CANADIAN MINING JOURNAL

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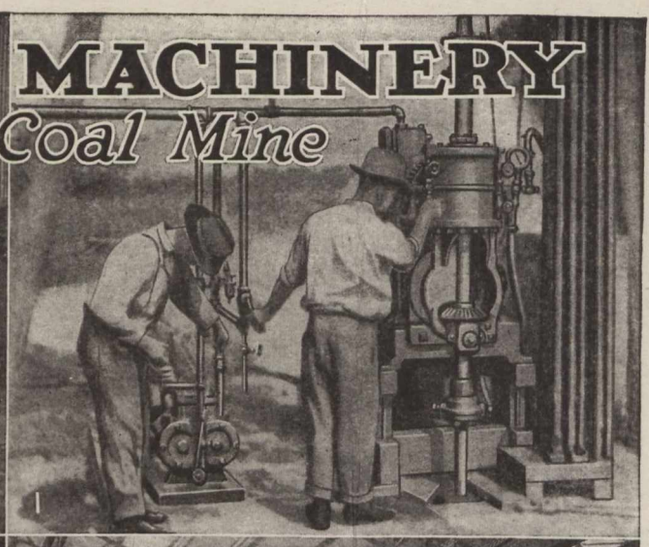

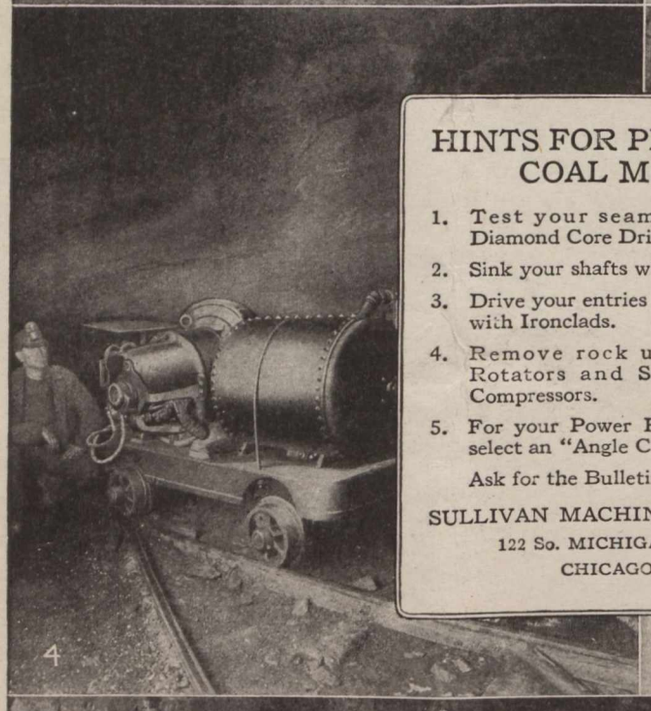

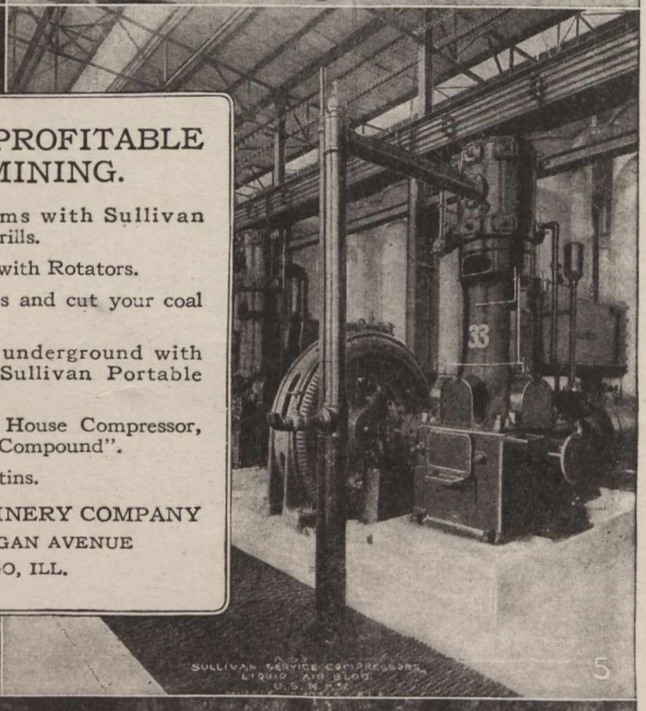

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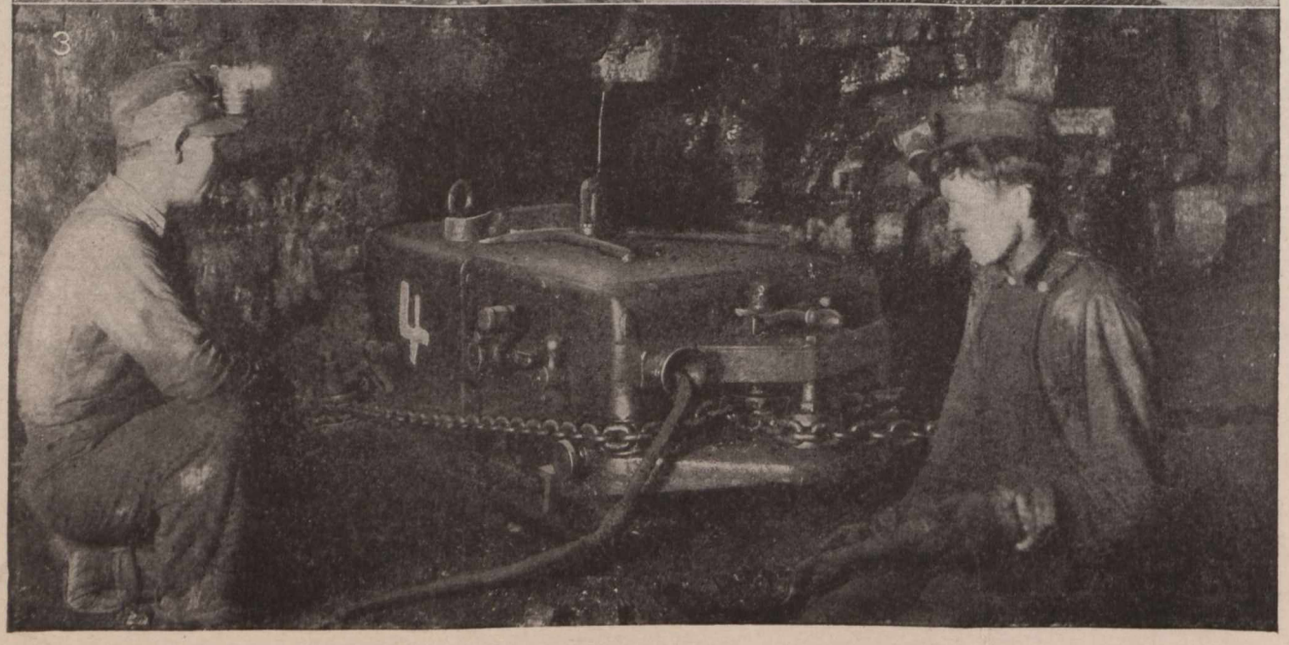

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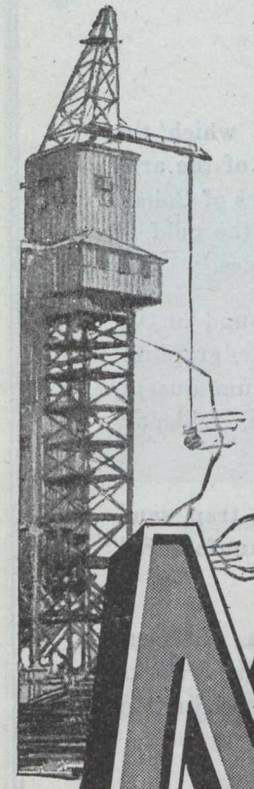

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Ontario in 1918 produced 45 per cent. of the total mineral output of Canada. Returns made to the Ontario Bureau of Mines show the output of the mines and metallurgical works of the Province for the year 1918 to be worth $80,308,972 of which the metallic 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 loca-tion in surveyed or unsurveyed territory.

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EDITORIAL

Canada's Coal Supply

Commenting on the paper prepared by the Editor for the recent meeting of the Canadian Mining Institute in connection with the coal supply, the "Colliery Guardian" of London remarks: "A thriving "country such as Canada cannot face the future with "any serenity if it is unable to provide for a growing "consumption of fuel. . . . . Happily, relations be- "tween the peoples of Canada and the United States "are very cordial, but the latter country has often in "recent months found great difficulty in supplying "the demands of its own population, and, at the same "time, is stirred by the compunction that it has obliga- "tions to assist by large contributions of coal in the "industrial rehabilitation of Europe. Under these "circumstances, we can conceive that the feelings of "the patriotic Canadian are not very dissimilar from "those of our French Allies at the prasent time."

We are afraid that the bulk of the Canadian population has never bothered to think out the fuel problem of Canada, except insofar as attention is forcibly drawn to it by the constantly increasing price of fuel. Neither do we think it will entail any great strain on the coal resources of the United States to supply both this country and Europe with coal. The difficulty of coal supply in North America is at least seventy-five per cent a difficulty of transportation, complicated and exaggerated by seasonal demand. There is no shortage of coal in the ground, neither in Canada or in the United States. Our neighbors come first, and we come second in possession of the coal reserves of the world. These remarks apply to bituminous coal but they require much qualification. In the case of anthracite there is a decided shortage, as was clearly pointed out by the article on the anthracite supply available to Canada that appeared in our issue of 2nd April. There is every likelihood of decreased supply and increased price of anthracite to Canadian consumers. It will shortly be a luxury for the rich alone, and we should indeed be facing calamity were anthracite so indispensable as it is popularly supposed to be.

Under these circumstances, and in face of the greatest demand for Nova Scotia coal that has been known in the Maritime Provinces, Quebec and a portion of Ontario, it is surprising to know that no attempt is to be made during the present season to bring Nova Scotia coal into the St Lawrence market. There are certain passing reasons that justify this condition, the chief being that the Nova Scotian collieries are producing so little coal that they cannot do more than overtake the local manufacturing and domestic demand, and the bunker and export trade that is at the present time so brisk. The present attractiveness of the export market to coal operators on the Atlantic Coats, or having access thereto, is not to be gainsaid, but it upsetting to all pre-conceived ideas regarding the Canadian coal trade to read in the "Financial Times" a statement attributed to a gentleman who is associated with the promoters of British Empire Steel Corporation, as follows: "We—the Nova Scotia coal operators—have been for some time convinced that the markets in the central and western provinces are practically lost to Nova Scotia coal and steel..... the years of the war have given almost complete control of the St. Lawrence market to dealers in American coal." This expresses a complete reversal of the policy of those who directed the affairs of the Dominion Coal Company until it became as important a transportation agency as it was a coal-mining enterprise, and until it possessed loading plants at the mines and discharging plants in the St. Lawrence River that exceeded in speed and efficiency, and in low cost of handling, any coal transportation system in the British Empire. To imply that because through Admiralty requisitioning of coal freighters during the war period and because of shortage of miners occasioned by enlistments and the stoppage of immigration, United States' coal controls the St. Lawrence market and that this market cannot be regained, is a counsel of despair which the circumstances do not warrant. There is an immediate and pressing home market at St. Lawrence ports for not less than three million tons per annum of Nova Scotia bituminous coal. Any reversal of policy which implies that Nova Scotia coal is henceforward going to look to Europe and South America for its markets, and that the provincial operators are prepared to consider the Montreal market as the exclusive possession of United States' coal operators, will have the most dangerous consequences.

The coal reserves of Great Britain are estimated at 189,533 million tons. Those of Nova Scotia are estimated at 9,718 million tons. The total reserves of Europe are 784,190 million tons or over eighty times greater than the reserves of Nova Scotia. If it were

possible to extract every pound of coal represented by the ten billion tons which is approximately Nova Scotia's reserve, it would serve the coal requirement of the British Isles about thirty years. Compare the map of Britain and that of Canada, and consider the extent of the coal reserve of Eastern Canada in relation to its extent and expected population with that of Great Britain, and it will be speedily apparent that, unless Canada wishes to become a satrapy of the United States, it must look to Nova Scotia to provide the coal that is an indispensable requisite of national independence. Nova Scotia, so far as its coal resources are now known, contains 0.7 per cent of the coal reserves of Canada, and it is the only supply that Canada can call her very own in a territory that contains eighty per cent of the population of our country.

The dependence of Europe on America for coal is at this time very impressive, but it is only a passing phase. Europe contains great stores of coal, iron, potash, sulphur, lime, salt and timber, the essential raw materials of modern industry, and, though its present political position is a precarious one, the trained technical workers and scientists of Europe still exceed in numbers and are not less intelligent than their contemporaries on this side of the Atlantic. It is only a matter of time until Europe will recover. Recovery may take years, but it will come, and those who should exchange the policy of developing a home market for Nova Scotian coal for an export market will find that they have exchanged substance for shadow.

If coal is a first necessity of nationhood, and after 1914-1920 there can be little question about it, then the coal of Nova Scotia, and in particular the coal of Cape Breton Island, is a national asset of far greater importance than all our gold and silver mines, because it is a guarantee of national independence, and it should be so used and regarded at all times.

MINING CORPORATION OF CANADA TO PAY GREATER ATTENTION TO CANADIAN DEPOSITS.

The annual report of the Mining Corporation of Canada strikes a cheering note when it states its general policy to be "to lessen its field activities at great distances from headquarters, and pay more attention to possibilities nearer home." It is not the desire, or purpose, of the "Journal" to criticise the extension of the activities of Canadian mining companies to distant and foreign fields, but the number of such far away actvities, and their tendency to increase, causes doubt regarding the future of such districts as Cobalt and Porcupine, as it is very well known that the large mining companies whose original activities have centred in these fields have the very best knowledge of the prospects that are as yet undeveloped. When they therefore choose to re-invest in other fields it suggests that these prospects have been found uninviting. The publicly announced policy of the Mining Corporation, in pleasant contrast, suggests the opposite, and to that extent is encouraging. It is a little too soon yet to regard Canada as holding out no further attractions to development companies.

HYDRAULIC STOWING.

In this issue will be found a paper read before the Glace Bay Meeting of the Mining Society of Nova Scotia by Mr. Walter Herd, the Mining Engineer of the Dominion Coal Company, dealing with the applicability of hydraulic stowing to the winning of the undersea coal areas off Cape Breton Island. Mr. Herd has confined his discussion to that portion of the undersea coal area lying between the 200 and 800-ft. cover line, the most accessible, and therefore the most important part of the submarine coalfield. Mr. Herd did not discuss the applicability of hydraulic stowing to the recovery of pillar coal under the land, nor the extension of the system to the undersea coal lying beyond the 800-foot cover line, but some very interesting possibilities suggest themselves in both connections.

It may be forecasted that beyond the 800-foot coverline we shall see extensive winning of the undersea coal by adoption of the longwall method of extraction, assisted possibly by such application of hydraulic stowing as may prove possible when that point is reached. The conveyance of solid stowing material by water in seams of small inclination will present difficulty, and may even lead to the establishment of underground crushing plants near the goaf areas requiring to be stowed. That, however, is a very long-range forecast, but we may look for experiments on a large scale in hydraulic flushing in inshore undersea workings that will lead to a development of a local technique suited to local conditions. Mr. Herd's paper probably will be looked back upon as marking a definite break with hitherto accepted methods of extraction in the Cape Breton coalfield. The greater adoption of longwall mining in this district, both in land and sea areas is a certainty. The reluctance of the local miners to engage in this form of coal extraction will be gradually overcome, as it becomes increasingly evident that thorough-going adoption of the longwall method offers about the only possibility of profitable mining of the undersea coal.

It is of interest to know that the iron-ore workings at the Wabana Mines are also being laid out with a view to the adoption of hydraulic flushing should it seem advisable at a later date.

Mr. Wilson is an unfortunate phrase-maker. That "panic-stricken Navy" is a term which will survive, and it will be surprising if it is not adopted by the British Navy as a nickname, much as the Army adopted the Kaiser's phrase, and became the "Contemptibles."

