test the measures, which should be undertaken only after the preliminary examination outlined above.

The granites of the Canadian shield represent parts of the older continent; upon this rests the stratified beds, in which are entombed the remains of the passing life of the earth. Much of this represents the life in the sea, and the great mass consists of the simplest forms. These appear to furnish the material which is altered to oil, while the plant life in the marshes and lagoons and near the shores appears to have been preserved as coal. Large areas of these rocks have been stripped from the granite base, leaving bare the "Canadian shield," which must be excluded from our possible oil fields, and other areas are broken, folded and faulted, so that careful examination will eliminate parts where it would be useless to bore. In these areas it may prove, however, that the faulting has exposed to ready mining shales that have absorbed or have retained the oils or materials that can be distilled into oils.

The Oil Formations

In the United States, oil is found in formations of Palaeozoic, Mesozoic, and Tertiary ages. In the Palaeozoic, oil formations are found beneath the Coal Measures in rocks whose ages range as far back as the Cambro-Silurian. The greater accumulations appear to be in the porous beds of the Devonian. In the Mesozoic formations, porous beds of the upper Cretaceous

are productive in Wyoming. Similar strata have been prospected in the Canadian fields, but with little success. Oil has been found in Canada in the Lower Cretaceous, the horizon being approximately between the coal bearing Kootenay, and the western representative of the Dakota rocks. The Tertiary formations of the Pacific coast that represent marine deposits have proven rich in oil in the Californian fields. Very small patches of rocks of this age are found along the Canadian coast, but these so far have not proven commercially valuable.

Palaeozoic Formations

As these formations were deposited about the old continental nucleus, during the period of its greatest depression, they now form, or underlie, a large part of the present surface. They have, however, in large areas been stripped from the old continent during the long period through which they have since been subject to erosion. In the subsequent changes of elevation, the differential movements are impressed on the beds in the form of undulations thereby facilitating the collecting of any contained oil in pools, but where the stresses were very great the deformation reached the proportions of destruction.

Of the original measures surrounding and partially covering the ancient continent, not only has a large part been removed by denudation, but great zones are fractured, folded and crushed. From these zones much of the broken material has been removed. Blocks that have been elevated have become drained of any possible oil, and the folded and crushed areas in consequence rendered of very slight value as oil fields. Where, however, the oil has not migrated to the coarse porous beds or sands, but is retained in the shales, the fracturing may be an aid to their exploration.

The fracture zones of the continent are for the Palaeozoic sediments the limiting boundaries of the oil fields, although within these zones small areas may be found with indications of oil.

The Fracture Zones

Two main lines of intensive crushing and deformation are indicated. The greatest follows the line of the Cordilleras through the length of the two American Continents. In Canada this belt line of weakness or deformation, which affected the Palaeozoic sediments, is a broad one, and is represented by the Eastern Belt of the Canadian Cordilleras. In this, the zone in which accumulation of oil might have been looked for, is entirely destroyed, and the blocks that are elevated and exposed in the eastern edges of the Rocky Mountains appear to be already drained.

Near the Atlantic coast, lines of elevation and fracture show the effect of great lateral pressure exerted at various times. The lines of weakness are not continuous nor essentially parallel, so that the band of deformation contains within it areas not badly crushed, and in some of these small showings of oil have been found. The disturbed measures show large quantities of oil shales, and the potential value of the Maritime Provinces for the production of oil would seem to lie in these shales.

Fracture zones are found in the northern or Arctic regions. These represent what appears to be normal

*Composite abstract of papers read before the Royal Canadian Institute, March 28, 1920, and before the Annual Meeting of the Canadian Mining Institute, Toronto, March 8-10, 1920.

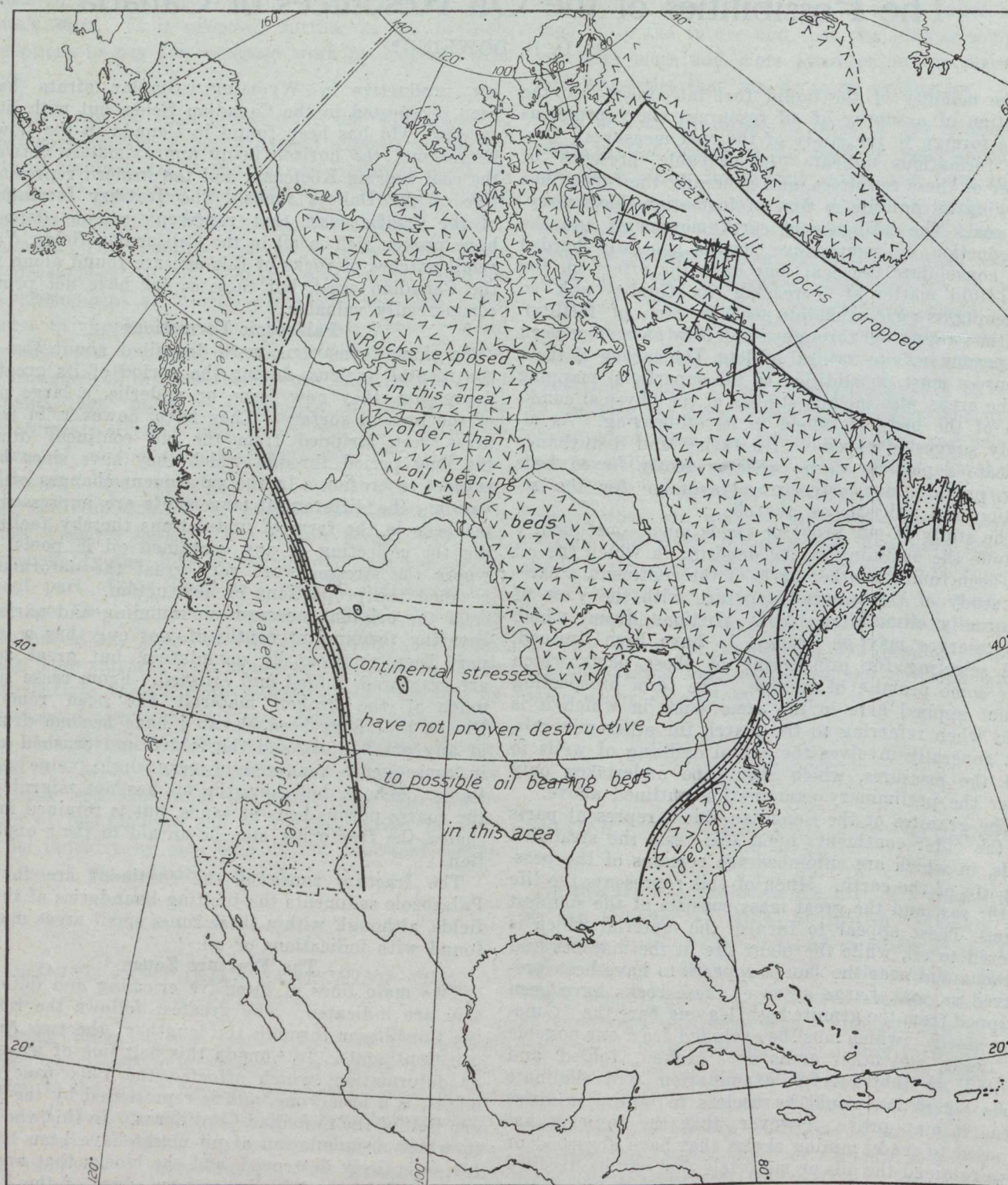


Diagram showing the area occupied by the Canadian shield (Archaean) and to the west and southwest, the disturbed and broken sedimentaries.

faulting and have made their impress on the topography mainly by the subsidence of great blocks as in Baffins Bay and Davis Straits.

Denuded Areas

A large portion of Canada forms what is referred to as the Canadian shield. This is an area largely denuded of any covering of Palaeozoic beds that may have been deposited on the pre-palaeozoic continent. It now forms an undulating or mammillated surface of crystalline or highly metamorphosed rocks.

Possible Oil Producing Areas.. Eastern Maritime Fields

Between the fracture zones of the Atlantic border there are a few areas which suffered but moderate deformation. The largest is in New Brunswick and a slight production of oil has been obtained. In the eastern part of Quebec in the Gaspè peninsula the presence of oil seeps has induced the spending of large amounts in prospecting. The attempt has not been successful in a commercial sense, owing no doubt, to



The Ontario Oil Fields.

the small area of the fault blocks. In Nova Scotia but one oil seep has been reported. In these areas the hope for oil production seems to lie in discoveries of oil shales rich enough for probable distillation. Promising fields of oil shales have been found in Nova Scotia and New Brunswick.

St Lawrence Fields

West of the broken area referred to above a narrow basin is found embayed in the St. Lawrence valley between the Archean area and the northward continuation of the Appalachian Mountains of the United States. In this basin sediments of the lower oil formations are found, but as the area was isolated probably as early as Carboniferous time through a period of elevation, and is of comparatively small size large accumulations of oil are not expected in it.

Ontario Fields

The basin lying to the west of the St. Lawrence basin extends westward to the Rocky Mountains and the sediments have suffered only slight warpings so that the accumulation of oil formed very large pools. This basin has been for a very long time the great oil field of the United States. In Canada the outer rim of this basin is found in Ontario where a steady production has been maintained for a long period. This has steadily declined, and many of the pools have been nearly drained. The demand for oil has revived the interest in further exploration. New pools have been located, and deeper drilling or drilling to lower horizons indicates that possible pools exist in these horizons.

Western Basin

The older deposits of the central part of the basin probably present the same succession of beds as in the southern and eastern fields but the deposits of the eastern and northeastern margin show for this central part of the continent a geological history very different from that of the areas more nearly connected with the outer seas. This has no doubt had an influence in the non-retention of oil in the beds of the outer margin of the basin. Bore holes in Manitoba and on Athabaska and Peace rivers in this outer margin give negative results in the search for oil. There is evidence in the absence of early Palaeozoic sediments and the absence also along the northeastern outcrop of Middle Devonian formations that the sea margin of this long period was a fluctuating one and that possibly the interval from Devonian to post-Carboniferous time saw a steady withdrawal of the sea or a slow elevation of the land.

During this long lapse of time it is quite possible that large areas suffered denudation, as the mantle did not consist of massive beds and would be easily fractured by differential elevation.

The retaining of fluid hydrocarbon in the elevated and probably thinner parts would therefore be extremely problematical. The central part of this continent was then depressed beneath the muddy Cretaceous sea and possibly the cover of shale then deposited on the remaining Palaeozoic beds has helped to retain in them some of the original oil. The general rise of the continent in Tertiary times brought the edge of the basin—the part now exposed—far above sea level and it would be natural to suppose that the drainage of the oil since that time would tend toward the basin.

In the Manitoba portion, where the Devonian section contains beds that are elsewhere oil-bearing, it should be noted that these beds are there about 800 feet above sea level. Their westward continuation at Moosejaw would be at least 1000 feet below sea level so that, provided the wastage before Cretaceous times did not exhaust the beds, the cover of Cretaceous shales and the limestones of the upper Devonian might retain the oil drained westward. In the absence of folding in the structure the oil might be found on this slope as low as the line of water saturation which is not known for this basin, but we might assume it to be as low as sea level.

The prospecting of this horizon would mean drilling through the Cretaceous shales and would be confined to a strip of country not more than about sixty miles in width measured from the edge of the Cretaceous escarpment.

