

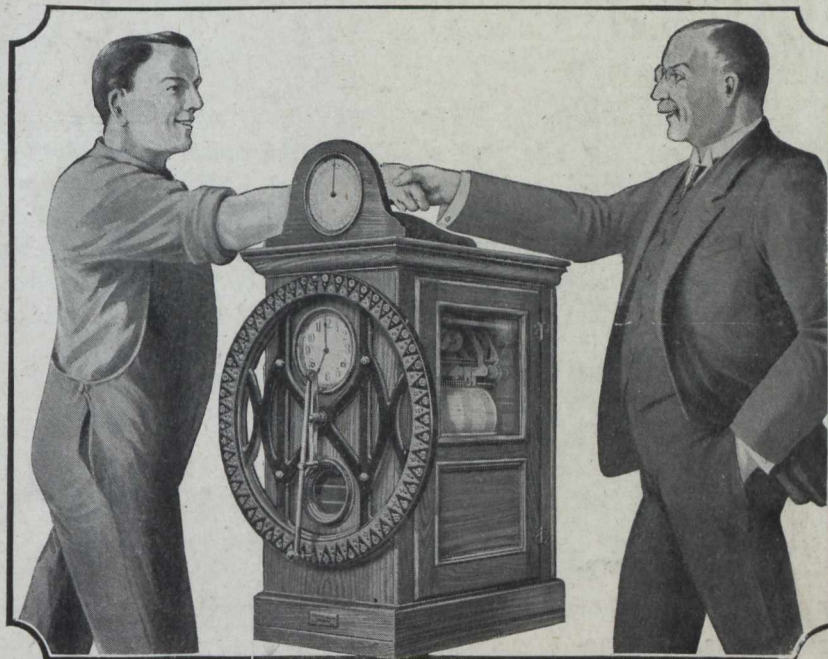
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CANADIAN MINING JOURNAL

VOL. XL.

April 2nd, 1919

No. 13



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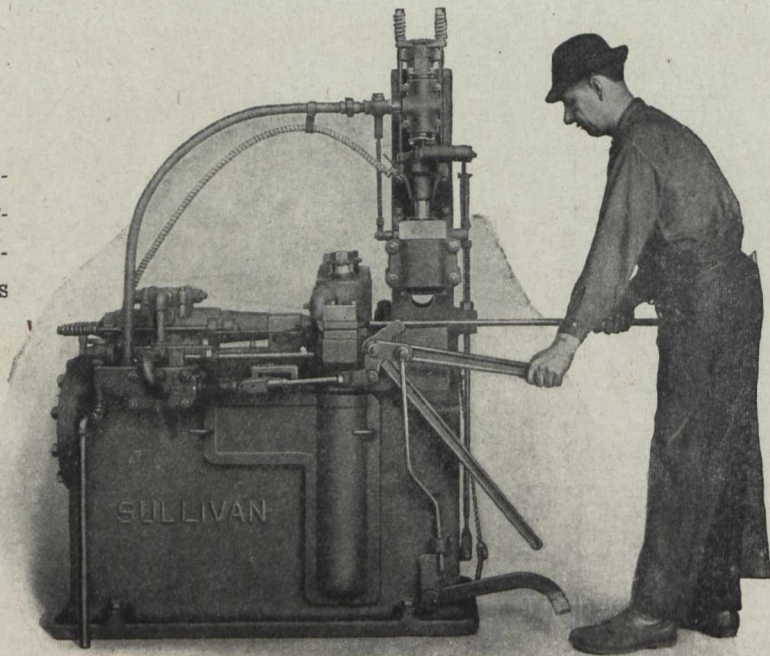
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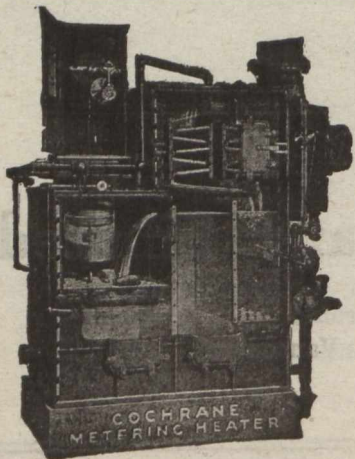
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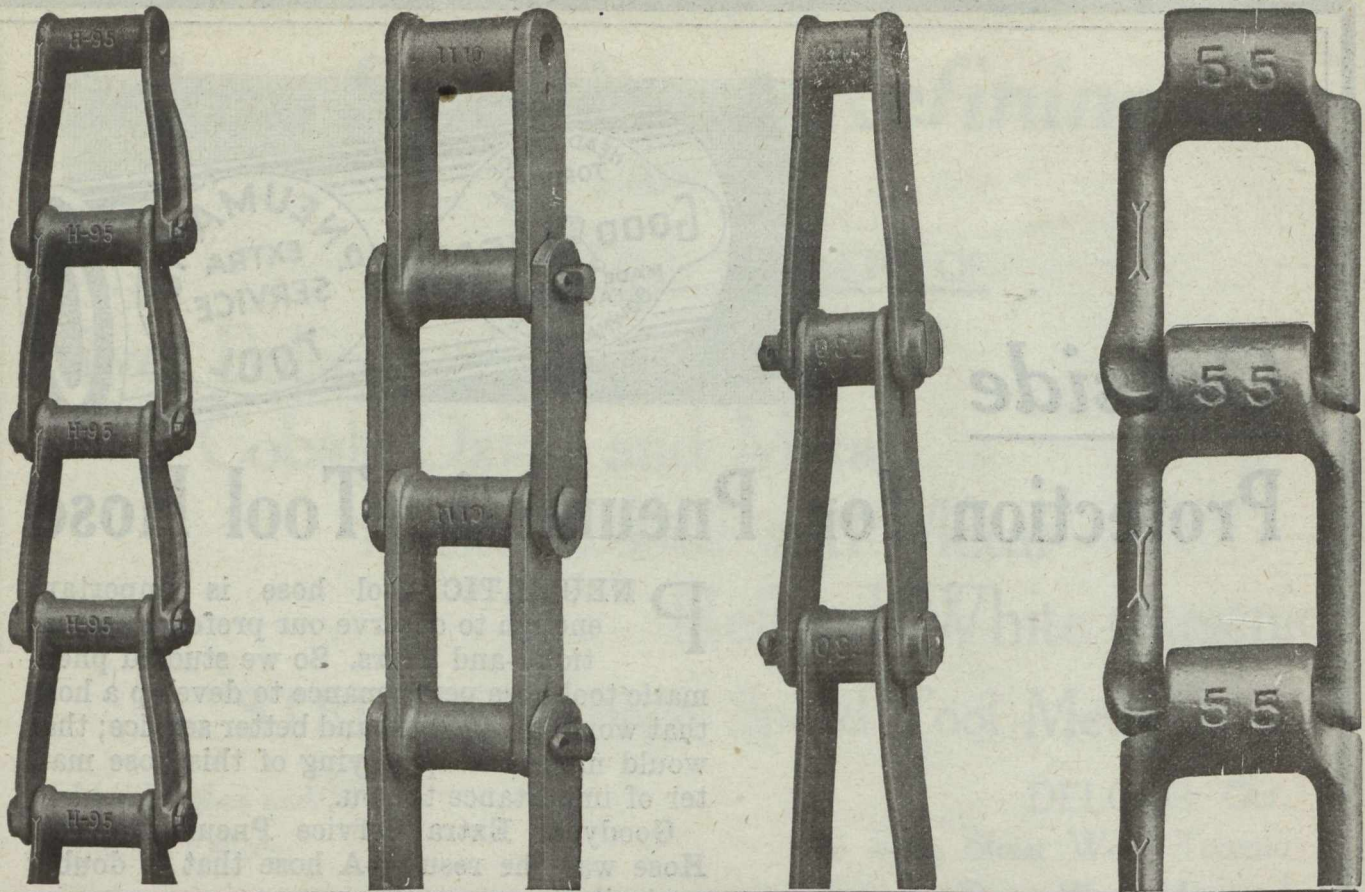
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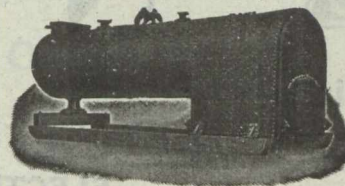
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On December 11, 1916, the SUPREME COURT OF THE UNITED STATES unanimously adjudged our basic patent for air-froth-flotation to be valid, holding that this patent covers any process of froth flotation wherein the results obtained are such results as are secured by the use of a fraction of one per cent., on the ore, of an oily frothing agent in an ore-pulp, with agitation. Three of the thirteen claims which specified the use of "a small quantity of oil" and which the Court held to be invalid have since, by proper disclaimer, been brought within the scope of the Supreme Court's decision.

On May 4, 1917, in the UNITED STATES DISTRICT COURT OF MONTANA, the opinion of Judge Bourquin was filed in the case of Minerals Separation Ltd., and others against Butte & Superior Mining Company, and was followed by a decree on September 17, 1917, wherein it was adjudicated that the three claims which had been limited by disclaimer were valid and infringed, and that the seven claims adjudged to be valid by the Supreme Court of the United States were infringed. The acts thereby adjudged to be infringement included the use of mixtures of petroleum oils and mineral-froth-forming oils in a total amount exceeding one per cent. on the ore, and also the use of Callow pneumatic cells.

On May 24, 1917, the UNITED STATES CIRCUIT COURT OF APPEALS at Philadelphia, in the case of Minerals Separation, Ltd., against Miami Copper Company, unanimously sustained the validity and broadly construed a second basic patent, owned by us, for the use of all "Soluble Frothing Agents." In the same opinion, the Court also validated a third patent for the use of cresols and phenols in the cold and without acid. The defendants, Miami Copper Company, endeavored to avoid infringement of these patents by using Callow pneumatic cells, but the Court held that the operations of the defendant company infringed all three patents.

On November 11, 1918, the SUPREME COURT OF THE UNITED STATES granted the petition of Minerals Separation, Ltd., and others for a Writ of Certiorari to review the decree of the United States Circuit Court of Appeals at San Francisco which had reversed so much of the decree of Judge Bourquin in the suit against Butte & Superior Mining Company as adjudged to be infringements those acts which employed oil of any kind or character used in excess of one-half of one per cent. on the ore.

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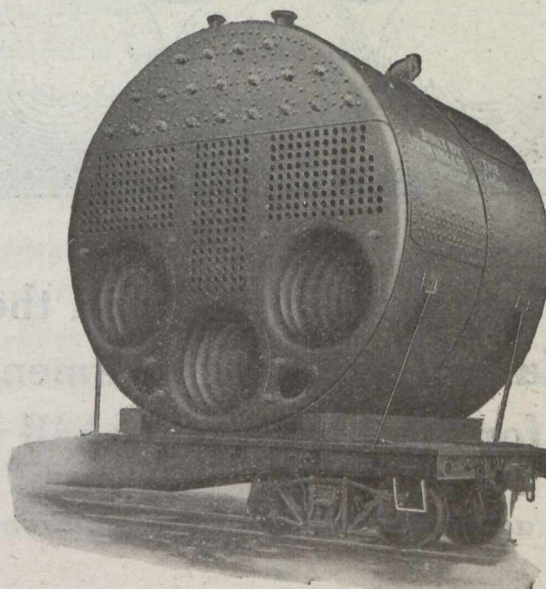
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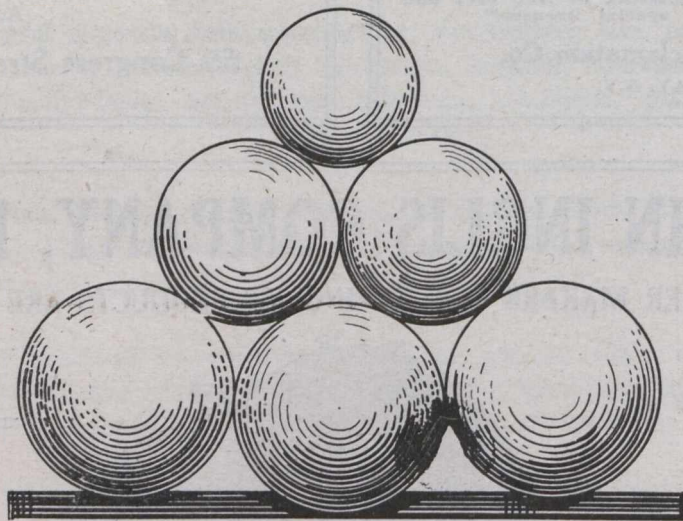
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VOL. XL.