"WHOM THE KING DELIGHTS TO HONOR"

The presentation of the Czowski Medal at a recent meeting of the Engineering Institue of Canada to Messrs. Phelps Johnson, G. H. Duggan, and George F. Porter, in recognition of their brochure on "The Design, Manufacture and Erection of the Superstructure of the Quebec Bridge" which merited the award as being the best contribution to engineering literature of the year 1919, raises some interesting considerations. The engineers who have been so rewarded by their fellows do not require the congratulations of others, but this periodical desires to commend those who made the award, and undertook, in so doing, to name the Quebec Bridge as "the greatest engineering feat of the century." The reason we venture upon these remarks is that we believe that men who achieve success in the arts of civilization should be privileged to receive the commendation of others than their fellows, and that the accomplishment of engineering work of the outstanding character of the Quebec Bridge should be signalized by honor from that source, which in our guileless and archaic fashion we believe to be the fountain of honor in the British Empire, namely the King. Either that, or Canada should provide some means by which honor can be conferred upon her eminent citizens, (other than those circumscribed—although highly prized honors—that proceed from incorporated societies with specialized scope) through which the desire of the people to honor some chosen person may be expressed.

The resolution adopted by the Canadian House of Parliament requesting the King to confer no further honors upon Canadians meant, in fact, that Canada no longer looked upon the King and his advisors as the source and fountain of public honor. That, presumably, is a course of action well within the rights of the Canadian Parliament, but the good taste, not to say anything about the wisdom of the Resolution, are open to the gravest doubt. The offensiveness of the Resolution lies, to our mind, in its essential snobbishness. The ordinance was by no means a self-denying one, for, while the average parliament of a self-governing country usually contains these men who excell in shrewdness and oratory, it is also usually singularly lacking in those men whom it has been the custom to honor by public decree from the earliest times because they have contributed to the world's progress in literature, science and the arts of civilization, of which engineering is not least. The Resolution meant, therefore, in addition to its remarkable lack of good taste, that a group of persons unlikely to be made the subjects of honor for their achievments of real and intrinsic value undertook to prevent, for ever, the expression of the desire of the Canadian people to honor a worthy citizen by the conferrence of a title.

We would also submit that the conception of the office of the Sovereign as representing any other thing than the voice of the people is contrary to British ideas the world over, and there is no other way under our present institutions by which the desire of the people to signalise worth in an individual can be accomplished except through our ancient and national custom of titular honours.

There are in Canada many men who have achieved world wide recognition of their achievments in engineering, medicine, literature, and art, but, within the conception of our legislators, these men are not worthy of any distinction above their fellows.

A recent issue of the "Atlantic Monthly" contained the life-story of a Russian Jewess, who, despite excellent wages and kind treatment decided to leave Toronto, "because of its parochial atmosphere." The parish-pump outlook is not confined to Toronto, but it is unworthy to parade such a viewpoint under the guise of democratic ideals or republican simplicity.

There are men who should be publicly honored for scientific and engineering achievements, and the erection of the Quebec Bridge is such an achievement.

It has been truly said that a prophet is not without honor, "save in his own country and among his own people."

Correspondence

The Editor,
The Canadian Mining Journal.

Sir,

Regulations of the University of Toronto governing students in the Department of Mining Engineering contain the following:

> "Candidates for the degree in the department of Mining Engineering will be required to present satisfactory evidence of having had at least six months' practical experience in work connected with mining, metallurgy or geology, for which they must have received regular wages.
>
> "The time may be spent on geological survey, in ore dressing, smelter or lixiviation works, in an assay office in the vicinity of mining or metallurgical works, on any work in or about a mine other than as an office man or clerk, or in prospecting. Not more than three months on geological surveys will be accepted, and prospecting will only count one-half (i.e., four months' prospecting will be counted as two months) and must not be submitted for more than three of the six months."

These regulations which were introduced some ten years ago have met generally with commendation but occasionally I have heard adverse criticism. Within the last few weeks a number of students have gone to our mining districts and obtained work along these lines, and I suggest that the matter might be a good subject for discussion in your columns.

H. E. T. HAULTAIN.

The Suggested Application of Hydraulic Stowing to Undersea Coal Workings, With Special Reference to the Sydney Coal Field

By WALTER HERD.*

A Paper read before the Mining Society of Nova Scotia, Glace Bay, May 14th, 1920.

Introduction.

Although the hydraulic stowing of mine workings has long since passed the experimental stage and is today adopted with success in many European coal mines and in South African and Australian gold mines, yet with the exception of a few American thick seam mines the English speaking countries generally have been very slow to adopt what has proved to be the best method of filling the space left by the extraction of a coal seam so as to cause a minimum of subsidence.

History.

Hydraulic stowing was first attempted in Pennsylvania, but to Upper Silesia belongs the credit of first having demonstrated its practicability on an economic basis. Previous to its adoption in that coal field about 20 years ago, seams of 20 feet to 40 feet in thickness were being worked which caused great surface damage and there was a large loss of coal through the difficulty of taking out the pillars in these thick seams. At the same time spontaneous combustion was added to their troubles, often necessitating building off large areas of coal. Since the adoption of hydraulic stowing practically the whole of the coal is extracted with a minimum of surface damage and gob fires are almost unknown. Very much less timber is required and accidents considerably reduced.

Sydney Coal Field Conditions.

Although these conditions do not exist in the Sydney Coal Field, there is the condition of large areas of coal lying under the sea at comparatively shallow depths where it would be imprudent to extract the whole of the seam. To be more definite, this applies to seams lying under the sea and having a cover of from 200 feet to 800 feet of solid measures. Already between these depths the greater portion of the best seams in the coal field have been formed into pillars, representing at least 50 per cent of the seam left to support the roof. No doubt in the past when considerable areas of these seams remained to be worked on the land area, the loss in leaving in these pillars did not seem so apparent as it does today, when Conservation Commissions are bringing home to most of us the necessity of husbanding our natural resources. This should apply particularly to coal, which is a wasting asset. The Sydney Coal Field undoubtedly contains a large tonnage but it has not the illimitable resources popularly supported. The workings in the thicker and best seams extend a considerable distance seawards and the necessity of conserving coal suitable for metallurgical purposes is very apparent.

Recovery of Undersea Coal.

By hydraulic stowing it ought to be possible to recover the many millions of tons of coal left in pillars having 200 ft. to 800 ft. of cover. The cost of recovering all these pillars now after the lapse of many years since they were found, would in some cases be prohibitive due to the roof in the rooms having fallen and the difficulty in collecting the stowage water, and many will have to be left till coal has a greater value than it has today, but there are many pillars which could be economically recovered at the present time. However, the plea the writer wishes to put forward is not so much for the recovery of pillars which have been formed in the past as the need for guarding against a repetition of the same procedure in the future.

In the future working of seams underlying or overlying those already formed into pillars and which extend under the sea, the writer would suggest that the area in these seams down to 800 feet of cover below the sea bottom, be blocked off into panels of suitable size, which in the case of the thicker seams would be formed into pillars to be extracted as soon as the broken work in the panel is completed, the pillar coal pulled up hill to the top level and the space left stowed by hydraulic means, as shown in Fig. 1. In the case of thinner seams the panel would be worked out by retreating longwall, the space left being filled as in the case of the pillar extraction in the thicker seam.

Stowing Material.

Generally it may be stated that the economic success of hydraulic stowing depends upon the existence of suitable stowing material near at hand; to a lesser extent the distance the material has to be transported underground and the head against which the return water has to be pumped must be considered. Of all the substances tried as a stowing material, sand has proved the best, both from the point of view of cost and for forming a densely packed stowed area with a minimum of shrinkage. Less water is required to flush sand than other subsidences tried and less material is held in suspension in the return water, reducing the cost of renewal to pump parts and pipeline. Experiments in recent years have shown that in some cases a ten per cent mixture of clay with sand produces a better filling material than sand alone. This experience not being general may possibly be explained by some of the clays tried being more or less of a cement nature which would bind together the particles of sand after the water had run off. Where sand is not procurable, pit-refuse heaps, boiler ashes and granulated blast-furnace slag have been used with success. The last named material is however very hard on pipes and if of too porous a nature to be used alone. In one large European installation special quarries have been opened to supply stowing material, the whole of the stone being crushed before being sent to the mines. As high as 4,000 tons of stone a day has been sent from these quarries to the various mines they supply.

Supply of Stowing Material.

The Sydney coal field is fortunate in having within a reasonable distance of the mines an adequate supply of sand. This sand could be extracted by means of suction dredges which should work backwards and forwards across the various beaches and sand bars in the vicinity of the mines. The sand would be delivered from the dredges into railway cars for trans-

* Mining Engineer, Dominion Coal Company, Glace Bay, Nova Scotia.

port to the mines, or where the sand has only to be taken a short distance an aerial ropeway would probably be the cheaper form of transportation. 150 tons per hour can be economically carried by this means.

Where sand is employed as the stowing material it should be possible to extract the entire seam up to the present legal limit of 180 ft. of solid cover between the seam and the bottom with practically no risk of the sea breaking in. It is not possible to entirely replace the original seam with stowing material as there will alhays be a certain amount of shrinkage consequent upon the stowage drying, but at least 90 per cent and possibly 95 per cent of the excavated space is filled. It is a generally conceded fact that the better an excavated area is stowed the further is the line of fracture thrown ahead, making in the case of 95 per cent stowing a line which forms an angle of about 60 deg. with the vertical in a seam dipping one in nine. Conversely an area which is not stowed at all will make an almost vertical break to the surface. In other words, the better the stowing the further is the extension of the "draw," with of course proportionately less subsidence. Consequently the risk of the sea entering through a break with a line very little removed from horizontal is much less than through an almost vertical break.

Description of Plant.

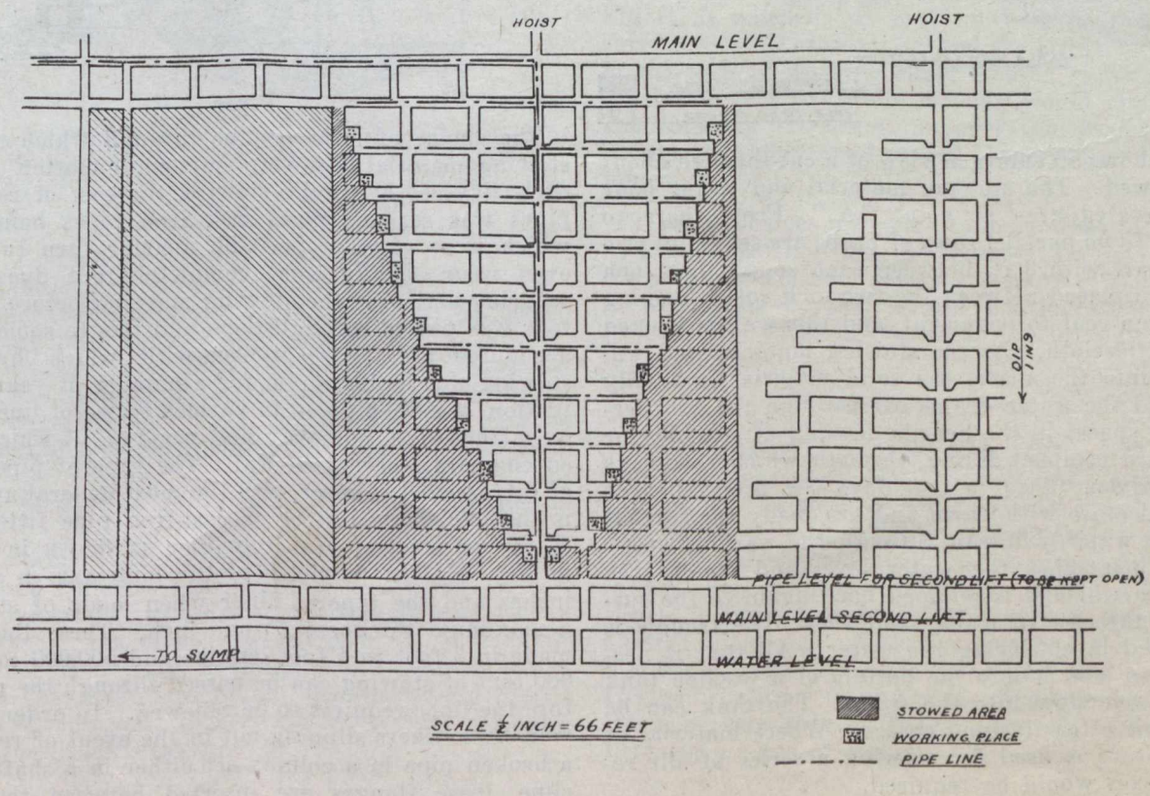
A short description of the procedure in hydraulic stowing may be of interest to those who have not seen it in use. The stowing material, whatever its composition may be, is conveyed from a storage bin by a spiral conveyor into a hopper in the shape of an inverted cone about 3 feet diameter at the top. The reason for using the spiral conveyor is that the quantity of material to be delivered can be accurately gauged to suit the water supply. The storage material is met at the bottom of the hopper with several jets of water and a little lower down the main jet enters ensuring a thorough mixture of the material with water. This water flushes the material down a pipe to which the hopper is attached. This pipe may either be placed in a shaft or slope from the bottom of which it is continued into the workings, or it may be placed in a borehole sunk close to the sea shore and as near as possible to the workings it is desired to stow. A simple arrangement is fitted on the hopper which stops the supply of stowing material should the water supply fail otherwise the pipe would fill with dry material which would soon choke it up. Branches are put in from the pipe to the various areas to be stowed and blank flanges instead of valves are used to divert the stowage to the required area.

Underground Layout.

In figure 1 the writer has endeavoured to show a standard panel formed into pillars in the usual way. These pillars are half cut and the sketch shows the panel at its maximum production. The next panel inbye is being split into pillars, the lower one being ready for extraction to replace the almost extracted lower pillar in the outside panel. These panels are designed to give a maximum output of 200 tons per day in a six-foot seam and an average output of 150 tons per day. The tonnage of sand required per panel would, due to it having a greater specific gravity than coal, be a maximum of 300 tons and an average of 225 tons per day to replace the coal extracted in pillars, but as the pillars only represent about half of the coal originally in the panel area the quantity of sand required daily will be double the figure on the average. An 8-inch diameter pipe will flush 120 tons of sand per hour under the conditions existing in this coal field, so that this size of pipe would be sufficient to store the output from two panels in one shift.

It will be observed that the stowing pipe is taken in the main level and down the headway, branches being put in to each room. The pillars are extracted

— FIG. 1. —



by a series of upward slices about 15 feet wide and when a cut is through it is immediately stowed. When a cut runs between the stowing and an old crosscut the latter should be stowed before the cut is begun.

The depth of the panel viz., 700 feet between main levels, may seem excessive in comparison to the width of 500 feet but the reducing of narrow work to a minimum has been kept in view also the fact that after a cut is through and has been stowed it will be a couple of days before the next cut can be started, as the stowage will take about that time to dry out, and a few extra places must be maintained to take care of the men n these circumstances. It will be noticed that after the first lift, three levels must be driven for future lifts, viz., a water level, main haulage-level and pipe level. The latter level is necessary to take out the pillar to the rise of main level otherwise the stowing would have to be forced uphill. Under certain conditions of good roof this level might be driven room width. For ventilation and also as a waterway it is necessary to keep open the main headway after the pillars have been extracted. It could be stowed as the pillars are extracted to a minimum width of 5 feet and left that way.