Along the northern border the problem is somewhat different in that it is not known with any degree of accuracy to where the supposed oil bearing beds which are exposed in Manitoba extend. The outcrops of the Palaeozoic at the contact with the Archean show overlapping of the beds, that is, at different points Devonian, Silurian and Ordovician sediments respectively are found in contact with the pre-Cambrian. Fluctuations of the margin are also shown in the individual beds of the formations; for instance, the Middle Devonian is absent in the exposures on Peace River below the cascades, and under the Upper Devonian is resting on the gypsum beds of the Silurian.

To the southwest the section is probably complete, and the location of the oil bearing Middle Devonian beneath the cover of shales and Upper Devonian limestones is the first problem to be solved, since on

its position depends largely the occurrence of oil in the Devonian. Where it can be found near the margin and at a convenient elevation, there would be some hope of a future production from this horizon.

As it is not certain that the oil beds are present at any point in the northern area and drillings in the Peace and Athabasca valleys are in the nature of explorations; but without such adventure little will be learned.

The northward continuation of this interior basin follows the western edge of the Canadian shield. In Dakota and eastern Montana and northward through the prairie provinces of Canada it assumes a definite basin form, in which is found above the Palaeozoic oil beds, those Cretaceous deposits which provide both coal and oil for the western states and very abundant coal reserves for Canada. Owing to the great depression in the central part of the continent to which the Palaeozoic beds conform the areas available for oil prospecting consist mainly of parts of a somewhat narrow rim along the eastern side of the basin that is in a way limited to the part which projects above sea level.

This assumption of a boundary to the productive area is a tentative one based on the fact that farther into the basin the depth of Cretaceous sediments to be pierced become so great that drilling operations become very expensive and very difficult.

The re-appearance of the Palaeozoic rocks to the west of the basin is generally in the form of fault blocks overthrust on the newer sediments, and the actual western rim is deeply buried. There may be places where these rocks could be reached outside of the fractured zone of the mountains, but a great thickness of Carboniferous and early Mesozoic deposits here overlie the Devonian, and experience in the American field points to the greater value of the Cretaceous beds which overlie them, as oil containers. Beside the surrounding rim it may be of interest to note that although there are little evidences of abrupt changes of slope or of structures favourable to the occurrence of probable oil reservoirs, one terrace or broad anticline can be traced on the eastern slope of the basin from the northern point southeasterly about parallel to the mountains. It is probably more sharply defined in the measures near the surface than in these beds, and is discussed as effecting the Mesozoic deposits. It is joined at almost right angles by an uprise, which extends northeasterly from the Bow Island anticline, which rises to the south to join the Sweetgrass arch. a structure running into Canada from the uplifted and intruded area of northern central Montana.

This ridge structure which crosses the basin may be too deeply buried for present prospecting, but its presence will be of interest should the Palaeozoic rocks of this basin prove at any place to have oil pools.

Northern Basins.

No exact dividing line is drawn between the western basin and those basins to the north. The syncline of the Western basin flattens to the north and the amount of depression in the front of the mountains lessens. A large area is underlain by Devonian beds that exhibit a very slight degree of folding. This area extends from the Rocky Mountains eastward to the granite areas of the Canadian shield. The relief is generally low and includes the Mackenzie valley. The disturbance which is marked by the upthrust of the Rocky Mountains extended into the area but with lessening force. A major fold or break crosses the

valley from south to north, dividing it into two distinct basins differing in structure. The area east of this fold and extending to Great Slave lake and Great Bear lake is a plain bounded on the south by the edge of the plateau built up of Cretaceous sediments, on the west by the Nahanni mountains and on the north-east by the mamillated surface of the Archaean rocks. The outcrop of the Middle Devonian sediments on Slave lake shows several oil springs. The rocks dip slightly to the southwest and seem to offer a large field for prospecting.

To the west of the dividing fold, noted above as the Nahanni Mountains, and along the lower part of the Mackenzie valley the sediments show a series of strong folds and oil seeps are quite common. In both these fields there seem to be great masses of oil saturated shales and porous dolomites from which oil is expected to be obtained by drilling. Should the drilling of the favourable structures not prove the presence of a fluid oil in commercial quantities, the reserve of oil in the shales should in itself be of great importance.

Arctic Islands.

The northward continuation of the strata exposed in the Mackenzie Valley is exhibited on several of the outer islands of the group. The structure of the islands exhibits very little of the compressive strains of the continent. Normal faulting is probably indicated as being the basis of the geographic features. The blocks which form the islands show the beds dipping at slight angles to the northwest and north. In rocks of Carboniferous age shales or cannel coals which appear to have a value as oil shales has been found on Melville island. The measures in which these occur are thought to thin out toward the east, as on Elsmere island they appear to be wanting. The rocks there exposed are mapped as Triassic overlying Devonian.

James Bay Basin.

An area of Devonian rocks to the south of the bay forms a small prospective area in which oil or oil shales may be discovered.

The Oil Possibilities of Western Canada.

The wonderful increase in the various uses to which the products of petroleum have been applied within the last few years, has called for an intensive search for new fields that is world-wide in its extent.

Canada has not hitherto been considered a particularly promising field but the large production that has been realized from the Cretaceous deposits of the western American plains, has stimulated prospecting in the northward continuation of these beds and also in the underlying Palaeozoic deposits which are found in the Dominion of Canada.

The structure of the oil-bearing area which lies in front of the mountains of Wyoming and Colorado has no exact counterpart in Canada inasmuch as the flexures in the beds are there largely due to uplift as well as to the effects of tangential pressure, while to the north the deformation is largely due to tangential stresses. There is thus a more complicated structure in the American fields than in Canada and to this is probably due a greater alternation of the petroleum-forming substances and probably a greater migration through the measures to retaining beds. It is noted also that horizons found to be oil-bearing in Wyoming have in Canada yielded but slight indications of oil. In the lower horizons we have evidence of the presence of a heavy oil at several places, but as the re-

ords are not numerous a general statement is all that can be offered.

A study of the structure to which is added the few drilling records has however been compiled in the following observations.

Oil-saturated sands have been found at the following localities:—

(1) At the southern edge of the Province of Alberta near the Sweetgrass hills—vaseline-like saturated sands.

(2) On Milk river in the Beaver well, a small flow of oil in artesian water.

(3) In Etzikon coulee at the United Company's well sands saturated with heavy oil.

(4) Gas wells Nos. 2 and 4 at Viking, a small showing of oil in gas sands.

(5) Oil shales at bottom of Morinville well.

(6) The MacMurray sands exposed on the Athabaska river, called generally the "Tar sands"

(7) At Peace river, thick oil in sands bored through between 900 and 1100 feet below surface.

These occurrences all appear to be in sands of approximately the same age and may be considered as indicating a rather extensive sheet impregnated by a heavy oil—in many places too thick for commercial extraction except where they occur at the outcrop. The areas in which commercial exploitation might be suggested are those which surround the deep basin of the Alberta syncline and include the outer foothills which are on the western edge; the upraise at the south in the Bow Island anticline and the north-eastern margin of the basin as far south as the depression leading to the eastern basin which centres about Estevan. In this eastern part it is not known that the oil horizon of Alberta is present.

The occurrences in the foothills do not seem to prove the continuance of the oil deposits, in their crude state, as far as the mountains. The oil that is there found in association with wet gas has the appearance of having been condensed by some natural distillation process, that is, it is not crude oil. Its transformation might be hypothetically assumed to be due to the great pressure and moderate temperature to which the heavy oil of the sheet just mentioned would be subject especially in the part deeply depressed in the Alberta Syncline. Its volatile constituents of the oil would follow the short limb of the syncline up toward zones of lower pressures and temperatures where they would be condensed. The condensed portions reaching the overturned edge would there be trapped as appears to be the case in the Turner valley anticline, and the gas would have vapours of the lighter oils still in it.

Renewed interest is being taken in the structure features of the outer foothills as being the edge of the Alberta syncline. Where this edge is marked by anticlines not too deeply buried, prospect drillings are to be prosecuted by the larger interests, in the hope of striking either light oil or finding gasoline vapour in the natural gas.

The production of the foothill areas last year was about 13000 barrels of light Kerosene oil containing probably 60 per cent of gasoline. Small stills are installed at three of the wells and the oil broken up for domestic use. At the Calgary Petroleum Products Cos. wells, absorption plants are installed and from the natural gas it is expected that up to 30 barrels per day of light gasoline will be obtained.

In connection with the foothill area an area forming

part of the mountains near Waterton lake merits consideration. Here the rocks are very much older than any known oil bearing rocks but in their bedding planes have distinct evidences of oil. As the oil does not seem to be indigenous to the rocks, it has been assumed that it comes from the Cretaceous beds that have been over-ridden in the overthrust of this mountain mass over the plains. It has been assumed that the plane of the thrust fault is at a low angle and that the shortening of the crust reached large proportions so that an extensive area may be underlain by rocks from which the oil might be derived. This assumption which has elements of probability might predicate an overlap between twenty and thirty miles in width, but in the mountains to the north of this no single thrust reaches this proportion, so that it seems necessary to modify the original theory.

The presence of the oils in rocks far above heights to which it could be borne by general water saturation and its light specific gravity suggests that the transference was gaseous probably along with vapour distilled from carbonaceous material in the overridden Cretaceous. The overlying beds are not badly folded and form a rather large covering mass that would retard the escape of the vapours.

The form of the cover is a synclinal trough, the lowest point being near the watershed which is here only a few miles from the eastern edge of the mountains. The trough is edged by anticlines and near these oil seeps are found both east and west of the summit. If the ascending vapours penetrated the base of the syncline where there would probably be open fractures and followed the beds in both directions it might be expected that the lighter oils would be found at a greater distance from the centre of the syncline than the heavier oils as they would have a greater penetration and longer life in the gaseous form. The facts seem to accord with this hypothesis as the seeps at the west about eleven miles from the centre of the syncline, yield oil of very light gravity (40° - 42° Baume') while those to the east four miles from the same point yield oil much heavier (30° Baume').

The distillation process that might be presumed to have been active at one time, seem to have declined at the present time as there is little evidence of the escape of gas or of gas pressure in the wells now bored. These wells appear to be merely draining the beds above their level and if this is true it follows that prospecting may have to proceed on the assumption that the saturation is not being supplemented by present emanations of moment, that is oil derived from the draining of the beds by gravity from each side of the anticline should be the object of drillings.

The supposition outlined above of a gaseous origin for the oil introduces another interesting possibility namely that the sand beds of the Blairmore formation, which no doubt underlie the Cretaceous of the plain in front, may have also acted as passage beds and that some of the oil may have been transferred through them to retaining structures under the plains in the folds which parallel the outer edge of the overthrust mountains.

On the plains most of the prospecting has of late years been centred in the Peace river valley, where several wells averaging eleven hundred feet in depth pass through sands impregnated with heavy oil. The

flow is necessarily slow and although the presence of oil seems to be proven, no production has been attempted possibly on account of the trouble with water which can generally be attributed to insufficient or defective casing, and to lack of restraint on the part of the operators in drilling through the oil sand into the water bearing bed which lies below it.