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No. 13

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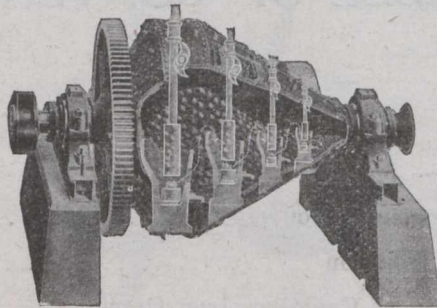
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EDITORIAL

THE VANCOUVER CONVENTION.

There was held in Vancouver, March 17, 18, 19, a convention that should help to draw attention to the great mineral resources of the West, particularly those of British Columbia. The Pacific province has long been an important producer of minerals, but only a small part of the big province has yet been developed.

The Committee in charge of the arrangements spared no effort to make the Convention a success. Western mining men attended in large numbers. Hundreds of Easterners would have liked to attend, but the long journey made attendance impossible for more than a few.

Among the important subjects of discussion were: gold mining in British Columbia; legislation to make possible the reduction of local ores within the province; possibility of establishing a smelter and refinery on the Southern Coast of British Columbia; taxation of mining properties; the prospector and how to encourage him; better utilization of British Columbia coal.

All these matters are of vital interest to the industry. Some of them are more particularly important to Westerners, but even these demand the attention of men in other parts of the Dominion. Some of the subjects are of great general interest.

The men whose efforts made the Convention possible deserve much credit. We have no doubt that good results will follow, that further discussion and action will lead to the solution of some of the many problems which confront those who endeavor to utilize our resources to better advantage.

A full account of the Vancouver Convention will be published in our next number.

MINING TAXATION.

The mining industry must bear its share of the cost of government. It is incumbent on those engaged in the industry to see that it be not burdened with more than its share and to see also that the burden be justly distributed among them. Discussion on mining taxation is therefore properly undertaken by members of the Canadian Mining Institute. All members are directly interested in the Federal taxes. Also, since the Provinces need money, the various branches are interested in Provincial taxation.

At the recent meeting of the Canadian Mining Institute an excellent paper on the general principles of mining taxation was presented by Mr. T. W. Gibson. He recognizes that taxation must be fundamentally based on profits, no matter what is called the basis. He holds that the destination of profits or the purposes for which they are used, being wholly in the control of the company, should not affect the right of the state to its share. We imagine that all will agree with him in this. The value of a mine is determined by the profits it will make. Taxation in any form is therefore properly determined by the profits even if, as is sometimes done, it is based on valuation of the property.

But though all recognize that the proper basis for taxation is profits; there are many opinions as to how the principle should be applied. Determining the profits during the life of a mine is not a simple matter, in fact, perfectly accurate determination is impossible. We can only make approximate estimates. It is the making of such estimates that leads to much difficulty and many differences of opinion. It is the proper business of those in the industry to see that such estimates are as nearly accurate as the known facts make it possible. It is also the proper business of those in the industry to see that others who have a voice in determining taxes should not be allowed to reach inaccurate conclusions owing to lack of knowledge of the determinable facts. Attempts to tax capital invested in the industry under the pretext of taxing profits should be fought to the last ditch. Some, if not all, such attempts may be attributed to failure of the tax gatherers to appreciate the facts. It is a recognized failing of tax gatherers that they will take any money that they can legally get their hands on. We have to see to it that the laws are so framed that they get only a just amount and from the proper sources from the profits and from the profits only.

While it is evident that a perfectly accurate estimate of profits cannot be made during the life of a mine, it must be admitted that the state cannot wait until the profits are accurately determined. Taxation of mines is therefore likely to be applied unfairly. We can only hope to devise methods that will result in a close approximation to proper distribution.

Since the profits cannot be accurately determined in advance, a close approximation to correctness demands short term assessments. The basing of taxation on annual profits is therefore more nearly accurate than any system which, like that of estimated value of the property, implies ability to determine profits for several years ahead.

REDUCTION OF CANADIAN IRON ORES.

One of the matters which has recently received much attention in British Columbia is that of devising ways and means for the utilization of the known iron ore deposits. The establishment of a local iron and steel industry is much to be desired. Last summer the Provincial Government commissioned Dr. Alfred Stansfield of Montreal to make an investigation into the situation and his report on the commercial feasibility of the electric smelting of iron ores in British Columbia has recently been published. Dr. Stansfield reported that there is a sufficient quantity of iron ore conveniently located, water-power available for development of electrical energy, and waste wood from saw-mills for production of charcoal. He considers that iron ore, power and charcoal could be produced sufficiently cheaply for the commercial smelting of iron ores in electric furnaces; but that the power available now is too costly and development of water-power at this time inadvisable owing to high costs. He reports that it appears advisable; to develop more

of the best iron ore deposits and to make complete tests of the ore; to reserve a suitable water power for future development; to establish a plant for the economic production of charcoal from mill waste; and to investigate the new process for the production of pig iron, and if this is found satisfactory to begin immediately to produce pig iron, purchasing power for this purpose until the water power can be developed.

It is to the last of these proposals that we would direct attention, for the utilization of such a process has been under investigation in Ontario for some time. Some account of the new method is given in this number of the journal by Mr. Jas. W. Moffatt, who has had long experience in the making of iron and steel in electric furnaces and by Mr. Stansfield in his report. It was apparently to such a process as that devised by Mr. Moffatt, that Dr. Stansfield refers in his report, though he is not very clear on this point. At least the processes are similar in that the main idea is the separating of the two stages of the smelting process and carrying them out in separate furnaces.

In Ontario and Quebec as well as in British Columbia there are many iron ore deposits which will become valuable if the new process proves successful. It is to be hoped that it will be well tried out.

The iron industry of Canada is not one of which we are very proud. It is true that we turn out good iron and steel and that we contributed a large quantity of much needed munitions during the war, but the utilization of Canadian iron ores lags far behind the capacity of our furnaces. We are almost entirely dependent on imported ores for our iron. Our great plants in Nova Scotia draw their ore from Newfoundland. The rest of Canada depends largely for its iron ore on the Lake Superior States.

Ontario, Quebec and British Columbia have in the matter of utilization of domestic iron ores a problem in common. They might well unite in testing out the new process. In the several provinces and for each deposit there will be variations of the problem; but there is much in such an investigation that would be for the common good.

THE "BLUE SKY" BILL IS DEAD.

The Attorney-General of Ontario has acknowledged that his "blue sky" bill needs much consideration and revision before it is enacted. In its present form, the bill, so far as mining companies are concerned, is dead. It is to be hoped, however, that some of the ideas for the protection of investors may be put into practice. A new draft, with the objectionable features eliminated, should be prepared at an early date, so that there will be plenty of time for consideration before another bill is presented next year. We assume that Mr. Lucas will not be so discouraged by criticism that he will fail to make another effort. The bill has brought out much information that should help him in drafting a bill that would meet with the approval of those engaged in mining.

It cannot be too often pointed out to the public and our governments that the development of rich mineral resources is only possible so long as there are rich prizes for those who are successful. If by over heavy taxation the successful companies are deprived of their reward, there will be fewer deposits developed. If, by legislation, development is limited only to proper-

ties that are certain to prove profitable, there will be no deposits developed.

There is no certainty that any deposit discovered will be worked profitably. Some prospects are more promising than others and the chances may then be considered very good, but among undeveloped properties there are few, if any "sure things." Those who spend money in development take big risks. It is proper that the risk should be taken by those who are able to stand the probable loss, for the number of failures is far greater than the number of successes. The selling of shares to the general public is therefore to be commended, for the losses are thus more widely distributed and more easily borne. If there were certainty of success there would be no necessity for public subscriptions.

It is also proper, however, that those who are granted permission to sell mining company shares to the public should be required to file an honest statement of the affairs of the company and real descriptions of the property. It is also desirable that such information should be very readily available, so that shareholders may learn as much about their property as is reasonably possible. The public should be encouraged to take the risks involved in developing mineral deposits; but they should be well informed as to the nature of the risks.

It is natural that some persons will take improper advantage of the privilege to sell shares. There should therefore be provided severe penalties for offenders and suitable machinery for prosecution. It was probably with this object in view that Mr. Lucas drafted his bill. Unfortunately, some of the provisions of the bill are so drawn that, owing to the nature of the industry, the effect would be to prevent desirable flotations in order to make sure that there were no undesirable ones.

It would be very regrettable if the bill as drafted had been enacted. Assurance has, however, been given that the bill, if enacted, will not apply to mining companies this year at least. We hope that it will never be revived in its present form.

British Iron and Steel Manufactures May Now be Exported Without License.

Advices have been received by Mr. G. T. Milne, Montreal, and Mr. F. W. Field, Toronto, British Trade Commissioners in Canada, that the following additions have been made to the list of goods which may be exported without license:

Fancy goods made of Morocco and light leathers; iron and steel manufactures generally except high speed steel and certain special articles; machinery of all kinds except textile machinery and machinery wholly made of brass or copper; toys and dolls; games of all kinds.

PERSONALS.

Mr. J. B. Tyrrell has been elected a member of council of the Institution of Mining and Metallurgy, London.

Mr. Robt. Bryce has returned to Toronto after examining a property in Nova Scotia.

Mr. G. C. Bateman has returned to Cobalt.

A meeting of the Toronto branch of the Canadian Mining Institute was held on Saturday, March 29th.

A New Method for the Smelting of Iron Ores

A Process Designed for the Treatment of Canadian Ores.

By JAS. W. MOFFATT.

A new method for the production of metals from their natural oxide ores, or from their roasted sulphide ores, lies in the duplexing of two known furnaces. The ore is first treated in a "reducing" furnace of comparatively low temperature in which the ore is deprived of its oxygen as completely as possible and is then known as "sponge." This product is transferred, either hot or cold, into an electric furnace to be melted down and finished into any desired metal. More particularly, it is for the manufacture of iron and steel and their alloys, and naturally the finishing of the metal in the melting furnace makes the process a discontinuous one,—one more convenient in operation and more suitable for meeting trade demands.

Iron Sponge.

Iron sponge has been defined by Raymond as "metal in a porous form obtained by reduction *without fusion*." Approximately its weight is about one-third that of cast iron.

In past efforts, the reduction of the oxide ores has been attempted with the use of a gas, but without substantial commercial success, as it is very difficult to get practically complete reduction without lengthening out the operation too long, and when the ore has been finely crushed, the reduction is very imperfect.

The earliest workers in iron must have been familiar with iron sponge in their crude forges, as they used the sponge, with further application of heat, for making the balls they hammered and squeezed into a malleable metal. Many subsequent efforts have been made to use it, but certain difficulties have been found to seriously interfere, and it is rarely heard of except in the trade.

These difficulties were largely encountered in the securing of complete reduction of the ore, in the lack of careful and accurate control of the heat and partial fusion or melting than occurring in consequence, and there was always present the difficulty of handling a material so readily oxidizable, for it will reoxidize both in cooling down and in being heated up again to bring it into a liquid state if an oxidizing atmosphere is present.

Temperature control is now easy and accurate with pyrometers, guidance in the control of gas analysis can be had with the use of CO₂ recorders, and a sure and certain atmosphere of reducing gas, in which to melt the sponge without reoxidation, is securable in the electric furnace.

