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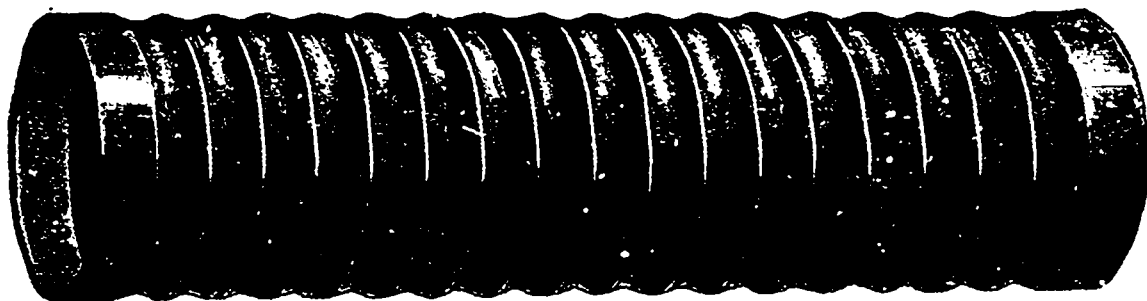


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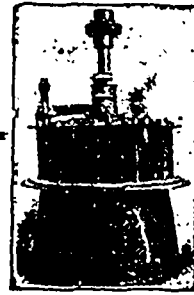
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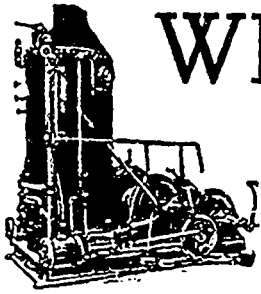
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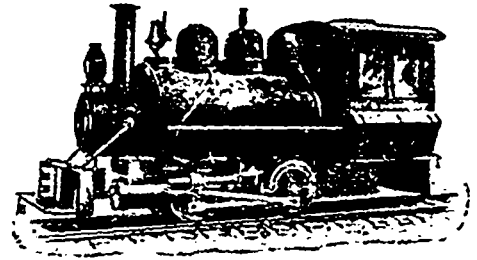
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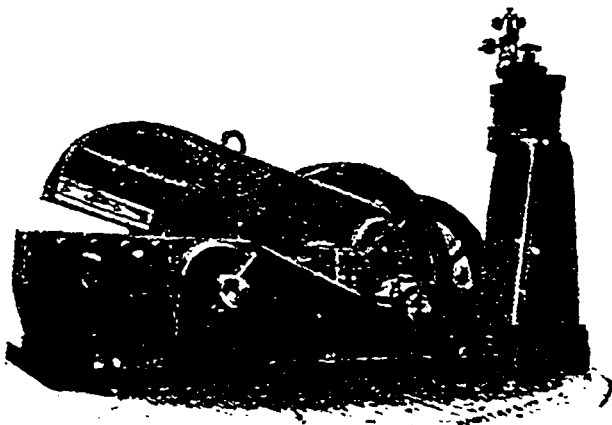
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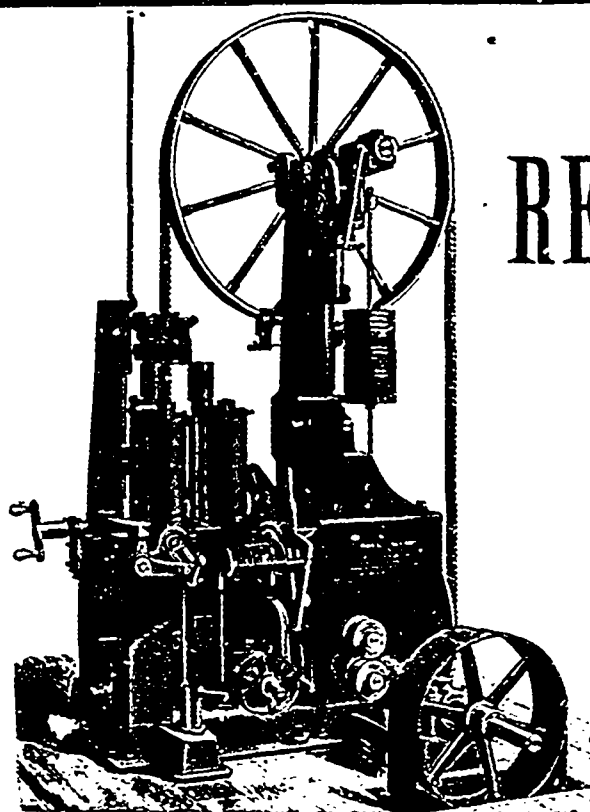
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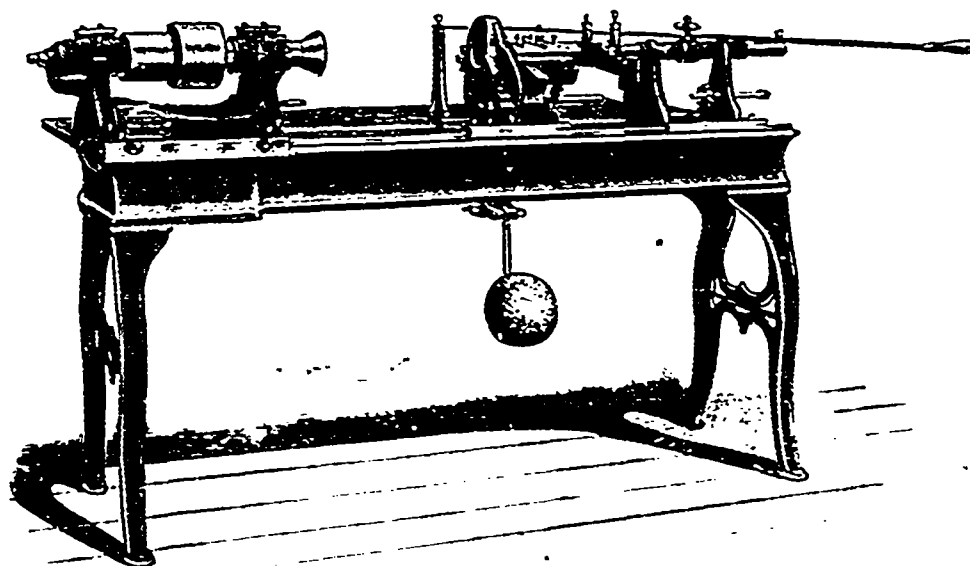
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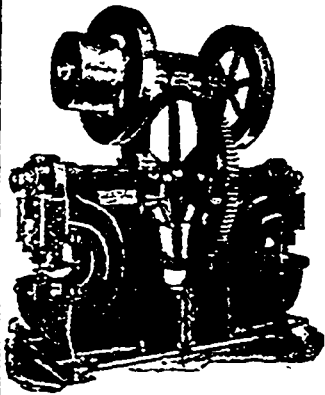
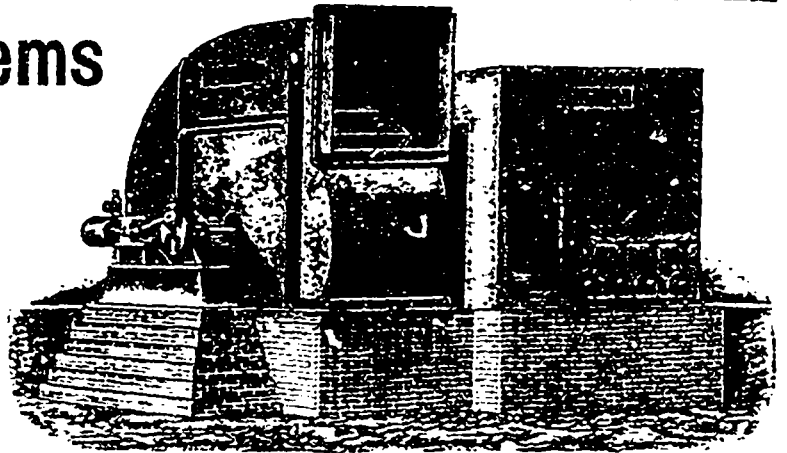
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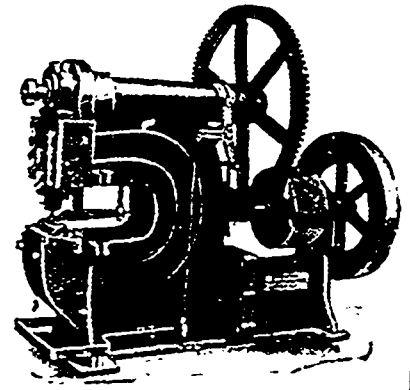
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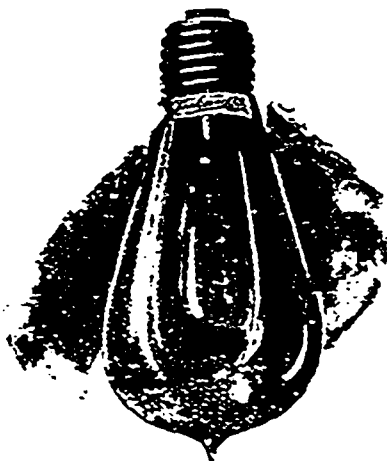
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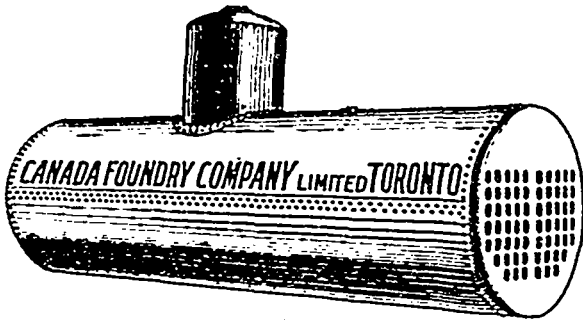
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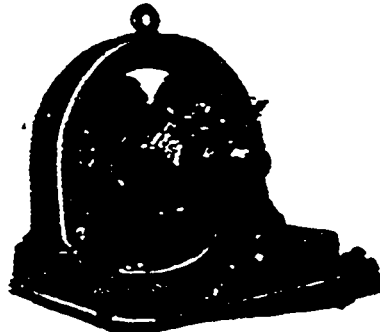
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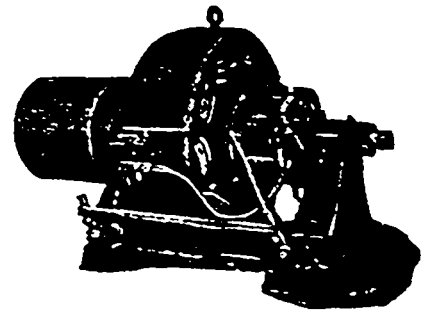


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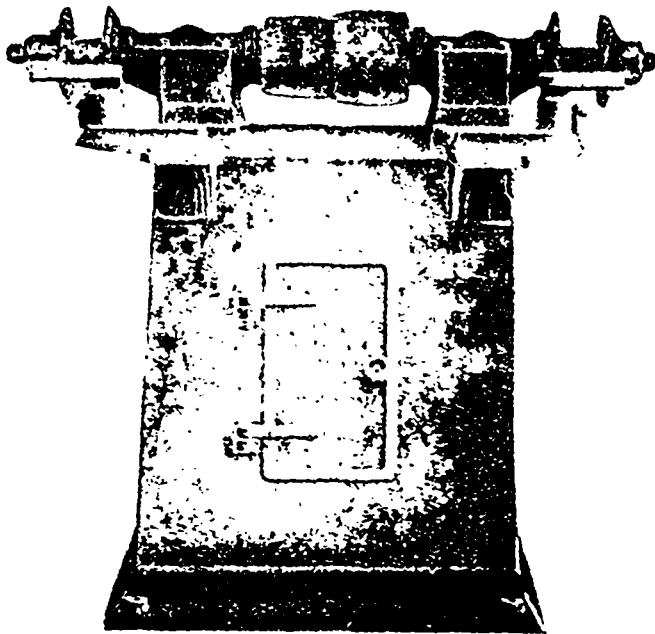
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# THE CANADIAN MANUFACTURER

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## MOLYBDENUM.

A very large proportion of the world's supply of nickel is produced in Canada. At the time of the discovery of the vast deposits in the Sudbury region of Ontario, the production of refined nickel in the United States amounted to only about two hundred tons a year, a quantity barely sufficient to supply the demand of the United States Government in the manufacture of a subsidiary coin of the value of five cents, hence the common name attaching to it. About the time of the discovery of the Sudbury deposits it was also discovered that in the manufacture of armor plate for war ships, and for other purposes, the admixture of a small quantity of nickel rendered the metal much tougher, adding a quality of invulnerability which they did not before possess. The United States Government were quick to see the value of nickel in the manufacture of armor plates. A commission of scientists and experts were sent to the Ontario nickel deposits to investigate the value and extent of them, with the result that that Government now obtain from that source all of that metal they require. There is only one other similarly large deposit of nickel known to the world, although nickel is found in small quantities in some countries. It was esteemed a wonderful thing, and of the greatest advantage in the manufacture of armor plates that the dead weight of war ships were required to support; and now armor of infinitely greater resisting power is being used than that which protected ships only a few years ago. With the advent of nickel-steel armor, which was then able to successfully resist the destructive effects of the shot and shells in use in those days, the invention of both guns and projectiles of much greater power were invented. To successfully resist these improved projectiles, armor plates of yet greater resisting power must be had, but from where, and of what material? It is improbable that the increased resisting power can be obtained by increasing the thickness of the armor, for the average war ship is already handicapped by the decreased buoyancy, and any further decrease of buoyancy caused by the increase of weight of armor cannot be allowed.

As Canada produces an unlimited supply of nickel for the manufacture of armor plate, which does not now possess the resisting and defensive effect that it once had, even so Canada seems to possess in abundance a metal which will by proper

admixture with steel, produce an article which will admit of the reduction of weight and increase of resisting power of such armor. That material is molybdenite.