The direction of the extension of the oil horizon depends on the attitude of the beds and as there are few exposures of the outcropping rocks and few bore holes by which to trace it, the general features only can be indicated. The gas fields at Viking and the Peace River oil fields are situated on a structural terrace which consists of a flattened strip on the eastern slope of the Alberta syncline. The flattening may in places even reverse the dip and form low anticlines. The western edge of the terrace is marked by an abrupt change of dip and at the point where this line swings to the southwest from near the border of Saskatchewan, surface crumpling is quite evident. The position of the oil-sands in this part of the terrace is here probably lower than desirable, but the flattened area or structural terrace widens considerably and there is always the possibility of local flexures and rolls in the bed providing local catchment areas for oil and gas. With this possibility in view a bore is being put down near Czar, Alta, on Ribstone creek. Boring near Lesser Slave Lake is being undertaken with the hope of extending the Peace River field. The information at present available is not sufficient to determine the exact direction of this extension; its position can be determined only by future boring toward the south east.

The belief that is so general among the drillers, that the really profitable oil horizon is in the limestone of the Devonian which lies beneath the oil impregnated sands of the lower Cretaceous has led indirectly to the spoiling of several possible productive wells in the Peace River field, as with the object of reaching the limestones, borings have been continued below the heavy oil of the Cretaceous into the water-bearing beds which overlie the Devonian limestone.

Tertiary Formations.

During the later history of the continent and after much of the deformation and erosion of the older oil formations, beds of Tertiary age were deposited along the western edge of the continent. Those found in the interior are generally of continental origin and what carbonaceous material they contain appears to have been altered to coal or in places to a very heavy asphalt. The more fluid hydrocarbons are at present supposed to be associated with the beds formed near sea level including those of the west coast and possibly some of the Tertiary of the extreme north on the Arctic islands.

On the Coast the rocks of the valley and coast of California have been found to contain very large stores of oil. Small exposures along the coast northward and in the depression occupied in part by the Straits of Georgia have been partially examined, so far with little success. In the delta of the Fraser river boring is now proceeding, but the deposits are very thick and the sandy nature of the measures suggest that the oil may be widely dispersed rather than gathered into pools.

The Part Played by the Canadian Geological Survey in the Development of British Columbia

Speech by Hon. WILLIAM SLOAN, Minister of Mines, British Columbia.

I desire to bring to your attention the serious state of affairs which threaten to have a most unfortunate effect on the development of the mineral resources of this Province. I refer to the recent resignations of a large proportion of the staff of the Geological survey of Canada, by reason of which, British Columbia is immediately deprived of the services of four geologists who worked here last summer, and will probably later lose others now available.

Everyone in this province knows more or less in a general way, of the work of the Geological Survey, but not many outside the mining fraternity, among whom I class that indispensable pioneer, the prospector, realize the great value of this institution to Canada.

It is my intention to set before you certain facts in connection with the survey with special reference to its work in this province, so that we all may realize the imminence of the danger to development of the natural resources of British Columbia and to suggest means by which it can be averted.

The Fathers of the Survey

The Geological Survey of Canada is largely the outcome of the personal enthusiasm of William Logan, with whom became associated Dr. T. Sterry Hunt, men whose names are yet honored among scientists the world over for the work they did.

I do not know in just what year Sir William Logan's first work was done, but it was prior to 1843, for by that time the Geological Survey was in existence, and the first "Report of Progress" was for the year 1843, although not published until 1845. Naturally at that time, the first work of the "Survey" was in the "Upper and Lower Canada" of those days and in the Maritime Provinces.

Later came in the service, Sir William Dawson, who subsequently became principal of McGill University, and who was to be followed in later years in the Survey by his equally illustrious son, Dr. George M. Dawson, whose name is one to conjure with all over Canada, particularly in British Columbia.

The geologists and mining engineers of later days following in his footsteps, marvel at the accuracy and scope of his explorations, and geological chartings.

The first office of the Geological Survey was in Montreal and was later moved to Ottawa. The first Director of the Survey was Sir William Logan, who was succeeded by Dr. A. R. C. Selwyn, Dr. George M. Dawson, Dr. A. Bell, Dr. A. P. Low, Dr. R. W. Brock, and others, down to the present day Director and Deputy Minister, R. C. McConnell, now in his 42nd year of service in the survey.

Volume 1 of the Survey Report was for the years 1870 and 1871, practically the date of entry of B.C. into the Confederation of Canada.

With the opening of the West came the need of surveys, of exploration of its resources of all kinds, and the Survey stepped into the breach, and how well it did the work is a matter of history.

Maintenance of Geological Survey a Condition of British Columbia's Adherence to Confederation.

So well and favorable was its work and the need of such work appreciated, even in the then far-off B.C. at the time of Confederation, that we find in the Terms of Union of B. C. with the Dominion of Canada in 1870, in Section 5 subsection H. a separate and distinct proviso that the Dominion Government shall maintain and contain a geological survey in B. C., a proviso, I believe, inserted and insisted upon by the Hon. J. S. Helmcken, one of the few still with us of those farsighted pioneers who shaped our history and so well laid our national foundations. Possibly its acceptance was one of the things which reconciled him to the entry of this Province into the Confederation. So B.C. has a unique claim to the survey. We adopted it as one of the conditions of entry into the Dominion.

Of the early explorations of the Survey's staff, particularly to the West of the Rocky Mountains, the work of Richardson on the Coal Fields of Vancouver Island, etc., these are familiar to all of us interested in mining.

Then came Dawson and his work along the surveys of the C.P.R.'s various routes and his exploration into and through the Yukon, the latter taking place in the year 1887. I well recall the Fall of '96, when camped at the mouth of the "Throan Duik," which usage soon converted into "Klondyke," that the question came up of naming what it was known, in view of the importance of the discoveries, would become a busy centre. The name of Dawson was finally adopted and met with general satisfaction, it being considered an honor properly due the distinguished Canadian who years before had made tracks in a trackless land. Dr. Dawson's survey of Queen Charlotte Islands, his map of which, made from a sailing schooner, still practically constitutes the official chart of its eastern shore, and his trip up the Stikine with McConnell as assistant, the latter continuing down the Dease and Liard rivers, wintering at Fort Providence on the Mackenzie River, are other achievements with which his name always will be associated.

The Geological Survey has been the "Lookout" of Canada

Tyrell, of the Survey, told us of the Barren lands of the far northern interior, a district which possesses much mineral wealth. Low, afterwards director of the Survey, spent two years continuously in the Hudson's Bay, gathering data of all sorts and now Hudson's Bay promises to be the outlet for the grain of the great Northwest, Malloch died while wintering among Arctic ice. Drysdale was drowned, fording the Kootenay river. Capt. Leroy was killed in action in France.

These are the stories of patriotism, service and adventure that should stir our young Canadians to prepare themselves by intensive scientific study to be fitted to carry on; to bring a lasting name to themselves and permanent benefit to their Country.

They were willing to abandon the dream of future wealth, ever present with youth, for science, with very small monetary reward for many years. Must they

see their hopes of advancement to a higher rank barred by the stone wall of an unappreciative or indifferent country?

Perhaps the most striking result of the early work of the Geological Survey was the elucidation of the complex structure and relations of the great Pre-Cambrian formation in the vicinity of the Great Lakes. This was done by Sir William Logan, that great pioneer of Canadian geology, and his able assistants, working under handicaps of transportation, difficulty of obtaining supplies, etc., that the present day workers can scarcely realize. The great "Pre-Cambrian Shield" of Canada, contains the largest single area of rocks of that era exposed in the world, and besides being of unexceptional scientific interest these rocks contain numerous extremely rich mineral deposits. The names "Cobalt," "Porcupine," "Sudbury" and the iron and copper ores of the Lake Superior district are sufficient to remind one of the economic importance of this region. In that country, then a wilderness, Logan and his assistants, little dreaming of the vast wealth later to be discovered, carried on their labors. Their classification of the Pro-Cambrian formation stood in its entirety until recent years, and even yet forms the basis of Pre-Cambrian geology in America. Their work was done largely from the point of view of the pure scientist animated by no love of gain, and it has proved of inestimable value in the study of the highly mineralized areas which since have been discovered.

Logan, and later Sir William Dawson, were the first to study carefully the magnificent section of Carboniferous rocks exposed at the head of the Bay of Fundy, in Nova Scotia. Their detailed sections stand unrivalled to the present day, and are a lasting monument to the painstaking efforts of those early investigators. Their work in Nova Scotia was carried on by Hugh Fletcher and our present knowledge of the geology of that Province is largely due to the efforts of that extraordinary field worker whose name is a household word in that Province. With men like those to father the Survey and establish its custom, a pace has been set and tradition grown up that are not excelled by any other Governmental Geological Survey.

Work Done in British Columbia.

One of the most important pieces of geological field work ever done in America and certainly the largest single investigation undertaken in recent years was done in B. C. in connection with the re-survey of the International Boundary on the 49th parallel. This was done between the years 1901 and 1905 by Dr. R. A. Daly, a Canadian, now head of the Department of Geology at Harvard University. His report embraces several large volumes and an unequalled series of maps, illustrating the geology of a belt of country for 5 miles north of the boundary and stretching from Sumas Mountain on the Pacific to the frowning rampart of the Rocky Mountains overlooking the great plains in Alberta. Dr. Daly's work has thus given us a complete geological section across British Columbia, and it forms the basis for surveys and investigations carried on by later workers in the important mineral bearing districts in the southern part of the Province. The facts elicited during this intensive study of the Canadian Cordillera have contributed largely to the advancement of geologic science, and in Dr. Daly's hands have tended to solve problems of world interests.

Mr. Camsell, now the senior member of the staff working in this Province, has obtained valuable re-

sults at Hedley in his study of the Nickel Plate Mine, and later by his important discovery of the increased possibilities for prospectors in the Coast range, particularly along the line of the P.C.E. He is now in charge of the Vancouver office of the Geological Survey, an institution which is greatly appreciated by the mining fraternity of this Province.

An account, however brief, of the work of the survey in B. C. would be incomplete without reference to the topographic and geologic maps of the southern portion of Vancouver Island. These maps are masterpieces of accuracy and detail, and were intended as a standard type for Canada. An expert topographical engineer, R. H. Chapman, was obtained from the United States Geological Survey to superintend the mapping of these sheets and carried on his work from 1909 to 1913. The geological mapping was done by Dr. C. H. Clapp, now at the School of Mines, Butte, Montana.

In particular, the Geological Survey of Canada has developed and perfected the photographic method of surveying, and this research of great practical value was carried on in this Province.

Mention must also be made of the work of Dr. Schofield in the East Kootenay and other parts of the Province; of Dr. Allan in the Ice River district, and of Malloch in the Groundhog coal fields.

Work Done in Recent Years in B. C.

Having considered briefly some of the more important studies carried on by the Survey in the past in B. C. it is of interest to examine in more detail the work done in recent years from other points of view.

The following tabular statement compiled from the summary reports of the Geological Survey for the years specified, is very significant.

Field Parties.

| Years | Geological |
|-------|------------|
| 1908 | 8 |
| 1909 | 13 |
| 1910 | 12 |
| 1911 | 12 |
| 1913 | 14 |
| 1914 | 3 |
| 1915 | 9 |
| 1916 | 1 |
| 1917 | 3 |
| 1918 | 7 |
| 1919 | 8 |
| 1920 | Possibly 3 |

And here let me say a word in connection with the efforts of the late Hon. Wm. Templeman, during the period he held at Ottawa the portfolios of Inland Revenue and Mines, on behalf of British Columbia's claim to the attention of the Geological Survey Branch. The table strikingly shows the results of his intercession in the interests of the Province. There were more parties in the field here during this period of office, 1909-10-11 than there have been in the last eight years.