In the manufacture of iron sponge, excellent information can be had in a study of H. H. Campbell's "Graphic Representation of the Weight of Substances in the Blast Furnace," as it also shows the temperature at which the various chemical reactions take place. Hematite (Fe₂O₃) begins to be reduced at a temperature of about 300° C., and has been converted wholly into magnetite (Fe₃O₄) at a temperature of 450° C. This ore, with the natural magnetite in the charge, begins to be reduced to ferrous oxide (FeO) at a temperature of about 500° C., and the reaction is complete at about 590° C. Ferrous oxide begins

to be converted into iron (Fe) at 700° C., and the reaction becomes more rapid when 700° C. is reached, and is complete when a temperature of 800° C. is reached, all the iron being in a spongy metallic state. The sponge iron is all melted when temperatures of 1100° to 1300° C. are reached, there being some variation in the heat required according to the analysis of the iron.

It may be noted that at 800° C., the limestone of the charge is converted into lime, and in a furnace operated for the reduction of ore the stone is advantageously mixed with it, as it will act as a catalyzer and speed up the reaction. It would be inadvisable to add stone with iron sponge in the charge of the electric furnace, since carbon dioxide will begin to oxidize spongy iron at a temperature of 300° C. as pointed out by H. H. Campbell in what he calls the "landmarks" in the smelting of iron ores. The foregoing data is based on the average work of a 75 foot blast furnace, but clearly the size of the ore and the time occupied by it in passing through any particular zone of temperature must be taken into consideration of the occurrence of each reaction. The writer has made a few ounces of iron sponge at different times in experimental work when the entire operation did not take five minutes.

Previous Efforts to Utilize Iron Sponge.

Efforts have been made to utilize iron sponge in various types of furnaces, some of which may be quoted.

Harvey devised a process in which coarsely ground ore, mixed with charcoal, was placed on inclined shelves within a puddling furnace in a position that allowed it to be heated by gas entering the furnace, and, when deoxidation was thought to be complete, the reduced ore was raked off the shelves, further heat was employed to fuse it, and under it the sponge was worked into the puddled balls.

In Clays process, the reduction was effected in retorts made of fireclay, the ore having been mixed with carbonaceous material, the heat being applied externally, and the sponge iron product was then further heated and balled. It is said that his process proved slow and costly, and the iron was not always satisfactory.

Newton also used a closed container in a somewhat similar way, heating it externally to a white heat for about 48 hours, and taking the product while hot to a puddling furnace or when cold to a crucible furnace. Such a prolonged operation was naturally an expensive one.

Roger mixed ore with coal, and effected reduction in a rotating cylinder, heated externally. This he located above his puddling furnace into which the resulting sponge was dropped, further heated, and then balled.

The Carbon Iron Co., deoxidized iron ore in a reverberatory furnace provided with a carbonaceous hearth. The ore was mixed with retarded coke,—which oxidizes very slowly,—and the reduction of the ore was slow in consequence, but the sponge had the advantage

of resisting oxidation in further handling better than in the other processes mentioned.

Some attempts have been made to use iron sponge in the crucible furnace, of which a few may be noted.

Belford put a mixture of iron ore and carbonaceous material into a suitable container, heated it externally, and transferred the sponge while hot to crucible, and then melted it down, but in later practice transferred it through a closed runner to a decarburizing chamber, heated externally, where it was acted upon by decarburizing gases or steam. Evidently he found his sponge too high in carbon for making steel by the crucible process.

Lucas used a furnace similar to that employed in the cementation process, reducing in a covered container, and melting the sponge in crucibles.

The utilization of iron sponge has also been tried out in the open hearth furnace.

The Carbon Iron Co., coated the sponge made with lime to retard its oxidation in the transfer and during the melt down in the open hearth furnace,—the coating would naturally be put on while the sponge was still on the hearth of the reverberatory.

Tourangin made sponge and protected it from oxidation by covering it quickly with ashes as soon as it was withdrawn from his furnace, or he dropped it into containers with water-cooled walls, covered it with air-tight cover and allowed it to cool down.

Trosea dropped his sponge into an air-tight buggy.

There are many other processes in which the use of iron sponges was attempted in the puddling, crucible and open hearth furnaces, but all of them could only be considered as furnishing part of the metal used in the finished iron or steel, and all would certainly in their time introduce more or less iron oxides into the bath of molten metal and in consequence increase the work of finishing the metal, for carbon dioxide in the gas used will oxidize iron sponge at as low a temperature as 300° C. in the melting down period.

Of the older types of furnace, there remains the blast furnace, and at first glance it would seem as if an agglomerated iron sponge would be able to take the place of briquettes and furnish a means of disposing of comminuted ores; but unfortunately the gas at the top of the furnace is too oxidizing as there is usually 10% to 17% of carbon dioxide present and only 20% to 27% of carbon monoxide. The sponge while being heated in the upper regions would be re-oxidized, and all the work previously done on the ore would be wasted, and have to be done over again on the material reaching the reducing zones of the furnace.

The New Process.

How the sponge is made is immaterial to the writer's process (Canada patent No. 186994, granted Oct. 15th, 1918; United States patent No. 1,294,514, allowed Oct. 26th, 1918, and issued Feb. 18th, 1919) of duplexing a reducing or metallizing furnace with an electric melting furnace.

Any scrap melting electric furnace, that can be made practically air-tight, melts the iron sponge as readily as it melts the scrap,—no special design of electric furnace is necessary for the process.

The design of a reducing furnace must suit the materials used for supplying the heat and the means of reduction, for what may be the most convenient and economical in one locality may not be so in another.

As noted already, reduction is an easy operation to carry out successfully with the assistance of modern scientific apparatus, and when the crude methods

of the past are replaced by well designed furnaces for making iron sponge solely.

Such furnaces should be mechanically charged, rabbled and discharged, and means should be provided for making small additions of carbon to the charge when necessary. Preferably, the gases of combustion supplying the heat should not be passed over or through the ore being reduced. As the porosity of the ores is variable, and all ores may not be crushed to the same degree of fineness. The time occupied in the work will vary, and the furnace should be designed to take care of that. It should also be supplied with at least one, and preferably two, stationary pyrometers, indicating by colored flash lamps any variation, up or down, from the proper temperature.

An intelligent laborer could operate a number of such furnaces and the labor cost per ton of ore would be very low.

Perfect reduction at the lowest cost is the one consideration however, and how it is actually arrived at is quite secondary.

Any scrap melting electric furnace, that can be made practically air-tight, melts the iron sponge as readily as it melts the scrap,—no special design of electric furnace is necessary for the process.

Canadian Ores Available.

Ores of high metallic iron content, say 63% and over, in the crude state, are becoming increasingly difficult to get in Canada and the United States within reasonable transportation distance of any market. One of the largest concerns in the United States catalogues the product of thirty odd mines without showing one such ore; seven however range between 60% and 62%. Outside of the Helen and Magpie mines of the Algoma Steel Corporation, the Atikokan mine of the Atikokan Iron Co., and the Moose Mountain Mine of the Moose Mountain, Ltd. The orebodies in the older and more populous parts of Canada are not large, and are of low grade as a rule.

In Ontario, except the ones mentioned, no really large property has been thoroughly proved to contain one million tons of marketable ore, though there are a few of undoubted promise, such as the Canada Iron Mines properties in Hastings County and the Belmont mine in Peterborough. There are, however, many small bodies of ore in Ontario, situated conveniently to the market.

In the 48 years between 1869 and 1916, the Dominion Government reports show a total production of about 4,350,000 tons of iron ore in Ontario, an average of 90,625 tons annually, or a little less than 250 tons daily, an amount insufficient to alone supply one very small blast furnace.

In the Province of Quebec, from 1886 to 1916, a period of 30 years, there was a total production of 379,953 tons, making the yearly average 12,655 tons, or a daily average of 35 tons.

New Brunswick in 68 years,—1848 to 1916, produced 272,850 tons, a yearly average of 4,013 tons, or a daily average of 11 tons.

Nova Scotia in 30 years,—1886 to 1916,—produced 1,279,637 tons, a yearly average of 42,655 tons, or a daily average of 117 tons.

British Columbia in 30 years,—1886 to 1916,—produced 65,078 tons, and exported practically all of it to the neighboring State of Washington. This tonnage is a yearly average of 2,170 tons, or a daily average of 6 tons.

The other Provinces have done little or nothing in mining iron ore. Dominion Government reports also supply other statistics of the total output of all Canada. For a period of 30 years,—1886 to 1916,—the total production was 5,759,540 tons (2,000 lbs.) a yearly product of 191,985 tons, or a daily average of about 526 short tons, or 470 long tons, the latter being the ton used in the pig iron market. This 470 long tons of ore would have to carry about 55% metallic iron to meet the supply required for only one small blast furnace making 250 tons of pig iron daily, which is one-half the size of what is considered a good furnace to-day, when they are being built to produce up to 600 and 700 tons of pig per day.

In 1916, the United States produced about 75,500,000 tons of ore. The population being about 100,000,000; this is equivalent to 75.5 tons per 100 of population. The same year, Canada produced from her mines 340,000 tons, or 4.25 tons per 100 of population, or about one-seventeenth of what the United States did!

This is a pitiable showing when it is remembered that our geologists claim that the great producing iron ranges found in the States of Minnesota, Michigan and New York are also found in Canada, and that the last twenty years, in the thirty year period of production mentioned, include what is proudly called "Canada's growing time." There are undoubtedly many reasons why such a state of affairs exists. Some can be removed by legislation,—but the great cause of the trouble is that few of our iron mines with convenient shipping facilities can produce even 100 tons per day, and the great majority of all Canadian ores unfortunately require crushing, grinding and concentration with subsequent briquetting to render them acceptable to blast furnace operators. This cost of briquetting finally proves to be the last straw, and then nothing is done.

The Canadian blast furnace operator is able to deal with one American selling agent for his entire requirements in ore for a year's run, feeling absolutely sure of its delivery to him and of its being according to the analysis guaranteed him when making his selection. It might be added that, when that ore enters Canada, there is the enormous duty of eight (8) cents per ton to be paid on it,—and no war tax! However, if he imports his ore from Great Britain, he does not have to pay so high a duty, he can get it into Canada for six (6) cents per ton, and without a war tax as before!

New Process Will Make Canadian Ore Marketable.

It is natural to ask how can such an unfortunate condition be overcome. The best solution seems to lie in the utilization of the scores of small iron mines that are to be found between the Lake of the Woods on the west all the way down the north shore of the Great Lakes water system to the Straits of Belle Isle on the east. As there are very many large water powers available for the generation of electricity at points sufficiently convenient for the transmission of the power to suitable smelting locations, the past difficulties can be largely overcome by a reversion to the use of the iron sponge of the ancients, melting it in the very modern electric furnace, with its ideal conditions for that work, and, without removal, finishing the metal into any desired iron or steel.

Market for Product of Duplexing Process.

And what about a market for the product? It is not at all likely that the electric furnace can market ordinary pig iron in opposition to that made in the blast furnace, except under most unusual conditions, such

as a very long haul from blast furnace to that market where an electric furnace is operated. Low-phosphorus—high-silicon pig iron, however, could be made for sale to the open hearth steel furnaces, and some washed metal (metal with the phosphorus, sulphur and silicon practically eliminated) and other special irons would have some market.

The natural product of the electric furnace is steel, and to that metal its work is advantageously confined from a financial point of view. It is particularly well suited to furnish the molten metal in a steel foundry, but this class of work is only prosperous in the centres of large population, and most of our smaller iron mines are situated at some distance from the cities.

During the war there was a ready market found in casting ingots for the forging of shells. The war taught us new possibilities. If existing forging and rolling plants are not disposed to continue that practice, the electric furnace plants could cast ingots, scrap them, (remelting the cropped ends with the iron sponge of the next heats), and ship the ingots to a district forging works or rolling mill which they themselves had combined to build and operate. A plate mill would find a ready market for its entire output in Ontario for instance. Rolling billets, too, would probably be satisfactory. Electric furnace steel, owing to its superior quality, will always find a sale in competition with other steels, and at a higher price even when steel of high quality is wanted.

Magnetic Concentration of the Ore.

Under the new process, the ore should be crushed fine enough to effect the best magnetic separation of the iron oxide from its associated gangue, usually silica. It is rather expensive to get rid of rock material by means of slags made with electric heat in a furnace, and an ore should be concentrated up until it carries as high a metallic iron content as possible,—over 63% say, though no hard and fast rule can be laid down, as it all depends on the analysis of each ore.