According to the 1902 report of the Ontario Bureau of Mines, molybdenite is alluded to, in which is published a synopsis of a paper read by Mr. S. Dillon Mills, M.E., of Toronto, before the Canadian Institute, who had examined some deposits of ore found in the Haliburton district of Ontario. Mr. Mills said:

"This ore is a bi-sulphide with the following composition: Molybdenum, 59.6 per cent.; sulphur, 40.4 per cent.; specific gravity 4.45; crystalline system hexagonal. It occurs mostly in the form of plates of differing sizes and thicknesses, varying from mere scales up to plates ten inches or more in diameter, and up to an inch in thickness. It is foliated like some graphite, but may be distinguished from the latter by the peculiar steel-blue tinge noticeable in freshly split folia. The specific gravity, as above given, is nearly double that of graphite, being 2.25. Molybdenum also occurs as a molybdate of lead, commonly known as wulfenite, the composition of which is molybdic trioxide, 34.25 per cent.; lead protoxide, 64.42 per cent.; equal to about 22.5 per cent. of molybdenum; and as molybdic ochres, containing the molybdic trioxide in a condition of greater or less purity. When pure the trioxide contains 65.7 per cent. molybdenum. There are a few other minerals which contain molybdenum, but they are of minor importance."

Molybdenum-steel tools possess the quality of cutting ribbons from steel bars with ease, and it cuts the bar as readily when it is red-hot as when it is cold, and when the tool is once tempered, it retains its temper under all circumstances. Some years ago it was thought that molybdenum was used at the Krupp works, in Germany, for the manufacture of a steel alloy for armor plates, along with tungsten and some other of the rarer metals; and in 1895 experiments were made at the Creusot works, in France, with the result that armor plate of excellent quality was obtained with 2 or 3 per cent. of molybdenum, and the same amount of chromium. The interest now excited in ores of molybdenum arises from its recent application to the production of a peculiar high-grade steel, a matter which, like many others, has been rendered possible by recent advances in electro-metallurgy, with the result that molybdenite has emerged from its position of comparative obscurity as a rare mineralogical specimen, and become an article of great commercial value. The output of ferromolybdenum in the United States in 1899 was 30,000 pounds,



and in 1900, about 32,000 pounds, a bagatelle of only about 15 to 16 tons.

The uses for which molybdenite is in demand includes the manufacture of armor plate, crucibles, self-hardening tool steel, coating cartridges for rapid-fire guns, the manufacture of heavy artillery, and the manufacture of jewelry. As a lubricator for diminishing friction in machinery and preventing hot boxes, it probably has no equal. Molybdic acid, a product of molybdenite, is valued by wholesale druggists at 55 cents per ounce, and molybdenum powder is quoted at \$2.62 per kilogram, or \$2,380 per ton. Ninety-five per cent. molybdenum electrol is valued at \$15.47 per 100 grammes, or \$77 per pound or \$154,000 per ton. It is also used in a preparation for coloring porcelain and in the manufacture of certain chemical re-agents, especially of ammonium molybdate, which is used in the determination of phosphoric acid. It is of the greatest value for packing for fire-proof safes, not being affected by heat. Because of the scarcity, heretofore, of a practically pure quality of the article, it could not be supplied in sufficient quantities for all commercial demands. Appreciation of the rarity of molybdenite may be had when it is considered that it has been found in only a few places in the world besides Canada, chiefly in Sweden, Norway, Bohemia, Saxony and Australia. The average assay of the molybdenite ores found in Canada show 52 per cent. pure molybdenite and 48 per cent. sulphur.

When nickel was first discovered in Ontario, although the intrinsic value of the metal was well known, without any effort whatever on the part of the Canadian or the British Governments to secure the control of the deposits, they passed into the possession of United States capitalists and corporations, and now the British Government is obliged to pay to American and French holders whatever they may demand for their requirements of nickel in the manufacture of armor plates and heavy guns; and British manufacturers generally find themselves in similar fix. Fortunately Canada possesses the largest and most valuable deposits of corundum known to the world, and equally fortunate for the country these deposits are owned and operated by Canadians.

How about molybdenum? The largest and most valuable deposits of molybdenum known to the world are in Canada. For many manufacturing purposes it is, as we have shown, simply invaluable. The country that controls the Canadian supply could dominate the world in the production of armor plates, cannon, marine and other machinery, the manufacture of iron and steel working machines, and a thousand other things where strength, lightness and durability are required. Canada and Great Britain may in the not far distant future, have occasion to most bitterly regret the lost opportunity, but they should not be surprised to see these large Canadian deposits of molybdenum pass into the control of that most wide-awake and warlike nation, Japan. Ontario has placed two million dollars to the credit of the new Lake Superior Corporation which is being equipped with the best and most up-to-date machinery for the manufacture of steel in many of its most important forms, into which it does not appear that molybdenum enters. Why not? The new steel plant at Sydney, N.S., is being equipped in the same manner, but not to make molybdenum steel. Why not?

#### STEEL BY ELECTRICITY.

This subject is attracting attention from new sources.

An interesting paper was lately read by P. M. Bennie before the Foundrymen's Association at Philadelphia and reported by The Iron Trade Review.

Although in Canada there are good iron ores, the country is backward in metallurgical industry, owing, it is said, to scarcity of fuel.

But if such is the case, there are numbers of water powers which can produce electric energy cheaply and on a large scale, and now that public attention is being directed to it we may hope that, by the aid of capital, successful enterprises will be started which will render valuable both our ores and our water powers.

Mr. Bennie says: The application of the electric furnace to iron and steel production has made greater progress in Europe than in America. In Alpine, France, Switzerland and Italy the existence of abundant water powers which could be developed at low cost, greatly assisted the growth of electrical industry. The art of electro-metallurgy, although still young, has progressed so rapidly in recent years that it may justly be said to have passed its youth and entered upon a vigorous career. It is now being diversified and developed along specific lines for specific purposes.

Mr. Bennie divides the application of electrically generated heat for iron metallurgy into four classes, namely:

1. Treatment of molten pig iron as it comes direct from the blast furnace for the purpose of refining and converting it into steel of certain grades, which may be called the electro refining of steel.

2. The treatment of cold pig iron or a mixture of pig and suitable scrap to produce steel.

3. Direct reduction of iron from its ores and subsequent refinement into steel beginning with raw ores, which is the most important if it can be done economically, but to do this on a commercial scale requires very cheap and pure ores, and water power of at least 10,000 h.p. capacity capable of being developed for the production of electricity at low cost.

4. Production of various ferro-alloys, either by starting with iron ores and ores of the metal to be alloyed, or starting with a mixture of pig iron and minerals to be reduced and alloyed therewith.

The first of these methods can be used as an adjunct to blast furnace working, the second partially so, while the third and fourth are entirely independent.

Excellent steel, equal to crucible steel, has been made by Kjellin's electric furnace in Sweden from pig iron and scrap, but the efficiency of this furnace seems to be rather low and capable of improvement.

The Electrical World says that a patent has recently been granted to G. P. Schneider, of Le Crusot, France, which contains improvements, and his specifications give interesting suggestions concerning the application of the electric induction furnace not as a substitute for, but in combination with ordinary metallurgical furnaces, quite a promising field of usefulness.

In the same line is the suggestion of Dr. Richards, President of the American Electro-Chemical Society, of the auxiliary use of electric heating to take off "the peak of the load," so to speak, in open hearth steel furnaces, that is, to furnish the last few hundred degrees of necessary temperature while the combustion of gas furnishes the lower range.

The Engineering and Mining Journal of May 26 contains a note in which some figures are given as to the cost of producing steel by Keller's electric furnace at Livet, France, which are surprisingly low and indicate marked advances over previous trials. Mr. Bennie says this is to be expected with greater experience and skill in operating, which will come with time as will other economies, his conclusion being that "the electro-metallurgy of iron and steel has already left the domain of the laboratory and experimental plant and taken on the serious aspect of an established industry."

The production of ferro-alloys has made most progress, having been in practice for some time and is of undoubted value, these alloys being produced by electricity much more efficiently than by other methods.

The chief of these are ferro-silicon, having a high percentage of silicon, ferro-manganese, ferro-chromium, and ferro-alloys of titanium, tungsten and molybdenum. This latter mineral in the shape of molybdenite is found in many places in Canada. It is a most valuable mineral and can be used instead of tungsten for making specially high grade tool steel, and is as efficient as double the amount of tungsten.

Prices of these special steels are quoted as follows in New York, wholesale :

Ferro-tungsten (37 per cent. tungsten).....	38c per lb.
Ferro-molybdenum (50 per cent. molybdenum). \$1.25	“
Ferro-titanium (10 per cent.).....	90c “
“ (20 to 25 per cent.).....	55c “

#### THE UNION LABEL BILL.

Mr. Ralph Smith, M.P., of Vancouver, B.C., has introduced in the Dominion House of Commons a bill entitled “An Act Respecting Labor Union Labels,” which is now under consideration in that body. It is recited in the bill that the expression “labor union” means any and every association of working men and women. The expression “label” means a label, trade mark, term, design, word, letter, emblem, figure, sign, seal, stamp, diagram, ticket, device or form of advertisement registered in accordance with the provision of the proposed Act.

Only two arguments are advanced in favor of the bill, (1) to prevent manufacturers using the label who are not entitled to it; (2) that it tends to favor higher wages as against low wages. The bill provides as follows :

Every labor union which before the passing of the Act has adopted or used, or which hereafter adopts and uses a label to designate, make known or distinguish any goods, wares, merchandise or other product of labor as having been made, manufactured, produced, prepared, packed, handled or put on sale by such labor union, or by a member or members thereof, may register such label in the Department of Agriculture by leaving two copies thereof with the Minister or his deputy, along with one application for the registration of the label, and by filing therewith a declaration made by the president, secretary or other officer of such labor union, specifying the name of the labor union on behalf of which such label is being registered, the class of merchandise and a description of the goods to which it has been or is intended to be appropriated, and stating that, to the best of his knowledge, information and belief, the labor union on behalf of which the application for registration is being made has the right to use the same, that no other person, firm, labor union, association or corporation has the right to such use, either in the identical form or in any such near resemblance thereto as may be calculated to deceive, and that the facsimiles or counterparts are true and correct; and, thereafter such labor union shall have the exclusive right to use such label for the purposes aforesaid.

The Deputy Minister shall deliver to the labor union so registering a certificate of such registration to the effect that such label has been duly registered in accordance with the Act, and such certificate shall have attached to or incorporated with it a copy, counterpart or facsimile of such label, and shall also set forth the day, month and year of the entry thereof in the proper register; the name of the labor union registering such label, the number of such label and the number or letter employed to denote or correspond to the registration; and such certificate in the absence of proof to the contrary, shall be sufficient proof in all Courts in Canada of the label, of its adoption by the labor union, of the name of the labor union, of the registration, of the commencement and term of registry, of the labor union named being the owner or proprietor of the label, and of compliance with the provisions of this Act; and,

generally, the writing purporting to be so signed shall be received as *prima facie* evidence of the facts therein stated without proof of the signature of the officer signing the same.

The Deputy Minister shall not record for any person, firm, or labor union, association or corporation any label that might possibly be mistaken for one already registered by or on behalf of any labor union.

Any labor union that has registered a label may petition for the cancellation of the same, and the Deputy Minister on receiving such petition may cause the said label to be so cancelled, and the same shall be considered void and of no effect after such cancellation.

Every such labor union may, if at any time it becomes merged in or affiliated with any other labor union, serve the Deputy Minister with notice of the fact and of its desire to have the label which has been registered in its name transferred to the name of such other labor union, and such transfer shall be made accordingly and such transferee shall have all and the same rights as the labor union that first registered such label.

The exclusive right required for a label, when registered, shall be valid for the term of twenty-five years, but may be renewed before the expiration of the said term, by the labor union which has registered the same or by its transferee, for another term of twenty-five years, and so on from time to time; but every such renewal shall be registered before the expiration of the current term of twenty-five years.

If in any case the consent of the labor union registering such label is or has been given to the user thereof, the subsequent withdrawal of such consent shall have no effect, so far as anything done under the prior consent is concerned.

It shall be unlawful for any person, firm, labor union, association or corporation, other than the labor union registering such label, unless with the consent of such labor union,—

(a) To mark any goods or any articles of any description whatever with any such label or with any part thereof, whether by applying such label or any part thereof to the article itself or to any package or thing containing such article or by using any package or thing so marked which has been used by the labor union which has registered such label; or

(b) To knowingly sell, offer for sale or dispose of any article marked with such label or any part thereof; or

(c) To counterfeit or imitate any such label; or

(d) To sell, offer for sale or dispose of, or in any way utter or circulate any counterfeit or imitation of any such label; or

(e) To keep or have in his possession with intent that the same shall be sold or disposed of, any goods, wares, merchandise, or other product of labor to which or on which any such counterfeit or imitation is printed, painted, stamped, impressed, or otherwise displayed; or

(f) To knowingly sell, offer for sale or dispose of any goods, wares, merchandise or other product of labor contained in any box, case, can or package to which or on which any such counterfeit or imitation is attached, fixed, painted, printed, stamped, impressed or displayed; or

(g) To procure either for himself or on behalf of any other person, firm, labor union, association or corporation, the registering of any label under the provisions of this Act by making any false or fraudulent representation or declaration verbally or in writing or by any fraudulent means whatever; or

(h) To use or display the genuine label of any such labor union which has registered the same as required by this Act in any manner not authorized by such labor union; or

(i) To use the name or seal of any such labor union or officer thereof in and about the sale of goods or otherwise not being authorized to so use the same by such labor union; or

(j) To make any die, block, machine or other instrument for the purpose of forging or being used for forging a label; or

(k) To dispose of or have in his possession any die, block, machine or other instrument for the purpose of forging a label; or

(l) To cause any of such things to be done.

Every person, firm, labor union, association or corporation contravening the provisions or any of the provisions of the next preceding section shall be guilty of an offence and liable, for each such offence on summary conviction, to a fine not exceeding five hundred dollars or to imprisonment for a

period not exceeding one year or to both fine and imprisonment; and such fine may be levied by warrant of distress under the hand and seal of the magistrate and shall be paid to the labor union which has registered such label, together with the costs incurred in enforcing and recovering the same.

Every complaint under this section may be made by a member of the labor union which has registered the label as in this Act provided.