The foregoing table shows the number of field parties the Survey maintained in B. C. for the years specified. It will be noted that in 1916 the effect of the war was most apparent. This year, owing to the resignations from the staff, it is possible that no more than 3 parties will be in the field, and perhaps not even that number.

In view of the almost certain large increase in prospecting, developing and general activity in the mining affairs, this condition is nothing short of deplorable.

Since 1914 the Geological Survey has lost a number of its most able field workers in B. C. by death. Besides, others have left for various reasons. Dr. C. H. Clapp, whose work on Vancouver Island has provided us with the key to the geology of the Coast District, is now at the School of Mines, Butte Montana; Dr. John Allan, of Ice River fame is head of the Department of Geology at the University of Alberta; Dr. A. M. Bateman is professor of economic geology, Yale University; and Dr. J. D. Mackenzie, who worked in the Queen Charlotte Islands and in the Telkwa District is still suffering from the effects of wounds received in France.

A review of the present situation shows, in brief, that out of 21 men fit for field work on the Geological Survey, eight have already resigned and more are likely to follow, leaving possibly only eight men available to carry on the Geological work of the Survey next summer, throughout the Dominion. This is less than the average number of geological parties in B. C. alone for the four years preceeding 1916. In addition to the loss of these trained experts the men who are immediately available to replace them are going as well; opportunities in commercial work are so much more advantageous than any offered by the Governmental service. This lays the Survey open to the danger of being recruited by insufficiently trained men; and in the calling of a geological expert, insufficient experience and lack of careful training is an insuperable bar to success. Even provided the Dominion Government offers sufficient inducement to students now in College to train for the survey work, they will not be ready to take up the duties of such men as Mackay, Wright, and others who are leaving, for ten years at least. It will take this time to gain the experience and knowledge necessary to make his opinion as valuable as that of the men who have just gone.

The present high standard of scientific attainment and the personal integrity of the survey men has long been recognized by all interested in mining in this country. The "Man from the Geological Survey" has always been welcome in mining districts, and the prospector has invariably welcomed him as an expert adviser. Survey men can obtain information and facilities for work from owners and operators that otherwise would not be available.

If the Survey slackens its efforts or if poorly trained men carry on its prestige will invariably suffer, the high tradition will be lost, and the whole country will lose accordingly. I wish now to bring to your attention how the losses will immediately affect this province.

On this point it is well to remember that British Columbia is somewhat differently placed to most of the other provinces of Canada because of the immensity of her undeveloped mineral resources, the wide expanses of unknown country geologically speaking and the fact that under the terms of the Confederation the Dominion Government undertakes to have carried out a geological survey of the Province.

The name "Cariboo" is one to conjure with B.C., and in fact the rush to the Cariboo placers in the 50's gave the first considerable impetus to the settlement of this Province. The gold in the present day channels

was soon largely taken out but if the ancient buried channels can be discovered, the possibilities are unlimited, as witness the richness of the Tertiary river beds of California and Victoria, Australia. Recently the Geological Survey has had Dr. B. R. Mackay working on this problem, Dr. Mackay possesses unique qualifications for the admittedly difficult problem of tracing out the old river beds, as he had special training in physiography and long experience as well. To this energetic, keen and highly trained scientist, his country offered the salary of \$2,580 per year, with an annual increase of \$180. He has resigned leaving his work incomplete and is now receiving \$5,000 a year and all expenses.

The Portland Canal District is one that has produced very lately some of the richest ore mines in this Province, and is a new field where the services of a trained geologist would be particularly valuable. Dr. J. J. O'Neil who worked in that area last summer, and who like Mackay received \$2,580, has resigned also, leaving his work incomplete to accept a salary of \$5,000 a year and all expenses. Other instances are those of L. Reinecke, who spent last year on geological work in the Princeton and Pacific Great Eastern Districts and J. Stewart who worked for years in the Peace River District of B. C. Mr. Reinecke was receiving \$2,580 and Mr. Stewart \$1,900 per annum. Both have left the service and are now receiving \$5,000 a year and expenses.

The many promising prospects and mines of Vancouver Island and the Southern Coast Districts are well known and their future development would be greatly facilitated by a comprehensive study of their peculiarities. Dr. V. Dolmage, who possesses special qualifications, is now engaged in this work at a salary of \$2,100 a year and no doubt unless his position is materially bettered, he too will be lost to B. C.

Few, if any, of the Geological Surveys in the world, demand such a high standard of educational preparation as does our Canadian Survey for entrance into the geologists' ranks, and few have the scope for the field work to turn out such good men.

That this is appreciated abroad, if not in some portions of our homeland, is evidenced by the fact that Pearsons of London, who have need for geologists in all parts of the world, sent their chief geologist to Canada to corral as many of our Geological Survey as possible. We know they took six in one day at Ottawa, chiefly British Columbia of Western men and we know that they sent to Vancouver to try and get further recruits from the B. C. branch, but without success, so far, perhaps owing to the disinclination of the individuals to leave the Province.

Are we to see these men obliged, for financial reasons to leave us?

Present Value of the Geological Survey of Canada to British Columbia.

The present value of the survey to this Province

As to the present value of the survey to this Province. I will briefly list some of the less obvious, but none the less valuable, general benefits to be derived by B. C. from having the services of an active corps of geologists at the disposal of the mineral industry of the Province.

(a) It secures the services of the most highly trained scientists to work on local problems.

(b) These unbiased investigators can approach their problem in an entirely impartial manner.

(c) The staff are trained and expected to solve the larger geologic problems for which no individual mining Company can afford to maintain experts.

(d) These men are associated at Ottawa with others who work all over Canada and who are thoroughly conversant with the latest geological information. Thus, by criticism and suggestion, B. C. problems receive the benefit of this world-wide experience.

(e) The results of the work of the surveys are free to all, to the prospector as well as the mine manager or capitalist. Verbal information is given to any owner or investor at once. Written information in advance of Reports can be obtained at short notice on application at Ottawa.

(f) Geological maps form an accurate and reliable guide to prospecting. They act positively in directing the attention to most promising districts and in scarcely less valuable negative manner by outlining areas likely to be barren.

(g) The present day problem of mining are often largely geological in their nature. Such questions as haulage, transportation, ventilation, etc., can be easily solved by modern methods and there are plenty of engineers competent to do this.

It is not possible to get back the men who are gone for some years at least, if at all, but the 5 or 6 members of the staff who are now unsettled, can be retained, and students can be encouraged to train for the vitally important work of the Geological Survey as a career, if the situation is met promptly.

The cause of the dissatisfaction which has led to the wholesale resignations is not so much the scale of the salaries set out by the classification of the Civil Service, although this is by no means liberal, as it is due to the grading by the Civil Service Commission.

British Columbia is essentially a mining country. Our future is dependent upon that industry.

Proportionately as compared with other Provinces, we are more vitally interested in it than in any other part of Canada. If we do not have the mines, the rest is of no avail. We have vast areas totally unexplored, and vast areas merely run over, but sufficiently known to indicate wonderful mineral possibilities, and we need the geological survey. It is the one branch of the Dominion Civil Service that has any direct bearing on our future.

The Survey Crippled at the Threshold of its Work.

And what do we find? The survey crippled, its usefulness threatened with paralysis for the next eight or ten years just at the critical period of our development, when reconstruction after the war is so essential.

It is now nearly fifty years since we entered Confederation, and, as I have stated one of the stipulations we made, and one of the undertakings given by the Dominion, was that a Geological Survey of the Province would be completed. This, as I have stated, was one of the terms of union. If the work is carried on no faster than it has been, it will be centuries before it is finished. I am speaking now from no close computation, but am sure that an estimate is well within the mark. And I am of the opinion that those who were assenting parties to the Terms of Union, in so far as this Province at least is concerned, never contemplated that this survey would extend into the period indicated. Let it not be supposed that I am unappre-

ciative of what has been done. That, however, is not the point. Again let me say that British Columbia is differently situated as compared with her sister Provinces at this time, when reconstruction is beginning, when the mining industry is commencing to take the important place in our industrial life which the extent and richness of our mineral resources warrant, and when bright and a prosperous future, provided mining men are given proper help and encouragement, is assured—I say that it is particularly unfortunate that, at this moment, the efficiency of the Geological Survey, in so far as B. C. is concerned, should be so seriously crippled.

In conclusion I have endeavored to present this matter fairly and without criticism and I trust that the House will unanimously support the resolution which I am about to move. This endorsement is sought in the hope and expectation that the Ottawa authorities will give immediate consideration to substantial financial increases to members of the Geological Survey and also that they may more fully grasp the importance of this scientific work and take such steps as are necessary to assure a more generous compliance with the Terms of Union in this respect than up to the present has been the experience of British Columbia.

BOOK REVIEW.

L. OR, PROSPECTION, GISEMENT, EXTRACTION, by Georges P. Proust. Gauthier-Villars & Cie., Paris. 1920. Oct. Paper Backs, 320 pages. 10 francs.

This volume, in French text, is a comprehensive account of the occurrence of gold and its extraction in all parts of the world. It deals with the geology and chemistry of gold ores, prospecting for gold, the mining and recovery of the metal by concentration and cyanidation, and extraction costs. A rather unusual chapter is one of advice on outfit and clothing for colonial prospecting, which includes information on the raising and preparation of edible vegetables. A lexicon of minerals and their characteristics is appended. The work forms one of a series of science and industrial primers.

MINERALOGY, by F. H. Hatch, Fifth Edition Revised, with 124 illustrations, 7 ins. by 5 ins. Boards, 258 pages with index and tables. Six shillings net. Sir Isaac Pitman and Sons, London.

This work by Dr. Hatch, past-President of the Institution of Mining and Metallurgy, and well-known as an authority on petrology and the geology of ores, was first issued in 1892, and has been reprinted three times, without revision. The present edition is rewritten and enlarged, but Dr. Hatch in the preface states he has been careful to retain the essential features of its original arrangement. New features in the edition are tables of specific gravity and the refractive indices of the more important minerals, which will be found useful for those engaged in mineral separation and microscopic work. In the reference to iron ores there is, probably through inadvertence, no mention of the hematite deposits of Wabana, Newfoundland, nor to any of the Canadian occurrences, except as these may be included in the references to the Lake Superior District.

Northern Ontario Letter

The Silver Mines.

The upward turn in quotations for silver has been signalled by the resumption of bullion shipments, from the producing mines of Cobalt. During the period when a slight decline in quotations occurred, practically no bullion was shipped, the operators believing the recession to be only temporary. In this they appear to have reckoned accurately.

Reports that a shipment of \$250,000 in bullion had been made from London to New York, and that the consignment was a part of a fairly extensive amount soon to be shipped from Germany via London served to influence the market more or less adversely. The influence caused was not so much due to the amount of silver involved, but was chiefly on account of its possible significance. It now develops that no adverse influence has resulted, and the quotations have accordingly strengthened considerably. Also, the former belief that a new upward movement is pending is taking renewed form among the silver producers.

An announcement of interest to Northern Ontario is that this district will be visited in September by a company of approximately six hundred journalists from the British Isles. It is stated that this will comprise perhaps the most distinguished group of journalists that ever paid a visit to the Dominion. The party will arrive in Cochrane at an early hour on September 6th, being accommodated in two trains of about ten coaches each. They will visit the Porcupine gold district in the morning and will arrive in Cobalt late in the afternoon of the same day, and will leave Cobalt for North Bay in the late evening.