Reduction.

For reduction purposes, the carbonaceous material should be ground to the same size of grain as the ore and be very thoroughly mixed with it. Its analysis should show the weight of fixed carbon, volatile matter, moisture and ash. Theoretically the metallic iron should have one-quarter of its weight of fixed carbon present for complete reduction, but in practice a further small percentage is added. For example: 1,000 lb. of 65° iron ore (Fe_2O_3) has 650 lbs. of metallic iron, and theoretically requires $162\frac{1}{2}$ lb. of fixed carbon for complete reduction, which would be found in 271 lb. of charcoal showing 60% fixed carbon in analysis.

Limestone, also finely ground like the concentrates, may be mixed in the charge, and will be calcined in the process, or it may be added as lime in the electric furnace. There should be enough lime present to make a very basic slag in the melt down in the electric furnace.

In the iron sponge making operation, there will be a considerable elimination of the sulphur in the ore, and to some extent a lowering also of the phosphorus in some ores.

Handling the Iron Sponge.

The iron sponge may be handled hot or cold. When transferred hot, the reducing furnace should be provided with means for discharging its contents into containers having air-tight valves, taking every care that air is not allowed access to it while the discharge is being made. The containers must be discharged into

the electric furnace, with like care, and preferably through the roof, the furnace having previously rendered air-tight. The current can then be put on, and it will be noticed that the charge will carry the current steadily at once without the very objectionable surging found in melting cold scrap. Indeed if the sponge is only reasonably warm, this will occur, and the running will be smooth.

The reducing furnace may be provided with a large air-tight cooling chamber underneath into the top of which the iron sponge may be dropped when reduction is complete. When this chamber is constructed to hold the product of several runs, it becomes a storage bin as well, with the lowest charge cooled below the oxidizing temperature. But, still being warm, it could be transferred without care and be charged into the electric furnace through its regular doors.

In the case of a low grade hematite, or a mixed hematite and magnetite ore, which ores do not answer well to magnetic concentration, a partial reduction to Fe_3O_4 will render it well suited for it as a rule.

Fuel.

The heat required for the chemical reactions can be either secured by burning coal or coke on a grate, or by using these in powdered form blown in with air to a combustion chamber or by using liquid fuel such as fuel oil. The burning gases from any of these fuels should heat externally the container in which the work of reduction is being carried, but preferably should not be allowed to enter it. If electric heat is used it can be applied in the same chamber as that in which reduction is going on.

The operation of the electric furnace is practically the same as in melting and refining scrap, and no description is needed of it to-day.

Comparison With the All Electric Heat Method.

With the Swedish electric furnace (Electro Metals Co.), it requires about 1.1 K.W. hours of power to produce 1 lb. of metal, and the metal is a white iron only. This is equivalent to 2,200 K.W. hours for a net ton. It is transferred while liquid to an electric furnace, where about 300 K.W. hours of additional energy are required to finish the metal into steel, making the total energy used about 2500 K.W. hours from ore to steel.

Properly reduced iron sponge melts as readily as cold scrap, which can be melted and finished in good practice with 700 or 750 K.W. hours per ton. As the rock material remaining in the iron concentrates will frequently necessitate a larger amount of lime to secure a very basic slag. The weight of the slag used in the iron sponge process will be some larger than that in the scrap melting process.—probably a fair average will be 800 K.W. hours with the sponge using process, or about one-third the amount required by the all electric process used in Sweden.

In this new process no high temperature heat is lost in waste gases leaving the electric furnaces, as there will be practically no gas generated there, and, compared with the all electric heat processes, using 1700 K.W. hours of energy more than that required in the process using iron sponge, where the heat for reduction is got from lump coal, powdered coal, fuel oil or any of the ordinary available fuels, the economy in the production of steel by this method is readily seen.

Quantity of Ore Required One 6 Ton Furnace Heat.

A 6 ton electric furnace (1500 K.W. or 2000 H.P.) will require the iron sponge made from about 10 tons of 63% Fe. concentrates per heat. Four heats can be easily be made in 24 hours, but a skilled furnace oper-

ator could get five if the plant is conveniently arranged. Taking the number of heats at four, a six ton furnace would then readily produce 24 tons of liquid steel in 24 hours, and would require 60 tons of 63% of Fe. concentrates for it. If the ore mined would need concentration of $1\frac{1}{2}$ into 1 to produce 63% Fe. concentrates, one 6 ton furnace would use 90 tons per day of such crude ore.

Iron Sponge Will Cost Less Than Scrap.

Owing to the existing instability of the prices of materials, and to the labor unrest it appears to be quite inadvisable to make any attempt to quote an average cost for either plant or product,—a cost quoted to-day will probably be useless a few months later. Iron sponge, however, will cost less than scrap, as soon as the war scrap is all used up.

Patent Claims.

The following are the main claims granted in the patents,—they are identical in Canada and the United States:—

1. A discontinuous process of treating metallic oxides ores which consists in reducing a charge of ore without fusion in a suitable furnace, and after reducing, excluding oxidizing gases from contact with the charge while its temperature is above the lower limit at which re-oxidation can take place, placing the reduced charge in a separate electric furnace and fusing it there in an inert or reducing atmosphere.

2. A discontinuous process of treating metallic oxide ores which consists in reducing a charge of granular ore without fusion in a suitable furnace and at as low a temperature as possible to maintain the granular form of the reduced ore, and after reducing, excluding oxidizing gases from contact with the charge while its temperature is above the lower limit at which re-oxidation can take place, placing the reduced charge in a separate electric furnace and fusing it therein in an inert or reducing atmosphere.

3. A discontinuous process of treating metallic oxide ores which consists in reducing a charge of ore without a flux without fusion in a suitable furnace, and after reducing, excluding oxidizing gases from contact with the charge while its temperature is above the lower limit at which reoxidation can take place, placing the reduced charge in a separate electric furnace and fusing it therein with a flux in an inert or reducing atmosphere.

4, 5, and 6. Cover the cooling of the charge after reduction and before fusion to a temperature below that at which reoxidation can take place, as already set out in 1, 2 and 3.

FLORENCE SILVER.

Another monthly dividend has been declared by the Florence Silver Mining Co., amounting to $1\frac{1}{2}$ cents a share. A body of ore has been opened up from Stone No. 7 from No. 2 tunnel level. At a point 30 feet up it shows two feet of clean shipping ore running nearly 70 per cent. lead and 22 ounces silver, with five feet of milling ore. This is in virgin territory, west of the big original orebody which was stoped to surface and showed maximum width of 40 feet. Vertical depth from surface is about 350 feet, so that the orebody can be followed up to surface on the dip about 500 feet. The downward continuation of the same body has already been developed by No. 5, or lowest level. 360 feet down on dip of vein. Intermediate level No. 3 and 4 have not yet been extended far enough westerly to catch it. No doubt is felt, however, that the shoot will be opened up on all four levels.

EXAMINATION AND SUPERVISION OF COAL MINES.

"It is time that British Columbia ceased being the happy hunting ground of aliens. We propose, therefore, that there shall be a more rigid examination and supervision of all who are permitted to enter our mines."

These sentiments were emphatically asserted by Hon. Wm. Sloan, Minister of Mines, when moving the second reading of a Bill to amend the Coal Mines Regulation Act. Taking the measure by section he first referred to that which provides for the appointment of a Minimum Wage Board. This principle, he said, was not new to British Columbia, having been laid down by the Provincial Legislature at its last session and having wrought, he thought, generally satisfactory results. Coal mining was a dangerous industry and for that reason it was particularly apt that the principle should be applied to it. It was to be understood, however, that the Minimum Wage proposal did not extend to all the underground workers, but only to the actual miners who held certificates of competency. Of these there were in British Columbia 1685, of whom 156 were Orientals. The argument that it was discriminatory to permit the establishment of a minimum wage district in one section while another, perhaps adjacent, was excepted was answered by the statement that such action might be warranted by entirely diverse sets of conditions in different districts, in fact such differences might exist between mines in the same locality. In this respect the Act followed closely the British Act, there being 23 Minimum Wage Districts in Great Britain. In British Columbia it was intended to define not more than 3 or 4. As to the cost which also had been advanced against the contemplated amendment Mr. Sloan stated that it was the intention that the Chief Inspector of Mines should be the board's chairman and, as the other two members would be appointed from the particular districts affected, there was no force to such a contention. The cost would, he said, be infinitesimal in comparison with the results to be achieved.

As to the changes in the system of examination and the personnel of the examining board, Mr. Sloan declared the present arrangement to be cumbersome as well as loose in its supervision of candidates. For examination of mine officials a board would be appointed consisting of the Chief Inspector of Mines and two other competent and experienced men, one to represent the operators and the other the men. Miners' certificates of competency would be issued by a board consisting of the mine inspectors of the district in which examinations were being held and two others representing the Companies and the employees respectively.

It was here that Mr. Sloan declared that it was the intention of seeing that there should be a closer supervision of those authorized to go underground. Too long had this Province been the happy hunting ground of the alien. No longer when this amendment became law would unqualified men, or men of alien birth and indifferent qualification, find it possible to engage in coal mining in British Columbia.

Explanation then was given of clauses proposing the clearer definition of the duties of a Fireboss, the fixing of a definite standard in respect of gas contents of coal mines for the withdrawal of men. By mutual agreement between the Mines Department and the Crow's Nest Pass Ry. Company, when the Coal Creek Mines were found in any place to contain 2½

per cent. or more of methane the men were withdrawn. Now it was intended that this rule should be general throughout the Province. It was a safety measure solely and was in line with the provisions of the British Act. There also were amendments which it was thought would make it obligatory on the part of practically all collieries to introduce safety lamps and which would require that cables used in the hoisting of men should be lubricated at regular intervals and should not be kept in use for a greater period than two years.

Reference was made to a change which would give the Minister of Mines power to make new rules from time to time by order-in-council. This authority, it was stated, had been given by the former British Columbia Coal Mines Regulation Act. It also was contained in the Placer and the Metalliferous Act. In Great Britain the Secretary of State had power, not only to make rules, but to amend the Act. This Mr. Sloan said he was not asking for, but he thought that the Minister of Mines should have authority to make such rules as were considered necessary for the promotion of safety in coal mining operations.

Mining Taxes in British Columbia.

In the course of his budget address before the Legislature of British Columbia Hon. John Hart, Minister of Finance, made some informative statements regarding income from taxation of the mining industry and mining property of British Columbia. He stated that the mineral tax was expected in the forthcoming year to bring in \$150,000, an increase of \$65,000 over the previous year's estimate. Taxation on Crown Granted Mineral Claims, he said, was expected to yield \$60,000, which is \$20,000 more than in the preceding twelve-month. "By bringing the coal mining companies under the alternative of income tax or mineral tax," said Mr. Hart, "which is the method of taxation applied to other mining companies, we can hope for a revenue of \$200,000 instead of the \$160,000." Discussing arrears of taxes the Minister of Finance pointed out that some \$800,000 still remained to be paid at the end of the year on account of income tax. This, he stated, was made up largely of amount expected to be derived from mining corporations and "following an audit which has just been completed will probably be paid into the Treasury before the end of the month (March)." In reference to events of the past year affecting his department Mr. Hart mentioned the holding of a sale for arrears of taxes owing to unworked Crown granted mineral claims. He said: The total arrears represented by the property which the owners allowed to go to sale were \$56,192. The receipts from the sale were \$6,790, of which \$140 was surplus over tax arrears and costs, and unsold parcels represented arrears and costs to the amount of \$49,542. The refinements of the Taxation Act which were affected at the last session of the Legislature for the purpose of enabling us to deal with the mining and other industries in a manner which would be fair to these industries as well as to the Province have been worked out in practice by the Taxation Department and are giving satisfactory results."

Mr. F. M. Sylvester, managing director of the Granby Consolidated Mining & Smelting Company, has left on a business trip to New York. It is understood that no announcement will be made concerning resumption of work at Anyox smelter until his return.

UTILIZATION OF IRON ORES OF BRITISH COLUMBIA.