An action or suit may be maintained in any Court of Record having jurisdiction to the amount claimed by any labor union, or by a member or members of such labor union, which has complied with the provisions of this Act as to registration against any person, firm, labor union, association or corporation contravening any of the provisions of this Act.

Nothing in this Act contained shall enable any suit, action, garnishee, interpleader or other proceeding to be brought, had or maintained against a labor union, except for the purposes of this Act.

When complaint in writing, verified by affidavit is made to any court or officer having authority to issue search warrants, showing that complainant has reason to believe that counterfeits or imitations of any label registered as in this Act provided, or tools, cuts, plates, dies, blocks, machinery or materials prepared or provided for the making of such counterfeits or imitations, are concealed in any building, receptacle or place, particularly describing the same, such court or officer, if satisfied that there is reasonable cause for such belief, shall issue a warrant to search such building, receptacle or place for the articles described in the complaint.

Notwithstanding anything in this Act contained, no label shall be put or placed upon any goods, wares, merchandise or other product of labor, without the consent of the owner or proprietor of such goods, wares, merchandise or other product of labor first had and obtained.

We are pleased to observe that the Canadian Manufacturers' Association are interesting themselves in the suppression of this most obnoxious bill, and are advising all members of the Association to immediately write the members of the Dominion House of Commons representing them, protesting against the passage of the bill. Of course this advice is addressed to only the members of the Association, but we trust that our clientele will act on that advice. The bill should be snowed under. It is not in the interest of the general public, as it provides no guarantee for the quality of the goods made. It is directly opposed to the interests of the great body of free working men of Canada. It is detrimental to both the domestic and foreign trade of the country. It would interfere with the progress, development and success of the manufacturing industries of the countries, and would be in the interests of only a small portion of the working men of Canada. It is essentially wrong in principle. A bill that might prove acceptable not only to the trades unions as organized bodies, but to the members also, and to all laboring men, and to their employers, including the manufacturers, by which the confidence of the manufacturers and the public generally would be secured, should stipulate that any organizations of labor unions, to enjoy any of the advantages secured under the bill, should become registered responsible bodies, accountable for their acts collectively as organizations, or of their individual members, same as joint stock companies are required to do. If they are not prepared to assume such responsibilities they should not be entrusted with the privileges asked in the bill.

#### SPEAK TO THEM.

The man who whispers down a well,  
About the goods he has to sell;  
Will never make the shining dollars,  
Like he who climbs a tree and hollers.

In the Good Book it is written "Go speak to the children of Israel;" and the successful manufacturer or merchant, intent upon selling his goods, will lay particular stress upon the word

"speak." This journal was not published at the time that Moses was leading the Israelites away from the Land of Egypt; but it is not unreasonable to suppose that some sort of a journal or bulletin was issued each lawful morning in the week, and each afternoon also, perhaps, in which the general orders for the day or the next day were published for the information of the hosts of Israel and the captains thereof, and in this way the speaking to the children of Israel was done.

The population of the vast army, of the Israelites under the control and generalship of Moses, including the non-combatant old men, women and children, amounted in number to only about one-tenth of the population of Canada; and even as Moses required a daily bulletin, Saturdays excepted, to "speak" to his hosts, even so to-day do the manufacturers and merchants of Canada require the regular and frequent publication of THE CANADIAN MANUFACTURER, and perhaps a few other trade journals, to speak for them to the six million host of this blessed country, to inform them who manufacture and have for sale the things they require while journeying through and abiding in this Land of Promise, more fair and beautiful even than the trans-Jordan premises. It is not possible for any manufacturer or merchant to make his individual voice heard very extensively in the land, even if it be like that of a turtle dove; then how else can he possibly speak to those whose ear she desires to fill with his annunciations of the merits of his goods than by publishing them in THE CANADIAN MANUFACTURER? (Send for advertising rates; sample copies free on application.) It is expensive to send hired men to do the speaking, and frequently traveling expenses exceed the profits; but for a financial consideration, through the advertising pages of this journal, the speaking can be accomplished most satisfactorily, and in no uncertain sound. It would be like the sounding of the timbrel o'er Egypt's dark sea; and perhaps "The Timbrel" was the name of the bulletin Moses published so successfully. For further particulars enquire of the editor.

#### PEAT FUEL BY ELECTRICAL PROCESS.

The steadily growing consumption of fuel for the various purposes of manufacture, transportation, and domestic economy, together with the gradual but inevitable exhaustion of firewood in most civilized countries, have combined to give during recent years a new and important interest to the utilization of the vast beds of peat which have hitherto lain almost neglected in many portions of Europe and America. Peat in its ordinary condition contains about 80 per cent. of water. All the earlier methods of utilizing it involved the elimination of this by air drying, which is tedious and uncertain in wet, cloudy weather, and practically ceases in winter. The problem has been, therefore, to devise a process which would carbonize and convert the substance of peat into coke or coal by the consumption of its gaseous elements, a process which should be self-sustaining, simple, and so cheap in operation as to produce carbonized peat at a cost below or not far exceeding the average price of bituminous coal.

In a report from United States Consul-General Mason, at Berlin, Germany, an account was given of a German process by which peat is coked in retort ovens heated by the flame of the burned gases generated by the coking process itself. This method is practically self-sustaining, produces coke of high quality, and, aside from the difficulties of cutting and excavating peat under intense cold, can be worked during the winter in even an arctic climate.

The latest step forward in this branch of industry appears to have been made in England, where at the works of Messrs. Johnson & Phillips, at Charlton, in Kent, there has been

exhibited an electrical process for converting ordinary peat into firm, smokeless steam coal at a cost which promises to bring the product far within the industrial price limit of steam fuel in Great Britain and Continental Europe. From the numerous and elaborate report in the English press the following description of the apparatus employed and its method of operation has been derived.

The peat is cut and excavated by machinery, loaded into dumping cars which convey it from the bog to the plant, where it is packed into rotary iron cylinders of a peculiar construction. The cylinders being rotated at high velocity, the centrifugal pressure, aided by an interior beating device, expels all but a small remnant of the 80 per cent. of water which the material originally contained. Electrodes connected by conductors with a dynamo are then inserted in the cylinders in such a manner that the mass of centrifugally dried peat becomes the medium through which is completed the circuit between the electrodes. The resistance offered by the peat, like the filament of an incandescent lamp, generates heat which carbonizes the material, producing a mass of disintegrated black globules, which retain all the valuable elements of the original material. This part of the process, which depends largely upon the conductivity of the peat, may be promoted by moistening the mass with certain cheap liquid chemicals, the use of which is covered by the patent.

From the cylinders the carbonized material passes to machines, which kneed it into a putty-like mass, which is then pressed into briquettes or left to dry and harden in masses, which are broken into lumps, screened, and graded like ordinary coal. Among the special advantages claimed for this method is the fact that the electrical current converts but does not destroy any of the valuable elements of the peat, whereas coking by fire heat expels a large percentage of these elements in the form of gases, which, being either wasted or burned as fuel beneath the retorts, are lost from the composition of the ultimate product.

Briquettes produced by this method can be compactly stowed on shipboard or elsewhere; they are practically smokeless, leave no clinkers whatever, and, according to English press reports, have the high thermal value of 9,000 British units. The cost of a plant capable of treating 100 tons of peat per day is stated to be £4,000 (\$19,466). The actual cost of producing one ton of peat fuel by this process is stated to be 5s. (\$1.21), equal for all steam generating purposes to a ton of South Wales steam coal, which costs at the mouth of the mine 8s. 4d. (\$2.02). These are given as the economic results in a location where the electric current used by the process is generated by steam. In districts where generators can be driven within a working radius of peat bogs by water power, the cost of production would be proportionately reduced.

There are in Canada, and in New England and the Middle and other sections of the United States, vast beds of peat which have been heretofore left neglected as waste material in the economy of nature. In the Yukon country, in Alaska, and on the islands which lie along its shores—where the limited supply of coal brought from British Columbia sells for \$20 per ton and men perish from cold for want of fuel—there is a practically unlimited supply of peat of the best quality, all of which would be available as fuel if carbonized and converted into coal or briquettes. No process which includes air drying or works the peat at ordinary temperatures would be practicable there for more than a small part of each year—the brief arctic summer of that northern clime. If these vast deposits of fuel material are ever successfully utilized it must

be by some process similar to those herein described, whereby the peat is quickly machine dried by means independent of sun or wind and then carbonized by heat that can defy even the cold of an arctic winter. This electrical method will be first tried on an industrial scale in Ireland, an island which, with a total area of 32,393 square miles, has 2,830,000 acres of peat.

#### CANADA'S WATER POWER.

Electric smelting has become so live a subject that it is well worth recalling the statement of Mr. T. C. Keefer, the eminent engineer, that Canada was unsurpassed in the matter of power, says the *Toronto Globe*. The statement was made in his presidential address to the members of the Royal Society of Canada in 1899. "An examination," he says in the course of that address, "of any good map of our broad Dominion reveals, as its most striking feature, an extraordinary wealth and remarkably uninterrupted succession of lakes and rivers, suggestive of ample rainfall, the first great requisite in the occupation of any country. This feature would be still more impressive if all the waters could be shown on the map. Over large areas only the more important rivers have been explored and delineated, while in the surveyed districts many are necessarily omitted to leave room for other information to be given." Mr. Keefer points out that the very circumstance which makes a number of rivers unnavigable, namely, that they are broken by falls or rapids, imparts to them nevertheless another economic value. This would be a good illustration of the law of compensation.

The curious thing is that this rich endowment of lakes is confined almost wholly to the Dominion. In the United States, between the Atlantic Coast and the Rocky Mountains, as far South as the Gulf of Mexico, and as far north as the Dakotas (with the exception of part of New York and New England), there is an entire absence of lakes, while throughout Canada north of the St. Lawrence and stretching northwest toward the Mackenzie River basin they are innumerable, in fact have never been numbered, and thousands of the smaller ones have never even been represented on any map. The upper sections or sources of most of the Canadian rivers are chains of lakes, occupying in many instances the greater portion of the watercourse. This terrace-like profile of the rivers constitutes a series of elevated natural mill ponds containing latent power of unknown extent and value. These steps from high to lower levels in every rivulet, branch, tributary, or main stream of nearly every one of our northern rivers produce more or less broken water, which never freezes over, but remains open during the coldest weather.

In a country of this description the modern use of electricity in industry and the arts becomes a subject of the most pressing importance and magnitude. The coal measures of the continent may give out, but while the laws of nature continue to operate, these natural means for the creation of power can never become exhausted. It was a most commendable thing, therefore, to conduct an inquiry into the methods of the electrical smelting of metals. Something important should flow from the investigation.

According to the census of 1901, there were 14,650 industrial establishments in Canada, with a fixed capital of \$209,378,638 and a working capital of \$237,537,849; 313,344 employees were engaged on wages and 17,453 on salaries, and a pay roll during the year of \$89,573,204 for wages and \$13,411,464 for salaries. The total value of raw material consumed was \$266,527,858, and the value of the articles produced \$481,053,375. With the exception of butter and cheese factories, only establishments employing five hands and over are included in the above.

# ALUMINUM ELECTRICAL CONDUCTORS.\*

BY RODERICK J. PARKE, E.E.

The use of aluminum for electrical conductors has grown to an extent which renders imperative the consideration of its possibilities when designing any system of distribution.

It is so far the only material known which possesses the requisite properties to render practical its substitution for copper.

Previous to 1898 aluminum was little known in the commercial world, but since that year, when it was first placed upon the market in the form of solid drawn conductors, the consumption has rapidly increased, until, in 1902, the date of the latest complete statistics available to the writer, the world's production was estimated to be 8,000 tons per annum. The production of copper is estimated at 497,000 tons per annum. The available statistics at the present time show that the production and consumption of aluminum is rapidly increasing, and that it has become a very strong competitor of copper for electrical conductors.

There are now nine plants in the world producing aluminum of which three are in America, two in France, and one each in Great Britain, Germany, Switzerland and Austria. The total power utilized in the production of aluminum is from 36,000 to 40,000 h.p., practically all water power.

I will not intrude upon your time unnecessarily by describing the process of the manufacture of aluminum, further than to say that it is derived from a species of clay, technically termed bauxite. One of the principal processes of the manufacture of aluminum is its reduction from bauxite in the electric furnace after the bauxite has been subjected to several preparatory processes.

The following figures are for commercial aluminum and commercial copper of sizes commonly used in practice, the copper being hard drawn.

	Aluminum	Copper
Specific gravity . . . . .	2.68	8.93
Conductivity (Matthiessen standard) . . . . .	62.	97.
Tensile strength (per square inch) . . . . .	28,000	45,000
Coefficient of linear expansion (per Foot) . . . . .	.000128	.000093
Coefficient of temperature resistance . . . . .	.00114	.00117
Modulus of elasticity . . . . .	9,000,000	14,000,000

Using the above figures we find that the cross section of aluminum will have to be  $\frac{97}{62}$  or 1.564 times that of copper, to have the same resistance per foot. The weight of the aluminum will therefore be  $\frac{2.68 \times 1.564}{8.93}$  times that of copper or .47.

The tensile strength of the aluminum will be  $\frac{28,000 \times 1.564}{45,000}$  or .96 that of the copper.

The diameter of the aluminum will be  $\frac{1.24}{1.25}$  or 1.25 that of the copper.

The price of aluminum for equal cost would be  $\frac{1}{2.13}$  or 2.13.

Tabulating these results we have:

	Aluminum.	Copper.
Cross section for equal resistance	1.56	1
Diameter " " "	1.25	1
Weight " " "	.47	1
Tensile strength " " "	.96	1
Price for equal cost	2.13	1
Rate of temperature change (resistance) . . . . .	1.	1

To demonstrate clearly the relative proportions of aluminum and copper having a like resistance, I have two specimens here which I will hand to you for inspection. One is a piece of 500,000 c.m. stranded copper conductor, the other is a piece of aluminum stranded conductor having a cross-sectional area of 625,000 c.m., or 1 1/2 times that of the copper specimen, the resistance per 1,000 feet being the same for each.

By inspection of the above table we see at once that the principal difference which exists from an engineering standpoint is that aluminum possesses less than half the weight of copper for equivalent resistance. This is a marked advantage and results in benefit in three ways.