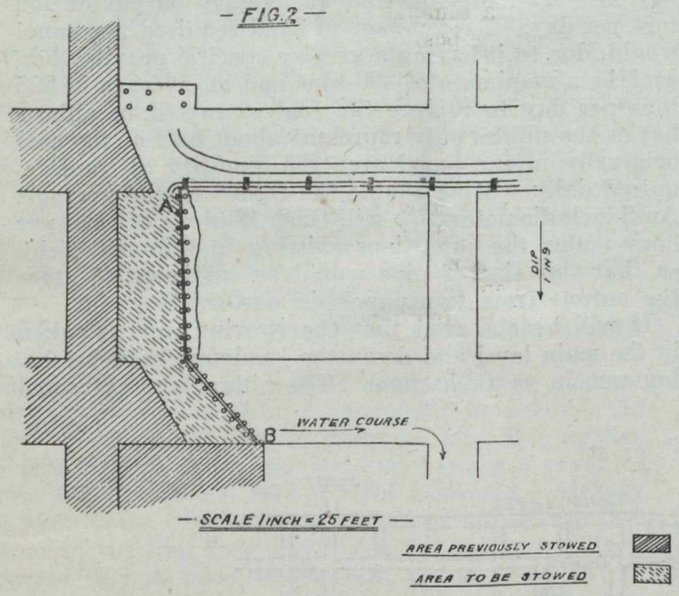


Fig. 2 shows an enlarged view of a cut-through about to be stowed. The stowing material and water pour into excavated area at point "A," From there to point "B" two parallel rows of props are set about two inches apart with 3 ft. between each couple, one inch boards are placed between the two-inch space forming a wall from roof to pavement, and this wall is backed with bratticecloth. As the stowing material and water flow into the space, the solid material gradually settles and the water drains off through the bratticecloth and spaces in the boards, leaving after a day or two, a hard compact filling, through which roadways can be driven. After a few days the props, boards and brattice are withdrawn and are ready for further use. The water will run through the various crosscuts till it reaches the water level and finally the sump from which it is pumped back again to the surface. In the case of using sand very little trouble is experienced in clarifying the water. All that is necessary is to lend it into the bottom of a wooden tank letting it overflow into the sump. The tank can be cleaned out after flushing ceases. Where material of a clay nature is used for stowing a series of silt recovery boxes would be required.

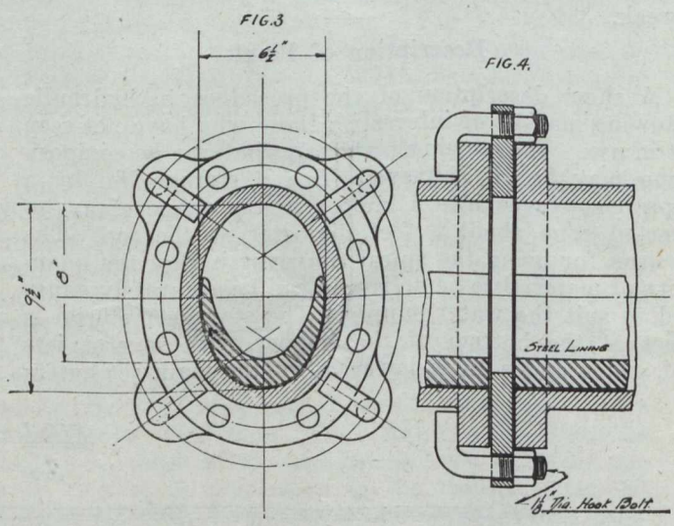
It will be noticed that the stowing is not flushed tight up against the next cut. If this were done it would not be possible to drain off the water. At the same time the leaving of a space ensures good ventilation, an open end for the next cut and the coal does not become mixed with the stowing material.

All stowing should be done on the night shift and telephonic communication established between the men in charge of stowing below ground and the surface.

Before the commencement and after the completion of stowing operations, water only, should be run through the pipes for a few minutes to make sure there are no obstructions.

Water.

The quantity of water required varies with the stowing material used. In the case of sand volume for volume is sufficient, that is 6 to 7 gallons of water will flush a cubic foot of dry sand into the workings. Twice this quantity of water would be required if material of a clay nature was used. This quantity of water is based on the assumption that no stowing material has to be forced into the workings to the rise as the water required increases very rapidly when a head is put against the stowing material.



Pipes.

The choice of type of pipe through which to flush stowing material is a very important matter. In the early days of hydraulic stowing the cost of renewing pipes was serious, plain cast iron pipes being used which were given a periodic quarter turn to ensure even wear. Many wore completely out due to the scouring action of the stowing material before 100,000 tons was passed through them and this to some extent accounted for the scepticism with which hydraulic stowing was looked upon for a number of years. Attention was then given to various forms of liners such as earthenware, porcelain and wood all of which proved comparatively successful. The type of pipe which of late seemed to meet with the most general approval is the oval-shaped steel or cast-iron pipe fitted with a tapered steel or cast-iron liner as shown in section in Fig. 3. The diameter of the long axis is about 3 inches and the tapered liner when made of steel has a maximum thickness of one inch. These liners are made in 3 foot to 4 foot lengths and 500,000 to 1,000,000 tons of stowing can be passed through the pipe before the liner requires to be renewed. In order to prevent these liners slipping out in the event of replacing a broken pipe in a column set either in a shaft or incline, loose flanges are inserted between the fixed

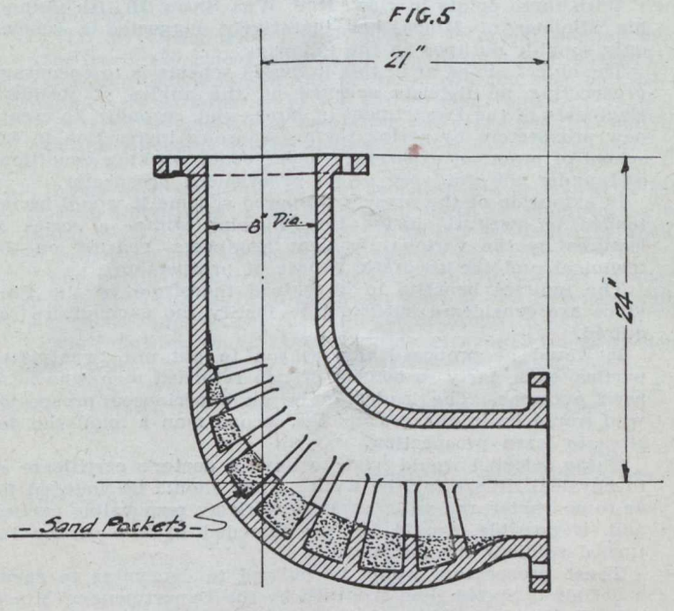
flanges as shown in Fig. 4. These loose flanges have a space area equal to the internal diameter of pipe and liner combined. Special bolts keep this loose flange fixed to the flange of the pipe above so that when the lower pipe is removed the liners are held in place.

The greatest wear takes place in bends and a simple and effective method of counteracting this wear is to have a series of ribs a few inches apart in these bends at right to the flow as shown in Fig. 5. The material collects between these ribs and protects the metal from excessive wear.

Cost.

It is often argued against hydraulic stowing that it will put a prohibitive cost on the coal mined. In some cases this would be so. Below, the writer has attempted to give an approximate estimate based on present day prices of the cost to instal a plant in this district under average conditions, also the extra cost it would put on the ton of coal produced. The estimate is based on one installation supplying two panels similar to those shown in Fig. 1, each producing 150 tons of coal per day for 200 days in the year. The writer does not consider it economically possible to

FIG. 5



continue hydraulic stowing during the winter months in the Sydney Coal Field. During this period the formation of panels could be pushed forward and in the thicker seams the pillars formed.

Cost of Average Installation.

2 Lined boreholes 600 ft. deep 8" and 6" diameter respectively	$ 7,000.00
2,000 ft. of lined piping (laid) at $2.50 per foot	17,000.00
Storage Bin, Hopper and water supply pipe	10,000.00
Return water pipe	3,000.00
Pump and Motors complete	5,000.00
Total cost of installation	$42,000.00

This, taking interest and depreciation at 20 per cent per annum entails a yearly charge of $8,400.

Approximately 1½ tons of sand will be required to replace every ton of coal taken from the panels, but at the time of stowing, in the thicker seams where the panel is first split into pillars, approximately 3 tons of sand is required. In arriving at the cost the total coal in the panel is taken.

Estimated Cost of Stowing Two Panels Producing 300 Tons of Coal per Day.

	Per ton of coal
450 Tons sand at 50c per ton = $225.	= 75c
Interest and depreciation on Plant	= 14c
Pumping	= 2c
Labour	= 7c
Total	98c

In the case of pillars already formed the cost would be practically double this amount.

This estimated cost is no doubt higher than would actually be the case in comparison with the coal won from the lower levels of the mine where hydraulic stowing was unnecessary; as, being nearer to the outlet, haulage charges and upkeep of roadways would be less, ventilation would be much simpler and more timber could be recovered. Again the pillars left are in the thicker and more profitable seams and their extraction, using hydraulic stowing, might not be actually more costly than certain seams now being worked. Also it must be remembered that these pillars will constitute an extra tonnage to the mines as presently developed, making possible an increase in output which would further reduce overhead charges, for which credit must be given.

Conclusion.

In conclusion the writer would suggest that some form of hydraulic stowing be adopted in the remaining seams to be worked under the sea down to 800 feet of cover. If this is not done then the seam could be left intact until a cover exceeding 800 feet, is reached, with the exception of driving winning places through this area to reach the coal having a cover greater than 800 feet. Beyond this cover there ought to be no danger in extracting the whole of the seam without solid packing. A Crown Lease permits of the total extraction of a seam eleven foot thick after a cover of 810 ft. is reached. It may however be necessary to carry hydraulic stowing beyond the 800 ft. cover mark, in the case of working superimposed seams simultaneously; in fact hydraulic stowing would allow of this simultaneous extraction, an operation that without it should be highly condemned, being the ruin of many mines.

The writer does not mean to argue that to introduce hydraulic stowing into the Sydney Coalfield is a simple and easy matter. There are many difficulties, but it well deserves the careful consideration and cooperation of those interested in the ultimate recovery of all the coal.

Jutland was fought in May, 1916. The United States did not come into the war until a year later. During the interval it is curious that the Germans, who had the second most powerful navy in the world, did not take advantage of the indecision and timidity in the British naval command that Washington so clearly perceived at long distance, and from a disinterested viewpoint. The Germans had the benefit of a closer acquaintance with the Navy, and were in an excellent position to judge the fighting qualities and spirit of our ships. They came out eventually, in 1918, on a piece of string.

BRITISH COLUMBIA ADOPTS MODIFICATION OF CANADIAN MINING INSTITUTE'S PLAN FOR SOLDIER PROSPECTORS.

An outline of proposals formulated jointly by the Provincial Departments of Mines and of Industries for the general encouragement of prospecting for minerals in British Columbia and in particular for the extension of aid to returned soldiers wishing to engage in that line of work is made public by Hon. Wm. Sloan, Minister of Mines.

Briefly it is intended that 25 parties shall be put in the field, each of which will consist of two men, one a practical prospector of experience and the other a returned soldier. The parties will be grub-staked and the total number for which provision is being made will be divided among the six mineral survey districts of the Province in proportion to the population of each of the said districts.

The details in connection with organization are being placed in the hands of the Resident Mining Engineers of the Provincial Mineral Districts and Hon. Mr. Sloan states that it is expected that the scheme will become operative, at least in respect of preliminary preparation for the season's work, in the course of a few days.

Following is the complete memorandum referred to:

The general idea of such assistance is not new; it was proposed by the Canadian Mining Institute over a year ago, and the scheme as then outlined in the May, 1919, Bulletin, page 521, was to send out parties under returned mining engineers, all of whom would be paid "a reasonable salary or wage," together with expenses.

Any moneys realized from sale of properties found would belong, 75 per cent to the Government, while remaining 25 per cent would be divided among the prospecting parties.

Dr. J. A. Dresser was deputed to elaborate this scheme and to lay it before the Dominion Government. The scheme as elaborated by Dr. Dresser was fully set out in the July, 1919, Bulletin, page 725. In brief, the organization consisted of a head office under a "Chief Engineer," with staff of accountant and clerks; Divisional Engineers; and with each party of four prospectors a Field Engineer. The estimated cost of from thirty to fifty parties was from $135,000 to $255,000 for the field season.

The ownership of the results of such prospecting was to be 50 per cent to the field party making the discovery and 50 per cent to be divided among the entire number of men employed.

The Government to be recouped from a royalty on output of such mines as might be discovered, but the Government having no direct ownership interest in these properties.

The memorandum indicates that this scheme was chiefly intended to provide employment for "mining engineers, miners, and other suitable returned soldiers in prospecting" rather than a direct stimulus to prospecting.

In the August, 1919, Bulletin, C.M.I., page 830, is a copy of letter from Dominion Minister of Mines, Mr. Martin Burrell, dated July 8th, 1919, in which he says: "The proposal has been definitely refused by the Department of Mines."

In October, 1919, General R. G. E. Leckie proposed a scheme which aimed, not so much at providing employment for mining engineers and miners, but rather to educate returned soldiers to become prospectors. In outline General Leckie's scheme was about as follows:—

(a) To establish in cities "Prospecting Schools or Schools of Mines," where returned men could receive instruction in prospecting, elementary mineralogy, and geology.

(b) After successfully passing the "prospecting course" these men would be formed into groups of, say, ten prospectors under charge of a more experimenced leader, outfitted with all requisites, and sent to some district selected by the Government, where a central camp would be established, from which the prospectors would radiate under supervision and control of the leader.

((c) When a discovery of mineral was made, it would be examined by the leader, who would sample it and send samples and report to the Resident Engineer of the District, and if he considered the discovery of sufficient importance, he, the Resident Engineer, would examine it and report, and might direct the whole party to do some development-work on the property.

(d) The Resident Engineer's report would then be sent to the larger exploration companies, and thoroughly advertised as for sale by tender or public auction.

The Government was expected to supply the men during schooling, etc., with a "good living." The proceeds of any sales would be divided, first, 50 per cent, to the Government; then, after deducting all expenses, the remaining 50 per cent would be divided among the men.

While both these schemes mentioned met with the general sympathy of the British Columbia Minister of Mines, neither of them seemed to be sufficiently practicable or directly to the point to meet with his unqualified endorsement.

The present need is for more prospectors in the hills, and the kind of training prospectors need, required to more nearly approach practical working conditions. Prospectors in real life do not go out in parties of ten under the control of any person; they are a very independent lot of men; the independence of the life is its very charm to them; are used to act on their own judgment, and ready to stand the consequences for better or for worse. They go out separately or in pairs, esldom more than partners.

The point desired is to offer good substantial assistance to the prospector who really desires to prospect for the chance of what mineral he may find.

With these points in view, Hon. Wm. Sloan, British Columbia Minister of Mines, has tentatively suggested a scheme only roughly outlined in the following:—

The object aimed at in this proposed scheme is to encourage prospecting in districts selected on the advice of Resident Engineers of the Department of Mines and, secondly, to create new prospectors by giving them a season's instruction in the school of practical experience under exact working conditions and under the guidance of an experienced prospector.

In extension of the present proposed scheme it would be intended to institute during the following winter a series of lectures by the various Resident Engineers, bearing on the technical and the theoretic aspect of prospecting.

The indirect benefits to be gained therefrom by the Province are considered sufficient to justify the expenditure required.

It would be proposed this season to put out twenty-five parties, each party to consist of two returned men who have been overseas. The leader to be an experienced prospector who would be in charge, and the second man a man who desires to learn prospecting.

Those selected would have to have a doctor's certificate as to physical fitness for the work. They should be vouched for as to character and willingness to work by responsible parties, and, if possible, should be recommended by one of the returned soldiers' organizations.

These prospectors would be obliged to determine to spend a definitely stated time specified by the Department of Mines, actually in the field, and at the close of the season and so often as the Department of Mines may require would be obliged to make report by affidavit giving time, places, dates, and nature of the work on which they were engaged, together with such other information as may be required of them as to the nature of the country traversed and mineral formations, etc.

The Government would undertake to provide camp equipment consisting of tent, fly, ground-sheet, blankets, cooking-utensils, and tools and incidentals, which at the end of contract would become the property of the prospectors, or in lieu of such equipment the government would contribute $50 towards the purchase of same; the prospectors to supply their own personal equipment.

Further, the Government to make an allowance, uniform for all the Province, of $1.50 for food and other expenses, etc., to each man for each day in the field, payable monthly or as might be arranged.

At the end of the season men who had served the full term of their contract undertaking properly attested to, would be allowed, to the experienced prospector the sum of $125 and to the inexperienced man $100. In exceptional cases the Resident Engineer might remit a portion of the contract time.

Further, transportation to the nearest point on transportation lines, including pack-train or boats, would be paid by the Government to men going in and coming out to starting-point. So as to bring amounts expended on transportation within reasonable limits, the Government reserves discretionary right with regard to men desiring to go to districts very distant from their starting point, in which case the Government might

offer to pay a portion only of such transportation costs.

The Government will provide each man with a free miner's certificate.