As another step in the direction of encouraging the development of the Magnetite Iron Deposits of British Columbia and the establishment of an Iron and Steel Industry, those preceding having been the offer of a bounty on pig iron produced in the Province and the obtaining of a report from Dr. Alfred Stansfield, Professor of Metallurgy, McGill University, on the commercial feasibility of treating the iron ores of the Province by means of electro-smelting, Hon. Wm. Sloan, Minister of Mines, proposes asking the British Columbia Legislature, now in session, for authority to take from any of the iron ore properties of the Province a quantity of ore, not to exceed 10,000 tons in the aggregate, for experimental uses. There are at present two small furnaces situated near Vancouver, B. C., and owned by two distinct and enterprising companies which are prepared to take advantage of the terms of this legislation.

Although it is felt that, in cases where iron properties are being held with no effort to develop them, the Government should have unconditional power to take whatever action may be deemed expedient to facilitate opening them up, thus assisting the industry which it is hoped will grow to the importance, which the country's resources warrant, it is not the intention to take the ore without recompensing the owners. The latter, it will be provided, shall be allowed 25 cents per ton free of taxation on the ore taken.

One of the companies in question is the Tudhope Electro Metals, Ltd., whose office and factory is situated at False Creek. This company have been treating scrap iron. Following interviews between Hon. Mr. Sloan and representatives of this concern, the latter reached the conclusion that, in order that a complete and satisfactory demonstration might be made as to the practicability of smelting British Columbia iron ores on a commercial basis, it might be necessary to operate a plant for an experimental period of six months, more especially if various deposits were to be drawn upon for these experiments. As an inducement to undertake this they asked of the Provincial Government 5,000 tons of ore at the rate of approximately 1000 monthly. Mr. Sloan holds the opinion that there is available an ample supply of ore of the character necessary for the production of the class of pig iron demanded by the British Columbia and foreign trade. There is no doubt in his mind that there is plenty of ore, and has been confirmed by investigations carried out since he took office as Minister of Mines. It is likely, however, that the ore to be secured most readily is that to be found on claims, either undeveloped, or very little opened up, situated on or close to tidewater. This, therefore, explains his action in asking for legislative power to secure the quantity of ore in question.

With further reference to the Tudhope Electro Metals, Ltd. It is explained that its directors, as soon as assured of a supply for their experiments, are prepared to proceed and make necessary changes in their electric furnace for the treatment of magnetite ores. They, then, would be in a position, providing the results were satisfactory, to continue production, possibly upon a much larger scale, as additional electric units can readily be added to the plant to increase capacity or to carry the operations through to finished steel. The present equipment consists of an electric furnace of 1500 K.W., with a capacity of 25 tons daily and was completed recently at a cost of \$50,000.

It is considered to be sufficient for the work proposed and it is thought that the demonstration outlined should result in the definite determination of the feasibility of utilizing British Columbia iron ore upon a competitive commercial basis.

The Vancouver Magnetite Iron and Steel Smelting Co., Ltd., is another company interested in the securing of iron ores for experimental purposes. It has a plant situated at Ronaldsay, Howe Sound, twenty-seven miles from the City of Vancouver. This is a blast furnace having an estimated daily productive capacity of 25 tons of pig iron. The company has been engaged in the production of pig iron from scrap iron, etc. The management of the company is anxious to try the smelting of the magnetite iron ores of British Columbia, and, with a supply for demonstration assured, is prepared to make such changes as are necessary to the plant. On this point Mr. C. Campbell-Johnston, Mining and Metallurgical Engineer, says:—

“Slightly different features to those in some other places face the iron industry of British Columbia on the coast; namely, the class of iron ores obtainable locally are magnetites; hematites do not occur along the Coast Ranges of Mountains, to flux these magnetites as is practical in other plants elsewhere. This necessity of smelting by themselves magnetite iron ores, together with fluxes of limestone and coke, calls for a much higher heat in these furnaces, namely, about 3,000 degrees Fahrenheit, to exceed well the melting point of these iron ores used. Such a degree of heat is not obtained in the ordinary blast furnace practice, but can certainly be regularly acquired by the addition, as already installed at this furnace at Ronaldsay, of ample auxiliary heat from several oil burners, to be used in conjunction with the coke, where the oil is previously warmed to 80 degrees F., and atomized under 100 lbs. pressure at least, blown into the furnace by air blast, to provide the necessary oxygen for combustion of oil, to generate a high heat, but finally leaving no free carbon atmosphere—an absolute chemical requirement to reduce the iron to metal, and combined with oxygen in the ore, to carry this same gas away.”

From this it will be seen that both these companies are confident, or at least very optimistic, in regard to the practicability of treating the iron ores of British Columbia and producing merchantable pig at a cost that will permit the meeting of local and perhaps outside market requirements. They claim they have the plants necessary for satisfactory experiment, and it is Mr. Sloan's intention to do what can be done to assist them in making the attempt. If they are successful he thinks it not too extravagant to hope that, from their small beginnings, will spring industries which will exploit the iron ore resources of the Province on a larger scale and eventually lead to the establishment in the Canadian Northwest of the network of allied industries which follow the production of iron and steel on a large scale. And Mr. Sloan makes it clear that any other companies prepared to undertake such experiments in British Columbia also will be accorded every possible considerations.

In support of the efforts he is making to assist and encourage those who are disposed to enter into the utilization and the development of the Iron Ore Deposits of the Province, Mr. Sloan points to the history of the industry in Nova Scotia. From a little forge shop with a capital of \$4,000 and ten employees it has developed into a great industry and one of the most notable industrial enterprises of the American Con-

continent. In view of this experience he thought that he was justified before the members of the Legislature, and would be backed up by the country generally, in extending all assistance possible to companies which were prepared, no matter on how small a scale at the start, to demonstrate the practicability of producing high grades of pig iron from the raw material now lying undeveloped in large quantities in British Columbia.

PRESIDENT HANNA PROMISES RAILWAY TO FLIN-FLON IF SMELTER BUILT.

The Pas, Man.—Manager John Black of the Flin-Flon syndicate, and John Hammell of the original owners, with Professor R. C. Wallace and J. A. Campbell, M.P., of The Pas, formed a part of the big Western delegation that waited upon the government with reference to railway development in New Manitoba.

President Hanna, of the National railways, received the delegates at Toronto, and, after hearing their representations, he pledged to do the following railway construction:—

Flin-flon Railway—If the owners of the big ore deposit there will guarantee to erect a smelter, with a capacity of at least two thousand tons a day, the railway will be built from The Pas forthwith. The syndicate owning this ore have the matter in hand, and it is expected they will agree to the erection of the smelter. It rests upon them whether the mineral fields of New Manitoba will be opened up this year.

Melfort-The Pas Railway—President Hanna assured the delegates that this line would be partly constructed this year. Work would commence from Melfort, and up the Carrot river valley for a distance of 30 or 40 miles. Grading only would be done this year, the rails laid down next year.

The Vonda spur to Melfort will have 20 miles of steel laid this year. With the Carrot river line, this will give direct connection with the Hudson Bay railway and The Pas.

The Melfort-Saskatoon-Humboldt road from Breux to Humboldt will be completed this year. The Estevan and Souris delegates were told that a line was contemplated from west of Moose Mountain to the Hudson Bay railway.

The deputation also asked that Sturgis, on the Thunder Hill line, be connected up with the Hudson Bay railway. Assurance was given that half of this work would be done this year.

All told, six lines of railway projecting towards The Pas, to connect with the Hudson Bay railway, were favorably dealt with. Two more lines, one the Flin-Flon road, are near realization than thought possible a week ago. The C. P. R. is reported to have surveyors out, running a line west of The Pas, through the Carrot river valley towards Athapapuskow like region. These two bring the total up to eight railway lines pointing New Manitoba way.—The Pas Herald.

The drift on the tenth level of the Silversmith Mine has not run out of the ore shoot yet, according to well authenticated reports. Another carload of high-grade ore is ready for shipment to the smelter. This will be the thirteenth car moved since the resumption of operations and will bring the net smelter receipts to \$75,000 or \$80,000 on the 90 per cent, preliminary settlement basis. The value of the shipments has ranged from \$4,000 to \$7,000 on this basis. The crude ore contains about 40 per cent: lead and 90 ounces of silver to the ton.

OPPOSED TO "SALE OF SHARES ACT, 1919."

Prospectors, mining men and business men in all parts of the north have become thoroughly aroused over the "Sale of Shares Act, 1919," fearing it will be a misfortune for the Province if actually put in force. Resentment appears to be unanimous. A mass meeting is to be held in the Town Hall, Cobalt, on Monday night in an effort to arrive at some plan whereby the passing of the bill can be prevented.

Leading opinion points out the fact that the present criminal law, if enforced, would prevent misrepresentation, which after all is the food on which the wild-cat subsists. If an attempt to secure money under false pretenses is made, it is but necessary to apply the criminal law. This method would not work a hardship on legitimate enterprise.

It is contended that any individual who desires to raise money for the exploration of even the rawest prospect is entitled to do so, provided always that the property being explored is not misrepresented. The pioneer always assumes the risk of loss. At the same time he also stands the chance of enormous returns on his speculation. The stock company is an excellent medium whereby the speculating public can place funds with the chance of big returns. In this way a large number of small speculators constitute a big factor in providing funds to explore and develop mining territory. In this way the small speculator is given a chance to win a share of the success, instead of the big financial interests which are able to operate without forming stock companies.

Prospecting in Manitoba.

Active claim staking is going on throughout The Pas mineral belt. About thirty were recorded during the month just closed. Mr. John Forbes, T. R. Edwards and G. B. Hall were active between Mile 191 and Mile 195 along the H. B. Ry., and they accounted for the majority of claims registered. They acted for the North Canada Exploration Co., Ltd. Dr. Robertson's party were active around Big Island. J. B. Moors got several claims at Cranberry lake. F. G. Moore and Joseph Moran staked three on the south shore of Clearwater lake. Thomas Riddoch got one at Mile 195. Bob Hasset and Deakin Hall recorded several located on the east arm of Athapapuskow. As far as The Herald is able to ascertain, there will be three large exploration parties in the field this summer. They are the Longyear, Paull and Chica.—The Pas Herald.

Dome Mines.

General Manager C. D. Keading has returned to the Dome Mines at Porcupine, and former mill superintendent Dowset is expected within the next week or so. The work of installing the large underground crusher at the 800 foot level of the property is being proceeded with, and it is expected about a month will be required to complete its installation. This will constitute one of the concluding steps in the big scheme which aims to place the mine on a producing basis larger than ever before in its history, greatly facilitating the handling of the ore and reducing the costs of operation. All this tends to strengthen reports to the effect that operation of the Dominion Mines at full blast is only a matter of a few weeks.

Work of National Production Committee U.S. Fuel Administration

By JAMES B. NEALE.*

(A paper presented at New York Meeting, American Institute of Mining Engineers, February, 1919.)

From the beginning of its activities, the members of the national Production Committee have felt that the following points were essential to the success of its work: The operators must feel that their operations were not 100 per cent efficient; that they should be courteous and fair in their treatment of their employees; and that they should set an example of hard work and patriotic interest in increased production.

Every move made must appeal to the sense of fairness of all parties concerned.

The men must feel that in working more faithfully, and consequently producing more coal, they are rendering a distinct service to their Government in the time of its great need. As the workers feel that greater efficiency on their part results only in greater profits to the operators, the advantage to the operator should be lost sight of, as far as possible, and the advantage to the Government in fighting the war emphasized.

Both operators and workers should know that the Government considered increased production an obligation, and opportunity for service, resting on both parties and not on the operators or the workers alone, and that both parties could very much better the efficiency of the pre-war period. Had the committee intimated that it thought the coal shortage was due entirely to the idleness and inefficiency of the workers, its campaign would have failed, for the men would have resented the charge because only too frequently their efforts to produce more coal were thwarted by bad management; besides the operators would have lacked stimulus to better effort. On the other hand, had the impression been given that the committee thought that the coal shortage was due entirely to bad management, the operators would have resented the charge because only too frequently their efforts to produce more coal were thwarted by the idleness and inefficiency of the workers; and the workers, having been thus indirectly pronounced 100 per cent efficient and patriotic, would have lacked stimulus to better effort.