1st. The cost of transportation of aluminum is less than that of copper.

2nd. The cost of erection of the aluminum is less.

3rd. The durability of the line is greater, and cost of maintenance is less on account of the smaller strains to which poles, crossarms, pins and insulators are subjected.

An additional advantage in the use of aluminum is that on account of its peculiar nature it retains for years some of the grease used in drawing, and this grease prevents any great amount of sleet from forming upon it, thus avoiding one of the serious causes of interruption to service over pole lines. The result is rather surprising, and its announcement is often greeted with incredulity, but the fact has been noted often enough to be well established.

To balance the advantages cited there are the following disadvantages:

1st. Difficulty in making joints.

2nd. Greater sag due to larger coefficient of expansion.

3rd. Insufficient strength for conductors of the sizes used for telephone and telegraph wires.

Referring again to the question of sleet affecting metallic conductors, the writer was informed by an electrical engineer for one of the large companies in the United States, of a very practical illustration. He states that he was called to Kansas City to make an inspection of the Kansas City and Leavenworth Railroad. He happened to get there on a day while there was a very severe sleet storm in progress, and he found the copper trolley wires so badly covered with sleet that it was almost impossible to run the cars. They were running scrapers instead of trolley wheels, and were compelled to keep a man on top of the car to assist in knocking the ice from the wires. On the other hand the aluminum feeders, located

on poles adjoining the tracks, were entirely free from sleet; and he states that this condition was not due to the fact that the wires were carrying sufficient current to warm them, which was not the case, as there was only one car on the line between the power house and the part of the line referred to, and the feeder system was of ample size, so that the temperature rise was insufficient to have any effect in preventing the formation of sleet. In addition to this there would be from half an hour to an hour at a time when no car would be on the line at all, and of course no current whatever would be passing over the line.

It does not follow however, that sleet will never gather on aluminum wire anywhere, because in the neighborhood of railroads and manufacturing plants the wires are likely to become coated with smoke or some other foreign substance upon which the sleet will form. It may be safely assumed however, that sleet does not form upon aluminum wires.

### HARDNESS.

Aluminum being a softer metal than copper, more care must be exercised in handling it than is necessary with copper. A conductor is liable to be greatly weakened through the careless adjustment of the tie-wire or the handling of linemen's tools in erecting the wire. It is also liable to be seriously injured and its strength impaired if the wire be drawn over a road paved with sharp stones.

It may be opportune at this point to offer a word of caution to those who use electrical conductors, whether of copper or aluminum, namely, that too much care cannot be exercised in the handling of conductors, to avoid scratching and scarring. If the surface of the round wire be broken ever so little, the tensile strength of the wire is greatly weakened at that point, and in making tension tests of conductors the universal experience is that an otherwise perfect conductor will break at that point at which the slightest scratch is apparent. If any one will take a piece of No. 6 B. & S. copper wire and with the sharp blade of an ordinary jack-knife describe a circle around the wire by turning it under the blade of the jack-knife, putting no pressure upon the own weight, it will be found that the wire can be broken in one or two bends, whereas if the surface be not so broken it will take anywhere from 8 to 20 bends to break the conductor, depending upon the degree of hardness to which it has been drawn. Investigation will show that where wires have been scarred or scratched parallel with the circumference, the reduction of area, under tension, first commences at that point, upon the application of strain considerably below that corresponding to the elastic limit of the material; consequently when bare conductors have been erected without due care, it is sometimes found that their ohmic resistance has been considerably

\*Read before the Canadian Electrical Association at Hamilton, Ont., June 16, 1904.

increased at points where the wire has been scratched, through the reduction of area caused by strains produced by low temperatures. The lower resistance might not be noticed in cold weather owing to the effect of the temperature coefficient of resistance, but the increased resistance will almost certainly be noticed in warm weather. The increased resistance, of course, in any event may be negligible, nevertheless it is advisable to place much importance upon the fact that for erecting conductors made of any metal, and intended for important line service, none but careful and experienced linemen should be employed.

#### TYING.

For tying aluminum wires from No. 2 B. & S. up to the largest sizes, No. 2 B. & S. solid aluminum wire should be used, and for any size smaller than No. 2 B. & S., a solid tie-wire having the same cross-sectional area as the stranded conductor should be used. The tie should be put on firmly enough to prevent the wire slipping through it in order that after spans and deflections have been set, the relative positions and deflections of the conductor shall be maintained permanently at all points. Care should be taken in putting on the tie-wire that the conductor is not pinched by the tie, nor injured by pliers.

For tying small wire the bridle tie will be found to give the best results. In making this tie, the tie-wire is passed completely around the insulator and the two are wound in opposite directions around the main conductor, being wrapped at least five or six times around it, one of the ends passing above the line wire and the other underneath, so that the main wire and the ends of the tie-wire lie side by side on the insulator. Any form of tie, however, which will hold the wire without pinching it, will be found to be satisfactory.

#### JOINTS.

The difficulty of soldering aluminum is well known and, while it can be done, the operation in the majority of cases is attended with so much difficulty that unsoldered joints are preferable. The difficulty in soldering aluminum arises from three causes: First, because solder does not alloy with aluminum at a low temperature. It will alloy with copper at approximately 460° F., but the alloying temperature with aluminum is about 200° F. higher; second, because of the high thermal conductivity of aluminum the latter metal conveys the heat away very rapidly from the solder and from the soldering iron, making it difficult to maintain a soldering temperature, and, thirdly, when aluminum is exposed to the air a thin invisible coating of oxide of aluminum instantly forms upon the surface although in this respect aluminum is not different from all other metals, because the surface of any metal becomes covered with its oxide immediately after exposure to the atmosphere. It is well known that it is necessary to remove this oxide coating in order to permit of the formation of an alloy between the solder and the metal, because the alloying can only take place on a clean surface of metal and an interposing

film of oxide prevents the solder from coming into actual contact with the metal. In regard to metals other than aluminum the oxide coating can be dissolved by means of soldering salts, but no such salt or flux, so far as the writer can learn, has been discovered for aluminum, hence the difficulty in soldering it. Attempts have been made to use various materials as fluxes to remove the oxide coating of the aluminum, but the results have not been satisfactory and in fact have been in most cases detrimental to the aluminum because of the resulting formation of a chemical compound which interferes with soldering instead of facilitating it.

For joining aluminum wires smaller than No. 4-0 B. & S. gauge the two ends are inserted into a piece of flattened tube and the tube given 2½ twists by means of two pairs of ordinary wire connectors. This makes a perfectly satisfactory joint of low resistance and as strong as the wire joined. I have here a couple of specimen joints showing this method of joining the ends of No. 0 B. & S. aluminum. The question as to the mechanical strength of this type of joint has been answered to the writer's satisfaction by submitting sections of wire having joints of this type in them, to a tension test, to destruction, the conductor breaking outside of the joint in every instance, thus showing that the joint is actually stronger than the wire. No solder is used in making this joint.

Larger sizes are conveniently joined in any of three ways.

1st. By means of the ordinary dove-tail cable splice. (The Niagara Falls-Buffalo Line, consisting of 500,000 c. m. aluminum cable, is joined in this way and has been in use for three years and has given perfect satisfaction.)

2nd. By means of terminals compressed on the ends of the cables at the factory, these terminals being threaded and thus adapted to be united in the field by a threaded stud. To illustrate this type of joint I have a specimen which I will hand to you for inspection, and will ask you to note that the terminals are compressed upon the ends of the cables by hydraulic pressure, and a small cone is driven into the end of the cable, inside the terminal, thus causing the component strands to spread so that when tension is applied upon the cable and joint, the tendency is to increase the resistance offered by the joint against pulling out. The male threaded piece for joining the two terminals has a right and left hand threaded surface provided by the thread being about equal to the cross section of the conductor, consequently the strength of the two are about equally proportioned. It is customary to place these terminals on the ends of the cables before shipment from the factory, but this work can also be done in the field if a small portable hydraulic pump be made a part of the linemen's tool equipment. As to the liability of this joint unscrewing because of the vibrations set up in the line from any cause, or variations of the strain due to variations of sag corresponding to the change in temperature of the atmosphere, you will notice a small hole in the side of the intermediate

piece, into which a steel pin can be inserted for use as a lever and the joint can thus be screwed up very tightly.

3rd. By inserting the ends to be joined into a cast sleeve and compressing the sleeves between dies in a small portable press. It was not convenient to obtain a sample of this type of joint, but it is practically the same as the screwed joint except that there is only one piece into which the ends of the cable are inserted until they meet at the middle and the sleeve is then subjected to a heavy hydraulic pressure. I have not had an opportunity to subject this joint to a tension test, consequently do not care to express a definite opinion in reference to its efficiency. This type of joint has of course to be made in the field, although the manufacturers can affix a sleeve to one end of each cable, leaving the other end to be adjusted by the linemen.

Taps are made by means of aluminum clamps, one of which carries a lug into which the tap wire is either soldered or secured by set screws. Soldering into a lug is one of the pieces of aluminum soldering which can be readily accomplished. In this form of tap it is possible to also use copper "take-offs" instead of aluminum, provided that that part of the joint at which the copper and aluminum unite be covered with a permanent water-proof coating of compound or rubber in order to prevent electro-galvanic action between the copper and the aluminum and the consequent destruction of the aluminum at that point.

I should have mentioned that aluminum is highly electro-positive to all of the other commercial metals. In the electro-chemical series of metals, in the order of the most positive first, aluminum is 10th on the list, zinc 13th, iron 15th, nickel 17th, lead 20th, tin 22nd, copper 24th, and carbon 37th; consequently if aluminum and any other of the above mentioned metals, or the carbon, be brought into contact and subjected to moisture, galvanic action immediately commences, from the aluminum to the other metal or carbon, and the aluminum quickly becomes pitted, and if the action were allowed to continue the aluminum would ultimately be consumed just as the zinc in the zinc-carbon battery is consumed. On this account, therefore, it is highly essential that where aluminum is to be used in conjunction with any other metal in the open air the joint should be thoroughly protected from exposure to the atmosphere and moisture. This is not as difficult a matter to avoid as it would at first sight appear, nevertheless, where other things are equal the writer would recommend that aluminum take-off or branch conductors should be used instead of copper.

It will be seen from the above that the difficulties of making aluminum joints have been reduced to an extent which leaves almost no disadvantage whatever.

#### SAG, OR DEFLECTION IN SPANS.

The sag of aluminum conductors is somewhat greater than that of copper in hot weather and on ordinary spans, on account of the fact that the co-efficient of expansion of aluminum is 38 per cent. greater than that of copper.

The sag is not as much greater as might be expected, however, because the lower modulus of elasticity of aluminum causes it to contract more as the strain is relieved from it, and because the weight of aluminum for equal areas is only 3-10 that of copper, while the strength of it is 7 that of copper. This causes aluminum to start with a smaller minimum sag than copper.

One curious result of this is that whereas aluminum will have a maximum sag of three or four inches more than copper in a 100 foot span it will have actually a smaller maximum sag in a 1,000 foot span, for while the span moves further, or deflects more rapidly than copper, for a given temperature change it starts with so much smaller sag at low temperature, that it never overhauls the copper, when long spans are used. On this account, and that of its small weight, it would seem to be the better material for long span work.

Believing that the information arranged in a convenient form may be useful to any of the readers who contemplate using aluminum wire, the writer has prepared a set of tables, No. I to VII inclusive, showing the tensions of the various sizes of aluminum stranded conductors from 1,000,000 circular mils to No. 0 B. & S. gauge, when erected on standard spans ranging from 80 to 400 feet. These tables are based upon the table of tensions and deflections prepared by the Pittsburg Reduction Co., and presented by Dr. Perrine and Mr. F. G. Baum in a paper which these authors read before the American Institute of Electrical Engineers at Philadelphia, May 18th, 1900. The tables provide for a minimum temperature of 20° F. below zero and a maximum of 90° F. The deflections are calculated on the formula for the catenary, and the permissible tensions and corresponding deflections specified in these tables are based upon a maximum strain of 15,000 pounds per square inch on the aluminum at 20° below zero.

It must not be understood, however, that the figures given in these tables can, in practice, be made to correspond exactly with the tensions and deflections which the linemen will observe in the field when using the dynamometer, because other conditions are almost certain to have some effect upon the results, which conditions obviously cannot be taken into account in the calculation of the tables owing to the fact that they are necessarily unforeseen and arise from other conditions due to the topography of the country, strength and solidity of the supporting structure, etc., but they can be taken as a safe guide for the linemen in placing a limit of minimum deflection which must be allowed in order that the strain produced by the fall to minimum temperature shall not exceed the limit permissible for the aluminum which in respect to these tables is placed at 15,000 pounds per square inch. To demonstrate the practical application of the tables, let us assume that the linemen are erecting a circuit of No. 4-0 aluminum stranded conductors on 200 foot spans and that the temperature of the surrounding atmosphere is, at the time of striking the sags, 80° F. On referring to the table we find

that the tension on the conductor under these conditions would be 267 pounds absolute tension, and not the tension in pounds per square inch. The dynamometer reading therefore should be 267 which, other things being equal, would indicate that the corresponding sag should be 45 1/2 inches. The value of the table becomes apparent in demonstrating to the linemen that at 80° F. and 200 foot span the deflection for No. 0000 aluminum conductor must be not less than 45 1/2 inches. Of course the deflection can be greater if necessary and any figure less than 257 shown in the table would be on the safe side, assuming of course that any deflection allowed greater than 45 1/2 inches does not cause the particular conductor to interfere with or approach too near to the next conductor below it. It will also be apparent that in a series of spans of 200 feet a deflection of 45 1/2 inches and a corresponding tension of 257 pounds for No. 0000 aluminum at 80° F. will result when the temperature lowers to 20° below zero, in a strain of 2,523 pounds absolute, on the conductor, corresponding to 15,000 pounds per square inch.

The tension of 15,000 pounds per square inch upon which the tables are based is assumed as being within the limit of elasticity of the aluminum, in other words it represents the maximum strain which can be applied to a bar of aluminum one square inch in cross section which will not cause the bar to elongate too far beyond the assumed safe point, although not necessarily causing it to approach within close limits of the breaking point, as the latter is found at a tension of approximately 28,000 pounds per square inch in pure aluminum, this figure varying under certain conditions, and characteristically according to the nature and quantity of alloy of any other metal or of impurity which may be present.