The services of Resident Engineers in the districts in which the prospectors are employed and of the assay laboratories and other branches of the Department of Mines, would be available for assistance and advice to these prospectors.

All recording fees, assessments work, etc., to be paid for by the stakers, exactly the same as an ordinary prospector, and as set out in the "Mineral Act."

The following is a tentative proposal as to disposal of any claims that might be staked:—

Any claims staked by such prospectors shall belong equally to the two partners, and be so recorded in the Record Office of the District.

There shall be recorded a first charge on behalf of the Government on such claim or claims equal in amount to sums advanced by the Government to such pair of prospectors with interest thereon at the rate of 6 per cent per annum, together with a bonus equal to the amount so advanced wtih interest at 6 per cent per annum, computed annually. It shall be payable to the Minister of Mines and shall be a first and paramount charge upon the claims as a debt due to the Crown in the right of the Province of British Columbia.

Eevery such Crown debt shall be recoverable in the manner following, and not otherwise:—

(1) By taking 10 per cent of the value of any ore or mineral or gold or silver or metal, precious or base, or coal or substance mined, won, or gotten from the premises charged;

(2) By charging and recovering a sufficient portion of the purchase price an any sale of the premises charged, provided that a sale of any premises charged may only be subject to satisfaction of the Crown debt; and

(3) By foreclosure of sale after ten years from the date of the recording of the charge.

It has been suggested that in selecting the personnel of the parties, comprising in all fifty men, these be assigned, as to their origin, to the various Mineral Survey Districts about in proportion to the population thereof.

The parties would not be restricted to the district of their origin, but could elect to go to any part of the Province, subject to the approval of the Minister of Mines.

The following rough approximation gives an idea as to how this would allot the assignment of the parties:—

Memo re Population from Health Department.

	Population	Percentage	No. of Parties
District No. 1	9,069	2	1
" 2	23,078	5	2
" 3	25,442	6	2
" 4	25,064	6	2
" 5	39,060	9	3
" 6	318,484	72	15
	440,197	100	25

DIAMOND DRILLING AT THETFORD MINES.

Diamond drilling on a large scale is now in progress at Thetford Mines. The Asbestos Corporation of Canada has let a contract for 20,000 feet of drilling to the Sudbury Diamond Drilling Co., and Mr. Fitzgerald, the president of the drilling company, has six drills in operation. A churn drill is being used in the overburden and five diamond drills are cutting cores. The drilling should give the owners of the property a much better idea of the future possibilities. There is a good demand for asbestos and the ever widening market makes it more necessary to learn what the resources or raw materials are.—R. E. H.

The President of the United States did not apparently believe in "watchful waiting" for the British Navy.

JAMES McGREGOR SUCCEEDS GEORGE WILKINSON AS CHIEF INSPECTOR OF MINES IN BRITISH COLUMBIA.

The resignation of George Wilkinson, Chief Inspector of Mines for British Columbia since early in 1917, and the appointment to the vacancy of James McGregor, senior member of the Mines Inspectors' Staff of the Province and a trusted official of many years service, are important changes recently announced by Hon. Wm. Sloan, Minister of Mines, in connection with his department.

Mr. Wilkinson, who has accepted the management of the Pacific Coast Coal Mines Ltd., succeeded Thos. Graham, now general superintendent of the Canadian Collieries (D) Ltd., as Chief Inspector. At the time of his appointment he was the manager of the Reserve Mine of the Canadian Western Fuel Company. His term of office has been marked by signal advances especially in respect of the improvement of underground working conditions. Mr. Sloan expresses regret at Mr. Wilkinson's decision, asserts that the civil service is losing a valuable member and the public a capable and loyal servant, and wishes him every success in the performance in the duties of an active mine operator.

The selection of Mr. McGregor to the important post thus vacated it is assured will meet with general approval and this applies particularly to the mining men of the Province who are familiar with his work during the twenty odd years he has been connected with the Department of Mines. Mr. McGregor is a native of British Columbia, his parents having come from Scotland when Vancouver Island was a Crown Colony. They were among the passengers by the sailing ship "Harpooner," which reached the Canadian West early in the year 1849, his father being one of a party of eight coal miners engaged by the Hudson's Bay Company to open up coal mines at Fort Rupert Vancouver Island, the first coal mining undertaking of which there is any record in western Canada.

Among the earliest recollections of the present Chief Inspector of Mines, therefore, are those of coal mines and coal miners. He grew up in the atmosphere and as a boy went to work in the Nanaimo mines, in this way obtaining a practical knowledge that has been invaluable to him in the official duties he was to perform later as an inspector in the service of the public. Ambitious to qualify himself technically for higher and more responsible position Mr. McGregor started when a lad to attend both day and night schools, obtaining by this means a foundation which later was supplemented by private tutition under the late C. C. McKenzie, formerly Superintendent of Education for the Province of British Columbia. While Overman at the South Field Collieries of the New Vancouver Coal Company in 1888 he qualified for a First Class Mine Manager's Certificate. His standing as a citizen in Nanaimo is indicated by his election in the year 1894 to represent that constituency in the Provincial Legislature. Later he was appointed to the position of Inspector of Metalliferous and Coal Mines for the Kootenays which position he still occupied at the time of receiving his present well earned preferment.

The policy of the British Navy during the war was one adopted deliberately, and its long, patient waiting must have galled Nelson's Navy to the limit of endurance, but in the Navy orders are orders. Scapa Flow was its supreme justification.

BUREAU OF MINES REPORT ON WEST SHININGTREE GOLD AREA.

The Ontario Bureau of Mines has just issued a report and geologically colored map of the West Shiningtree gold area, Sudbury Mining Division. It is the work of Mr. Percy E. Hopkins of the geological staff of the Bureau. Mr. Hopkins spent four weeks in the area last September and in spite of bad weather and the short time available for the work he succeeded in getting together much useful information.

The area mapped includes parts of four townships, Churchill, MacMurchy, Asquith and Fawcett. The properties mentioned in the report include the Wasapika, Herrick, West Tree, Saville-McVittee, Atlas, Churchill, Corona, Cochrane, Miller-Adair, Foisey, McIntyre-McDonald, Bennet, Wood, Gosselin, Buckingham, Holding, Kubick, Burke, Steep, McRae, Moore, Gibson, Moore-Macdonald, Clark, Thompson-Peterson, and McGuire.

Of these properties Mr. Hopkins says "a few have promise, but they are still in the prospect stage. Whether they will become mines or not will only be determined by further developing the vems underground and sampling the same. It is not the practice of the Bureau of Mines to undertake systematic sampling of gold or other deposits this being naturally a function of the technical or professional men employed by the property owners."

Mr. Hopkins states that the greatest development in the area has been done on the Wasapika property, but the poor transportation facilities and lack of capital have retarded development considerably. When he visited the mine in September cross-cutting at the 100 ft. level was in progress.

Tt the Herrich property Mr. Hopkins found that a shaft had been sunk 50 feet on the "Kingsley" vein and diamond drilling to test the vein at depth was in progress. At the West Tree a shaft was being sunk. At the Atlas a tunnel was being driven into a hillside, to test a vein exposed some 60 feet higher up.

Mr. Hopkins in his report outlines briefly the geology of the area mapped and gives descriptions of the several mineral deposits which he examined. He concludes from his examination that:— "The encouraging results obtained on a few properties will probably lead to mining being conducted on a larger scale. There seems no reason why the veins which have a satisfactory length and width should not extend to considerable depth. One would also expect to find the values underground much the same as they are within a foot or two of the surface, since any oxidized or weathered surface has doubtless been removed by glaciation. All the rock formations are worthy of prospecting except the diabase."

Copies of the report and map can be obtained on application to the Department of Mines, Queens Park, Toronto.—R. E. H.

SHININGTREE NOTES.

It is reported that "Tommy" Saville has sold his interest in the Saville-McVittie claims, Shiningtree, to Toronto parties for $10,000. Some work has been done recently on these properties which are now known as the White Rock claims. "Tommy" is a well known and popular prospector and guide and it is said that he and his wife were the first to discover gold in the West Shiningtree Area, though claims were staked by others a few days before they arrived to prospect an area in which the Tenagami Indians had told "Tommy" that there were outcrops of quartz. He reached Wasapika lake on his prospecting trip and found gold in a quartz outcrop at the edge of the lake on the property now known as the Atlas. It had been staked a few days previously by Mr. Jefferson. "Tommy" staked the adjoining claims and has held an interest in them for several years.

Mr. M. P. McDonald of Cobalt is at the Atlas property in the Shiningtree district. He will have charge of development work at this property and is at present engaged in making a preliminary examination of it.

The headframe is up and machinery is being installed at the Herrick mine. The early break-up made the transportation of plant difficult; but it did not prevent the accomplishment of the task. The company proposes to resume sinking of the shaft as soon as the plant is installed and can be operated. Last summer this company carried on exploration by diamond driling.

The road to Shiningtree has naturally been a rough one since the frost came out of the ground. The first 13 miles from Westree station to Boreland's is now in fairly good shape but the next six miles is bad and the last six almost impassible. There are some men at work on the road and it is hoped that a considerable improvement will be effected this summer. To as great an extent as possible the operators use the winter roads for transportation of heavy loads; but there is always some work that must be done after the snow has gone and any improvement in the waggon road is therefore much appreciated.

Those who travel the Shiningtree road this summer will be pleased to find improved accomodation at Shiningtree Lake. The "Palisade" Hotel, built last fall, is reached by stage from Westree. Bob Adair runs the place and it is proving popular.—R. E. H.

DR. SORBY OF SHEFFIELD, ENGLAND.

Pioneer of Microscopic Examination of Rocks and Metals.

At a symposium held in London, England, by the Faraday Society, the Royal Microscopical Society, the Optical Society, and the Photomicrographic Society on the design and uses of the microscope, fitting tribute was paid to the magnificent pioneer work of the late Dr. Sorby, of Sheffield. It was Sorby who first hit upon the notion of studying the structure of rocks by cutting thin slices and examining them under the microscope. In the face of ridicule he continued his experiments until he founded the science of microscopic petrography. When he turned his attention to the structure of meteorites, he found it impracticable to obtain thin sections and accordingly he developed the plan of etching a polished surface with acid and examining it microscopically under reflected light. Thus he gave birth to the microscopic study of iron, steel and other metals—a study which has been of incalculable benefit to industry. One remarkable fact about this British genius is that he did all his work in a private room in his house, with only the simplest materials. As Sir Robert Hadfield remarked at the symposium, "from the humblest of beginnings this method of research has grown into a giant."

The foregoing tribute to the late Dr. Sorby, of Sheffield is from the South African "Mining and Engineering Journal". Dr. Sorby's memory is perpetuated in the "sorbite" constituent of steel, and is also fresh in the recollections of those who remember him in his old age at Sheffield University. Dr. Sorby, among other things, was an authority on deep-sea organisms, and on Egyptology.—Ed.

THE TREASURE VAULT OF ONTARIO.

By J. A. McRAE.

From the silver and gold mines which have been developed in the district of Temiskaming during the past sixteen years, a total of $240,911,729 has been produced in new wealth. Nor does this appear to comprise more than the result of having developed what mining geologists declare to be only the southern fringe of the Canadian pre-Cambrian Shield, which spreads over the most northerly reaches of northern Ontario.

The silver production from this district up to the end of 1919, having amounted to 303,610,836 ounces valued at $182,039,972, and the gold output which only commenced in 1911 having $58,871,757 at the end of 1919, marks a commencement which compares favorably with the world's most important precious metal mining areas.

Beginning at North Bay and extending to the northward is the great Canadian pre-Cambrian Shield above referred to. It has its narrowest point at North Bay, and spreads like a giant fan to the north, north-east, and north-west, attaining a width of perhaps 2,000 miles at its widest point, where it reaches into the Arctic Circle. This great stretch of territory has been described by geologists as the vertebra of the earth. This is believed to have been a debutant of geological time, having probably been the point where earth first projected above the sea. The series of rock formations over the greater part of the area are essentially metal-bearing.

In that part of the territory already penetrated by the railway, silver and gold in lavish quantity has been found to be associated with the rocks peculiar to the region. With this fact in mind, and also mindful of how small is the area so far opened up, and how enormous is that territory which still awaits the pioneer, the careful observer cannot avoid the logical conclusion that as wherever the outer edge of this territory has been explored it has been found to contain rich stores of precious metal, so in the unexplored area there exists excellent possibilities of similarly rich stores of metal.

Silver was first discovered in Cobalt in 1903. The discovery was the direct result of the construction of the Temiskaming and Northern Ontario Railway. The veins at outcrop were exceedingly rich, but were extremely narrow—being measured in inches. Not a few experienced mining men predicted a short life for the mines that were subsequently developed. The production of 303,610,836 ounces of silver bears testimony to the inaccuracy of the early predictions. The dividend record of $81,000,000 is material evidence that the deposits have been worked with a high degree of commercial success.

As to the present, the silver mines of the district are producing at the rate of about $1,250,000 monthly. An average of about 30 mines are being operated. The important producers amount to about one-half that number. Working forces engaged total about 2,700 men, while an abundant supply of motive power is generated in hydro-electric plants located on the Montreal river, within a few miles of Cobalt. For the operation of machines, etc., compressed air is supplied by a 5,000 h.p. hydraulic air compressor plant located at Ragged Chutes about nine miles from Cobalt. The largest silver-producing mine in the district is that of the Nipissing Mining Company. This property produced 3,731,892 ounces of fine silver during 1919, thus clearly demonstrating that age has not yet impoverished the mine. The mine is rated among the leading silver producers in the British Empire.

Silver deposits in Northern Ontario are not confined to the producing area of Cobalt. Contrary to the impression often gained by visitors to Cobalt, they cover a large area. The Casey-Cobalt mine situated fifteen miles north-east from Cobalt has been a heavy producer of silver, while the Wettlaufer mine, fifteen miles south from Cobalt, produced large quantities of silver ore. In the Gowganda district about seventy miles north-west of Cobalt, the Miller Lake-O'Brien mine is located and is producing about $1,000,000 a year. The intervening territory offers abundant scope for further exploration.

The proven riches, and the enormous potentialities lend to the silver-bearing area an excellent opportunity for capital to be employed to good advantage. The high quotations for commercial bar silver offer added incentive to intensify effort in connection with the exploration for new deposits, and the unremitting operation of those already found. In addition to this, the mining laws of the province of Ontario are such as to command the admiration of all who come into intimate touch with them; while the government, fully cognizant of the added prestige arising from the possession of a basic industry of such importance, is constantly endeavoring to encourage the development of mines. To the individual or corporation actively engaged in the mining fields, the abundant reasons for confidence in the Government's mining policy is a very favorable factor. It is to this desire of the Government to at once offer encouragement as well as protection that the citizens of this country point with much pride. Actual achievements justify the expectation of even greater rewards from future prospecting and mining in the unexplored areas.

The Gold Mines.

After thus reviewing the record of the silver mines of the district of Temiskaming, and finding that, barring a slight decline caused by the labor strike in 1919, the value of the metal produced compares favorably with the average of the past decade, it is interesting to turn to the gold-bearing areas where the industry, though young, is experiencing rapid growth despite the economic strain to which it has been in common with other industries subjected to during the past few years.

The gold mines of the Porcupine district, though having only commenced production in 1910, had up to the end of 1919 produced $54,205,836 out of the total of $58,871,757 produced by the entire province of Ontario during the ten years referred to.

Perhaps the most significant feature in connection with the gold mining industry of this district is the fact that during 1919, the province of Ontario produced a total of $10.451.688 in gold, of which Porcupine accounted for $9,941,804. Both for the province as well as for the Porcupine mines, the 1919 achievement was the best in their history.

The leading gold mine in Canada, in fact the leading gold mine in the western hemisphere, is the Hollinger Consolidated Mines, Limited, located in the Porcupine field. This mine during 1919 recovered a net value of $6,722,266. It closed the year 1919 with an ore reserve estimated at $39,928,430.

The vast area over which occur gold-bearing formation has caused a significant phrase to be coined among even the most conservative mining engineers,

which is: "Northern Ontario has been scratched only."