Method Adopted for Increasing Production.

With these points in mind, the committee devised the following plan: A production manager was chosen for each of the twenty-eight large producing districts. For the most part these managers were nominated by the operators in each district and they became the centres of the production activities. At a large percentage of the mines, production committees were formed, one at each mine. These committees consisted of six men—of whom three were appointed by the management and three were chosen by the workers—and worked under the direction of the production manager, who served as the umpire in case of division in the committee. The members of these committees were

given certificates of appointment and badges and every effort was made to have them feel that their position was one of dignity and responsibility; that they represented the Government and were fortunate in having an opportunity to render special service to the Government during the war. Their duties were carefully defined in a letter which was broadly circulated. In the main these duties consisted in discussing ways to better the efficiency of the mine and its equipment, and of the mine workers.

The members of the National Production Committee, in Washington, made every effort to protect mine labor from undue inroads by the selective draft, voluntary enlistment, munition plants, and other war activities. They looked carefully after the needs of the operators as to mine supplies and obtained proper priorities for such materials. They dealt with the railroads in reference to car supply and rendered valuable assistance to power plants selling electricity to the mines. Soldiers who had seen active service and could bring home to the workers the life in the trenches and their relation to it visited hundreds of mining camps and addressed the workmen. A great amount of material, such as posters, poems, etc., that it was thought would appeal to the men and arouse their patriotism, was distributed and personal letters were written to workers who made unusual records.

In many districts, the production managers established the daily tonnage necessary from each mine and had the local production committee accept it as the Government's requirements. This was one of the most stimulating features as it gave the men at the mine a definite goal and they felt that the standard was set by the Government and not by the operator, so the unwillingness to work hard for the operator's benefit was more or less lost. The net result was a very large increase in production.

During the five very active months the National Production Committee spent in Washington, the members came in close contact with hundreds of operators, miners' leaders, and mine workers. All were keenly interested in increased production and frankly expressed their views as to the causes that impeded production and as to the steps that should be taken to increase it. We discussed what we called methods for increased production, but which were really methods of increasing the harmony and co-operation between employer and employee, which is the true basis on which increased production must be built.

Need a Stimulating Ambition in Workmen.

There is undoubtedly throughout the world, as is evidenced by the rise and spread of Bolshevism, a feeling that the good things have not been evenly divided; that some persons have had too much and many others too little. This is true in theory but it is difficult of correction. Doubtless the unequal distribution of wealth is due to the unequal distribution of worth, and until worth is equally distributed there can be no permanent equal distribution of wealth. It

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seems essential, therefore, to make an earnest persistent effort to emphasize the need of worth and to do everything possible to stimulate it. The Bolsheviki are trying to distribute wealth on the basis of might and disaster can be the only result of the effort. Is not the promotion of worth the proper counter-irritant to Bolshevism?

We, operators, as the pace-setters in the coal industry, must do our part. Our workmen must be, much more than ever, a matter of deep concern to us. We must plan well and unselfishly for their general well being and must use every effort to stimulate them to greater efficiency as to labor and to higher ideals as to the proper use of their lives. There must be created an ambition for more comfortable homes, and better food and clothing for themselves, their wives, and their children. The education of their children also must become one of their main desires. Now, their dominating desire is more leisure; fewer hours at work is their goal and increased wages help them to attain it but at the expense of production. This ambition is disadvantageous both to the men and to the operators and the only way to relieve the conditions it produces is by creating new ambitions and aims. A man who needs \$30 a week to live in his accustomed manner and who can earn \$5 per day, will work six days a week. If his earning power is increased to \$7.50 a day, he can earn the \$30 a week necessary by working only four days, so there will be a tendency on his part to decrease his working days from six to four. This is uneconomical for all parties. By stimulating in the man higher aims and ideals, which will require more money for their satisfying, will not only increase his desire to work but will also tend to change his work into service. These aims and ideals will make him feel that his work is not merely dull toil but that it is an honorable means of enabling him to gratify his higher ambitions. The war has paved the way for this work on the part of the operators, for during the past 18 months, as never before, the work of the American workmen has been service in a great cause and now that the thought of work being service is in their minds, every effort should be made to intensify the thought and make it permanent. Surely war conditions cannot be a greater stimulant along this line than can peace conditions.

It is the duty of some one to promptly take this whole matter in hand; and if it is the duty of someone, surely that someone is the employer. He is the one who, by birth, environment, or some special virtue, is the one to whom this should appeal and he is the one best equipped for the leadership. The average workman is not just as we would want him to be, but that is no fault of his. He is the product of his opportunity. If we want him to be better, we must make for him a better opportunity. We get nowhere by complaining or by destructive criticism, but we can accomplish much by putting our shoulders under the wheel and lifting with a true desire to help for unselfish reasons.

If we are to assume this leadership we must first make firm our standing with the men along industrial lines. As yet the men do not feel that we actually owe them anything along the lines mentioned, but they do feel that we have certain industrial obligations. These we must meet and satisfy the men that we are fair employers before we can expect to exert an influence along higher lines. The men now look upon us with suspicion. They feel that we are their enemies, that their best interests conflict with our best interests, and that we constantly try to take advantage

of them. In days gone by, and to some extent today, many employers do try to take advantage of their workmen in an unfair way, so that the workmen are suspicious of all employers.

Industrial Obligations of Employers to Men.

The men feel that there are two industrial obligations on the part of the employer toward them: The first one is that the wages and working conditions, as defined in the scale contracts, must be met. We employers acknowledge this obligation, which is virtually a legal obligation and cannot be shaken off. individual failures. Nevertheless, if deposits so valuable pass into private ownership, there is nothing unreasonable in regarding them as charged with a lien in the form of a demand that a fair share of the profits derived from working them shall inure to the public benefit.

Twenty-five years have seen a great change along this line. Not only do the operators for the most part make an honest effort to abide by the scale agreements but they have set up courts of arbitration so that disputes under the agreements may be adjudicated by an impartial tribunal. The one fly left in the ointment, in this regard, is that very many men feel that the operator bitterly resents being taken before the board and that he will seek revenge against the man who brings the complaint. This feeling does away with much of the real virtue of arbitration. Every operator should make the men feel perfectly free to discuss their grievances with him and, failing to agree, to refer the matter to the board without any prejudice against the workman in days to come. If the operator is conducting his business fairly, he need have no fear of having his work reviewed by an impartial board.

The second industrial obligation that the employee feels should rest on the employer is that of making it possible for the employee to do a day's work when he reports for duty. This obligation the employer has not formally recognized in any way and it is the next step to be taken. We have recognized the first obligation and are very much better off for having done so. We must now formally recognize the second obligation and will be very much better off for doing that also. A new board should be set up or else the powers of the existing board should be broadened so that judgment may be passed as to whether or not the employer has failed in his duty of providing an opportunity to do a day's work. Before this board will come up questions as to whether or not the operator is to blame before a man is passed out, because his place contains water, because there is no timber or cars, and various other obstructions to good working conditions. A man feeling aggrieved along this line should be encouraged to bring the matter to the attention of the board for the effect of having fair judgment passed would be available. No mine foreman want to have an impartial board say that he is conducting the affairs in his mine in an inefficient way, so the very existence of such a board would be a tremendous stimulant to the mine management.

The board, also, should decide whether or not a workman failed in his duty by being absent from his work. There is just as much of a moral obligation on the employee to work, unless prevented by unavoidable causes, when there is an opportunity to do a day's work, as there is on the employer to furnish the opportunity. No good can result if the obligation is placed only on the employer. Both parties interested must share it. With these two obligations

acknowledged, with means provided for adjudicating differences of opinion regarding them, and with the men feeling that they are welcome to bring their complaints, we will have our industrial skirts clean and the decks cleared for active leadership along lines looking toward higher ideals and better manhood.

Obtaining an Equal Distribution of Worth.

We all know the main influences that can be made powerful factors toward a more equal distribution of worth. We must be keenly interested in the home, the school, the church, and all social activities, in fact, in everything going on in the community that has an influence on the lives of the people. Until now our thoughts have centered on material things, on mechanical devices, and along these lines we have made great progress; but we have paid little attention to the social, physical, and moral betterment of our employees. For the most part we have not tried to see that the boys entering our employ each year were better than the boys who entered the year before. We have given little thought to our workmen, excepting as workmen, and even then we have made no effort to teach them what we should. We have complained bitterly of their actions many times and yet have done little or nothing to better their environment and opportunity and to stimulate higher ambitions and ideals. We have engaged a young man as a fireboss, or a pit-boss, and have said to ourselves "That young fellow is a comer. I'll make a real man of him." We should consider each one of our workmen a comer and try to make a man of him. All of this may sound theoretical and impracticable but it is not. It cannot be done in a day or in a year, but it can and must be done if the good things of this world are to be gradually and fairly divided on the basis of worth, and are not to be suddenly and unfairly divided on the basis of might. We, operators, are face to face with a condition that is exceedingly important and serious, and I believe we are strong enough to meet it in the proper way.

During the past eighteen months the President of the United States, in his various addresses and messages, has set up a very high standard. He has given to the world high ideals and every effort must be made to live up to them. The great mass of the people feel, in a hazy way perhaps, that peace is going to bring to the world better conditions; that there will be a more equal division of this world's goods; and that brotherhood will become much more a fact than before. It will be a keen and dangerous disappointment if the President's ideals do not prevail in large measure.

ENCOURAGING PROSPECTORS IN BRITISH COLUMBIA.

That the sum of \$207,523 has been expended by the Provincial Government on aiding in the construction of roads, trails and bridges to mineral claims in British Columbia since the accession to power of the present Administration late in the year 1916 was announced in the British Columbia Legislature the other day by the Hon. Wm. Sloan, Minister of Mines. He explained that originally the vote for this purpose was \$200,000, which sum had been supplemented during the session of 1918-19 by \$75,000.

It is pointed out, in this connection, that the Government has adhered to its policy of encouraging the development of promising mineral deposits by assisting in the provision of transportation facilities ever since it was returned to office by the country. Since

January 1st, 1917, there have been built ninety-eighth and seven-eighths miles of mining roads; seventy-five and five-sixths miles of mining trails; and there have been repaired 437 $\frac{1}{4}$ miles of mining roads and 420 $\frac{1}{4}$ miles of mining trails. These roads and trails, it is explained, all were of such a character as to be of service, almost solely, to mines in the first stages of development, or claims on which work was proposed, and which were sufficiently encouraging in their prospects to warrant the expenditures. Under the terms of the "Mineral Survey & Development Act," which provides the Government power to extend the help indicated, the Government mining engineers, on receiving applications for aid in the building of roads or trails, must visit the district or the property it is intended to open up and make a report on the same. If their reports are favorable, showing that in their opinion the claims to be assisted are worthy of the same, the Minister of Mines may authorize the expenditure of 50 per cent. of the estimated cost.

Details of the expenditure along these lines during 1917 and 1918 are as follows:

"1. Total expenditure, \$207,523.34.

"2. Alberni; Marble Cove Group, Copper Island, \$500; Columbia Mines, Sproat Lake, \$500; Canadian Mineral Claims, \$500; Victoria Group of Mineral Claims, \$200; Great Central Lake to Big Interior, \$200; Monitor Group Trail, \$500; Black Prince No. 2 Trail and bridge, \$225.

'Atlin: Esperanza Group, Alice Arm, \$367; Bush Mines, Salmon Bear River Co., \$5,000; Salmon River Wagon-road, \$7,500; Georgia River Trail, \$1,500; George Copper Mines, \$500; Grey Copper Group, Bear River, \$150; La Rose Mine Trail, \$600; Maid of Erin Group, Rainy Hollow, \$635.50.

"Cariboo: Proserpine Mount Mines, \$500; Killam Cement Gravel Mines, \$1,032.15; Upper Horsefly Road, \$1,569.