It will be noticed that reference is made in the tables to "dynamometer readings." The use of a reliable dynamometer for stringing aluminum wire is strongly recommended as experience seems to indicate that it is a difficult matter to obtain linemen experienced in handling aluminum wire or who can be depended upon to provide that proper sag shall be set when stringing the wire. The use of the dynamometer does not involve any greater expense for the stringing of aluminum conductors than its non-use when stringing copper conductors because, owing to lighter weight of the former, the material can be handled much more easily and quickly than the copper can, size for size.

The third objection for aluminum applies only to telegraph and telephone and similar work. The smallest size of aluminum which it would be advisable to use in pole line work is No. 4 B. & S. gauge, which has a breaking strength of about 1,000 pounds, which is the minimum strength that should be allowed in any conductor on a pole line if interrupted service must be given over it.

The principal uses of aluminum conductors have been for railway feeders, high tension transmissions and busbars. Its use in Canada has not been very extensive, due to the fact that the beginning

of its manufacture here is of rather recent date. But there are very few places in the United States where it is not found in service. Very little need be said about its use for railway feeders, which have absorbed nearly two-thirds of what have so far been used. This use, however, presents no problems with which engineers are not familiar. For power transmission its use has become very extensive. The longest and largest transmissions in the world are now made over aluminum. From information furnished me by one of the manufacturers of aluminum conductors I have selected the following list and data which may be of interest:

Locations.	No. of Cables.	Miles per Cable.	C.M. Area of Each.
Niagara Falls to Buffalo . . . . .	3	20	500,000
Shawinigan Falls to Montreal . . . . .	3	85	183,708
Electra to Mission San Jose . . . . .	3	100	471,034
Colgate to Oakland . . . . .	3	144	211,000
Farmington River to Hartford . . . . .	3	11	336,420
Lowiston, Me . . . . .	3	3.5	144,688
Ludlow, Mass . . . . .	6	4.5	135,257

In addition to the foregoing list the lines of the Telluride Power Transmission Co., Utah, Colorado and Montana, use nearly 2,000 miles of wire, involving transmission distances of 130 miles.

In connection with the electrical transmission system of the city of Hamilton, Ont., the Cataract Power, Light & Traction Co., have installed three aluminum conductors between that city and the DeCew Falls power station of the company, a distance of approximately 35 miles. I do not remember the gauge of these conductors but I do know that they are stranded and have been in service for some months.

DURABILITY.

The question of the durability of aluminum conductors has frequently been raised since they have been brought into active competition with copper, but so far the information available shows that aluminum has thoroughly established itself as a conductor material offering no disadvantages which are not, in other respects, proportionately found in regard to copper or iron. Aluminum is not readily oxidizable, and the greater number of mineral acids seem to have no chemical effect upon it, but chlorine in any of its unstable combinations is more or less detrimental to it particularly where the conductors are exposed to sea air or where they are installed in the vicinity of certain chemical works. In reference to the question of protecting the aluminum conductors in the vicinity of salt water, the writer has heard the suggestion that the manufacturer should cover the conductors with a heavy coating of thick oil, which, owing to the porous nature of the metal, would be absorbed to a considerable depth, and should for a long time afford a protection for the metal from the action of the chlorine contained in the salt moisture laden atmosphere. As this experiment, so far as the writer can learn, has not been put to a practical test, and is an expedient of probably doubtful value in any event, the suggestion is mentioned here for what it may be worth.

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A positively effective method of protecting the aluminum from the action of the sea air would be to cover it with weather-proof insulation such as is commonly placed upon copper conductors, but as the area of the aluminum for equal resistance is 25 per cent. greater than that of copper, a proportionate increase in the amount of insulating material must be used, with a corresponding increase of cost, the net result of which would be to bring the cost of insulated aluminum higher than that of bare copper and practically equal to that of weather-proof covered copper. This question of the treatment or protection of aluminum conductors in the vicinity of salt water apparently remains for future solution.

On the other hand copper is liable to be detrimentally affected by atmospheres laden with acid fumes, consequently it would hardly be fair to condemn aluminum for lack of permanency any more than it would be to condemn copper. The most common impurity of aluminum is sodium which forms a very unstable alloy, readily attached and corroded in even slightly moist atmospheres. This defect, however, can be provided against by the manufacturers and no doubt the consumer can depend upon the purity of aluminum furnished by any responsible manufacturer as readily as he can depend upon the guaranteed qualities or characteristics of copper purchased from any responsible copper manufacturer.

It may seem that the statement made in the last paragraph, that aluminum is not readily oxidizable, conflicts with the statement made in reference to the difficulty of soldering aluminum on account of the instant formation of a film of oxide on exposure of the freshly scraped aluminum surface to the atmosphere. This is not the case however, because after the thin film of oxide has formed upon the aluminum it seems to afford a coat or surface which effectively protects the aluminum from further oxidation. It is quite unlike iron in this respect because, as is well known, if the surface of iron be exposed to the action of the atmosphere or of moisture, the oxide of iron commonly known as rust forms, and this action continues until eventually the entire piece of iron is destroyed, though this may take a very long time. I do not know whether this phenomenon is as yet clearly understood in respect of aluminum, but we have the fact before us that the protective coating forms as described.

Aluminum conductors were first placed on the market in the form of solid drawn wire, and in this form a considerable quantity of it was installed on transmission lines. Subsequent experience has demonstrated that the tensile strength of any given aluminum conductor is increased somewhat by building it up of several smaller strands wound together, and since this form has been adopted the writer has not been able to learn of any instances in which the conductors have broken on account of deficient tensile strength where they have been properly installed.

EFFECT OF WIND PRESSURE.

A phenomenon which is of interest and may imply a significant fact of considerable importance in respect of the com-

parative effects of wind pressure upon aluminum and copper transmission lines, was brought to the writer's attention by the perusal of a paper by Mr. L. B. Stillwell, descriptive of the electrical transmission system of the Niagara Falls-Buffalo transmission plant, this paper being read by its author before the American Institute of Electrical Engineers at Buffalo, August 23, 1901. He refers to the behavior of the two transmission lines, one of which is equipped with 350,000 c.m. copper conductors and the other with 500,000 c.m. aluminum conductors, the copper line having the

Approx. No. Gauge.	No. of Strands.	Approx. Gauge of Strands.	Twists in 6 inches.
000 B. & S.	7	7 B. & S.	21
0 "	7	9 "	22
2 "	7	10 "	30

poles spaced 70 feet while the aluminum line has the poles spaced twice the distance, or 140 feet. I take the liberty of quoting verbatim from Mr. Stillwell's paper, (Vol. 18, Trans. A.I.E.E., 1901, p. 521):

"An interesting difference in the behavior of the old and new lines when the wind is blowing at high velocity has been observed. At such times the tightly strung copper conductors of the old line swing or vibrate irregularly, but on the whole rapidly, and the strain caused by this vibration is transmitted to the insulators, pins, cross-arms and poles in such a manner that the trembling of the pole may be detected by placing the hand against it at a point near the ground. Under similar circumstances, the aluminum conductors tend to assume a fixed position, which is sometimes apparently as much as 45 degrees from the vertical plane in which they hang when the air is quiet. There is practically no vibration perceptible at the pole. The elimination of vibrating strains upon the insulator and pin is gratifying, as in the old line the tendency of insulators to work loose from their pins has been noticeable and I have no doubt that it has been caused by the vibration of the conductors during heavy wind storms."

CONDUCTORS FOR WELLAND CANAL.

In connection with the installation of the electrical lighting and power distribution system along the Welland Canal, this work being now in progress, the government has recently purchased a quantity of aluminum and copper conductors for the transmission and distributing circuits.

The writer's specifications called for Nos. 0, 2, 4, 6 and 10 B. & S. copper conductors, the No. 6 B. & S. to be medium hard-drawn and the No. 10 to be hard-drawn. Tenders were also taken as alternative, for the supply of aluminum conductors of resistances equivalent to those of copper conductors specified, and on comparing tenders it was found that the No. 3/0, No. 0 and No. 2 B. & S. aluminum conductors offered as equivalents for the Nos. 0, 2 and 4 copper would cost less than the copper, and the aluminum was purchased. The aluminum equivalent for No. 6 copper, taking into consideration the tensile strength specified for the medium hard-drawn copper, was found to be more expensive

than the copper, consequently copper was purchased for the Nos. 6 and 10 gauges. The writer desires to explain that the gauge numbers just mentioned for the aluminum conductors do not represent the correct relative proportions as compared with copper, but are the nearest gauge numbers corresponding to the area of the aluminum conductors representing the copper equivalent.

The writer tested a proportion of the aluminum conductors for cross-section, tensile strength, torsion and resistance, and found the results given in the following table.

Breaking Strains per sq. in.	Elongation in 6" per cent.	Res. per 1,000 ft. at 70°.
29,100 lbs.	2	.106
33,000 "	2½	.172
35,500 "	3¼	.262

The results seem to show that the tensile strength per square inch increases somewhat with a reduction in area of the smaller strands composing the conductor.

It will also be seen that the respective breaking strains of the aluminum, per square inch, exceed the breaking strain usually allowed for soft copper, (pure), namely, 23,600 pounds, and in the Nos. 0 and 2, aluminum equal the breaking strain of medium hard drawn copper.

ELECTRICAL CHARACTERISTICS.

The questions are often asked, with relation to alternating current work, as to the respective capacity, self-induction and skin effects of aluminum and copper.

As aluminum is one-quarter greater in diameter than equivalent copper, it is evident that the self-induction of the line will be the same when the aluminum wires are separated 25 per cent. more than the copper wires.

The static capacity of the aluminum will be approximately 5 per cent. greater than that of copper, with the same spacing.

The skin effect will be exactly the same with either of the two metals, since the effect of the greater diameter of the aluminum is exactly off-set by its greater specific resistance, in making the calculations for the per cent. increase of resistance.

All practical transmission lines possess sufficient excess of self-induction over capacity to cause a slight lag in alternating currents, and the power factor over an aluminum line would therefore be slightly better than that over a copper line, on account of the smaller self-induction and greater capacity. The difference is small, but what there is, is in favor of aluminum.

COMPARATIVE COST.

The market prices of aluminum and copper have always been such, for the past five years, that from 5 per cent. to 15 per cent. can be saved by the purchase of aluminum.

For instance the present market price of copper is about 14 cents. An equivalent price of aluminum would be 29.8 cents, whereas aluminum can be had to-day for 27.5 cents or the equivalent of 13 cents copper.

In view of all the facts, it would seem that we are no longer compelled to confine ourselves to a single material for carrying current as was formerly the case.



## CAPTAINS OF INDUSTRY.

The following items of information, which are classified under the title "Captains of Industry," relate to matters that are of special interest to every advertiser on these pages, and to every concern in Canada interested in any manufacturing industry whatever, this interest extending to supply houses also.

If a new manufacturing enterprise of any kind is being started, or an electric lighting plant instituted, or an electric railroad, or a telephone, or a telegraph line is being constructed; or a saw mill, a woolen, cotton, or knitting mill; or if any industrial establishment has been destroyed by fire with a probability of its being rebuilt, our friends should understand that possibly there may be something in the event for them. Do you catch on to the idea?

The starting of any such concern means a demand for some sort of machines, machinery, or supplies, such as steam engines and boilers, shafting, pulleys, bolting, lubricants, machinery supplies, wood or iron working machinery, ventilating and drying apparatus; pumps, valves, packing, dynamos, motors, wire, arc and incandescent lamps, and an infinite variety of electrical supplies, chemicals, acids, alkalies, etc. It is well worth the while of every reader of the Canadian Manufacturer to closely inspect all items under the head of Captains of Industry.

The Rio de Janeiro Light & Power Co., Toronto, have been incorporated with a capital of \$25,000,000, to carry on the business of an electric light, heat and power company, etc. The provisional directors include Jas. S. Lovell, Wm. Bain and R. Gowans, Toronto.

The Hamilton Ont., Gas Works Co., are installing a new coal handling plant.

The Economical Gas Apparatus Construction Co., Toronto, are installing a new gasometer at Winnipeg, Man.

The Canadian Westinghouse Co., Hamilton, Ont., have recently closed a contract to furnish the Shawinigan Water & Power Co., Shawinigan Falls, Que., with a 6,600 k.w., two-phase, 2,200 volt, 3,600 alternations, 180 R. P. K. Rotating Field Alternator, for direct connections with water wheel. Two 2,200 k.w. oil insulated water cooled transformers, 2,200 volt primary, 50,000 volt secondary, are included in this contract.

The Cummen's Cemen' Co., Akron, N.Y., have purchased 200 acres of actinolite and asbestos lands in Lennox and Addington County, Ont., and will develop these mineral deposits. The American Asbestos Co., Buffalo, N.Y., own 800 acres of adjoining property, and have opened asbestos mines.

The Industrial Construction Co., a United States incorporation have been licensed to construct canning factories, creameries, etc., in Ontario, with a capital of \$40,000. A. T. Boles, Leamington, Ont., is their attorney.

The Indiana Mfg. Co., a United States incorporation have been licensed to manufacture machine tools, implements, etc., in Ontario with a capital of \$40,000. W. D. Hogg, Ottawa, Ont., is their attorney.

The Crown Mfg. Co., Toronto, have been incorporated with a capital of \$40,000 to manufacture druggists supplies, etc. The provisional directors include Thos. Bates, H. Wase and A. W. T. Martin, Toronto.

The Canadian Saddlery & Harness Mfg. Co., Ltd., Oshawa, Ont., have been incorporated with a capital of \$50,000, to manufacture saddlery, harness, hardware, etc. The provisional directors include W. D. Earngey, A. Thomson, Toronto, and Jas. Kenny, Hamilton, Ont.

The Sovereign Oil Co., Comber, Ont., have been incorporated with a capital of

\$50,000, to produce petroleum, oil and gas, etc. The provisional directors include J. C. Winters, Mount Morris, N.Y., Wm. McIntosh, Petrolia, Ont., and J. A. McIntosh, Toronto.