Favorable developments on the University property of the La Rose Consolidated offers fair prospects of making it possible to maintain the record established by that company during the past calendar year. It is evident, of course that the University may not offer equal chance of large ore bodies as does the Violet property of the La Rose Company, but the amount of territory as yet undeveloped presents very important possibilities. The encouragement already met is considerable, and the company has commenced to ship medium grade ore, estimated to contain approximately fifteen ounces to the ton. Under present conditions, costs of operation are expected to continue to average about the same as last year, at which time it cost \$1.05 to produce each ounce of silver. Even at this, with silver quoted at between \$1.25 and \$1.30 an ounce the margin of net profit is fairly substantial.

Reports of a possible margin of the Kerr Lake, Crown Reserve and Dominion Reduction companies have not been officially confirmed. If such a deal is really under consideration, knowledge of it appears to be confined to the head offices of the companies mentioned.

Considerable doubt exists as to whether or not the Adanac will be included in a merger with the Victory Silver Mines. At the time of writing the odds are decidedly in favor of the Victory interests accepting an offer of financial assistance made by Buffalo men whereby funds would be provided for the commencement of operations this spring on the Victory property. That there is little or no hope of the present interests in the Adanac attempting any further work on the Adanac property is indicated in the fact that the pro-

perty is being dismantled, a part of the equipment, including the hoist, having been sold to the Oxford-Cobalt Company.

Underground work at the Cross Lake property has been suspended owing to the shaft having been flooded through the water in Cross Lake having risen several feet the outlet having become partially blocked by sand tailing from one of the custom concentrators.

The Tretheway Company, now confining its efforts to the operation of the Castle property in the Gowganda district, has met with the difficulty of an early breaking up of the road from Elk Lake to Gowganda. Whether or not this will delay the shipment of the carload of ore which the company has been assembling for shipment, has not been announced.

On the strength of a peculiar instrument operated by Andrew Cullen of Haileybury, with which Mr. Cullen claims to be able to discover mineral deposits, Mr. R. I. Henderson, of Toronto, has taken a working option on a group of claims located in the Gowganda district. The ultimate purchase price is said to be \$300,000. It is proposed to carry on sinking operations just as soon as possible. Mining men are entirely skeptical of the claim made for the instrument, and the general impression appears to be that it is but another delusion of the class of old-time divining rod. The Cullen instrument is claimed by its owners to be constructed and operated on the principle that two things of a like nature attract each other and that by use of a small particle of silver he can discover the presence of silver, by the use of a little gold he can discover gold deposits, and by the use of coal-oil he can discover oil wells, etc. The instrument, however, does not appear to be taken seriously in the North.

At the 180-ft. level of the Triangle property in the township of Auld in the Elk Lake Mining Division a shoot of ore has been encountered. The vein is stated to be from one to two inches in width and contains several thousand ounces of silver to the ton. The wall rock also carries considerable leaf-silver for several inches back from the vein. The force of men is being enlarged from 18 as at present to about 25.

On the strength of a reported silver find in the township of Pense about twenty-five miles North from New Liskeard, about 85 mining claims have been staked and recorded by Toronto men. While nothing of a definite nature can be learned regarding the reported find, it is known that the rock formation is favorable, being made up of conglomerate as well as diabase. The stakings have occurred in the central and northern part of the township, as well as a few claims being staked in the central and southern part of the adjoining township of Mulligan.

Rumors have been current during the past week or so that the Canadian National Railways might consider a scheme to tap the West Shining Tree and the Gowganda mineral areas, by extending a branch from the Canadian Northern to Gowganda, by way of West Shiningtree. The report is totally unofficial and is therefore received with all due reserve.

The Gold Mines.

The fairly general discussion of the tariff question by the political contestants in the Temiskaming by-election set for April 7th, has caused more than ordinary attention to be directed toward this phase of the economic situation as effecting this country. For this reason, an editorial appearing in March 5th issue

of the Canadian Mining Journal has been widely read in the mining districts. Here, while opinions are varied and numerous, the contention is heard that gold being the standard of value, the gold mines would stand to benefit greatly by a reduced tariff. It is pointed out that free trade would all but shatter Canada economically, that buying in the United States would increase and would cause a further violent decline in the value of the Canadian dollar, whereas the gold produced by the gold mines on the strength of cheapened Canadian money would command full value in the United States and thus operate to the benefit of the gold mines.

As to the attitude of not a few gold mine operators, it is interesting to learn that there is a strong desire to avoid too much meddling with the tariff. Free trade, it is believed, would greatly benefit the gold producing companies, but, in doing so, would all but destroy Canada industrially and economically. That the gold mines could offer a stronger argument in favor of free trade than that presented by the farmers seems to be quite evident. The one difference is that the mining interests are apparently willing to not sacrifice Canada's financial status by bringing about free trade that would operate to the profit of but a few favorably placed industries.

At the Hollinger Consolidated an average of about 2,200 tons of ore daily continues to be treated, and from the record set during the first quarter of the current year, it appears reasonable to believe that operations for 1920 will compare favorably with that of the preceding year.

With wages having been increased in the Porcupine district to a point where they about equal that being paid in the silver camps, there is no longer much competition for labor, the supply having a tendency to become more evenly distributed over the entire field. While there is still a shortage in the Porcupine district, the situation has not grown any worse while it has shown moderate improvement. With winter having about drawn to a close, with the consequent curtailment of lumbering operations, it is believed that a large number of workmen from the lumber camps will now find their way to the mines. Accordingly, during the next month or so there is fair promise of working forces increasing materially.

The McIntyre-Porcupine continues its high rate of output, and with the ending of the company's fiscal year on June 30th next, the record shown will exceed by a large margin that of the previous banner year. Heavy production and continued favorable developments at depth tend to strengthen the outlook for the McIntyre. The mine has a full supply of workmen.

It is reported that work will be carried out this year on the Gold Reef property, and that a shaft will be put down to the 300-ft. level for the purpose of exploring for the downward continuation of the narrow, but rich vein which was worked near surface.

After more or less prolonged negotiations, the Porcupine Crown and the Thompson-Krist properties will be merged. The directors of both companies have agreed upon the basis of the merger, and the scheme now awaits ratification at a special meeting of the shareholders. It is proposed to incorporate a new company with a capitalization of \$3,000,000, made up of 3,000,000 shares of the par value of \$1 each. Of this, 2,000,000 shares will go to the Porcupine Crown and

1,000,000 to the Thompson-Krist. The Porcupine Crown Company will remain in existence and will retain control. It also withholds its cash from the merger. The Porcupine Crown will be represented by six and the Thompson-Krist by three directors. The announcement has been received with fairly general favorable comment, as in offers to the Porcupine Crown an opportunity to perhaps develop new ore bodies on the large acreage of the Thompson-Krist, while to the latter it offers the advantage of being taken into a thoroughly going concern, fully equipped with a modern mining and milling plant.

In the Kirkland Lake district, the arrival of spring has been marked by a further increase in activity among the owners of property in the development stage. It is evident that many new mining operations will be carried on this year.

During the month of February, according to an official statement just issued, the Lake Shore Mine produced \$40,126.43. The tonnage treated amounted to a little under fifty tons daily or a total of 1,435 tons, while the average recovery from each ton treated amounted to \$27.96. This is the highest grade so far treated by the Lake Shore.

Work at the 200-ft. level of the Kirkland-Combined property has met with a fair amount of encouragement and the work is being continued aggressively.

At the Ontario-Kirkland, preliminary plans in connection with the matter of providing a mill have been up for consideration for some time, and an official statement is expected as to the probable date on which the work of erecting a mill will commence.

The Peerless Gold Mines, at Boston Creek, of which Shirley Ogilvie of Montreal is president, is making good headway in the development of its Mondeau property. The shaft has reached a depth of 250 feet, where a station is being out preparatory of commencing lateral operations. Once drifting is well under way at this point, it is proposed to continue the shaft to a depth of about 400 feet. The vein on which the shaft at the present depth of 250 feet.

The Miller Independence is proceeding with cross-cutting operations at the 500-ft. level. Delays have occurred in connection with turning on electricity, but the difficulties have now been overcome, and within a few days power will be switched on and will thus make it possible to speed up operations.

A small mining plant has been shipped to the Kennedy-Boston property where it will be installed for the purpose of continuing the shaft from its present depth of 100 feet to the 150-ft. level where it is planned to carry on drifting operations.

Announcements that the Ontario Government is favorably disposed to continue the Temiskaming and Northern Ontario Railway from Cochrane to James Bay have been made. The date of commencement, however, is very vague, so much so that many things may in the meantime happen to alter the Government's opinion. For instance, it is stated that while in sympathy with the projected line, it would be unreasonable to proceed with the plan until such time as economic conditions become reasonably adjusted. This latter plan is believed in the North to be the proper course. However, it offers an opportunity for politicians to express "Costless" sympathies.

The Northern Manitoba Field

By R. C. WALLACE, Commissioner of Northern Manitoba.

At the date of writing, more than a month before breakup, prospects look very bright for the summer and for the future in the territory north of The Pas. The fact that the Flin Flon property has been optioned to very responsible copper mining interests has meant that the eyes of the mining world on this continent are being turned to this territory. Mr. Hammell, who has negotiated the twelve months option under which \$200,000 will be spent on the property is in the district, as also Mr. Koerner who will direct operations for the Thompson interests. The contract has been taken by the Longyear Exploration Company and Mr. Eubanks, with forty miners, has already gone through to Flin Flon. It is understood that Mr. Stovel, who is well known to Ontario mining men, is in general charge for the Longyear Company and that he will himself visit the district at breakup. The plant belonging to the Mandy Mining Company has been bought by the optionees and it is understood that the Prince Albert Mining Co's plant at Beaver Lake is also being taken over. The intention is to sink two shafts on the ore body to the 400 ft. level, to drift at that level the whole length of the property and to cross-cut to both walls at short intervals. There is a good set of buildings on the property which will be sufficient for the preliminary development work, and all the heavier machinery and supplies will be taken in over the ice before the break-up.

Arrangements are also being made that the Provincial Government put into shape for summer transportation the seventeen-mile wagon road between Sturgeon Landing and Lake Athapapuskow. This will enable summer transportation to be carried through almost entirely by water with the exception of this stretch of wagon road. With those who know the property well and who understand what the development work now to be carried on means, there is confidence felt that the option will later mean a sale of the property, and that the initiation of a copper smelting industry there and the building of the railway to the property which will necessarily follow, will establish a solid mining industry of large proportions in Northern Manitoba. On this will also be built a gold mining industry at Beaver Lake, Copper Lake and Herb Lake; the former area lying on the western end of the belt in Saskatchewan. Whether another Flin Flon will yet be discovered in this area is on knees of the gods, but even the most conservative would admit that the chances of the discovery of other copper properties of value in this territory, which has only been imperfectly prospected, are very good. Even at present a custom smelter erected at the Flin Flon would result in the development of some properties on which it is possible to concentrate the copper ore and ship the concentrates to the smelter.