"Columbia: Bugaboo Trail, \$75; Brisco No. 3 Creek, \$91.33; Boulder Creek to Siting Bull, \$1.130; Boulder Creek to Relief Mines, \$150; Boulder Creek to Pretty Girl Mine, \$150; Brisco to Lead Queen, No. 3 Creek, \$1,200; Canyon Creek Trail, \$55; Canyon Creek Trail to 15-Mile Creek, \$225; Giant Mine Road, \$8.50; Horse Thief Creek to Mabel Road, \$200; Horse Thief Road to Gallop Mines, \$98; Paradise Mine Road, \$109; Paradise Mine Bridges, \$700; Spilimacheen Road to Warren Creek, \$225; Tennessee and Tarheel Mines, \$100; Toby Creek Cut-off, \$11.500; Toby Creek Road, \$422.01; Toby Road above 11-Mile, \$600; I.XL. Condor Mines, \$30; Four-foot Trail above 11-Mile Post, Toby Creek, \$500; Trojan Copper Mines Sleigh Road, \$4,000; Carbonate Spruce Camp Bridge, \$300; Carbonate Spruce Camp Trail, \$200; Lead Queen Sleigh Road, Francis Creek, \$1,050; Bugaboo Creek Trail (Mercier's), \$50; Fred Ball's Trail, Mineral Creek, \$250; Gallop's Claim, Horse Thief Creek, \$298.

"Comox: Valdes Island Copper Mines, \$3,000; Vantbert and Ophir Mines, \$250; Blue Bell Mine Trail, \$50.

"Cowichan: Blue Grouse Mines, \$1,023.50; Jubilee Mines to Cowie Mineral Claims, \$270.08; Robertson Silver Mines, \$475.

"Cranbrook: Dibble Mine Trail, Fort Steele, \$75; Society Girl Mine, \$50; North Star Mine, \$150.

"Dewdney: Molybdenum Stave River Pack Trail, \$300; Esquimalt: Section 93, East Sooke, \$4,625; Leach River Trail, \$300; Sunloch Mines, Jordan River, \$7,500; McDonald Creek Bridge, \$200; Sooke Lake, Leach and Phillips, \$265.

"Fernie: Burton Mine, Elko, \$1,000.

"Grand Forks: Paulson-Christina Lake, \$2,500; Tursig Claim, Norway Mountain, \$200; Paulson-Molly Gibson Mine, \$150; Galloping Mountain Trail, \$2,600; Rock Candy Group, \$3,000; Gloucester Group, Maple Leaf Claim, \$1,200.

"Greenwood: Big Copper and King Solomon Mines (trail to First Chance, Jim Hill, and St. Paul Mines; see Galloping Mountain, Grand Forks), \$200; B. C. Mine to Junction, \$150; Providence Mine Road, \$100; Enterprise Mine Road, \$100; Standard Fraction Claims, \$400; Castor Fraction Claims, \$101.37.

"Kamloops: Dunn Creek, Windpass Group, \$300; Lydia Group, Canyon Creek, \$800; Copper King and McLeod Group, Seymour Road, \$3,000; Seymour River Bridge, \$1,000.

"Kaslo: Cork Mine, South Fork Road, \$2,500; Circle City, Elsmere Group, \$500; Levina-Butte Trail, \$200; Howser-Argenta Road, \$2,500; Cultus Creek \$1,500; Eden and Crescent Mines, Coffee Creek, \$2,500; Jackson's Wagon-road, \$2,000; Bayonne Camp, Sheep Creek, \$100; Bannockburn Camp, Hall Creek, \$900; Lincoln Group, Spring Creek, \$100; Ainsworth Road, \$5,000; Tenderfoot Bridge (Porter), \$750.

"Lillooet: Sucker's Hill, Bridge River Road, \$1,000; Hautier Line, Texas Creek, \$125; Gun Creek to Copper Mountain, \$2,500; Timothy Mountain Trail, \$300; Shalath Siding, Bridge River, \$362.50.

"North Vancouver: Bowen Mines, Dorman's Ranch, \$100; Indian River Trail Bridges, \$3,000; Squamish-Summit Trail, \$100; Sun Group Trail, \$1,554.37; Mamquam River Trail, \$255; Tonquillo Creek Trail, \$1,000.

"Newcastle: Majuba Trail and Sutton Trail, \$400.

"Omineca: Road to Babine Bonanza Mining & Milling Company, \$150 and \$15,674; Dockrill Road, Howison Creek Mines, \$21,600; Delta Copper Mines, \$750; Hudson Bay Mountain Coronado Group, \$200; Nine-

mile Mountain Road, \$2,500; Ashman's Coal Property Road, \$500; Quartz Creek Trail, \$250; Hudson Bay Mountain Sleigh Road, \$4,000; Shaefer, Wood, Anderson Claim, \$500.

"Prince Rupert: Drum Lummon Mines, \$1,250; Pacific International Copper Company's Trail, \$1,500; Tuttle's Account, Legate Creek, \$500; Golden Wonder Mine, \$125; Chindemash River Pack Trail, \$100.

"Revelstoke: North Road Big Bend Trail, \$17,000; Woolsey Group, Silver Creek, \$2,300; Fish Creek Trail (Stuart), \$150; Mastodon Mine Trail, \$1,500; Mountain Chief Mine, \$750.

"Rossland: Burlington and Anaconda Mines, \$1,000.

"Similkameen: Red Star Mineral Claims, \$100; Oregon Group Trail, Hedley, \$250; Princeton-Copper Mountain, \$1,000; Summit Camp Trail, \$200; Coalmont to Tulameen, Granite Creek, \$350; Tulameen River Bridge, \$500; Pack Bridge, Champion Creek, \$550; Treasure Mountain Group Trail, \$50.

"Slocan: Carnation Mine Trail, \$300; Echo Mine Road, \$2,434; Silvertown-Four-mile Road, \$1,500; Elkhorn Mine Railway Siding, Sandon, \$1,000; Ten-mile Creek Road, \$500; Springer Creek Road, \$500; Millie Mack Trail, \$450; Sand Creek, Lighting Peak Trail, \$107.25; Sovereign Mine Road, \$483.48; Arlington Mine Road, \$200; Victor No. 6 Mineral Claim, near Sandon, \$80.

"Trail: Gordon Group Trail, \$187; Headland Trail, \$153.70; Lost Creek Trail, \$520.95; Wild Horse, \$100; Ore Hill Road to Sheep Creek, \$450; Reno Trail, Downey Brook Group, \$500; Eureka Mine Road, \$525; Noonday Group Trail, \$375; 49-creek Road, Gold Hill Group, \$200; Aspen Mine Trail, Deer Creek, \$350; Hall Creek to Copper Mountain, \$100; Southern Bell Mine Trail, \$200; May and Jennie Mill, \$50.

Industry Must Bear the Cost of the War*

By D. B. DOWLING.

We rejoice that we are able to welcome many who have returned from the scenes of their brilliant exploits on the western battle front and to have the assurance that soon the remainder will be coming home. It is gratifying to know that our engineers have demonstrated their heroism, tenacity, skill and ability to construct military works or to take part in operations which showed their great adaptability and initiative. We rejoice also to know that the fire of patriotism burns as hotly in the breasts of the mining engineers and miners as in any class, and that their wish to participate was only checked by the absolute need of the nation for their services to help provide fuel and material for munitions.

With the present meeting the Canadian Mining Institute attains its majority. The event occurs at a momentous period in the history of Canada. We have completed a campaign in which Canada has shown her virility as a belligerent nation. She has now to show her ability to recuperate under very trying conditions and for the first time without help outside

her own resources. As a new nation in the British Empire, our cousins and neighbors have shown that we are accepted in their affections in a somewhat more intimate association, a relationship which may be likened more to that of brotherhood. The Joint Meeting of the American Institute of Mining Engineers with the Canadian Mining Institute, held in New York in February, has shown the close bond of sympathy that exists and we are glad in turn to welcome them at our meeting and with them rejoice at the successful termination of the war.

We meet together to celebrate the coming of age of the Institute. From small beginnings it has grown to be representative of the mining engineers and the mining skill of Canada. Our doors are opened wide to those whose study or experience makes them an asset to Canada in the working out of the problems that are to be met with in the proper utilization of mineral resources. As an Institute we have reached our majority at a time when our responsibilities have greatly increased over pre-war conditions.

As a people we have a debt to pay and we must realize that **it must be by industry**. The proper utilization of labor, to gain the maximum return for the nation,

*Presidential address, Montreal Meeting Canadian Mining Institute, March 5, 1919.

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must be the great problem of the future. **Our self-evident fact that seems to be worth our earnest consideration is that unskilled labor produces the smallest return. To make us efficient, technical education in all lines should have a prominent place.**

To many of the nations of the old world the scope of labor is restricted; to some the production of food and clothing is the main avenue; to others the possession of fuel has opened the way to manufacturing; while some of the small states depend on the production of the various raw materials. The depletion of national assets is greatest when the production consists of mineral materials alone, less where manufacturing is the main industry, and least where the products of the soil are the commercial assets.

The depletion of national resources is one of the serious problems facing the nations of Europe and is the cause of much of the insecurity felt by the smaller powers. The large organized powers have cast covetous eyes on the mineral riches of their weaker neighbors—the plea for a place in the sun advanced by Germany being merely an excuse to rob her neighbors, since the outer world seemed pre-empted. The close of the war renews the economic strife to maintain manufacturing supremacy, and with it the attempt to conserve raw materials within and for each nation. Those not favored by trade and manufacturing advantages will find large outside markets for their resources. This opportunity will be offered to Canada, but if we are to build up a self-sustaining country our known ability to provide foodstuff for a very much larger population should be taken advantage of along with our natural power resources to foster many other industries.

We are happily situated. We do not find ourselves restricted as to our agricultural products, and happily

for us the revenue derived from the products of agriculture forms a large addition to our income without a corresponding depletion of our assets. For manufacturing we have large sources of power from fuel and waterfall. The natural power is one of our greatest assets and its utilization like the production of food is not a charge against our resources.

Our highest aims economically should therefore be to develop our basic industries, notably agriculture and mining and also our manufacturing, which in turn will provide our own markets for raw materials. Following our arguments, the manufacture of foreign raw materials may be of advantage, as has been found in England, but we must remember that very soon the purchase of foreign unmanufactured articles will become increasingly more difficult so that without a domestic supply there will be a restriction of activity and there would probably set in a tide of emigration to other centres of population.

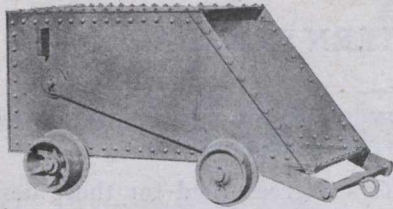
Our mining interests will always have markets for their products, but it seems desirable that these products be utilized at home. Many of our resources of the less precious materials have been neglected and Canada has spent vast amounts to keep foreign labor employed, when the materials could be fabricated at home.

The return of the army has been considered as a labor problem and the attention of private and governmental committees will be centered upon placing this body of men at remunerative work as quickly as possible. This may artificially stimulate the manufacturing industry, but to maintain the economic equilibrium agriculture and mining must also be fostered. To keep up the supply of raw materials for the many industrials in existence and to provide material for other possible ones will be a national obligation. The responsibility lies very heavily on the members of the Canadian Mining Institute; on the mining engineer to economically and safely recover the mineral riches; on the prospector to test and examine our prospective ore bearing areas; and on the explorer and geologist to examine the larger regions and show the way by maps and reports to the additional possible areas or to call attention to new minerals and their possible use in the arts or manufactures.

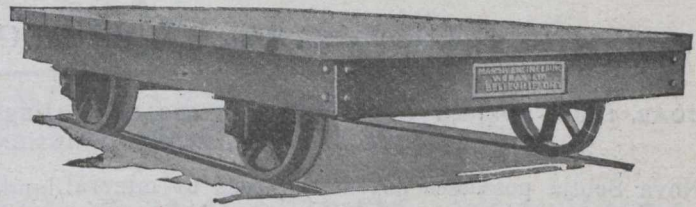
We know that our public men are alive to the needs of the country during the constructive period; but they require the help of everyone in forwarding their projects. To encourage prospecting when mineral prices fall is no easy matter. Help may come from an unconsidered source. The chemical industry or the metallurgical industry may send out the call for material that the prospector may readily find. The various governments are no doubt considering possible schemes for the encouragement of prospecting^{1/4} but the burden of a general exploration of the country has long been on the Federal Government and very much of the success of this work must be credited to the Geological Survey. During the war many of the staff have been employed overseas, and the efforts of the rest turned to work, more or less directly connected with the supply of munitions. Now, with their return, an enlarged programme is being arranged and this is facilitated by the fact that the Minister of Mines is fully alive to the need of the many interests.