The Frankford Canning & Packing Co., Frankford, Ont., have been incorporated with a capital of \$50,000, to carry on a fruit canning business, etc. The provisional directors include O. Sils, Geo. Weston, and W. E. Windover, Frankford.

The China & Japan Silk Co., Toronto, have been incorporated with a capital of \$40,000, to manufacture silks, etc. The provisional directors include A. J. Moreland, J. A. C. Poole, Toronto, and E. S. Hassberger, Montreal.

The Canadian Adjustable Bearing Co., Windsor, Ont., have been incorporated with a capital of \$100,000, to manufacture adjustable bearings, etc. The provisional directors include, J. F. Harrigan, and A. W. Atterbury, Detroit, Mich., and F. H. Macpherson, Windsor.

Messrs. Imrie, Graham & Harrap, Toronto, have been incorporated with a capital of \$40,000, to carry on a general printing business. The provisional directors include E. Imrie, D. I. Graham, and G. A. Harrap, Toronto.

The Thamesville Canning Co., Thamesville, Ont., have been incorporated with a capital of \$50,000, to carry on a general fruit canning business, etc. The provisional directors include, J. M. Thompson, E. S. Hubbell, and Wm. McKenzie, Thamesville.

The Dominion Brass Works, Ltd., Port Colborne, Ont., have been incorporated with a capital of \$100,000, to manufacture brass goods, lead pipes, hardware, etc. The provisional directors include W. R. P. Parker, E. H. Bickford and W. A. Hare, Toronto.

The Union Tobacco Co., Leamington, Ont., have been incorporated with a capital of \$150,000, to manufacture tobacco, etc. The provisional directors include H. McSween and W. McSween, Leamington, and J. A. Gerow, Detroit, Mich.

The Alvinston Power Co., Alvinston, Ont., have been incorporated with a capital of \$40,000 to produce electricity, etc. The provisional directors include R. McLaughlin, Metcalf, Ont., A. S. Harkness and T. A. G. Gordon, Alvinston.

The Elginfield Oil & Gas Developing Co., Dutton, Ont., have increased their capital from \$49,000, to \$200,000.

The Guelph Axle Mfg. Co., Guelph, Ont., have changed their name to the Guelph Spring & Axle Co. Limited.

The Richter Mfg. Co., Toronto, have been incorporated with a capital of \$50,000, to manufacture burlaps, canvasses, etc. The provisional directors include, P. C. J. Richter, Tenafly, N.J., R. E. Menzie and J. McK. Murray, Toronto.

The Bias Corsets, Limited, Toronto, have been incorporated with a capital of \$100,000, to manufacture corsets, etc. The provisional directors include, H. G. Snider, E. W. Goulding and W. H. G. Snider, Toronto.

The Stratford Cordage Co., Stratford, Ont., have been incorporated with a capital of \$40,000, to manufacture twines, ropes and cordage. The provisional directors include F. Richardson, N. Richardson, and H. E. Holmes, Stratford.

The A. R. Williams Machinery Co., Toronto, have been appointed agents for the Advance Machinery Co., Toledo, Ohio, who manufacture the well known Wetmore glue tank heater. This appliance is now manufactured in Canada.

The Consumers' Gas Co., Toronto, will build a reserve gasometer, 184 feet in diameter, to have a capacity of 3,000,000 cubic feet.

Wm. Eizerman's planing mills at Mitchell, Ont., were destroyed by fire June 25.

The St. Catharines Box & Lumber Co.'s planing mills at St. Catharines, Ont., were destroyed by fire June 24. Loss about \$50,000.

John B. Atchison's saw mills and sash and door factory at Cornwall, Ont., were destroyed by fire June 24. Loss about \$40,000.

S. O. Cooper, Clinton, Ont., has been awarded the contract for the erection of a post office building at Wingham, Ont., at a cost of \$15,500.

The Department of Public Works, Ottawa, are inviting tenders for the construction of a steel tow boat for the Fraser River, B.C.

J. McCartney, town clerk, Galt, Ont., is inviting tenders for the construction of 10,500 lineal feet of trunk sewers.

The building occupied by the Holmes Protection Co., Stewart & Thomas; Phillips & Wrinch and Legg Bros., Toronto, was partially destroyed by fire June 18. Loss about \$20,000.

The Rat Portage Lumber Co.'s sash and door factory, Rat Portage, Ont., were destroyed by fire June 17. Loss about \$125,000. They will rebuild.

The Verity Plow Co., Brantford, Ont., will erect large extensions to their factory and will double their capacity, giving employment to about 250 more men.

At the recent annual meeting of the Imperial Steel & Wire Co., held at Collingwood, Ont., the following directors were elected: J. Charlton, M.P., Linwood, Ont., M. J. McLeod, Cornwall, Ont., Major S. Wood, London, Ont., W. H. Schneider, Hamilton, Ont., Major Currie, W. J. Lindsay, N. H. Stevens, Chatham,

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Ont., W. Saddington Mull, Ont. A.H. Notman, Toronto, Major Donald, Dr. McKay, and J. T. Duguid. At a subsequent meeting of the directors, the following officers were chosen: Major Currie, president; Major Shaw Wood, first vice-president; W. J. Lindsay, second vice-president; W. Saddington, third vice-president; Major Donald, secretary. The annual statement of the affairs of the company was very satisfactory. The plant, which is designed for an output of 100 tons of wire daily, will be completed some time in July. The company will manufacture wire, wire nails, and wire fencing, and will employ about 200 men. The plant will be one of the finest in America.

The Canadian Iron Co., Ottawa, have been incorporated with a capital of \$2,000,000, to carry on a mining, milling, and reduction business. The provisional directors include, H. F. Gooderham, H. N. Barry, and Robt. Weir, Toronto.

The General Artificial Silk Co., a United States incorporation, have been licensed to manufacture fibres, rods and tubes from cellulose, and to manufacture artificial silks, etc., in Ontario, with a capital of \$40,000. M. Waddell, Toronto, is their attorney.

The ratepayers of St. Catharines, Ont., have voted favorably on a by-law granting \$20,000, to the Niagara, Queenston, and St. Catharines Electric Railway.

The Ontario Foundry at Peterboro. Ont., was damaged by fire June 16. Loss about \$3,000.

The steamer Milton, operated by the Wolverine Fish Co., was destroyed by fire in Georgian Bay, June 19.

The Rouan Motor Co., Toronto, have been incorporated with a capital of \$100,000, to manufacture engines, motors, machinery, etc. The provisional directors include Jas. S. Lovell, Wm. Bain, and R. Gowan, Toronto.

The Electrical Development Co., Toronto, have purchased from the Allis-Chalmers Co., 12x16 self contained throttling engine, a No. 5 "B" elevator, and considerable other new machinery.

The Lakefield Portland Cement Co., Lakefield Ont., and the Canadian Portland Cement Co., Strathcona, Ont., were successful bidders for cement for Trent Valley Canal, and each will furnish 14,000 barrels.

The Sun Portland Cement Co. Owen Sound, Ont., will change from the dry to the wet process.

The Canada Brass Rolling Mills, New Toronto, Ont., of which Mr. J. R. Barber, M.P.P., is president, and Mr. R. E. Menzie, Toronto, managing director, are prepared to purchase machinery for their works.

The Sovereign Mfg Co. will erect a perfume factory in Toronto.

The Standard Varnish Works, Staten Island, N.J., will establish a branch works in Toronto, at a cost of \$40,000.

The largest safe ever made in Canada is now in use at the head offices of the

Canadian Bank of Commerce in Toronto. It weighs 31 tons and was made by the Goldie & McCulloch Co., Galt, Ont. The mechanism is such that it requires eight men to open it, each knowing a special part of the combination. It is equipped with a time lock and is automatic self-locking.

The Packard Electric Co., St. Catharines, Ont., inform us that they have secured what they claim to be the largest contract for electric meters ever sold in Canada. The purchaser was the Winnipeg Street Railway Co., who own the lighting system of that city.

C. H. Vogel, Ottawa, Ont., will prepare plans for repairing the dam at the power plant at Ragged Rapids, for the town of Orillia, Ont.

C. W. Wheeler, architect, Port Arthur, Ont., has prepared plans for a new General Hospital building 96x45 feet, at a cost of \$12,000.

About 70,000 feet of cement sidewalks will be constructed in Cannington, Ont.

The Southwestern Traction Co., London, Ont., will build five bridges in connection with the construction of their electric railway to St. Thomas and Port Stanley, Ont., the largest of which will cost about \$50,000.

Lighting Canada is every day becoming a more and more interesting proposition, for the wonderful accomplishments of electricity are gradually making daytime last twenty-four hours. Taking an active part in turning night into day, the Packard Electric Co., of St. Catharines, Ont., with branch houses at Winnipeg and Montreal, are at present engaged in making extensive alterations and additions to their splendid plant at St. Catharines. The demand for Packard lamps and other Packard products has been increasing so steadily of late that the company have a busy time to keep pace with the popular demand for their output.

The Toronto Railway Co. have purchased controlling interest in the Toronto & Mimico Railway Co., the Toronto & Scarborough Electric Railway, Light & Power Co., the Metropolitan Railway Co., the Schomberg & Aurora Railway Co., and the Toronto & York Radial Railway Co., and have also secured the route for the power line of the Electrical Development Co., which is practically the Toronto Railway Co., and have purchased a site just outside the city for the erection of a power house. Mr. E. J. Lennox, Toronto, has prepared plans and is inviting tenders for same.

The Northrop, Lyman Co., Toronto, will erect a large new warehouse.

The H. Webb Co., Toronto, will erect a candy factory at a cost of \$15,000.

Building permits have been issued in Toronto as follows. The McClary Mfg. Co., four-story brick warehouse, \$25,000; Copp-Clark Co., five-story brick warehouse, \$30,000; Hendrie Cartage Co., three-story brick stable, \$40,000; W. J. Gage & Co., five-story brick warehouse, \$50,000; J. J. Walsh, nine pairs of semi-

detached two-story brick dwellings, \$36,000; A. Bradshaw & Son, four-story warehouse, \$20,000; H. S. Howland & Sons, four-story brick warehouse, \$45,000; Parisian Laundry Co., three-story brick laundry, \$20,000; Matthew Bros., three-story brick and stone factory (addition), \$20,000; Central Methodist Church, alterations and additions, \$30,000; Geo. Lawrence, two-story office building, \$30,000.

The Canadian Pacific Railway Co. will erect a large grain elevator at Fort William, Ont., and will also enlarge their freight sheds there.

The British Admiralty have loaned a torpedo and a number of armour piercing shells for the Toronto Exhibition. Models of battleships are also likely to be sent.

H. Reynolds' sawmill and cheese factory at Verona, Ont., was destroyed by fire June 26.

W. B. Kelly's sawmill at Bridgenorth, Ont., was destroyed by fire June 27.

The congregation of St. John's Presbyterian church, Toronto, will have a new church building erected.

Hon. Mr. Prefontaine states that his department will operate a powerful fog alarm by compressed air at Toronto.

The Toronto city engineer states that the Ontario Paving Brick Co., Toronto Junction, are the only company who manufacture paving brick near Toronto.

The establishment of a modern hospital building in connection with the Toronto University is under consideration.

The ratepayers of Creemore, Ont., have voted favorably on a by-law, granting \$17,000 for the installation of a system of waterworks.

Messrs. Dunbar & Sullivan, dredging contractors at Amherstburg, Ont., have been awarded the contract from the United States Government for the widening and deepening of the channel over the Amherstburg beach, and out into Lake Erie as far as Bar Point, at a cost of about \$1,000,000.

The ratepayers of Oshawa, Ont., have voted favorably on a by-law granting \$10,000 to the Canada Saddlery & Harness Mfg. Co., towards the construction of their works.

J. A. Pansden, Weston, Ont., is inviting tenders for the construction of a new steel bridge over the Humber River at that place. The Locomotive & Machine Co., Montreal, have been awarded the contract for the steel work at a cost of \$3,350.

A. T. Reid, Toronto, will erect a four-story warehouse at a cost of \$30,000.

The Northern Reduction Co., are commencing operations at their plant near Nepigon, Ont., for the separation of iron from the sands in the vicinity. The sands along the north shore of Lake Superior are filled with iron and the company use an electrical process for the separation.

The Avon Hosiery Co., Stratford, Ont., recently incorporated with a capital of \$40,000, will commence operations shortly. They will manufacture hosiery, etc. D. M. Ferguson is president and treasurer of the company; R. L. Baker, agent and B. M. Williams, superintendent. The plant will be equipped with dye house and operated by electricity.

The Portland Cordage Co., are erecting a large cordage plant at Smith's Cove, Ont.

F. S. Johnstone, will start a hosiery mill at St. Thomas, Ont.

Messrs. Davis & Henderson, Toronto, will erect a two-story factory at a cost of \$18,000.

Messrs. A. A. Allan & Co., Toronto, will erect a six-story warehouse at a cost of \$50,000, to replace the one destroyed in the recent Toronto fire.

John White-side's saw mill at Huntsville, Ont., was destroyed by fire June 18. Loss about \$15,000.

The General Committee of Underwriters on fire adjustment for the Toronto conflagration have completed their labors. The total value of property destroyed as reported to the committee, is \$9,611,779.60, on which insurance has been allowed amounting to \$7,883,529.75. The committee estimate that with smaller claims that were not reported the total insurance is about \$8,500,000.

The Department of Public Works, Ottawa, are inviting tenders for the construction of a snag boat for the Fraser River, B.C.

The Penberthy Injector Co., Windsor, Ont., will have a process exhibit at the forthcoming Dominion Exhibition at Winnipeg, Man. They will send their sales-manager, Mr. E. B. Kelly, to have charge of the exhibit, and will also send one of their best lathe hands who will perform the machine operations which are necessary to complete "Penberthy" injectors. This should be of considerable interest to threshermen and engineers, in fact to anyone who has never been inside a brass shop. They will also make some very attractive display stands of brass goods.

The Department of Railways and Canals, Ottawa, are inviting tenders for the construction of the Welland Canal electrical distribution station.