There will be solid development work on the gold properties throughout the belt during the coming summer. In the Beaver Lake area in Saskatchewan, Ontario mining interests have secured a sampling option on the Graham property. The Wolverine properties in the same area are included in the Flin Flon deal and will doubtless be operated either for a flux or independently. It is also known that the Ontario interests have an option on a sulphide body at Ross

Lake, one of the numerous sulphide bodies of large dimensions which are to be found throughout the belt. On Gordon's big dyke at Copper Lake, diamond drilling operations are now in progress, the contract having been obtained by Smith and Travers. It is understood that fifty thousand dollars will be spent on this property. In the Herb Lake district it is a matter of gratification that sufficient money has been obtained through Winnipeg financial men to recommence operations immediately on the Rex Mine, the successful development of which is now confidently expected by all who know the property well. Work will also be recommenced immediately on the Northern Manitoba property, on which very rich ore was obtained to the 100-ft. level to which the property has already been developed. Preparations are also being made for the operation of the Bingo property which shows very high surface values. On the Apex group at the north end of the Lake, which represents a large body of mixed quartz and granite, mineralized to widths in places of sixty feet with arsenopyrite and with good surface values in gold; it is expected that work will be begun in the Spring and that development will be carried out immediately by diamond drilling to ascertain the value of the ore body as a whole. Some four car-loads of canoes have already been sold at The Pas and the indications from enquiries made from many quarters on the continent are that a large number of mining men and prospectors and many mining companies will be actively interested in this district during the coming summer.

The Associated Engineers at Crosby, Minnesota, represented by Messrs Pearl and Knickerbocker, have made arrangements to instal an assay office at The Pas and to place in charge a qualified assayer of some seven years' experience. This office will be of great assistance to prospectors and mining companies, owing to the fact that considerable time will be saved in getting returns for material taken in from the field.

THE BELCHER ISLANDS IRON DEPOSITS.

Popular interest in the Belcher Islands has been aroused by rumors that an attempt would be made to take examining engineers to the property this winter by airplane. It is quite unlikely that the hazardous journey will be made, but it is understood that it was seriously contemplated by certain engineers. There is good reason to believe that the deposits will be examined this year as soon as weather permits transportation by water.

Excellent iron ore has been brought to Toronto from the Belcher Island by the discoverers and by engineers who visited the property for the owners. Evidence is accumulating that large bodies of good ore have been found. It is not at all unlikely that an iron mining industry will be founded on these discoveries. It is possible also that waterpowers on the adjoining mainland will be utilized to smelt electrically the iron ore from the islands. The present difficulty of access has made naturally for delays in recognition of the mineral possibilities of Hudson Bay. It seems likely now that this year will see a long step forward on what has been a very slow journey.

NOVA SCOTIA NOTES.

The Dominion Coal Company's Glace Bay collieries in March showed an encouraging increase in output.

The production for the first quarter of the year compares with 1919 as follows:

| | 1920 | 1919 |
|--------------------|---------|---------|
| January | 275,129 | 276,036 |
| February | 248,338 | 262,876 |
| March | 292,668 | 273,051 |
| | 816,135 | 811,963 |

It therefore approaches 1918 figures by approximately five thousand tons. April is a short month, containing several holidays, but it should be possible to exceed the production of 1919, which was only 258,196 tons, unless drift-ice interferes with the shipping.

The suggestion has been made in the Nova Scotian newspapers that the Dominion Coal Company will not, during the coming Summer, make any determined attempt to send coal to the Montreal market, but will content itself with supplying the local demand, and selling cargo and bunker coal, for which of course there would be a brisk demand during the coming season. While it is probable that local demand will absorb so large a portion of the coal production as to leave for export a much smaller quantity than was the case before the war, it will be a surprising reversal of the policy of the Dominion Coal Company, if no decided attempt is made to regain the Montreal market, where, as recently pointed out in these columns, a potential market of at least three million tons per year exists for Nova Scotia coal.

The improvement which had commenced in the European coal situation, and which led to hopes that industry there was resuming its interrupted progress, has been nullified by the events in the coal district of the Ruhr, Germany, the result of which will be quite far-reaching. Britain and the United States will be called upon to make good the deficiency of coal in France, Italy, Holland and Denmark, and along the whole course of the Rhine which will arise from the troubles in the Ruhr District. A continuance of European demand for coal from North America may therefore be expected, from which Nova Scotia will benefit, but it is not to be expected that the Nova Scotia operators will lose sight of the necessity to regain their own proper and ancient market, which extends, or should extend, just so far as ocean-going vessels can navigate the St. Lawrence channel.

There is ground for much cynical comment in the announced intention of the United Mine Workers in Nova Scotia to base a new demand for increased wages on the increase recently granted to the bituminous miners in the United States. Two years ago the coal operators of Nova Scotia and the United Mine Workers executed an agreement, the crux of which was that miners' wages in the States were not to be used as a basis for adjustment of miners' wages in Nova Scotia. The spokesmen for the United Mine Workers at the conference in Montreal where this arrangement was formulated and signed by the parties thereto made much capital out of the solicitude of that organization for the sacredness of contracts, and urged recognition and acceptance of the control of the mine workers by the United Mine Workers because this union always kept its agreements, a fact that would ensure satisfactory and permanently harmonious relations in the future. The truth of this statement now awaits confirmation.

MANITOBA LETTER.

By CHAS. E. MILLICAN, Winnipeg.

2,200 lbs. of ore has been shipped to Ottawa from the "Wolf" property, east of Little Rice Lake for the purpose of having a comprehensive test made. A local assay of this shipment gives \$86.00 per ton.

The Ripstein Syndicate, a close Corporation holding several claims in the Rice and Long Lake Areas, have a party of men doing a considerable amount of stripping.

The Northern Copper and Nickel Mining Co. near Ingolf, east of Winnipeg, have men on the ground proceeding with stripping. This Company has ordered a diamond drill and as soon as it is on the claim boring will be started. It is the intention of this Company to operate three drills this season.

On the Pan Extension all machinery has now been installed and sinking operations begun.

A very comprehensive map has been compiled by the Overseas Development Corp'n. Ltd. of Winnipeg showing the respective prospected mineral areas in South Eastern Manitoba to date. This map has been compiled from various authentic surveys and a great deal of additional information has been embodied, such as the existing winter routes, proposed summer road to Rice Lake. The map proper is on a scale of 3 miles to the inch and shows the relative positions of all these mineral areas to Winnipeg and to the different water and rail routes as well as the different power sites. It is understood that copyrights will be allowed for this map.

It is expected that, with the opening of the water routes, a considerable amount of exploration work will be undertaken this summer in those parts of the Rice Lake Area which have not yet been thoroughly prospected. It is also probable that more attention will be paid to the copper discoveries in the vicinity of Lac du Bonnet and the country north of the Winnipeg River.

It is proposed to induce parties of students of the University of Manitoba to engage in prospecting trips during the summer vacation, and in some cases we believe that several of the students interested in geology will be taken on the different mining gangs where exploration and development work will actively be carried out this summer, especially in the Rice Lake country. In all probability some of the work being undertaken on the Gabrielle camp this summer will be done by students under the direction of an experienced foreman.

The Public Works Dept. of the Provincial Government has issued the necessary authority for the construction of a Summer Road into the Rice Lake District via the Hole River and Hole River Lake water route to the lower Bellevue Mine Landing, thence in a South Easterly direction to Caribou Lake.

A Portage Road about two miles long on the South side of the River from the head of Lake Navigation to the upper side of the rapids is to be put into good shape.

The Dominion Government is to be asked to repair the rock dam located just above these rapids, which was damaged by ice some years ago. The result of

this work will be to raise the water in the river and lake to a sufficient height to afford draft for boats and barges drawing four or five feet right up to the Bellevue Landing—a distance of about 20 miles inland. Under present conditions a boat drawing 3 feet can make this point.

From this Landing the new road—about 15 miles long—will be constructed to Caribou Lake, following ridges where possible, and will serve a number of Mines in this District, which will be reached by short lateral roads, and will prove of great assistance in getting summer supplies.

From the Caribou Lake end of the road a good canoe route can be followed to Long Lake, with only three short portages to negotiate.

On the Bingu Mine a camp is being constructed, having a present capacity for a crew of 12 to 15 men. The buildings are of log construction—the timber being in close proximity to the Camp site.

The Company are installing a gasoline engine of sufficient power to carry sinking operations to the 500' level. A hoist is also being installed. A contract has been let for sinking to the 100 ft. depth.

C. H. Miles, M.E., exploring engineer, Fort Frances, Ont., is in Winnipeg en route to the Copper Lake district, northern Manitoba, where he and his associates have secured a large number of mineral claims. They will carry on development operations this summer. There are six experienced miners and prospectors in the party.

THE LOW-GRADE ORES OF ONTARIO.

Successful Beneficiation of Masabi Range Ores of Similar Character, Suggests Similar Possibilities in Ontario.

By J. J. O'CONNOR, Port Arthur, Ont.

The successful development on a commercial scale, of Canada's enormous reserves of low grade iron ore, situated mainly in Northern and North Western Ontario, would do more to place this country on a sound, independent economic basis, than any project looking to production, that could be undertaken.

Few Canadians realize the enormous wealth in iron ore lying dormant and undeveloped within our borders. Most of them believe that we are without sources of supply, of this most necessary basic metal. They are not blameable for this opinion, so generally held, but feel that they are justified in holding it, in face of the fact that we now import 96 per cent of the iron ore used in Canadian blast furnaces, and in addition, import upwards of 100,000 tons of pig iron, and about \$175,000,000 worth of iron and steel products annually.

During the past five years railway maintenance has been at the lowest ebb, railway construction practically nil, and all other forms of constructive development, almost at a standstill. We now find ourselves in the midst of a period of readjustment, and reconstruction, when these arrears of construction work must be caught up. With an immense mileage of railway improvements to make, and railway extensions to be constructed. Steel ships to be built as a necessary complement to our government owned railways, in pursuance of the adopted policy of a government owned merchant marine, for the expansion of Canada's foreign trade. With all other industrial lines to be developed and expanded, to enable Canada to pay its enormous war debt. There has never been a time in

the history of this country, when the maximum of possibilities were as great as they are today, never has been a time when we are so much in need of our latent mineral wealth, as we are at present.

With 14,000 miles of railway on our hands, and more to follow, with traffic to find for this enormous mileage, for its maintenance and necessary extensions, together with other industrial needs, it would seem to be a fitting time for the government to come to the aid of the iron ore industry, in a practical way, and make Canada independent, instead of practically dependent, on foreign ores, as she is today.

At this time, when the Canadian dollar has lost a considerable portion of its face value, through over purchasing abroad, the logical course is to turn to our own resources, and make of them, assets in fact. No natural wealth can be considered an asset until it is developed.

Instead of importing over two million tons of iron ore annually, develop our own ore, help stabilize exchange, and bring the Canadian dollar back where it should be.

One of the greatest factors in retarding the development of Canadian ores, is the easy accessibility of United States, Lake Superior ores. Furnace men are able to import these high grade ores free of duty, at low freight rates, and consequently have paid no attention to our own ores.

Canadian blast furnaces have been subsidized to the extent of \$17,000,000, they have been placed on a sound basis at the expense of the neglect of our own ores. It is not reasonable to expect them to turn to the use of ores that must be beneficiated in some form, while other ores are so freely open to them.

That we have immense deposits of low grade beneficiable ores, has been amply proven. Particulars of the location, quality, extent, and amount of development that has been done on them, has already appeared in these columns.

The twenty-eighth annual report of the Ontario Bureau of Mines, 1919, just issued, says, on pages 31-32, "The fact that most of the iron ore mined in Ontario requires beneficiation before smelting has undoubtedly retarded the development of iron mining in the Province. There are very large reserves of ore in the northern and northwestern regions, but so far as the character of the deposits has been revealed, they are in the main low in metallic contents, and in some cases carry an objectionable proportion of sulphur." "Many of these deposits are contained in ranges of banded ore, composed principally of magnetite, but frequently carrying hematite as well. In these layers iron ore alternates with layers of silica or jasper, such layers varying in thickness from that of leaves in a book, to a foot or several feet. The intermixture of iron and silica being intimate, fine grinding is necessary before any method of magnetic concentration can be employed, and complete separation between the particles of ore and those of silica is difficult."