In closing it is with a great deal of pleasure that your President can assure the Institute that the publications of the Department of Mines will in future be facilitated by the personal attention of the Minister of Mines, the Honorable Martin Burrell.

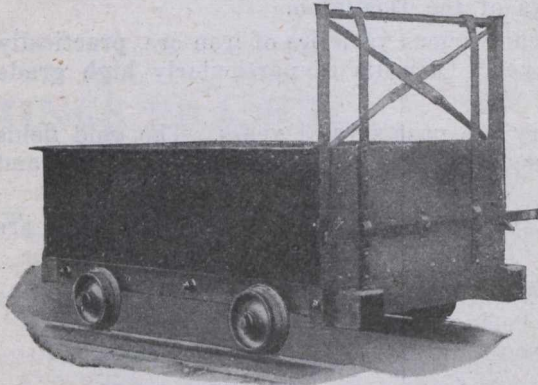
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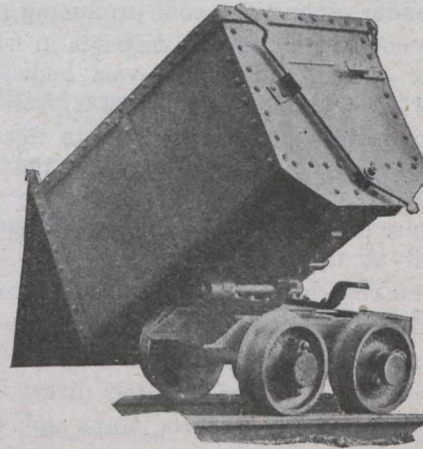
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Shipments to Trail Still Large.

Considering the unsettled state of the metal market since the armistice, and the total lack of market of any kind for lead and copper, and practically the same condition affecting spelter, the showing of ore shipments to the Trail Smeltery for the first two months of 1919 is very satisfactory, 65,733 tons of ore and concentrates having been received in that time. This is even more than it was over the same period of 1919 when the total was 61,393 tons. A year ago, however, Trail was just recovering from the smeltermen's strike of five weeks, so that the 1919 total for the first two months may more properly be compared with the first two months of 1917, when ore shipments reached 77,537 tons. There were then no ripples on the horizon so far as the metal market is concerned and the war demand from overseas was most insistent.

The Minerals of Nova Scotia

THE MINERAL PROVINCE OF EASTERN CANADA

COAL, IRON, COPPER, GOLD, LEAD, SILVER, MANGANESE, GYPSUM, BARYTES, TUNGSTEN, ANTIMONY, GRAPHITE, ARSENIC, MINERAL PIGMENTS, DIATOMACEOUS EARTH.

Nova Scotia possesses extensive areas of mineral lands and offers a great field for those desirous of investment.

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

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

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

Gypsum Enormous beds of gypsum of a very pure quality and frequently 100 feet thickness, are situated at the water's edge.

High grade cement making materials have been discovered in favorable situations for shipping.

Government core-drills can be had from the department for boring operations.

The available streams of Nova Scotia can supply at least 500,000 h.p. for industrial purposes.

Prospecting and Mining Rights are granted direct from the Crown on very favorable terms.

Copies of the Mining Law, Mines Reports, Maps and other Literature may be had free on application to

HON. E. H. ARMSTRONG, - HALIFAX, N.S.

Commissioner of Public Works and Mines



PROVINCE OF QUEBEC MINES BRANCH

Department of Colonization, Mines and Fisheries

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

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

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

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

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

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

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

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

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

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

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

HONOURABLE HONORE MERCIER,
MINISTER OF COLONIZATION, MINES AND FISHERIES, QUEBEC.

CANADA

DEPARTMENT OF MINES

HON. MARTIN BURRELL, *Minister* R. G. McCONNELL, *Deputy Minister*

MINES BRANCH

Recent Publications

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

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

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

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

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

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

Occurrences and Testing of Foundry Moulding Sands. Bulletin No. 21, by L. H. Cole, B.Sc.

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

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

Summary Report of the Mines Branch, 1917.

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

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

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

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

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

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

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

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

GEOLOGICAL SURVEY

Recent Publications

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

Memoir 95. Onaping Map-Area, by W. H. Collins.

Memoir 98. Magnesite Deposits of Grenville District, Argenteuil County, Quebec, by M. E. Wilson.

Memoir. 101. Pleistocene and recent deposits in the vicinity of Ottawa, with a description of the soils, by W. A. Johnston.

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

Memoir 106. Road materials in a portion of Vaudreuil county, Quebec, and along the St. Lawrence river from Quebec boundary to Cardinal, Ontario, by R. H. Picher.

Map 63A. Moncton Sheet, Westmoreland and Albert Counties, New Brunswick. Topography.

Map 132A. Southwestern portion of Rainy River district, Ontario. Soils.

Map 135A. Lower Churchill river, Manitoba. Geology.

Map 145A. Timiskaming county, Quebec. Geology.

Map 154A. Southwestern Yukon.

Map 157A. East Sooke, Vancouver Island, British Columbia. Topography.

Map 165A. Windermere, Kooteney district, B.C. Topography.

Map 174A. Blairmore, Alberta. Topography.

Map 179A. Onaping; Sudbury and Timiskaming districts, Ont. Geology.

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

Maps 1697 and 1698. Explored routes in a belt traversed by the Canadian Northern Ontario railway.—in two sheets: Sheet 1 Gogama to Missonga, Sudbury district; Sheet 2 Oatland to Penhurst, Algoma district, Ontario.

Map 1690. Whiteburn Gold District, N.S. Geology.

Map 1702. Klotassin, Yukon Territory. Geology.

Map 1710. Bothwell-Thamesville oil region, Kent county, Ontario.

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

Map 1714. The Niagara peninsula, Ontario. Geology.

Map 1715. The Ontario peninsula. Geology.

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

Maps published within recent years may be had, printed on linen, at the nominal cost of ten cents each.

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

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

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Aggregate Value of \$595,571,107

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

Production During last ten years, \$296,044,925

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

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

Mineral locations are granted to discoverers for nominal fees.

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

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Alfred R. Whitman

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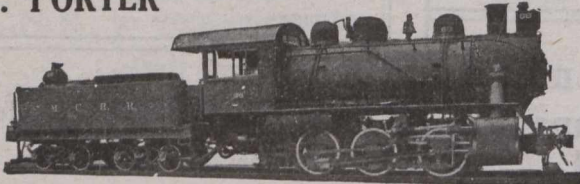
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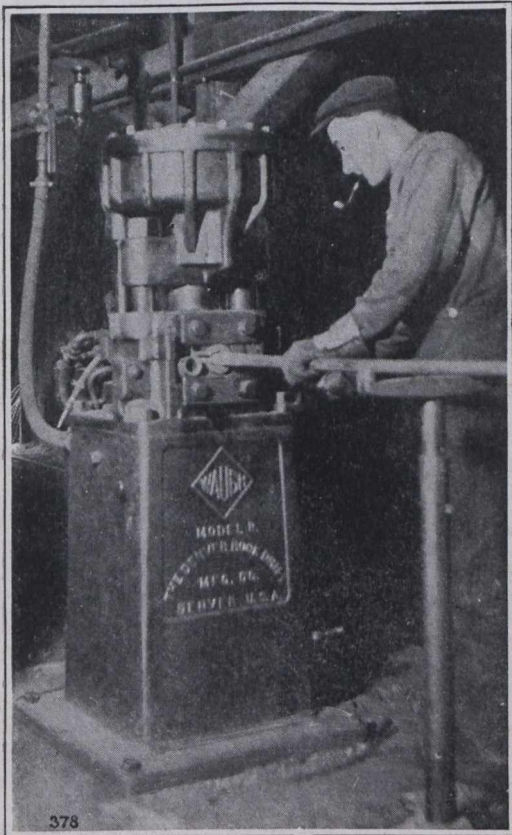
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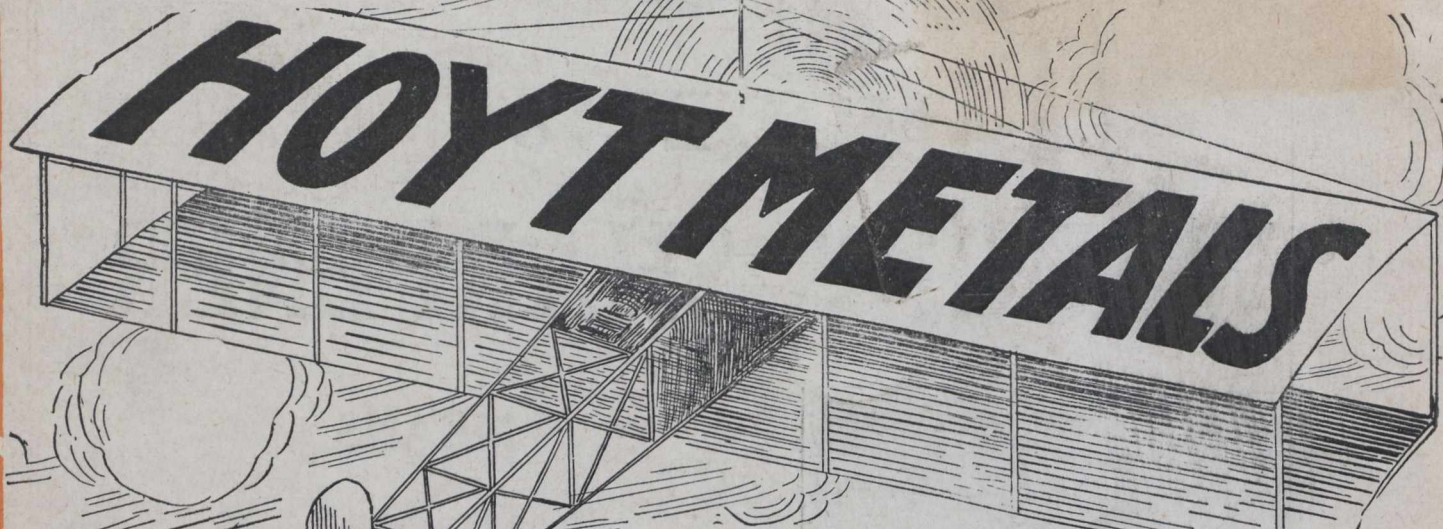
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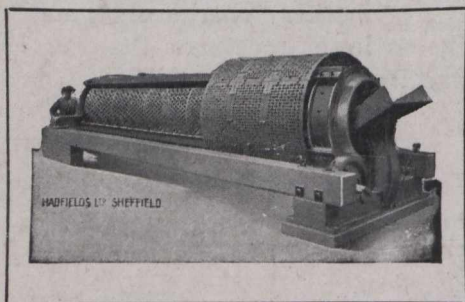
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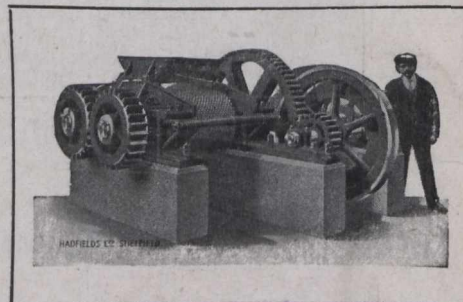
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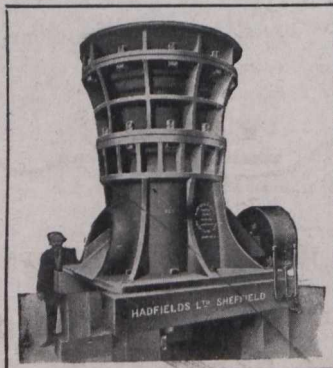
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