The Grand Trunk Railway Co. will make extensions to their shops at Stratford, Ont., as follows:—New boiler shop 102x102 feet; new tender shop, 52x102 feet; new brass foundry, 75x40 feet; 50 feet extension to east end of blacksmith shop; 50 feet extension to east and west ends of present tender shop. A large amount of new machinery has been ordered, and two hundred men will be added to the staff immediately upon the completion of the new building.

The Grand Trunk Railway Co. will erect a roundhouse at Woodstock, Ont.

The Dominion Government announce that they will build two ice breaker vessels to be operated on the St. Lawrence, and two for the great lakes to be built in Canada.

The Menzie Wall Paper Co., of which R. E. Menzie is manager, now have in operation at New Toronto, Ont., a wall paper factory, which takes rank as the largest and best equipped in Canada. All kinds of wall papers are manufactured, from the common grades to the very finest pressed. The main factory is 300 x 50 feet, and a warehouse, 210 x 60 feet, is being added. The boiler and engine house, machine shop, mixing room for colors, etc., are entirely separate, thereby reducing risk of fire and preventing injury to the papers from dust, steam, etc. The factory contains eleven machines and has a capacity of 70,000 rol. a day. The motive power is steam, and the company have their own pipe line to supply water from the lake. The manufacture of bur-laps and other decorations will also be taken up.

The Fort Frances, Ont., Times says that it is proposed to erect a large smelting works for treating iron and copper ore by electricity at that place.

A party of American capitalists headed by Mr. E. W. Backus of the American Power Co., propose erecting a 5,000 barrel flour mill and pulp mill at Fort Frances, Ont. Work on the construction of the dam will be commenced shortly, and will cost about \$500,000.

The contract for a new Grand Trunk Railway elevator at Montreal has been let to the John S. Metcalfe Co., Chicago, Ill., which will have a capacity of 1,000,000 bushels. The storage portion will consist of 132 rectangular bins 72 feet in height, ranging in capacity from 2,500 bushels to 12,000 bushels each. It will be fitted with ten legs and one marine leg, so that discharging from canal and rail, as well as loading into steamships for export, can go on simultaneously. A working house and a power house of ample capacity will be provided.

The Quebec Central Railway have ordered from the Locomotive & Machine Co., Montreal, two 8-wheel passenger locomotives. The general dimensions are: cylinders, 18 inches by 24 inches; diameter of driving wheels, 66 inches; boiler pressure, 180 pounds; number of tubes in boiler, 245; diameter of tubes, 2 inches; length of tubes, 11 feet 8 inches; total weight of engine, 110,000 pounds; weight of tender, 85,000 pounds in working order; water capacity, 4,000 gallons; coal capacity, seven tons.

The Star Chrome Mining Co., Montreal, have been incorporated with a capital of \$450,000, to carry on a chrome, asbestos and mica mining business. The provisional directors include F. Bayard, P. E. Beaudry and J. A. Brossard, Montreal.

Messrs. Thos. May & Co., Montreal, have been incorporated with a capital of \$48,000, to acquire the business of the Canada Ribbon Co., and to manufacture fancy goods, ribbons, etc. The provisional directors include E. J. Major, B. McNally and H. Giroux, Montreal.

The following buildings were destroyed by fire June 20, at Wakefield, Que.:—Geo. Patterson, general store, \$20,000;

Geo. Thomas, Hotel Union, \$10,000; Presbyterian church, \$7,000; Thos. Armstrong, \$3,000, and A. Dummoche, \$1,000

The Canadian Vacuum Cleaner Co., Montreal, have been incorporated with a capital of \$100,000, to acquire the patents of Booth's system of cleaning by vacuum suction, etc. The provisional directors include S. Carsley, W. F. Carsley and F. Hague, Montreal.

The annual sale of Quebec Provincial Crown timber limits took place June 22, when some 1,703 miles of limits were sold to the amount of \$258,166.

The Montreal Cotton & Wool Waste Co's. warehouse at Montreal was partially destroyed by fire June 14. Loss about \$15,000.

The C. Robin Collas Co, Limited, Halifax, N.S., have been incorporated with a capital of \$1,000,000, to acquire the business of Messrs. Chas. Robin, Collas & Co., and Collas, Whitman & Co., and to manufacture fish oil, fish products, etc. The provisional directors include A. E. Collas, A. H. Whitman and R. E. Harris, Halifax.

The Robb Engineering Co., Amherst, N.S., have been awarded the contract to supply a large Robb-Armstrong engine to drive an electric generator for furnishing light and power on a sugar plantation at Mayaguez, Porto Rico.

A cargo of Mesabi iron ore, guaranteed 60 per cent. iron and 0.077 per cent. phosphorus, was shipped to the Dominion Iron & Steel Co., at Sydney, N.S., by Pickands, Mather & Co. The cargo consisted of 1,704 gross tons and is the first to go in that direction.

The bounty of one and a half cents per gallon on crude oil recently granted by the Dominion Government will aid the New Brunswick Petroleum Co. in opening up oil wells in the Cheverie District, N.S., and in Memramcook District, N.B. The company will erect a refinery at Memramcook, N.B. under the superintendence of Mr. W. Lawrie, of Petrolia, Ont.

It is announced that the McAdamite Metal Co., St. John, N.B., will go into the manufacture of McAdamite on a large scale.

The Boston & Nova Scotia Woolen Mills have been incorporated under Massachusetts laws, with capital of \$150,000, to build a mill at Eureka, N.S. H. K. Fitzpatrick, New Glasgow, N.S., is president of the company, and Jas. Stewart, treasurer.

The contract for clearing the grounds at the site of the new slope at Big Glace Bay, N.S. Colliery, has been let, and the opening of the slope will be proceeded with shortly. This colliery will be known as Dominion No. 6.

W. S. O'Brien, Chicago, Ill., representing the Dawson Brothers' Marble Co., of that city, has been engaged in looking over the various deposits of marble at Cape Dauphin held by the Dominion Lime & Quarrying Co. He

reports finding excellent samples of marble, including some blue ribboned marble and some with a beautiful greenish background. The Chicago company proposes to arrange for the quarrying of a considerable quantity of Cape Breton marble in the near future.

The Bailey-Underwood Co., New Glasgow, N.S., inform us that they have recently erected an entirely new plant on land adjoining the Nova Scotia Steel & Coal Co.'s steel works. Their lot covers six acres of ground. The main forging shop, 300 feet long, is constructed of brick with steel frame and steel truss roof. The railway facilities are unsurpassed, sidings extending the full length of the plant on both sides. The company have recently installed a number of new machines for the manufacture of springs, including power hammer, punching and shearing, bending, polishing and wire coiling machines, and furnaces. Their tempering furnace has capacity of three tons of springs per day. The company have been in the spring-making business in New Glasgow, for the past twelve years, but their experience in the business covers a period of 35 years; and all their spring makers and temperers are expert workmen.

The Robertson-Adams Lumber Co., Crystal City, Man., have been incorporated with a capital of \$100,000, to manufacture lumber, etc. The provisional directors include F. Robertson, and G. E. Adams, Crystal City, and K. G. Adams, Cavalier, N.D.

The A. J. Falconer Co., Deloraine, Man., have been incorporated with a capital of \$100,000, to manufacture hardware, furniture, etc. The provisional directors include, A. J. Falconer, C. J. Clerihue and H. A. Sutherland, Deloraine.

The Empire Elevator Co., Winnipeg, Man., have been incorporated with a capital of \$2,000,000, to carry on a grain milling business, etc. The provisional directors include, N. Bawlf, W. H. McWilliams and S. P. Clark, Winnipeg.

The Winnipeg Granite & Marble Co., Limited, Winnipeg, Man., have been incorporated with a capital of \$60,000, to manufacture stone, metal, etc. And to acquire the business of the Winnipeg Granite & Marble Co. The provisional directors include A. J. MacIntyre, J. A. MacIntyre, Winnipeg, and Wm. Garrett, Monden, Man.

Coal and good brick clay are found within a mile and a half of Estevan, Ass. N.W.T. A syndicate of local merchants there first worked the coal mine, and then sold out to an American syndicate for \$12,000. The latter is now operating a coal mine and a brick yard side by side. Last year a brick plant was installed, but it proved to be unsatisfactory and had to be taken out, and new machinery has just been placed in position. The brick made is a very hard, deep red brick, and will be placed upon the Winnipeg market in competition with the white brick of that city. In a country where the coarsest lumber costs from \$22 to \$23 a thousand, a brick yard should

prove a valuable asset, but the operation of this yard is experimental as yet, although practical men think so much of the brick turned out that several are competing to secure control of the output, which is 24,000 bricks a day.

D. Hamilton will erect a hotel at Neepawa, Man., at a cost of \$30,000.

A by-law has been passed at Regina, N.W.T., granting a free site and exemption from taxation to the Western Mfg. Co., Indian Head, N.W.T., to establish works there.

The Palmita Mining & Development Co., have been incorporated at Victoria, B.C., with a capital of \$15,000, to carry on a mining and refining business.

The Chilliwack Power & Light Co., have been incorporated at Victoria, B.C., with a capital of \$500,000, to produce electricity, etc.

Messrs. Boyd, Burns & Co., Limited, Vancouver, B.C., have been incorporated with a capital of \$150,000, to acquire the business of Boyd, Burns & Co., and to manufacture engineers' supplies, hardware, etc.

Thos. Kirkpatrick's shingle mill at New Westminster, B.C., was destroyed by fire May 25. Loss about \$50,000.

The Granby smelter now ships about 2000 tons of low grade copper ore daily from Phoenix, B. C. to the smelter at Grand Forks, B.C. It is the intention of the Granby Company to double their smelting plant and to increase their daily shipments of ore to more than 4,000 tons.

The British Columbia Copper Co.'s smelter at Greenwood, B. C., will be completed shortly and will produce blister copper. At present the matte produced at this smelter is sent to Tacoma, to be converted into copper, but that work will now be done at the company's establishment at Greenwood.

The Rossland B.C. Miner, announces that the War Eagle, Centre Star, and Le Roi Mines have amalgamated under one management with a capital of \$10,500,000.

The Canadian Pacific Railway will build 28 miles of railway from Michel, B.C., to the properties of the Imperial Coal & Coke Co.

The Postmaster of Pilot Bay, B.C., is inviting tenders for the erection of a new lighthouse there.

The Chilliwack Electric Light & Power Co., B.C. of which Mr. J. B. Morgan, Grand Forks, B.C., is the head, has applied for permission to install an electric light system in the town of Chilliwack, and also to build tram-lines throughout the municipality.

The Driard Hotel at Victoria, B.C., was damaged by fire June 27. Loss about \$25,000.

W. H. Griffith, Cranbrook, B.C., will erect a saw mill at Fort Steele Junction B.C.

The Nanaimo, B.C., Electric Light Co., are erecting a new power house.

Some of the machinery for the Reliance B.C., Mining Co.'s quartz mill is being

delivered at the mill site on Forty-Nine creek. It will be all on the ground by the time the mill structure, which is now under construction, is finished.

The value of the exports from Canada to British South Africa for the fiscal years of 1902 and 1903 were as follows:

	1902.	1903.
Farm products...	\$3,514,509	\$1,264,684
Fisheries.....	9,990	12,736
Forest.....	82,560	246,839
Manufactures.....	181,803	362,111

A deposit of asphalt, estimated to contain about 500,000 tons has been discovered on Table Mountain, near Cape Town, South Africa.

Preparations are under way for a resumption of mining operations at the Helen mine of the Lake Superior Co., at Michipicoten, Ont. It is said that the mine will probably not ship much more than it has sold to Cleveland agents and for American consumption. If so it is probable that what ore may be required for the Lake Superior Co.'s furnaces at the Sault will be secured elsewhere. The company are also preparing to re-open their nickel and pyrotite mines at Sudbury and have already sent men there. In addition to the 50,000 tons of bessemer pig to be bought, the company are negotiating for a large purchase of coke, and are making ready to resume the construction of their two blast furnaces.

That the Nernst lamp is rapidly coming into favor in the city of Chicago is evidenced by the fact that many of the Company's customers are placing orders to increase the size of their Nernst lamp installations. Among these may be mentioned Armour & Co., and Nelson & Morris at the Union Stock Yards. The former company have recently added six 6-glower and nine 3-glower Nernst lamps to their system, while Nelson & Morris have increased their already large installation with twelve 3-glower Nernsts. In this connection it may be mentioned that Swift & Co. in the same locality have 125 6-glower and 750 3-glower Nernst lamps in satisfactory operation.

The Canadian manufacturers of linen fabrics are concerned over the scarcity of raw material, as Russia has heretofore furnished the chief supply. Before any disturbance in the foreign markets had become manifest, four linen mills had been projected in Canada. One of these is located at Edmonton, N.W.T., and one each at St. Joseph, at Orillia, and at Bracebridge, Ont. The last one is nearly ready to commence work. It will import its yarns from Belfast and will confine its operations to weaving and bleaching, producing damasks of medium and fine grades. The others will operate upon Canadian-grown fiber, large quantities of which are raised in western Canada, and which, at anything like present prices, will prove a valuable industry.

A special law for Iceland about the fencing of home fields, permits that during each of the years 1905-1909 there may be employed of the means of the so-called 'landkasse' 100,000 kroner, or \$26,080 for loans to farmers for the purchase of fencing material such as galvanized wire

fencing and galvanized iron posts for building fences. The purchase is to be done through the government. Canadian manufacturers of such goods, who might want further information, should communicate with C. E. Sontum, Canadian commercial agent at Christiania, Norway.

The price of aluminum is much less than formerly, thus making its use practicable for a number of purposes for which it would have been considered out of the question a few years ago. Judged by the price per pound it is still high, but when it is taken into consideration that a piece of aluminum of a given size weighs only one-third as much as the same bulk of steel, the apparent difference is modified. Weight for weight it is stronger than steel.