Gold mining, while having attained leading proportions in the Porcupine district, is being carried on successfully in other localities throughout Northern Ontario. For instance, at Kirkland Lake, some sixty miles south-east from Porcupine, there are four mines which are equipped with modern mills, each with a capacity of from 60 to 150 tons of ore daily. Mining has been carried to a depth of 700 feet, the average grade of the ore for the entire Kirkland Lake camp being $11.99 a ton up to the present. This compares with an average of $9.19 a ton to date at the mines of the Porcupine district.

In the order of their importance, the five leading gold producing mines of Ontario are the Hollinger Consolidated, Dome Mines, McIntyre-Porcupine and Porcupine Crown, all four being located in the Porcupine field; and the Lake Shore, the leading property in the Kirkland Lake field. These five mines are each earning substantial profits, in the case of the Hollinger amounting to close to $2,500,000 a year net, after paying all costs and providing liberal allowance for depreciation.

Diamond drills are exploring far ahead of actual mining operation, showing no change in the geological conditions down to 2,000 feet below the surface. Conformation of this is established by mining at a depth of 1,150 feet on the Dome and the Porcupine Crown, 1,250 feet on the Hollinger Consolidated; at the time of writing, and, 1,560 feet on the McIntyre-Porcupine. In each case commercial deposits of gold ore have been found to continue, while in the case of the McIntrye-Porcupine, the gold content of the ore has increased at depth.

It is certain that but for the scarcity of labor caused by the war, the gold mining industry of Northern Ontario would be even further advanced. This is made clear by repeated statements from the mines that many hundreds of mine workers are required.

Extensive building operations, comprehensive development schemes, and a general enlargement of the scope of work throughout the gold mining districts is held in abeyance pending the time when a full quota of men will be available.

As brief but conclusive evidence of the growth of the gold mining industry of Ontario, are given in the following figures, the importance of which is that despite the economic strain experienced during 1919 the gold output actually established the highest record in the history of Porcupine, as well as in Ontario:—

Ontario's Gold Production.

Year	Total Ontario Production	Porcupine
1910	$ 68,498	$ 35,539
1911	42,637	15,437
1912	2,114,086	1,730,628
1913	4,558,518	4,294,113
1914	5,529,767	5,190,794
1915	8,501,391	7,536,275
1916	10,339,259	9,397,536
1917	8,698,735	8,229,744
1918	8,567,178	7,833,966
1919	10,451,688	9,941,804
Totals	$58,871,757	$54,205,836

Following is a summary of gold produced in 1919 from the various parts of the British Empire from which it is interesting to note that Canada was the only country to record an increase.

	1919		1918	
	Ozs.	Pds. Sterling	Ozs.	Pds. Sterling
South Africa	8,330,091	35,383,974	8,418,292	35,758,836
Australia	1,074,713	4,565,088	1,277,474	5,426,360
Canada	767,167	3,260,459	699,681	2,973,644
Rhodesia	585,700	2,499,498	624,000	2,652,250
India	461,171	1,959,976	485,236	2,062,253
West Africa	292,500	1,240,691	307,950	1,333,553
Other Regions Estimated	175,000	750,000	200,000	800,000
Totals	11,686,342	£49,659,686	12,012,633	£51,006,696

	1919	1920
British Empire	$241,556,689	$248,301,124
United States	58,488,800	68,493,500
Other countries (Est.)	50,000,000	56,700,000
Totals	$350,044,489	$373,494,624

Canada's favorable record for 1920 is attributable to the successes met with in Northern Ontario, particularly in the Porcupine district.

Regarding the outlook for 1920, it is believed that the Canadian output will increase at least twenty per cent over that of 1919.

Our Northern Ontario Letter

THE SILVER MINES

The second week of May was marked by a further decline in quotations for silver. Influences at work are difficult to discern, but the chief one appears to be the British Government. As to this, the commonly accepted view of the situation as gathered from careful local observers is that the British Government has induced the banking houses of the Chinese Empire to curtail their silver purchases to a minimum, and, also, has caused the complete curtailment of silver shipments to India. The two ordinarily heaviest purchasers thus practically eliminated has so lessened the demand as to make the current supply appear adequate to meet immediate requirements.

That leading metal authorities in the United States may be more or less mystified is indicated in the presence of perhaps a million dollars in silver bullion stored in the vaults of the Nipissing Mining Company of which E. P. Earle of New York is president. That New York authorities believed prices would rule high is obvious, and has given rise to the belief that while a matching of wits may not have been indulged in between British and United States Governments, yet such may have reasonably been the case between the metal brokerage houses of the two countries mentioned.

As to the future prospects in connection with the price of silver, the "bear" raid is believed now to have perhaps attained its objective, and prices may rule for some time at around the present level. This, of course, is mere presumption, based upon the belief that further pressure would cause low-grade silver mines in various parts of the world to close down, and by thus lessening production defeat the very aims of the British Government. For that reason, pressure is expected to be regulated, and not become too severe.

As regards the outlook in Cobalt, with silver quoted at around $1 an ounce at the time of writing, the margin of net profit is still high. The mines as a whole are able to produce silver at an average of around 55 cents an ounce. This leaves around 45 cents net profit on each ounce of silver produced, and is almost equal to the gross value of the metal in 1915.

Statistics being prepared show the mines of the Cobalt district to have ended the year 1919 with a greater amount of ore in sight than that with which the year was commenced.

The annual report of the Mining Corporation of Canada for 1919, just issued, is favorable. Production during the year amounted 1,230,652 ounces of silver, as compared with 1,708,252 ounces during the preceding year. Net profit amounted to $908,748 as compared with $925,760 the previous year. During the period $622,518 in dividends were paid, thus leaving a balance sufficient to increase the surplus from $3,025,347 at the end of 1918 to $3,311,577 at the end of 1919. The report deals at length with the activities of the company in other fields, and contains the important announcement that from this date forward less attention will be paid to properties in faraway countries,and that the home field of Canada will receive greater attention. All other things being equal, Canada will be given the preference, with the United States taking second place and with Central America coming third. A feature of the report is that while the year's production amounted to almost as much as the total estimated reserve at the beginning of the year, the period was ended with a greater new reserve than that with which the year began.

During the month of April the Kerr Lake mine produced some 61,000 ounces of silver, as compared with 99,400 ounces in March, the decline amounting to more than fifty per cent. It is intimatetd that this decline may be permanent for the reason hat the higher grade ore shoots in the mine are bing exhausted, and that from now on it may be found necessary to deal with lower grade material. The question of making arrangements to have its 75,000-ton dump treated is still under contemplation and appears likely to be considered favorably, although definite announcement is still withheld at the time of writing.

A favorable feature of the week is the receipt of official advice that the Nipissing mine during the first four months of the current year produced $1,501,521. This being at the rate of more than $4,500,000 a year, is the highest record for any previous period of similar length in the company's history. In his regular monthly report, Hugh Park, manager, states that during April the mine produced $364,258. This compares with $384,723 in March, $329,401 in February and $423,139 in January. The report shows that during April no bullion shipments were made, the output being stored in the company's vaults at the mine.

Cobalt mining men and prospectors are taking considerable interest in the Butt township area in the district of Nipissiing where the promising discovery of radium-bearing ore was made last year. The Mining Corporation plans an early commencement of exploration work on its claims in that distrince, adjoining the original discovery group.

The assent of the Lieutenant-Governor is still being awaited in connection with the proposed construction of a light narrow gauge railway from Elk to Gowganda. The indications are that the construction of the line will mark the commencement of added activity in that district.

Stuart M. Thorne has taken over the management of the Castle property of the Trethewey Company, and has engaged Wm. Gowans as assistant. Mr. Thorne was manager of the Trethewey prior to enlisting for service overseas in the late war. His re-appointment is in accordance with an understanding at the time of his enlistment.

The Oxford-Cobalt is making good headway with its exploration work on property in Gillies Limit. The shaft is now down 50 feet and is being driven to a depth of 200 feet at which point lateral work will be carried on. Later on it is proposed to continue the shaft to a depth of 300 feet.

Arrangements in connection with the operation of the Victory Silver Mines, formerly the Hylands property, are again being made after a temporary delay in connection with the details. It is now proposed to increase the authorised capital from 500,000 shares as at present to 2,000,000 shares.

ORE AND BULLION SHIPMENTS

During the week ended May 14th four Cobalt companies shipped an aggregate of ten cars containing 715,131 pounds of ore. Nipissing was the heaviest shipper, sending out five cars, as shown in the following summary:—

Shipper	Cars	Pounds
Nipissing	5	388,707
Mining Corp	3	214,809
Coniages	1	87,360
O'Brien	1	64,255
Totals	10	755,131

During the corresponding period, no bullion shipments were made, although it is learned in official circles that a limited amount will be released during this week.

THE GOLD MINES.

On account of the distinction won by the gold producing mines of Northern Ontario during 1919 in making it possible for Canada to lay claim to being the only country in the world to increase its gold output during that year, added attention is being directed to this country by leading mining interests the world over.

Also, despite the most severe economic conditions, the mines of Porcupine and Kirkland Lake are actually producing now at a rate about twenty per cent greater than during 1919. Events following one upon another tends to make the likelihood of quite general expension in the leading gold-mining areas of the province.

Shareholders of the Porcupine Crown Mining Company, and the Thompson-Krist Company have ratified the by-laws authorizing the transfer of the two properties to the newly incorporated Northcrown Mines Company. The management will continue as at present at the Porcupine Crown.

Shareholders of the Porcupine V.N.T. await with interest the holding of the annual meeting of that company to be held May 27th. It is thought that some action may be taken with regard to obligations entered into some three or four years ago by Sir Henry Pellatt to underwrite a block of treasury shares. The agreement at that time specified a price ranging from

40 to 60 cents a share, as compared with current quotations of around 18 to 20 cents on the open market.

It is stated that the annual meeting of the Dome Mines Company will be held about June 18th, and that the annual statement for the fiscal year ended March 31st will soon be in the hands of the printers. While reticence is maintained as to the contents of the report, it is understood that a surplus of upwards of $750,000 will be shown. The achievement is regarded as exceedingly favorable as when the company resumed operation of its mill a year ago, the surplus at that time amounted to only $56,000 and during the intervening period the shareholders have been paid $200,000 in dividends.

Discussion of the affairs of the Gold Reef Mining Company will take place this week with a view toward arranging a program of work for this year. It is intended to sink a shaft to a depth of perhaps 300 feet for the purpose of exploring a vein indicated as a result of diamond drilling the property last year.

In the Kirkland Lake field the large volume of money being subscribed by United States interests toward exploration and development of new prospective mines is steadily increasing. Buffalo, Dayton and Rochester appear to have become alive to the favorable prospects and are now heavily interested.

Arrangements are being completed to resume work at the Tough-Oakes at the end of this week, and by June 1st it is hoped to have operations again well under way. Through the merging of the Tough-Oakes, with the Aladdin-Cobalt and the Burnside, ample funds have been provided to take care of the aggressive development program outlined, and sufficient ore is assured upon which to resume milling operations about the middle of July.

The Ontario-Kirkland has established another working level at a depth of 450 feet and the lateral work required to prove up the downward continuation of the ore bodies found at the 300-ft. level is underway. Following the completion of this work, the question of installing a mill will be gone into.

The Lake Shore, Teck-Hughes and Kirkland Lake all continue to produce at a normal rate, with prospects of an early further increase in output. The supply of labor is still below normal, but conditions seem to be showing some improvement.

The work in connection with mill installation at the Wright-Hargreaves is under way at full swing and it is evident that this mine will join the producing list by the end of the summer.

Farther east in the township of Lebel some real progress is being made, and the prospects of new mines being developed appear bright. The Bidgood property is standing up well under aggressive work, while on a number of other properties good results are also obtaining.

The Boston McCrea Company, controlled by Buffalo and Dayton interests has purchased the Jerred group of claims on which a vein some three feet in width and containing tellurides of gold has been opened up for a distance of about 200 feet on surface. In a test-pit driven to a depth of 15 feet the vein is found to carry an average gold content of about $25 to the ton. It is proposed to add to working forces immediately and to prosecute a vigorous exploration and development campaign.

Other properties in Lebel where good results are reported include the Wood-Kirkland and the Pinelle group.

From Skead township, returning prospectors report at least two new gold finds, and further increased activity. On their own initiative the enterprising claimholders of this area have cleared a road to the railway by way of Boston Creek, thus reducing the distance to rail by some 26 miles to between 8 and 12 miles. The road is now passible for teams and wagons with the exception of the crossing of the Blanche River. The Ontario government is being requested to bridge the stream.

At the 500-ft. level of the Miller Independence, while the cross-cut has not yet reached the point where the downward continuation of the main ore body is expected to be encountered, it is officially reported that in a small vein cut gold tellurides have been found. This is taken to indicate the likelihood of satisfactory mineralization at that depth.

Re port last week that the management of the Fort Matachewan Gold Mines had undergone a change were erroneous. Official advice to the "Journal" conveys the information that T. J. Flynn is still manager of the mine.

The report written by Percy Hopkins, geologist for the Ontario Bureau of Mines of the West Shiningtree Gold Area is receiving favorable comment in the mining centers. The frank declaration that mineral deposition has so far been found to be patchy, but that considerable inducement is offered for further work is received with fairly general satisfaction. It has appeared to place the standing of the district on a firmer footing than that formerly enjoyed, and the early future is expected to witness greater attention being paid to the exploration and development of the numerous promising prospects in that field.

PERSONAL.

Mr. Henry Schoch, Sales Engineer of the General Briquetting Company, has been elected Vice President of the Nukol Fuel Company, of Ontario, Canada—and will take up his work for that Company with headquarters in Toronto on May 17th.

The Nukol Fuel Company is actively manufacturing "Nukol," a high-class anthracite briquette for the Ontario Market. One plant is operating in Toronto; another is in course of construction at Port Stanley, and three more are prospected within the next two years.

Dr. Edwin T. Hodge has accepted the position of Professor of Economic Geology at the University of Oregon, and expects to leave Vancouver about October first.

During the past few years Dr. Hodge has been active in furthering the advancement of the mining industry in British Columbia. At the present time he is President of the British Columbia Chamber of Mines, on the executive of the Vancouver Branch of the Canadian Mining Institute, and is a member of the Mining Bureau of the Board of Trade. He was convener of the last C. M. I. convention, held in Vancouver. He was at the head of the contingent of B. C. Mining men who attended the recent International Mining convention held at Seattle, and took a very active part in the proceedings.

For the present Dr.Hodge has opened consulting offices in Vancouver, and will have branches in Seattle, and Portland for a group of engineers.

British Columbia Letter

THE METAL MINES.

Stewart, B. C.

The concentrator designed to treat the lower grade ores of the Premier Mine should be ready for operation before many weeks as the last of the machinery has been despatched over the trail. The mill will have a capacity of 100 tons daily and will be the first unit of a larger plant. Diamond drill development on the property is proceeding the contract being in the hands of Boyle Bros., of Spokane Wn.

It is stated that Boyle Bros., of Spokane Wn., have obtained a contract to perform 12,000 feet of diamond drilling this season on the Province Claim of the Big Missouri Group, Salmon River.

High grade ore, recently struck on the Forty Nine Group, Salmon River, is being developed, drifting being underway. Wesley W. Warren, consulting engineer, is directing operations and it is expected that it will be possible to commence shipping this year.

Lieut.-Col. T. A. Hiam, who is connected with the Pacific Coast Exploration Company which controls the Big Missouri Group, Salmon River, as well as other properties in which Sir Donald Mann is interested, is responsible for the statement that a limited service may be inaugurated this year on the Canadian Northwestern Railway. This road traversed the Bear River Valley from tidewater to its upper waters. The railroad was constructed years ago and has been lying idle since. If it is possible to put it in shape for rough and intermittent service it will be a boon to prospectores and mine operators.

Hedley, B. C.

A dispute between the employees and the management of the Hedley Gold Mining Co., regarding wages has been settled, the former receiving fifty cents a day increase. The minimum wage paid to any man in the mine now is $5 a day. G. P. Jones, the manager, states that it is not certain that the property will be able to operate at a profit under these conditions but he was willing to give it a trial, hoping that the Government would pass a bill giving a bonus to gold mine operators of $10 per oz. for gold used for manufacture.

Trail, B. C.

The supply the new concentrator to be installed at Trail B. C. the Consolidated Mining and Smelting Co. of Canada is constructing a pumping plant possessing some novel features. In order to be at the required disance from the water in the Columbia River at its lowest stage, and to avoid being flooded at high water, the plant is being housed in a waterproof solid concrete chamber approached by a waterproof sloping tunnel also of concrete. The tunnel portal is well above high water mark.