Much time, and a very large expenditure of money has been made on the Masabi range in Minnesota, in perfecting processes for the beneficiating of ores similar to our own. These processes have been brought to such a state of perfection, in their experimental plant in Duluth, by the Masabi Iron Company, that they are amply satisfied that they now have commercial success within their grasp.

Their plans are all complete, the money has been paid in, and construction is about to begin on their

new plant at Argo, Minn. The original unit will entail an expenditure of \$3,000,000. The new plant is to be constructed of steel concrete and wood. The first unit will have a capacity of treating 3,000 to 4,000 tons per day. Other units will be added as circumstances dictate.

The equipment will consist of crushers, ball mills, magnetic separators, sintering plant, etc.

Their product will be in the nature of a clinker, which is produced after the separation of the ore from the rock, by the sintering process. They are now experimenting with peat to be used in sintering. The product may be described as a clinker of high grade ore, free from moisture and all deleterious elements, very porous. The desirability of the product has been established by the preliminary tests, following the operation of the experimental plant in Duluth. They put three-quarters of a million dollars into the experimental stage of their enterprise, standing to lose it all, or make good.

If shrewd iron operators, on the richest iron range under development, in the world today, can make such huge expenditures for the beneficiating of low grade ores, it means that they have sufficient vision to prepare for a future that is certain to come, when high grade ores will be diminishing. They cannot last for ever at the present rate of fifty or sixty million tons per year.

Between 10 per cent and 15 per cent of the iron ore used in the United States today, is beneficiated. All of the New York and Pennsylvania ores undergo some treatment before smelting.

The enterprise and foresight shown by operators on the Masabi range in improving the grade of their ores, is increasing yearly, every season shows an increase in tonnage of beneficiated ores, over the preceding one.

With this example before Canada, why should not something be done along the same lines for the development of our own iron?

Our ores in the main, lend themselves to beneficiation and much more readily than the ores to be treated by the plant mentioned above.

The Bureau of Mines report above referred to, says "Undoubtedly the iron ore deposits of Ontario will be called upon, and it may be at no distant date." With this authoritative statement, some measures of aid should be undertaken by the Government of the Province, aided by the Federal authorities to bring about the early exploitation of this natural resource.

The Province should undertake the diamond drilling of the various ranges, to be recouped for its expenditure, where merchantable, or beneficiable ores are located, contingent on expending the money so repaid, in further drilling on another range, and so on, until the whole of the ranges were gone over. If they would undertake to do this an experimental plant would be erected in this district, that would demonstrate the feasibility of creating, not only an iron ore industry, but a steel plant, rail mill, by-product plant, and all the subsidiaries that go with an iron and steel enterprise.

The railway mileage to be maintained, and the mileage to be built in the future, will be greater west of the Great Lakes, than in the east. This means at least \$1.50 per ton on steel rails, in favour of this point, as against any point east of here.

This form of government aid should not occasion fear on the part of the public that that any one man,

group of men, or any one community would be the sole beneficiaries of the aid given, its benefits would be felt from coast to coast, no one section of the people would be so directly benefitted as the agriculturists. It implies the continuous flow of freight traffic. Prosperous communities would be built up, enlarging and bettering the farmer's market. More, and cheaper agricultural implements would be manufactured in Canada, leading to a solution of the tariff problems of the present.

The Federal government could give substantial aid to a beneficiating plant, without the expenditure of one dollar by admitting the heavy and expensive machinery necessary in such a plant, free of duty.

This is a concrete and feasible proposition, easy of accomplishments, that would demonstrate Canada's ability to stand on its own feet, in the matter of iron ore requirements.

SKINNER'S MINING MANUAL AND MINING YEAR BOOK

We have received a copy of the 1920 edition of this standard work of reference on mines and mine incorporations which has now reached the 34th year of publication. The price is 20s net, or 21s 6d post free out of Great Britain. The volume contains one thousand pages, and can be obtained from Walter R. Skinner, 11, Clements Lane, London, E.C.

The information given is unusually complete, and of a nature that will make it useful to consulting engineers and all persons interested in mining investments.

METAL QUOTATIONS.

Fair prices for Ingot Metals at Montreal, 6th April, 1920.

| | Cents per lb. |
|----------------------------|---------------|
| Copper, Electro | 24½ |
| Copper, Castings | 24 |
| Tin | 71 |
| Lead | 11 |
| Zinc | 11½ |
| Aluminum | 45 |

MINING SOCIETY OF NOVA SCOTIA.

Proposal to Change Name of Society and Date of Annual Meeting.

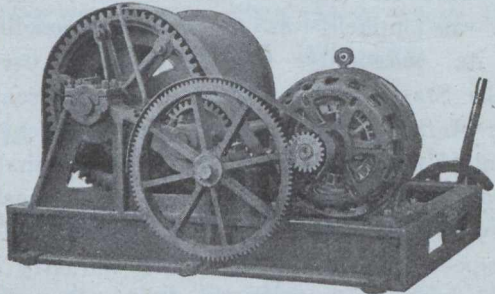
At the Annual Meeting of the Mining Society of Nova Scotia, which will be held in Glace Bay, Cape Breton, on the 4th and 5th of May, a motion will be made to change the name of the Society to "The Nova Scotia Mining and Metallurgical Society." A further motion will be made to allow the Annual Meeting to be held between January 1st and July 1st in each year, instead of between January 1st and April 1st, as prescribed in the by-laws.

POSSIBILITY OF OIL OCCURRENCES IN SPITZBERGEN.

The Northern Exploration Company, of London, in a letter to the shareholders states that following the observance of the gas flows in Spitzbergen by the Company's geologist, arrangements have been made for exploration of the neighbourhood for oil. The "Financier and Bullionist" refers to liquid oil springs and specimens of bitumen, noticed in Spitzbergen in 1905 by the Rev. E. T. Gardner.

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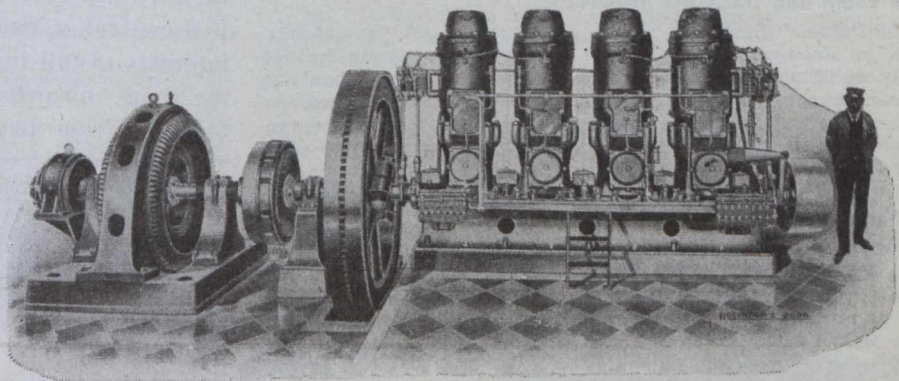
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A SIGNIFICANT STORY

The story of the discovery and early development of the Mandy ore deposits, as recounted by Mr. J. E. Spurr in the March 13 number of the "Engineering and Mining Journal," give some indication of the opportunities that Northern Canada presents to those who would develop mineral deposits. Mr. Spurr and his party were making a visit to the Flin Flon discovery when observations were made that soon led to the discovery of the Mandy deposit, which has now yielded several thousand tons of rich copper ore and which may yield a larger tonnage of lower grade copper-zinc ore in the near future. Manitoba's first copper producing mine became a producer very soon after its discovery. Mr. Spurr says of the events leading to staking of the claims:

"From Athapapuskow we travelled along the narrow Schist Lake; here we noted that the iron-stained rock gave the first suggestion of mineralization; and, indeed, we knew that we were not far from the Flin Flon discovery. We kept on the west shore, but got little protection from the wind sweeping straight down the lake. Arriving at what seemed to be a small island (where now is the Mandy mine), we kept inside the island for better protection against the choppy waves. It turned out to be a peninsula, and we returned with speed and disgust, for we had counted on making the long swamp portage between Schist and Flin Flon Lakes before dark, and it was getting late. Coming back along the shore we noted at one point very heavily iron-stained float at the edge of the woods. We stopped to land and investigate, but we were warned that if we took the time to do so our present day's schedule, and so our whole schedule, would be disarranged. It was agreed, however, that Jackson and Reynolds (two of the party), after visiting Flin Flon, should return by the way we had come and should investigate this locality carefully."

After visiting the Flin Flon and returning to the Pas, Mr. Spurr's party waited there for Jackson and Reynolds. Jackson arrived the following day and reported that he had found sulphide ore—

"Immediately under the moss at the spot we had noticed and discussed, had scraped off a space three or four feet wide and found no walls; and had located claims, those covering the ore in his own name and probable extensions in the name of friends. He showed me the ore, clean bronze-like massive pyrite, concerning whose value he was in doubt; but I advised him judging from the peculiar yellow shade, it should contain between 20 and 30 per cent copper. He accordingly recorded the claims, and a written agreement was made transferring his locations to the Tonopah Mining Co., of Nevada, of which I was vice-president and engineer, leaving him an interest in the property as compensation.

"Immediately I sent for an engineer—McDaniel—to come from Colorado to the Pas, and arranged to have him return to the spot with dog teams as soon as the river froze hard, make camp and trace the discovery."

"MacDaniels' first cut across the outcrop of the Mandy mine, as Jackson had named it, showed about forty-feet of nearly solid sulphides, copper and zinc, averaging about 18 per cent copper and high in zinc. Subsequent cuts, however, proved that the first had been the widest and later trenching revealed the surface outcrop as lenticular and a little over 200 feet long. Diamond drills were sent in to determine the depth and revealed the lens pitching to narrow dimensions in about 200 feet.

"The high grade copper lay in masses and layers separate from the zinc ores and mixed ores, permitting separate mining and the then high price of copper determined the plan of mining and shipping this copper ore. Mining equipment was hauled in over the ice, and when installed the ore was systematically mined."

The story of the discovery and development of the Mandy mine is a very creditable one. It shows how one little patch of the Northern wilderness has been made productive, and should prove an incentive to other enterprising men who are willing to spend time and money in exploring new fields.—R. E. H.

U. S. SUPREME COURT DECISION ON THE STEEL CORPORATION.

In "Some Considerations on Monopolies" discussed in this column in our November issue, we suggested there was "no good reason for objecting to large consolidations of capital, as such." The Boston News Bureau recently summarised the main feature of the U. S. Supreme Court decision in the suit of the U. S. Government against the Steel Corporation by the phrase: "Size no Sin." The U. S. Steel Corporation was upheld as a lawful consolidation because its monopoly had not been used to menace the State, which should serve to strengthen the hands of those who hold that the more complete the control of any industry, and the nearer that control approaches monopoly, the more economical and efficient will be the operation of the industry, and that in this respect unified control of any industry is for its general good, so long as no attempt is made to subvert legislative processes. As a means of obtaining the unified control that is necessary to ensure the fullest measure of efficiency, it will be generally admitted, after the lessons of the war period, that private control includes less evils, and is not so objectionable from the point of view of the public weal, as government control under a system of popular representation based upon the ballot.