Kalso, B. C.

At the annuel meeting of the Gibson Mining Co. Ltd., held recently, officers were elected as follows: President, F. E. Archer, Kalso; vice-president, S. C. Warr, Spokane; secretary-treasurer, E. H. Latham; directors, W. H. Phillip and D. P. Cosgriff. The property now is involved in litigation which, however, it is hoped will be straightened out before long, thus permitting operation on a satisfactory basis.

Sidney Inlet, B. C.

It is announced the the new 300-ton mill, recently installed by the Alaska-British Columbia Metals Company at Sidney Inlet, Vancouver Island, has commenced operations.

Nelson, B. C.

The Vincent Development Co. has relinquished its bond on the Eureka Mine, Eagle Creek, after doing considerable development. This work done consists of stoping on the 250-ft. level and driving a long crosscut on the 450 foot level with the object of striking the vein at depth. The Company proposes making a thorough examination of the Granite-Poorman Property, which it also has under bond, as soon as the snow leaves, with the idea of formulating plans for its development.

Dawson, Y. T.

The ice has broken on the Yukon River. This occurred some weeks ago. Navigation on the entire river soon will be possible. A considerable influx of miners and prospectors will take place to the Mayo Silver Camp. Spring operations are already underway in the Klondyke. The thawing of the dredges is underway and before the end of May it is expected that much hydraulic work will be started.

Vancouver, B. C.

Counsel representing the Dolly Varden Company has made application to the Supreme Court of British Columbia for an extension of time in which to file its statement of claim in connection with action being brought against the Taylor Engineering Company, holders of the Dolly Varden Mine, Plant, Railway, and general mine and transportation equipment. The explanation of this course is that the first mentioned Company does not wish to act until the Dominion Government has had an opportunity to disallow the legislation passed at the last session of the Provincial Legislature re-affirming the title of the Taylor Engineering Company to the rich Alice Arm property.

Metalliferous mining in the Slocan District of British Columbia has been tied up by a strike of the miners, who are demanding an increase of one dollar a day in wages. One of the richest silver producing camps of the Canadian West thus has become inactive for an indefinite period.

THE COAL MINES.

The coal miners' strike in the Crow's Nest Pass, which has more or less affected the mines of that district, particularly in the Alberta section, since the beginning of March, has been settled, according to a statement issued from the office of the Director of Coal Operations. There is a full crew working at Blairmore; at Bellevue the men are being taken on rapidly and much the same condition is reported from Hillcrest. The adoption of a new wage scale in line with United States' rates which would mean an additional increase to the miners' wages of about 11 cents a day, is to be discussed.

Lump coal for domestic use now is selling in Victoria, only eighty miles by rail from the Nanaimo collieries, at $13.50 a ton. For nut coal the charge is 50c. less. A few days ago the retail merchants an-

nounced an increase of $1 a ton which brought the sale figures to the point named. They state that no benefit whatever will accrue to them from the advance which will be absorbed by the following increased charges; (a) An advance of 65 cents per ton at the mine. (b) A towing-charge advance of 10 cents a ton. (Most of the coal used in Victoria is transported from the mines by water.) (c) An increase to the men employed in the handling of coal at the wharves and delivery of 25 cents per day. (d) An increase in gasoline and oil for deliveries.

TECHNICAL EDUCATION IN RELATION TO COAL MINING

British Columbia Night Schools and Correspondence Mining Classes

Pursuant to the Public Schools Act passed in 1914 night classes were established at different coal mining centres of the Province for the benefit of those who wished an opportunity to continue studies left off when they went to work and to qualify technically for higher and more responsible positions in connection with coal mining operations.

While admittedly this was a move in the right direction, it was agreed by the Provincial Departments of Mines and of Education in 1919 that this did not go far enough, that the miners on leaving the mines after a day's work could not be expected to leave their homes to spend the remainder of the day's leisure hours in school, and that more good would be derived by the establishment of a system of education by correspondence. This would permit the student to do his work at home, to study in quiet without leaving the house, to answer the questions asked by mail and to prepare his replies for posting the next day.

This system, therefore, was introduced and its popularity and success have been gratifying. Of a total of 88 applications received for registration for instruction by correspondence, 44 are boys who are taking the preparatory mining course, 16 of whom are residents of Nanaimo and 28 of Cumberland, so that a large proportion of those who are taking advantage of this educational opportunity belong to the chief coal mining centres of Vancouver Island.

As to the Mining Classes it is interesting to note that they continue to serve the purpose for which they are intended. These classes are established at Nanaimo, Fernie, Coal Creek, Merritt, and Cumberland. The average attendance at each of these schools per course follows:—

Nanaimo	7
Fernie	8
Coal Creek	8
Merritt	11
Cumberland	7

As to fees the Provincial Government has made them so low that they may be termed nominal, causing no hardship to those who are in earnest. For instance applicants for registration in the correspondence preparatory course are required to pay only $5.00. This course, it may be explained is sub-divided or graded in sections running from "A" to "F," the former grade providing for elementary study and the various intermediary grades to "F" carrying the student to the point where he may sit for a Mine Manager's Certificate. It is interesting and gratifying to note in this connection that the operating companies of Nanaimo and Cumberland (Canadian Western Fuel Co. and Canadian Collieries (D) Ltd., have shown their interest in the ambitious boys of their respective sections and in their employ by paying their admission fees.

Other courses, together with the fees set, are as follows:—

Preparatory course in arithmetic	$10.00
Course for Fireboss, Shiftboss, or Shotlighter's papers (3rd Class)	15.00
Course for Overman's papers (2nd class)	25.00
Course for Mine Manager's papers (1st Class)	35.00
Course in Mine Survey Work	35.00

The laying out of these studies, setting the questions, correcting answers, etc., is in charge of James Hargeaves, who is attached to the Department of Education. He is a mining engineer, a holder of First-Class Mine Manager's Certificate, in short a highly qualified man technically as well as a practical miner with experience covering years in this Privince as well as in Alberta.

In regard to the mining classes in the different centres, the teacher is selected by the Department of Education from residents of the districts in which the school is opened. He must have the necessary qualifications, of course, and the utmost care is exercised in his selection. His salary is paid as follows: Four-fifths by the Government and one-fifth by the School Board of the Municipality, this last named body also taking care of incidental expenditure.

Correspondence

IRON ORE BOUNTIES IN ONTARIO

Port Arthur, May 8th, 1920

To the Editor,
"Canadian Mining Journal."

Dear Sir:—In your issue of March 6th, 1920, there is an article taken from "Iron and Steel of Canada" on the Iron Bounty question which is being presented again to the Federal Government for consideration.

Special attention is drawn, and rightly to Mr. Mills' expression as to the advisability or necessity for developing our own iron ore deposits.

The Port Arthur Board of Trade has a mining Committee entirely of owners, prospectors, geologists and engineers who have, as far as lay in their power, given very careful consideration to the question of develop the iron ores of Northern Ontario. Up to the present time, however, the Minister of Mines has not met this Board, or as I can learn any member of it to discuss this matter at all. While it was quite true that in an issue of your journal of January 23rd, there was an article stating that a deputation of mining men from the City Council had been invited to meet the Minister of Mines, it was also quite true that this invitation never reached the Mining Committee of the Board of Trade and as far as I have been able to ascertain, there was not a single man in that City Council who has any special knowledge of mining, more particularly the more intricate subject of the development of our iron ranges.

In connection with the conserving of our iron ore reserves as stated by Mr. Mills, why not go further if we wish to take that line of thought and conserve all our coal, go on importing in huge quantities, our nickel deposits, also our pulp-wood areas, and only manufacturing what we need absolutely for our own use. As it takes forty years to grow spruce trees of

merchantable size, it can readily be seen our present areas might easily be largely or partially used up before new forests can be brought into service, We have iron-ore reserves in Northern Canada that will fill all demands for probably several thousand years. Many of these ranges are of course inaccessible at the present time, but can always be made available when urgently needed.

The Minister of Mines of Ontario is also much interested in the project of bringing iron ore from the Belcher Islands, Hudson Bay, down to the proposed Terminal of the T. &. N. O. Railway, thence over that line to Lake Ports. As this ore is admittedly of low grade, freight charges alone would more than cover the total returns of the ore, leaving nothing for mining costs or any other branch of the work. This project was carefully considered a few years ago by very competent engineers who simply stated that it was economically impossible and the condition now exists that though iron ore prices have increased greatly in the last two years, freight charges and costs of production have also increased in proportion.

In the article taken from the "Iron and Steel," it is stated that those who are requesting a bounty desire it to be paid upon the quantity of pig iron or steel made in Canadian furnaces or mills from domestic ores. **There is absolutely no foundation for such a** statement. A large number of Boards of Trade made representations to the Government asking for a bonus on iron ore to be payable to the operator of the mine, for the principal reason that formerly when bounties were paid on pig iron produced, the operator of the mine received none of this assistance and he is the one who does all of the pioneer work, puts up with the fluctuations of iron ore prices, etc., while the smelter received a great amount of assistance from the bonus during the lean periods. This plan was proven to be a failure by the results of the former bonus which was given to pig iron produced, and the fact that the same bounty given recently in British Columbia to smelters has not had the desired effect, the development of the iron ore resources remaining as before.

The Algoma Steel Corporation is in the rather unique position of being mine operator, beneficiator and user of its own beneficiated ore. Last year they produced a beneficiated ore from the Magpie Mines which ran, natural analysis, Iron 49.41 per cent, Phos. .014 per cent, Silicia 8.68 per cent, Mang. 2.72 per cent Lime 7.82 per cent, Sulphur .16 per cent, Loss by ignition none, Moisture 1.72 per cent. This makes a very desirable product, and while it is quite true that individual furnaces might not take a very great tonnage, the same reasons for not doing so would apply to many of the larger producers of straight mine-run ore in the United States. The marketing of beneficiated ore should not be any special worry as this is going on quite steadily from different States.

For its own furnaces and mills at Sault Ste. Marie the Algoins Corporation expects this year to use 40 per cent of its beneficiated ores and there will be ample demand in the American markets for any surplus. The granting of a bonus on pig iron would suit this isolated case admirably, but as the greater ore reserves are tributary to the head of the lakes, these would not receive any benefit.

The smelters and steel mills of Eastern Canada have received millions in subsidies, while the production of iron ores for domestic uses has dropped to 4 per cent of the raw material used. As this plan was a complete failure, why not give the bonus to the operator of the iron mine, and get this great import reduced.

The Western Provinces which were the strongest in opposition to the granting of the bonus on iron ores had no hesitation in recommending expenditure of public monies on the development of their coal resources, as is evidenced by the programme now arranged in the Western Provinces for the expenditure of $400,000 in experimental work on the western coal ranges. This sum is divided as follows:—50 per cent paid by the Federal Government and 25 per cent payable by each of the two Western Provinces, Manitoba and Saskatchewan. The principal objection would seem to be the word bonus.

Other writers in different articles have stated that the Government should give a bounty sufficient to pay the beneficiation. Personally, I would not be in favor of such a plan as the cost of the beneficiation varies so much that there would be endless controversies. The mine owners do not want to be guaranteed a profit, but simply assistance to tide over the installation of large plants which could only be planned after extensive and costly experiments on the individual ranges. This would be absolutely necessary as the operation that would suit one selection of ore might be entirely unsuitable for another. To give a bonus on Canadian ores equivalent to cost of beneficiation, to place these ores on a parity with straight ore mines, would mean that as soon as the bonus stopped the mines would have to shut down.

Suggestions have been made and it has been broadly hinted that if a bonus is granted at all it will be for $1.00 per ton and for a short term of say, from three to five years. This would suit Moose Mountain and the Magpie Mines, but would be absolutely worthless to any other part of Ontario.

It would take weeks, if not months, to complete negotiations in connection with the acquiring of a range; months for an expert survey of the same; still more months for diamond drilling to ascertain tonnage and get information as to plant needed at least a year to get this plant delivered and erected; another year to get on a reasonable shipping basis, but it would not take many minutes to figure out how much of the short-term bonus one would get. The benefit in figures would be represented by ciphers only.

A bonus of 50 cents per ton on iron ore for a term of fifteen years would have a far greater effect and a much more equitable distribution than a larger grant for a shorter term of years. This bonus should be payable only on production of certificate of sale to smelters or manufacturing agent.

Beneficiation must come and soon. So far as is known there are no large ore bodies of commercial grade in any of the provinces, but so little exploration has been done, and so many miles of favorable structure have been found on of the iron ranges that is is quite safe to assume that large bodies of good grade ore will be found, but it may take years to locate these, while it would take but a few months to bring our large deposits of easily accessible low grade material into active service.

The United States operators are turning their attention to this problem more and more every year and in a generation or two, when the larger deposits of marketable grade ores are worked out, they have only to turn to their own almost inexhaustible supplies of lean ores. They will probably never have to call on the Canadian ore reserves for any supply.

The solution of the problem of the iron and steel supply for west of the Great Lakes and provinces east of the Rocky Mountains woud be comparatively easy by following out the same line as was followed in establishing shipyards and dry-docks where **most needed** in the Dominion. Given a similar subsidy for for a term of years on actual capital invested, we would see large steel works established where Iron, Coal, Power and Shipping meet, at the Head of the Great Lakes. Enough of a subsidy to give the iron mine operator 50 cents per ton for an equal number of years could easily be arranged and this development could go on at once, as would be absolutely necessary before the establishment of mills and furnaces. The Government would not pay out one dollar unless it was well earned, and the resultant revenue, not only to the Government, but also to the Canadian National Railways which serve 75 per cent of the Iron Ranges of the Canadian Lake Superior Districts, would in itself much more than balance the expenditure. Every agriculturist in the west utilizes from $1,000 to $5,000 worth of steel and iron implements. On every one of these there would be effected a saving of from eight to twenty per cent of cost in the freight charges alone by the establishment of such a system, and the tariff critics would be saved much labor and argument.

Yours very truly

J. E. MARKS

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TORONTO NOTES ON MINING COMPANIES.

Among the new mining companies recently incorporated under the Ontario laws is the Miller Lake Silver Star Mines, Limited, with an authorized capital of $2,000,000 and head office at Gowganda. The Camburn Silver Mines, Limited, have been granted authority to increase its capital stock from $1,500,000 to $3,000,000. The Bousquet Gold Mines, Limited, with head office at Haileybury, has been formed and granted a charter, with an authorized capital of $2,000,000. The provisional directors are R. R. Tough, G. Tough, J. H. Tough, Pearl Devenny and Dollie Dwyer.

At a meeting held on May 10th the shareholders of the Thompson-Krist Mining Company approved of the action of the directors in the amalgamation of the company with the Porcupine Crown and the North Crown Mining Co. of the company's stock of $1,900,000 there was represented $1,800,000. It was also stated that a meeting in Montreal gave similar endorsement to the merger. Plans for the operation of both mines will be discussed at a meeting of the directors of the new company to be held in Toronto in a few days. The board will comprise six directors of the Porcupine Crown and three of the Thompson-Krist.

The Iroquois Mining Co. which was incorporated in 1911, with head office in New York, was wound up in Toronto this week on the application of R. T. Newman, a creditor for $858. The capital stock of the company was $1,000,000 and the liabilities are $4,122.

OBITUARY

L. T. O'SHEA, Hon. Secretary of the Institute of Mining Engineers,

The "Canadian Mining Journal" regrets to learn from English advices to hand of the death of Captain Lucius Trant O'Shea, Professor of Applied Chemistry in the University of Sheffield and Honarary Secretary of the Institution of Mining Engineers.

Professor O'Shea was a pioneer worker in the chemistry of fuel, and the phenomena of mine gases. In the chemistry of the coke-oven he collaborated with Mr. G. Blake Walker at the Wharnclife Silkstone Colliery, where the first by-product coke-ovens in Britain were installed. To his work on the chemistry of mine gases, and his lectures to mining students on this subject is due a great deal of the improved knowledge of the behavior of mine gases now possessed by coal miners in the Midlands District of England.

Professor O'Shea was the son of Major Rodney O'Shea of the 20th Regiment, and his mother was a daughter of Admiral Lucius Curtis, and, he was to be expected from such parentage, he took a keen interest in military affairs. He served, as a Royal Engineers Volunteer, through the whole course of the South African War, and during the recent war was commander of the O. T. C. of Sheffield University.

The respect in which the late soldier-professor was held is shown by the attendance at his funeral, which included the faculty of Sheffield University, representatives of the Institution of Mining Engineers, Coke Oven Managers' Association, Sheffield Society of Engineers and Metallurgists, Midland Counties Institute of Engineers, Manchester Geological Society, Mining Institute of Scotland, Midland Institute of M. C. and M. Engineers, North Staffordshire Institute, many colliery companies, military organizations and other technical societies not mentioned.

One of the most valuable historical papers of recent years was "Notes on the History of the Safety Lamp," which Prof. F. W. Hardwick and the late Prof. O'Shea prepared in collaboration for the Institution of Mining Engineers in 1916. This is the completest monograph on the safety lamp as yet published.

The Editor was a student under Professor O'Shea and received many personal kindnesses from him, and desires to be included in the hundreds of mining men to whom Prof. O'Shea's forceful and yet kindly personality is still a source of inspiration and pleasant memory.

Those who month after month watched the assemblage of convoys, and their regular departure under naval guard from the harbours of Sydney and Halifax did not notice any signs of panic during the late war.

Coal and steel shipments from Sydney, Nova Scotia, were never once interrupted during the war. It was very very occasionally that watchers on Canadian shores saw a glimpse of the ships of the Navy, but they also never saw a German ship.

Labor Turnover of Industrial Plants, and What Steps Can Be Taken To Minimize It.*

By A. W. MACDONALD, Welfare Superintendent Dominion Steel Corporation.

It is only within the past few years that the question of this factor in the labor problem has received very much attention from executives.

When it is realized that labor cost is by far greater than material cost in producing, it behooves companies employing large numbers of men to devise ways and means of reducing the turnover of labor on their plants to the lowest figure possible.

It has to be admitted that the putting to work of new men is one of the most important causes of a high accident rate.

Comparatively few employers have realized that for every man on their pay-roll they are probably hiring at least one new man every year. This shows a labor turnover of 100 per cent and should be a sufficint argument to cause any employer to study the reason for his works labor turnover. Any manager or superintendent of an industrial plant or other works employing large numbers of men, who is still of the opinion that the methods that obtained ten years or more ago are good enough to-day, as far as the hiring and discharging of workmen is concerned, is making a mistake that is costing his company dearly.

It might be well to give some consideration to what it costs a company to make a new employee efficient, that is to bring him from the stage of a "green man" to that of being a productive workman.

Some of the sources of this cost are:

(a) The difference between a standard day's work and that which a new man does while getting used to the job.

(b) The extra supervision required by a green man.

(c) Interference with the work of other men.

(d) Accidents caused by green men.

Various executives have computed the total amount of the costs, according to their own conditions, and the results range from $25.00 to $100.00 per man as the cost to a company of bringing a green man up to the stage of a productive workman.

It is evident therefore that the cost of replacing workmen is enormous and the necessity of taking drastic measures to prevent labor turnover is of first importance.

Of course to get rid of an employee is far easier than to help him "make good" and to let him go less troublesome than to find out in advance any condition of dissatisfaction and to attempt to remedy it.

One of the chief reasons why this matter has received so little attention from companies in the past is that they have no records to show what their labor turnover was, and therefore they did not know what it was costing them.

In the last analysis this hiring of men to replace men who have left the employ or, in other words labor turnover, is simply wasting labor, particularly at this time when men are scarce and most companies have already passed from the position of buying labor to selling employment, and it is clearly a matter of sound business for industrial organizations to hold out inducements for capable men to enter their employ, and to fully develop the capabilities of those they get.

The only reason why a company engages in business is to make profits, and any activity of the company that does not tend toward that end is poor business.

Large companies developed slowly from the primitive stage of industry in which each employer was his own foreman, and the tradition has been handed down that in order to preserve discipline the foreman must be able to hire and discharge his own men.

It has been pointed out in a foregoing paragraph that the labor cost of production is very much in excess of the material cost, probably in some instances two and one-half or three times as much, and we find that every company purchases its material through a well-organized purchasing department, while in the majority of cases its labor supply is picked up haphazard. More attention is certainly paid to the purchasing of material and the designing of equipment than to the selection of workmen.

This in no small measure contributes to unrest and dissatisfaction among workmen, and consequently is a dominant factor in labor turnover.

Work of all kinds can be analysed to determine the qualifications necessary for its performance, and in some places efforts are being made by executives along the line of selecting and training workmen, and the time is not far off when this will be a regular part of industrial activitiy. The majority of men are neither lazy nor unwilling to work. The trouble is that they are picked up without any effort at selection and placed at work for which they are unfitted.

The question of hiring and discharging workmen, on which alone rests the labor turnover of a plant, may be placed under two headings:

(1) Hiring and discharging by foremen.

(2) Hiring and discharging through a properly organized Employment Department.

In the first place hiring by the foremen frequently leads to practices that are detrimental to all concerned. It very often leads to the building up of racial and other cliques in a department that will cause trouble later. This is inevitable, as the only source of labor supply that is open to a foreman is through his relatives and friends and the friends of the men in his gang.

The only basis of judgment the foreman has in interviewing an applicant for work is the impression the man makes on him at the time. If the applicant is unknown to him personally he cannot tell anything at all about his ability, and he has not the time or means at his disposal to make the enquiry necessary to even approximately determine the fitness of the man for the work that has to be performed.

We can now consider the centralized hiring of employeees through an employment department.

One of the objections to this method was that it interfered with the authority of the foremen and superintendents. As a matter of fact it does nothing of the sort. It does not mean that they cannot dispense with the services of any man who is not doing his work in an efficient way. Instead of the faulty workman being discharged from the plant to the

* A paper read before the Mining Society of Nova Scotia at the Annual Meeting, Glace Bay, N.S., May 4th and 5th, 1920.

street, he is sent back to the employment office, where a further effort will be made to have him placed on a job where he will fit. It is evident that although a workman may not suit one job he may do all right on another one. If after a reasonable number of trials have been made, the man persists in being "no good" he should be discharged. In a modern organization no man should be allowed to leave the service without a searching enquiry into his reasons for doing so. These interviews with men who are leaving the employ frequently reveal objectionable conditions that in many cases can be easily remedied, and that are actually a disadvantage to the company as well as to the workman. The modern employment bureau is the only agency that is equipped to handle the problem of distinguishing between the man who is no good and the man who is wrongly placed.

Certain things are essential to successful centralized hiring of workmen. In the first place the employment manager should be personally familiar with the various works for which he has to secure workmen. He should have notice as far as possible in advance of the number and class of men required, so he can provide them when needed. He should have sufficient assistant so that his time will not be used up doing work that can be equally as well done by an ordinary clerk. He should have the standing and the authority in the organization that will enable him to perform his duties satisfactorily, so that the company for which he is working will get the best possible results.

Summary.

(1) The cost of labor turnover in industry is so large as to justify the adoption of any means to bring about its reduction.

(2) The most important and effective method is the establishment of an employment department properly administered.

(3) Hiring through an employment department does not impair the authority of the foreman or superintendent immediately in charge of the work.

(4) He hires his men from the employment department and discharges them back to it instead of to the street.

(5) The employment department is able to give the applicant for work special attention, and properly conducted it is able to devote special skill and knowledge to selling employment in the organization to the workman.

DIAMOND DRILLING AT KINGS ASBESTOS MINE.

The Sudbury Diamond Drilling Co. has taken a contract for drilling at Thetford Mines, Quebec, for the Asbestos Corporation of Canada. The contract calls for the drilling of 20,000 ft. and is an exceptionally large one. Mr. S. J. Fitzgerald, President of the Company, is on the ground and has started five diamond drills and one churn drill at the Kings property.

This drilling exploration should give the mining company much useful information concerning its property.

VANADIUM--Its Occurence and Utilization

(Abstracted from a paper on the Development of Ferro-Vanadian Metallurgy presented at the Boston Meeting of the American Electrochemical Society, April 10th, by B. D. Saklatwalla, General Supt. of the Vanadium Corporation.)

We will discuss briefly the technical evolution of the processes of reduction, and the general properties bearing on such processes, of an element which up to only a few years ago was characterized as a chemical curiosity, a so-called rare element. Following a recognition of its useful properties, this element, "vanadium," was suddenly converted from its laboratory obscurity into a commercial necessity of far-reaching importance. In this commercial evolution it resembles, to some extent, the element aluminum, which was similarly transformed from an element of chemical catalogs into a metal of everyday necessary technical domestic use. Vanadium, like aluminum, destined to be a great engineering factor, was known to exist, and its chemistry fairly well developed, years ahead of its actual entry into commerce.

This neglect of its useful properties was due to various substantial reasons. In the first place, its technical uses were limited until Prof. Arnold's researches conclusively proved its value in the manufacture of steel; hence there was very little incentive for its technical development. In the second place, though its presence was widely manifested, it was of rare occurrence in a commercially workable deposit. Vanadium had been classed among the rare elements, with very little justification. It was not the distribution of the element, but its occurrence in a concentrated form at one locality that was lacking until the discovery of the Peruvian deposits in the Andes, near Cerro de Pasco, by Don Antenor Rizo Patron, in 1905. In fact, vanadium is one of the most widely distributed elements on the face of the earth. It is diffused through all primitive granites and many sedimentary rocks and clays. Besides forming a number of special minerals, its presence has been proved, as accompanying other elements, in at least fifty different minerals. In large amounts it occurs in lead ores, and in very small quantities in iron and copper ores. It is found in the ashes of very many coals and various plants. Its distribution as to locality also is not restricted, none of the continents of our globe being free from it. To get an idea of the quantity of vanadium contained in our globe, Vogt comes to the conclusion from various quantitative determinations in minerals, that the entire crust of the earth would show an average content of between 0.0025 and 0.05 per cent vanadium. Further, the presence of vanadium is no restricted to our planet alone. Sir Norman Lockyer has shown its presence in the spectra of various heavenly bodies. Also a number of meteorites have been shown to contain vanadium.

The history of vanadium is more than a century old. It was discovered in 1801 by Manuel del Rio, in the lead ores of Zimpan in Mexico, but was considered by Collet Descotils, who analyzed these ores in Paris, to be identical with chromium. Thus del Rio's discovery was forgotten, until Sefstroem, in 1830, rediscovered the element in iron produced from certain Swedish ores. Then Woehler, taking up the analysis of the Mexican lead ores investigated by del Rio, conclusively proved that Sefstroem's new element was

the same as that found by del Rio., viz., vanadium. This controversy inspired Berzelius to investigate the chemistry of this new element in a most thorough manner. It will not be too much to say that the foundation on which the chemical knowledge of this element is erected is formed by the work undertaken by this old master in 1831. Comparatively little was added to it, until Sir Henry Roscoe, about 40 years later, through his researches from 1867-1870, furnished additional valuable data. The first suggestion of technical application of vanadium to metallurgy carries us back to the year 1863 when Lewis Thompson expressed the idea of vanadium having a similar effect to nickel on iron, since it was found in iron of remarkably ductility. A year later, Edward Riley suggested the extraction of vanadium from pig iron, which being analyzed by him, seemed to contain this element.

The treatment of vanadium-bearing materials and minerals can be said to have started following Roscoe's work in 1867-1870, when vanadium found application in the dyeing and ceramic industries, but it was not until 1896 that its entry into metallurgy can be said to date. In that year the Firminy Steel Works in France experimented with the use of vanadium in armor plates. However, the superiority of vanadium steels cannot be said to have been established until the year 1900, especially by the comprehensive investigations of Prof. Arnold in Sheffield, England, which work was further completed by the publications of Sankey and Smith in 1904. Immediately after these publications, establishing the usefulness of vanadium in steel metallurgy, the most important known deposit of vanadium-bearing mineral was discovered in Peru in 1905, thus ensuring a permanent supply for the establishment of a vanadium industry and a commercial technology for the treatment of vanadium minerals.

The Canadian Miners' Buying Directory.

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

A.C. Units:
MacGovern & Co.

Agitators:
The Dorr Co.

Air Hoists:
Canadian Ingersoll-Rand Co., Ltd.
Mussens, Limited.

Alloy and Carbon Tool Steel:
H. A. Drury Co., Ltd.
International High Speed Steel Co., Rockaway, N.J.

Alternators:
MacGovern & Co.

Spielman Agencies, Regd.

Aluminium:

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

Antimony:
Canada Metal Co.

Antimonial Lead:
Pennsylvania Smelting Co.

Arrester, Locomotive Spark:
Hendrick Manufacturing Co.

Arsenic White Lead:
Coniagas Reduction Co.

Assayers' and Chemists' Supplies:
Dominion Engineering & Inspection Co.
Lymans, Limited
Mine & Smelter Supply Co.
Pennsylvania Smelting Co.
Stanley, W. F. & Co., Ltd.

Ash Conveyors:
Canadian Link-Belt Company

Ashes Handling Machinery:
Canadian Mead-Morrison Co., Limited

Assayers and Chemists:
Milton L. Hersey Co., Ltd.
Campbell & Dayell
Ledoux & Co.
Thos. Heys & Son
C. L. Constant Co.

Asbestos:
Everitt & Co.

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

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

Balances—Heusser:
Canadian Fairbanks-Morse Co., Ltd.
Mine and Smelter Supply Co.

Babbit Metals:
Canada Metal Co.
Canadian Fairbanks-Morse Co., Ltd.
Hoyt Metal Co.

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

Ball Mill Linings:
Hardinge Conical Mill Co.
Hull Iron & Steel Foundries, Ltd.

Belting—Leather, Rubber and Cotton:
Canadian Fairbanks-Morse Co., Ltd.
Link Belt Co.
The Mine & Smelter Supply Co.
Northern Canada Supply Co.
Jones & Glasco.

Belting:
R. T. Gilman & Co.

Belting—Silent Chain:
Hans Renold of Canada, Limited, Montreal, Que.

Belting (Transmission):
Goodyear Tire & Rubber Co.

Belting (Elevator):
Goodyear Tire & Rubber Co.

Belting (Conveyor):

Goodyear Tire & Rubber Co.

Blasting Batteries and Supplies:

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

Bluestone:

The Consolidated Mining & Smelting Co.

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

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

Blue Vitriol (Coniagas Red):
Canadian Fairbanks-Morse Co., Ltd.

Bortz and Carbons:
Diamond Drill Carbon Co.

Boxes, Cable Junction:
Standard Underground Cable Co. of Canada, Ltd.
Northern Electric Co., Ltd.

Brazilian Rough Diamonds:
Diamond Drill Carbon Co.

Brazilian Mica:
Diamond Drill Carbon Co.

Buggies, Mine Car (Steel)
Hendrick Manufacturing Co

Brazilian Ballas:
Diamond Drill Carbon Co.

Brazilian Rock Crystal:
Diamond Drill Carbon Co.

Brazilian Tourmalines:
Diamond Drill Carbon Co.

Brazilian Aquamarines:
Diamond Drill Carbon Co.

Bridges—Man Trolley and Rope Operated—Material Handling:
Canadian Mead-Morrison Co., Limited

Bronze, Manganese, Perforated and Plain:
Hendrick Manufacturing Co.

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

Buckets, Elevator:
Hendrick Mfg. Co.

Cable—Aerial and Underground:
Northern Canada Supply Co.
Standard Underground Cable Co. of Canada, Ltd.

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

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

Canadian Miners' Buying Directory.—(Continued)

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

Cable Railway Systems:
Canadian Mead-Morrison Co., Limited.

Cam Shafts:
Canada Foundries & Forgings, Ltd.
Hull Iron & Steel Foundries, Ltd.

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

Carbide of Calcium:
Canada Carbide Company, Ltd.

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

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

Carriers (Gravity):
Jones & Glassco

Castings—Brass
The Canada Metal Co., Ltd.

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

Cement and Concrete Waterproofing:
Spielman Agencies, Regd.

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

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

Chain Drives:
Jones & Glassco

Chain Drives—Silent and Steel Roller:
Hans Renold of Canada, Limited, Montreal, Que.

Chemical Apparatus:
Mine and Smelter Supply Co.

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

Chrome Ore:
The Electric Steel & Metals Co.
Everett & Co.