In regard to the extension of the Steel Corporation's activities into Canada, it is fair to assume that some hesitation may have been present in the minds of those who direct the Corporation's policies, so long as the legal status of the consolidation was questioned by the government of the United States, but this uncertainty having been removed, there would seem to be no further reason for hesitation, and, seeing that the conditions which favour the extension of United States business organizations into Canada were never so powerful as they are at this time, a logical result of the Supreme Court decision may be the hastening of construction work at Ojibway. In such event, the Canadian steel companies will have to compete with the efficient forces of a great consolidation, under unified control, a condition that will force Canadian steel interests to fall into line with the general tendency of the times towards self-protection by a combination of forces.—From Iron and Steel of Canada.

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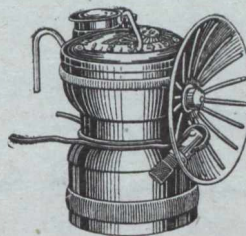
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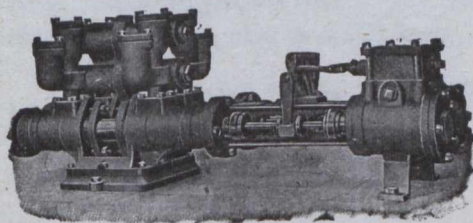
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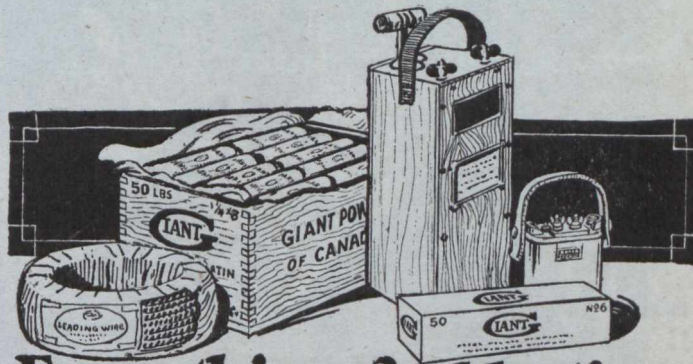
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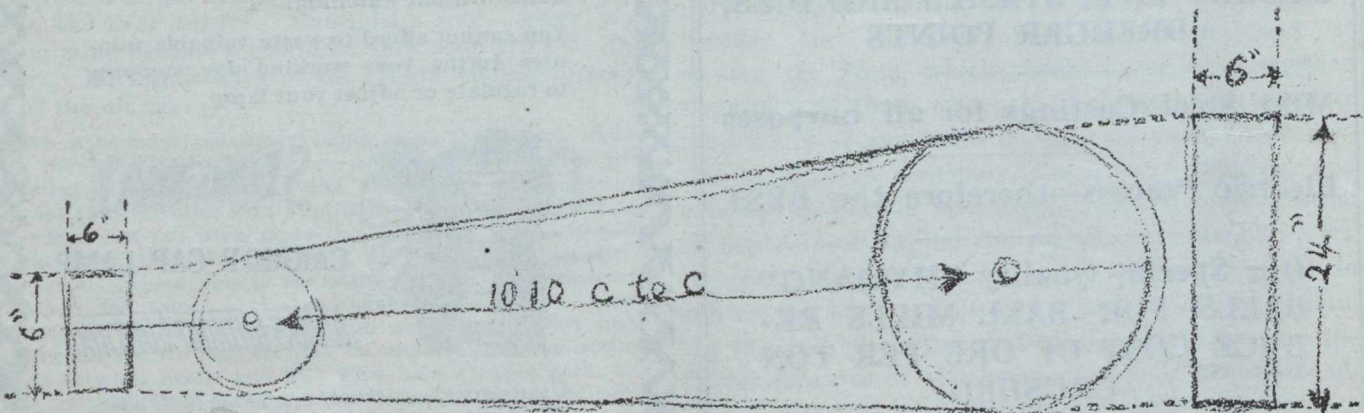
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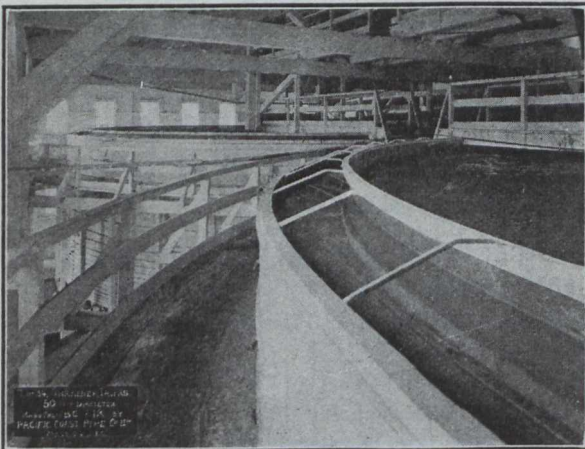
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- Agitators:**
The Dorr Co.
- Air Hoists:**
Canadian Ingersoll-Rand Co., Ltd.
Mussens, Limited.
- Alloy and Carbon Tool Steel:**
H. A. Drury Co., Ltd.
International High Speed Steel Co., Rockaway, N.J.
- Alternators:**
MacGovern & Co.
Spielman Agencies, 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:**
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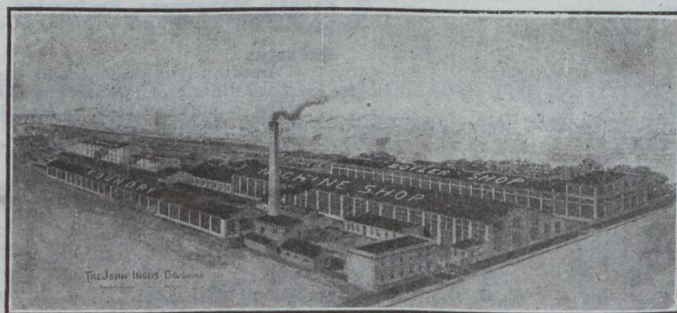
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The Wabi Iron Works
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No. 8301.

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No. 2171

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No. 17897.

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Two machines numbered as follows:

No. 4040.

No. 4041.

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No. 2595.

(With standard Air Receivers, 42" x 10'.)

No. 2596.

No. 2597.

We issue a weekly Bulletin, which shows the materials available for sale at date of issue. If you are not on our Mailing List, we request your name and address.

Toronto District Salvage Board, Ordnance Dept., U.S. Army

39 Adelaide St., E.,

TORONTO, Ontario

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, N.J.
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
Northern Canada Supply Co.
- Dynamos:**
Canadian Fairbanks-Morse Co.
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, Que.
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.
- Flourspar:**
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
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.
Coniagas 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.

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

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

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 & Glassco
R. T. Gilman & Co.

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 & Glassco
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.
 Mussels, 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.
 Mussels, 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.
 Mussels, 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.

Silene:

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 Electrico:

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.
 Mussels, 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.
 Mussels, 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.
 Mussels, 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.

Weighting 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.

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.

Zincconium:
Everitt & Co.

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

Zinc Spelter:
Canada Metal Co., Ltd.
Hoyt Metal Co., Ltd.

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The only reliable protection against the action of acid and chemical fumes. For batteries, battery rooms, chemical works, etc. — Used by Admiralty and War Office.

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Spielman Agencies, Reg'd., 45 St. Alexander St.,
Montreal.

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Entire charge taken of shipments from the receipt of bill
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Balbach Smelting and Refining Co.

Newark, N. J.

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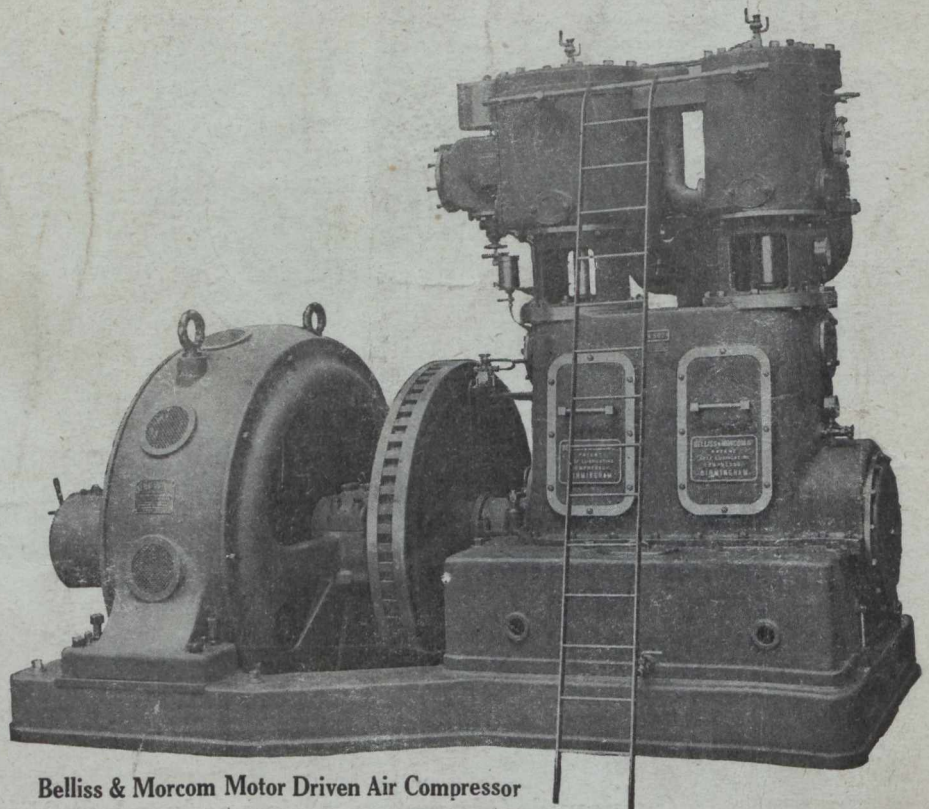
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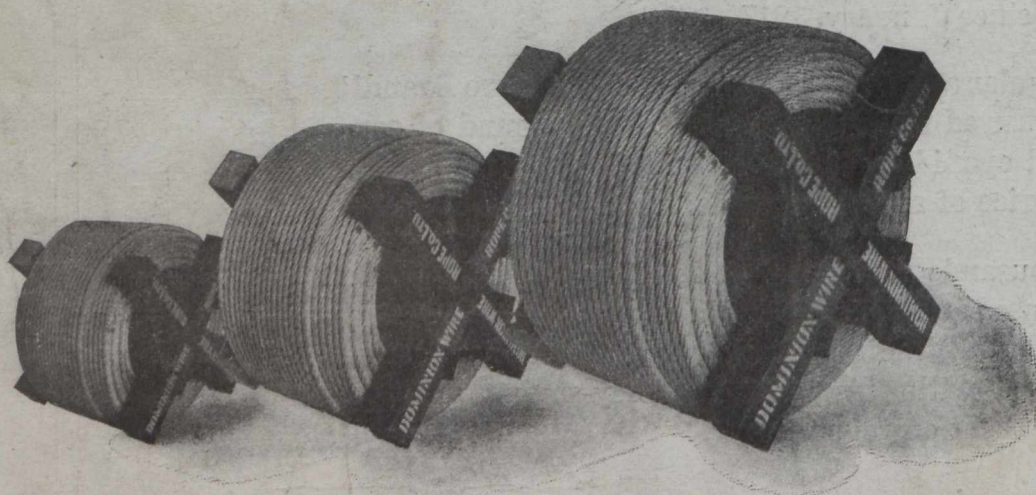
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