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

Clutches:
Hans Renold of Canada, Limited, Montreal, Que.

Coal:
Dominoion Coal Co.
Nova Scotia Steel & Coal Co.

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

Coal Crushers:
Canadian Mead-Morrison Co., Limited

Coal Mining Explosives:
Canadian Explosives, Ltd.
Giant Powder Company of Canada, Ltd.

Coal Mining Machinery:
Canadian Rock Drill Co.
Denver Rock Drill Mfg. Co., Ltd.
Osborn, Sam'l (Canada) Limited.
Canadian Ingersoll-Rand Co., Ltd.
Sullivan Machinery Co.
Marsh Engineering Works
Hadfields, Ltd.
Hendrick Mfg. Co.
Fraser & Chalmers of Canada, Limited
Mussens, Limited
R. T. Gilman & Co.

Coal and Coke Handling Machinery
Canadian Mead-Morrison Co., Limited.
Link-Belt Co.

Coal Pockets:
Canadian Mead-Morrison Co., Limited.

Coal Pick Machines:
Sullivan Machinery Co.

Coal Screening Plants:
Canadian Mead-Morrison Co., Limited.

Cobalt Oxide:
Coniagas Reduction Co.
Everitt & Co.

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

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

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

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

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

Conveyors—McCaslin Gravity Bucket:
Canadian Mead-Morrison Co., Limited.

Contractors' Supplies:
Canadian Fairbanks-Morse Co., Ltd.

Consulters and Engineers:
Hersey Milton Co., Ltd.

Conveyors:
The Mine & Smelter Supply Co.

Conveyor Flights:
Hendrick Mfg. Co., Ltd.

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

Conical Mills:
Hardinge Conical Mill Co.

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

Couplings:
Hans Renold of Canada, Limited, Montreal, Que.

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

Crane Ropes:
Allan Whyte & Co.
Greening, B., Wire Co., Ltd.

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

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

Crude Oil Engines:
Swedish Steel & Importing Co., Ltd.

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

MINING OPPORTUNITIES IN MANITOBA

Mineral Areas

Approximately three-fifths of the total area of Manitoba is Pre-Cambrian. In the Pre-Cambrian of Ontario, the well-known camps of Sudbury, Cobalt and Porcupine have been developed. In Manitoba, there was but little prospecting before 1912, when the Rice Lake Camp was opened up, and the Hudson Bay Railway gave access to the mineral areas in Northern Manitoba. Attention is being directed particularly to the Pas Mineral Belt and the Rice Lake Area, but prospecting is being carried on in the Cross and Pipestone Lake Area, the Oxford Lake, Knee Lake, God's Lake and Island Lake Area, and the West Hawk Lake, Falcon Lake, Star Lake Area.

Development

Since 1915, development has been rapid in the Pas Mineral Belt. Twenty million tons of low-grade copper ore have been explored by diamond drilling at Flin Flon Lake and are now being actively developed under option. High grade copper is exported from Schist Lake to the smelter at Trail, B.C.; over seven million pounds of copper have already been realized. Other copper prospects are under development and the building of a smelter at the Flin Flon property will lead to the establishing of a large copper industry. Gold is now produced at Wekusko (Herb) Lake, and active underground development work is being carried on at Wekusko Lake, Copper Lake and in the Rice Lake District east of Lake Winnipeg

Transportation

Transportation is available to the Rice Lake Area by steamboat from Winnipeg to the Hole River, and thence by launch and Provincial wagon road. The Copper Belt is reached from The Pas by the Ross Navigation Co's. steamboats to Sturgeon Landing, thence by wagon road and canoe. Herb Lake is reached from Mile 82 on the Hudson Bay Railway (less than one day from The Pas.)

Mining Regulations

The mineral resources are under Federal control and the Federal mining regulations apply to Manitoba. No mining license is required. Work to the value of $100.00 a year must be performed for a period of five years on claims filed under the quartz mining regulations. The office of the Mining Recorder for the Rice Lake district is in Winnipeg, and for The Pas Mineral Belt at the Pas.

Opportunities

The districts are comparatively new, and on the eve of substantial development. There are good opportunities at the present time for prospectors, mining companies, and particularly for development companies.

For maps, reports and general information, apply to—

THE COMMISSIONER OF NORTHERN MANITOBA

THE PAS, MANITOBA.

Canadian Miners' Buying Directory.—(Continued)

Cut Gears:
Hans Renold of Canada, Limited, Montreal, Que.

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., Rockawaw.
Osborn, Sam'l (Canada) Limited.
Mussens, Limited
Swedish Steel & Importing Co., Ltd

Drill Steel Sharpeners:
Canadian Ingersoll-Rand Co., Ltd
Canadian Rock Drill Co.
Denver Rock Drill Mfg. Co., Ltd.
Northern Canada Supply Co.
Sullivan Machinery Co.
Osborn, Sam'l (Canada) Limited.
The Wabi Iron Works

Drills—Electric:
Canadian Fairbanks-Morse Co., Ltd
Sullivan Machinery Co.
Northern Electric Co., Ltd.

Drills—High Speed and Carbon:
Canadian Fairbanks-Morse Co. Ltd
Osborn, Sam'l (Canada) Limited.
H. A. Drury Co., Ltd.
Hadfields, Limited

Dynamite:
Canadian Explosives
Giant Powder Company of Canada, Ltd.
Northern Canada Supply Co.

Dynamos:
Canadian Fairbanks-Morse Co., Ltd
MacGovern & Company

Ejectors:
Canadian Fairbanks-Morse Co. Ltd
Canadian Ingersoll-Rand Co., Ltd
Northern Canada Supply Co

Elevators:
Canadian Mead-Morrison Co., Limited.
Sullivan Machinery Co.
Northern Canada Supply Co.
Hadfields, Limited
Fraser & Chalmers of Canada, Ltd.
Mussens, Limited
The Wabi Iron Works

Engineering Instruments:
C. L. Berger & Sons

Engines—Automatic:
Canadian Fairbanks-Morse Co., Ltd.
Canadian Mead-Morrison Co., Limited.
Fraser & Chalmers of Canada, Ltd.

Engines—Gas and Gasoline:
Canadian Fairbanks-Morse Co., Ltd.
Alex. Fleck
Fraser & Chalmers of Canada, Ltd.
Osborn, Sam'l (Canada) Limited.
Sullivan Machinery Co.
Gould, Shapley & Muir Co., Ltd.
MacGovern & Co., Inc.
The Mine & Smelter Supply Co

Engines—Haulage:
Canadian Ingersoll-Rand Co., Ltd., Montreal, Q...
Canadian Mead-Morrison Co., Limited.
Marsh Engineering Works
Fraser & Chalmers of Canada, Ltd.

Engines—Marine:
Canadian Fairbanks-Morse Co., Ltd.
MacGovern & Co., Inc.
Swedish Steel & Importing Co., Ltd.

Engines—Steam:
Canadian Fairbanks-Morse Co., Ltd
Canadian Mead-Morrison Co., Limited.
R. T. Gilman & Co.
MacGovern & Co., Inc.
Fraser & Chalmers of Canada, Ltd.

Engines—Stationery:
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:
Canalian Explosives
Giant Powder Company of Canada, Ltd.
Northern Canada Supply Co.

Gears:
Hans Renold of Canada, Limited, Montreal, Que.

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.

Permissible Explosives:
Giant Powder Company of Canada, Ltd.

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

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

Pillow Blocks:
Canadian Link-Belt Company

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

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

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

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

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

Platinum Refiners:
Goldsmith Bros.

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

Powder:
Giant Powder Company of Canada, Ltd.

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

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

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

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

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

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

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

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

Pumps—Boiler Feed:
Smart-Turner Machine Co.
Northern Canada Supply Co.
Canadian Fairbanks-Morse Co., Ltd.
Fraser & Chalmers of Canada, Lt.
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
mart-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.

Roller Chain:
Hans Renold of Canada, Limited, Montreal, Que.

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.
Mussens, Limited

Rolls—Crushing
Canadian Steel Foundries, Ltd.
Fraser & Chalmers of Canada, Ltd.
Hull Iron & Steel Foundries, Ltd.
Osborn, Sam'l (Canada) Limited.
Hadfields, Limited
The Electric Steel & Metals Co.
Mussens, Limited
The Wabi Iron Works

Samplers:
Fraser & Chalmers of Canada, Ltd.
C. L. Constant Co.
Ledoux & Co.
Milton Hersey Co.
Thos. Heyes & Son
Mine & Smelter Supply Co.
Mussens, Limited

Scales—(all kinds):
Canadian Fairbanks-Morse Co., Ltd.

Screens:
Greening, B. Wire Co.
Hendrick Mfg. Co.
Mine & Smelter Supply Co.
Canada Wire and Iron Goods Company.
Link-Belt Co.

Screens—Cross Patent Flanged Lip:
Hendrick Mfg. Co.

Screens—Perforated Metal:
Hendrick Mfg. Co.

Screens—Shaking:
Hendrick Mfg. Co.

Screens—Revolving:
Hendrick Mfg. Co.

Scheelite:
Everitt & Co.

Separators:
Canadian Fairbanks-Morse Co., Ltd.
Smart-Turner Machine Co.
Mine & Smelter Supply Co.

Shaft Contractors:
Hendrick Mfg. Co.

Sheet Metal Work:
Hendrick Mfg. Co.

Sheets—Genuine Manganese Bronze:
Hendrick Mfg. Co.

Shoes and Dies:
Canadian Foundries and Forgings, Ltd.
H. A. Drury Co., Ltd.
Fraser & Chalmers of Canada, Ltd.
Hull Iron & Steel Foundries, Ltd.
The Electric Steel & Metals Co.
The Wabi Iron Works

Shovels—Steam:
Canadian Foundries and Forgings, Ltd.
Canadian Mead-Morrison Co., Limited.
Osborn, Sam'l (Canada) Limited.
R. T. Gilman & Co.

Ship Bunkering Equipment:
Canadian Mead-Morrison Co., Limited.

Silent Chain:
Hans Renold of Canada, Limited, Montreal, Que.

Siline:
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:
Hans Renold of Canada, Limited, Montreal, Que.
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.
Northen Canada Supply Co.
The Electric Steel & Metals Co.
Osborn, Sam'l (Canada) Limited.
Canadian Ingersoll-Rand Co., Ltd.
Mussens, Limited
Swedish Steel & Importing Co., Ltd.

Steel Drums:
Smart-Turner Machine Co.

Steel—Tool:
Canadian Fairbanks-Morse Co., Ltd.
H. A. Drury Co., Ltd.
N. S. Steel & Coal Co.
Osborn, Sam'l (Canada) Limited.
Hadfields, Limited
Swedish Steel & Importing Co., Ltd.

Structural Steel Work (Light):
Hendrick Mfg. Co.

Stone Breakers:
Hadfields, Limited
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
Osborn, Sam'l (Canada) Limited.
Mussens, Limited
R. T. Gilman & Co.
The Wabi Iron Works

Sulphate of Copper:
The Mond Nickel Co., Ltd.
Coniagas Reduction Co.

Sulphate of Nickel:
The Mond Nickel Co., Ltd.

Surveying Instruments:
C. L. Berger

Switches and Switch Stand:
Canadian Steel Foundries, Ltd.
Mussens, Limited.

Switches and Turntables:
John J. Gartshore

Tables—Concentrating:
Mine & Smelter Supply Co.
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.

Tanks:
R. T. Gilman & Co.

Tanks—Acid:
Canadian Chicago Bridge & Iron Works
The Mine & Smelter Supply Co.

Tanks (Wooden):
Canadian Fairbanks-Morse Co., Ltd.
Gould, Shapley & Muir Co., Ltd.
Pacific Coast Pipe Co., Ltd.
Mine & Smelter Supply Co.
The Wabi Iron Works

Tanks—Cyanide, Etc.:
Hendrick Mfg. Co.
Pacific Coast Pipe Co.
MacKinnon Steel Co.
Fraser & Chalmers of Canada, Ltd.
Mine & Smelter Supply Co.
The Wabi Iron Works

Tanks—Steel:
Canadian Fairbanks-Morse Co., Ltd.
Canadian Ingersoll-Rand Co., Ltd.
Canadian Chicago Bridge & Iron Works
Marsh Engineering Works
Osborn, Sam'l (Canada) Limited.
MacKinnon Steel Co.
Fraser & Chalmers of Canada, Ltd.
The Electric Steel & Metals Co.
Hendrick Mfg. Co.
The Wabi Iron Works

Tanks—Oil Storage:
Canadian Chicago Bridge & Iron Works
The Mine & Smelter Supply Co.

Tanks (water) and Steel Towers:
Canadian Fairbanks-Morse Co., Ltd.
Canadian Chicago Bdidge & 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 Appuiances:
Jones & Glassco

Transmission Machinery:
Hans Renold of Canada, Limited, Montreal, Que.

Troughs (Conveyor):
Hendrick Manufacturing Co.

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

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

TTrucks:
Canadian Fairbanks-Morse Co., Ltd.

Tubs:
Hadfields, Limited

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

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

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

Turbines—Water Wheel:
MacGovern & Co.

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

Twincones:
Canada Foundries & Forgings, Ltd.

Uranium:
Everitt & Co.

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

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

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

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

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

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

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

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

Wire Rope Fittings:
Canada Wire and Iron Goods Company.

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

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

Wolfram Ore:
Everitt & Co.

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

Zirconium:
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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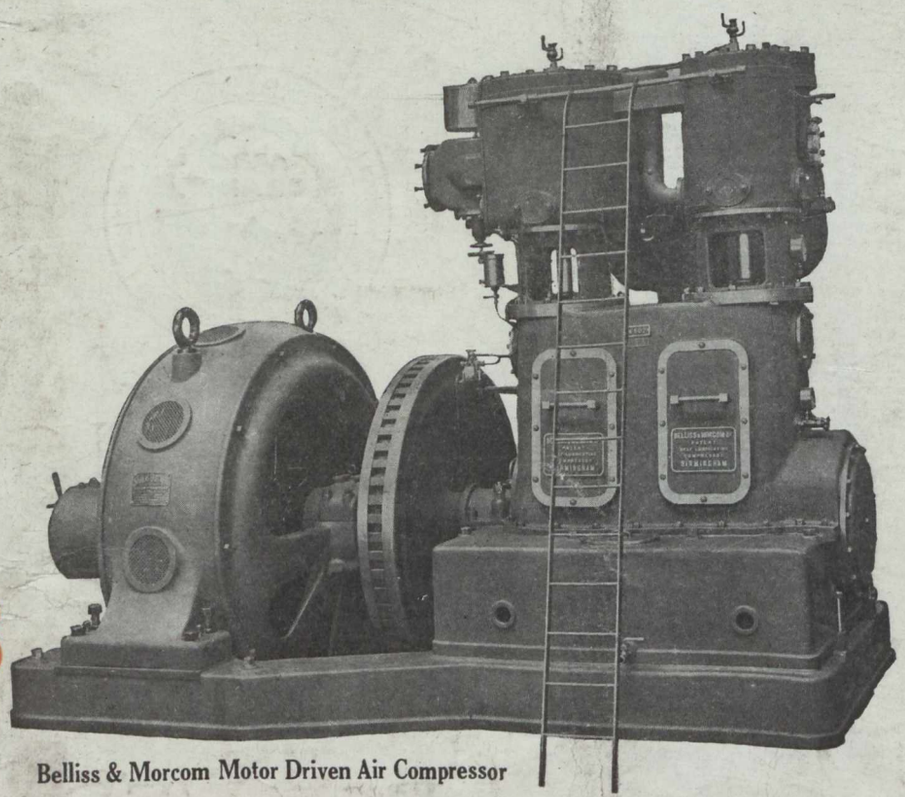

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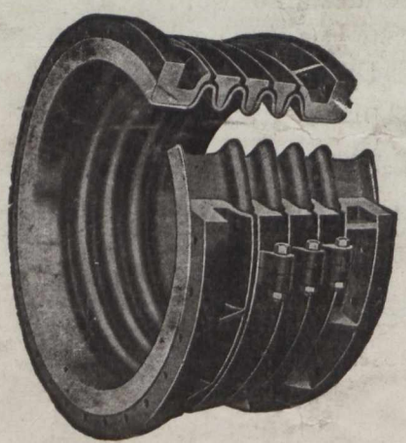

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