## FUEL.

For names of fuel dealers see "Coal and Coke" in Classified Index

Vancouver Island, B.C., coal trade conditions this year are decidedly bright, and there is every promise of an exceptionally large output, this being due to an increased Alaskan demand and the expansion generally of Northern trade and travel. Preparations are now being made for the survey and exploitation of the Imperial Coal & Coke Co.'s coal areas at Fording River, East Kootenay. Operations have been resumed at the Morrissey collieries. The output of coal and coke will be hauled by the Great Northern as formerly, and the demand will be materially increased when the Columbia Falls "cut off," now nearing completion, is in operation. This new portion of line saves 93 miles to Eastern points, and also does away with the 2,000-foot climb over the Hoskell Pass. Recently the Great Northern Railway have been overstocked with fuel from contracts entered into previously with American companies. This condition was aggravated by the falling off of trade. The traffic is rapidly increasing, and the demand for Morrissey coal, is expected to be steadily maintained henceforward.

The Kootenay Coal Co. have been incorporated at Victoria, B.C. with a capital of \$1,000,000, to carry on a general coal mining business, etc.

Messrs. Heyl & Patterson, Pittsburg, Pa., the contractors for the new coal washery for the Dominion Coal Co., Sydney, N.S., have the work now well under way. The building will be the largest of the kind ever constructed. Over 3,500 tons of structural steel will be used in the building, which will be over 400 feet long and five stories high. The work is expected to require a year for construction.

The obtaining of a supply of fuel is one of the chief difficulties that the Manitoba and North-Western farmer has to contend with. Where his farm is situated near some of the coal land in the North-West that difficulty is in a measure done away with, but a comparatively small percentage of the settled lands are contiguous to the coal fields. Farmers drive now as far as forty miles

to obtain coal and it is no uncommon thing for them to have to drive twenty miles and more for a supply of wood. At Rapid City, Manitoba, the nearest wood supply is twelve miles away.

Enquiries having been made of the commercial agent at Leeds and Hull, England, as to the prices of steam and gas coals, Mr. Jackson has obtained some valuable information. He expresses the opinion that only two things stand in the way of large exports of coal from Britain to Canada, one the export duty of 24 cents the other the import duty of say 40 cents. This is a matter of only 64 cents between the Nova Scotia coal producers and a competition that would certainly have a tendency to restrict output or cut prices. The best Yorkshire screened coal is quoted at \$3.00 f.o.b. Hull, and the cheapest Northumberland screened at \$2.38. The gas coals are about the same price. Were there no duty on imported coal the Northumberland article could be placed alongside Canadian seaports at about \$3.23, a price lower than now obtainable in the St. Lawrence for best Nova Scotia coals. Here we have another proof of what the Record has time and again called attention to, namely, that though the introducers of the National policy claimed that their action had been instrumental in wresting the coal trade from the clutches of the Americans, it really had no such effect, as the Americans never had control of the St. Lawrence coal trade, but that the imposition of the duty had assisted the Nova Scotia coal trade in a different direction. It had tended to the exclusion of British coal. And its retention is necessary to the continued prosperity of the coal trade.—Stellarton, N.S. Record.

In the Dominion Senate a few days ago Senator McMullen enquired whether, in view of the dependence of a large part of Canada upon a foreign country for its fuel supply, it was the intention of the Government to encourage the peat fuel industry. Hon. Mr. Scott, the Secretary of State, replied that the matter was under consideration, and no answer could be given at present.

A tremendous flow of natural gas has been struck in the gas well which is being drilled by the town of Medicine Hat, N.W.T., for the municipal gas system. In other wells gas was found at 600 feet. Two hundred and fifty feet of soft formation was drilled through. For several days the drilling was done on the hard formation, and at a depth of 1,010 feet a gusher was struck. A mercury test was made, and it is estimated that the well is flowing a million and a half cubic feet a day. The Council and Gas Commissioners are greatly pleased at the results of their experiments. The question of deepening the other wells on the town system will be considered. The finding of this gas flow will make Medicine Hat an important manufacturing centre of the West.

In an interview, Mr. Elliott, of the firm of Elliott & Baton, consulting coal mining engineers, Pittsburg, Pa., who designed and are now installing a plant

for the International Coal & Coke Co., at Coleman, N.W.T., stated that excellent progress is being made in the development of this property. The main gang is now 1,000 feet in No. 2 seam and cross-cutting to four other parallel seams will soon be started. Within a month rooms will be driven off, thus increasing the output very materially. The production now amounts to 150 tons per day, the entire work, pending on the installation of the plant, being done by hand. The plant is designed to maintain an output of 2,000 tons daily, and within three months one-half that output will be maintained. A larger tonnage cannot be handled until the tippie and remainder of the surface plant is installed. A considerable portion of the machinery has arrived, and the remainder is in transit. The completion of the first battery of ovens will be undertaken as soon as possible. Mr. Elliott further stated that the bituminous coal measures of the International Coal & Coke Co. were the largest he had ever seen. In Pennsylvania the largest seam in the famous Connelsville mine is nine feet thick, while one of the seams at Coleman is quite 18 feet in thickness. The Coleman coal is clean, being free from slate and other foreign substances. The output of the International Company, according to the reported statement of this authority, will only be limited by the number of plants the company may choose to build. The measures at Coleman are especially adapted for cheap mining, as there will be no shaft mining for several generations. Unlike the conditions prevailing in Pennsylvania, the coal at Coleman can be mined and extracted by gravity. As the mines will be self-draining no pumping plant need be maintained. The plant will be of the most modern and complete description, compressed air being utilized in haulage of the cars. Electrical machinery will also be utilized very extensively.—B.C. Mining Record.

During the month of May, 39,400 tons of anthracite coal passed through the American Sault Ste. Marie Canal, and 3,965 tons through the Canadian Soo. The shipments of bituminous coal through the American canal the same month amounted to 55,590 tons, and through the Canadian canal 98,772 tons.

The imports of bituminous coal into Canada from the United States during the month of April, 1904, were 267,186 tons as against 252,150 tons during April of last year. The total imports of bituminous coal during the ten months ending April 30, 1904, were 3,542,667 tons, a gain of 645,388 tons over the same period of last year. The imports of anthracite for the ten months ending April 30, were 1,387,025 tons, a gain of 510,025 tons over the same period of 1903. During the same time Canadian coal to the amount of 1,149,529 tons were exported to the United States.

A Press Telegram from Sault Ste. Marie, Ont., states that F. H. Clergue, A. B. Wolvin and W. F. Fitch, who are in the Soo looking after their interests in the gas franchise to be granted, are the prime movers in a company which soon

will begin the erection of a great coke plant in the Michigan Soo at a cost of \$750,000. "It is our intention," said Mr. Clergue, "to supply the surrounding country with coal for commercial purposes." The railroads centering at the Soo will receive their supply from there, as will all the industries on both sides of the river. The proposed company will handle probably about 350,000 to 400,000 tons of coal annually, using the fine coal or screenings for making coke. It will take 250,000 tons to supply the Algoma steel plant alone. The building of the plant will mean a reduction of \$500 per day in the running expenses of the steel plant.

Julius G. Hoffman, the well-known coal and coke dealer of Detroit, for whom J. H. Duthie, Toronto, is Canadian sales agent, reports a good Canadian business in Pittsburg, No. 8, Cambridge and Hocking coal, as well as in foundry and furnace coke.

The Crow's Nest Pass Coal Co. have received orders for 350 tons of coal daily for the Great Northern Railway and 125

tons of coke daily for Great Falls, while the Northport smelter has resumed, taking 150 tons of coke daily.

The Canadian Pacific Railway are opening a large anthracite coal mine at Banff, N.W.T., and invite tenders for driving a tunnel 1,200 feet long.

The Dominion Coal Co. are producing 13,000 tons a day and shipping an average of 7,000 to 8,000 tons per day. More than 3,000,000 tons have been sold in advance, of which 1,100,000 was purchased by the St. Lawrence district, and 15 per cent. more could have been disposed of at Montreal at the same prices.

Among the well-known United States coal concerns doing business in Canada is the O. W. Shipman Co., Detroit, Mich., of which F. B. Stevens is president, and J. S. Wandless, general manager. Mr. Brownlee, Galt, Ont., is Canadian sales agent. The company handle high grade Hocking, Massillon and Jackson coal and Pittsburg and West Virginia steam coal.

Mr. C. E. B. Adams' James Building,

Toronto, has been appointed Canadian sales agent for the Consolidated Coal & Coke Co., and the Coaldale Mining Co. The Buffalo offices of these Companies are in charge of Mr. E. C. Ring in the Prudential Building.

Coal is the cheapest article of general use in the world to-day, and brings to the family more comfort than any other article or articles which the same amount of money procures.

The old Liverpool coal mining property near Blairmore, B.C., is to be re-opened and worked.

A telegram from Fort William, Ont., states that Mayor Walsh representing the Pittsburg Coal Co., Pittsburg, Pa., had purchased water frontage there for the erection of extensive coal docks.

A seam of coal said to be of the finest quality in the world has been bored through at Chimney Corner, N.S. A number of other seams have lately been found in the same locality.

The Pittsburg & Buffalo Co., Prudential Building, Buffalo, N.Y., are among the

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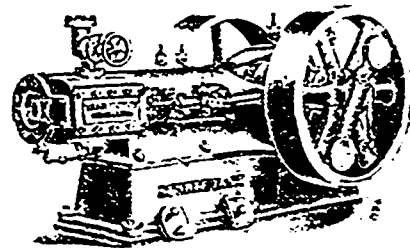
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large shippers of coal and coke to the Canadian market. They operate large mines in the Pittsburg district, and aside from producing Pittsburg steam coal, are prominent miners of Youghiogheny gas coal, and lower vein steam coal. The company operate a number of coking plants, brick and sewer pipe works and manufacture hollow building blocks. Their mines and plants have direct railroad connections with Canada by all roads centering in Buffalo and Pittsburg, and a large supply of individual cars enables them to handle Canadian business to the best advantage. Mr. M. H. McDonald, secretary and treasurer of the company, is in charge of the Buffalo office.

**PERSONALS.**

The proprietors of the newspapers of Nova Scotia at a recent meeting held in Halifax, N.S., have formed a Press Association including about 35 newspapers.

Mr. D. Martin has been appointed by the Dominion Customs Department to be Canadian Customs Officer in Buffalo, for the examination of baggage destined for Canada by the railways.

Mr. A. B. Lee, for years president of the Rice Lewis & Son, Limited, Toronto, died at the family residence, Jarvis street, June 22, aged 66 years. Mr. Lee had held a prominent position in business circles in Toronto. In 1878 he was president of the

Board of Trade, and in 1881 became chairman of the Board of Harbor Commissioners, a position which he held up to the time of his death. Mr. Lee entered the employ of Rice Lewis & Son in 1856; in 1877 he was made a partner, and in 1889, at incorporation, president of the company.

Mr. James Hardwell, of the Intercolonial Railway has been appointed traffic officer to the Railway Commission.

Toronto, No. 1, Canadian Association Stationary Engineers have elected the following officers:—1 resident, W. L. Oathwaite; vice-president, W. McGhie; financial secretary, W. J. Webb; recording-secretary; H. E. Terry; treasurer,

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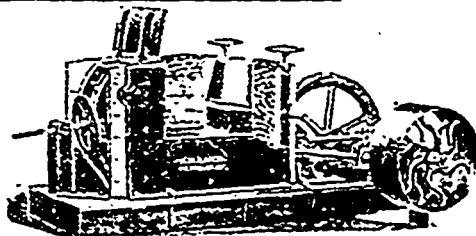
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**CAPTAINS OF INDUSTRY**  
Beginning on page 24.

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**J**UST to get acquainted, we would like the opportunity of sending one of these beveled edged rules free to every engineer. They are finely finished, **one foot long**, inch and metric systems. All that we ask is that you send us the coupon properly filled out, and a few small samples of the scale from your boiler. We will analyze this scale and send you a certificate of analysis. This is also free of any charge whatever.

We do this to learn about your feed water, that we may prove to you how and why Lord's Water Purifying Chemicals are the only compounds that will free your boiler from scale and keep it free.

Send the scale and coupon to-day.

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13 St. JOHN ST., MONTREAL.

GENTLEMEN, - I am sending you a sample of scale from our boiler. You are to analyze it, and send me a certificate of analysis and the rule, free of charge.

Number of boilers in use.....

Capacity of each boiler.....

Frequency of cleaning boilers.....

Frequency of opening the blow-off during working hours ..

River or other source of water supply ..

Boilers are used about..... hours out of the 24

Name.....

Street and No.....

City.....Province .....

Firm's Name .....



Chas. Moseley; conductor, W. H. Smith; doorkeeper, W. S. Butler; delegates to executive convention, W. J. Webb, Geo. Thompson, W. L. Oathwaite, and Geo. C. Mooring, trustees, J. Dixon, Geo. Thompson and N. V. Kuhlman.

At a meeting of the directors of the Canadian Colored Cotton Co., in Montreal recently, Mr. S. Greenwood, manager of the Cornwall Mills, was appointed general manager, succeeding Mr. C. D. Owen.

The principal speaker at the 50th banquet of the civic club of Niagara Falls, N. Y., on the evening of June 14th, was Hon. Geo. E. Foster, Toronto. Other Canadian speakers were L. Goldman, of the North American Life Insurance Co., F. A. Hilton, Jas. B. Murray, and E. P. Pearson. Mr. E. H. Taylor of the Frontier Mfg., Co., Niagara Falls, N. Y., is president of the club.

The Chicago office of the Nernst Lamp Co., in charge of A. E. Fleming, as district manager, has been removed from 638 National Life Building, LaSalle Street to 99 E. Lake Street. The new offices are larger and better equipped in every way to care for the increasing business of the company in that locality.

Messrs. Waddell & Hedrick, the well known consulting bridge engineers of Kansas City, Mo. have opened head offices for Canada in the Manning Chambers, Toronto, and the DeLano-Osborne Engineering Co., have transferred to them that branch of their business, and the two companies will hereafter work together. Messrs. Waddell and Hedrick are now

consulting engineers in charge of the great Frazer River bridge being erected at New Westminster. B. C. The DeLano-Osborne Engineering Co., are in charge of the inspection work of this contract, and the Dominion Bridge Co., of Montreal are furnishing the structural steel and doing the erecting. J. A. Waddell, D.Sc. LL.D. of Waddell & Hedrick is a Canadian, a member of the Society of Civil Engineers, and a member of the Institute of Civil Engineers of London, England, and of the American Society of Civil Engineers. Mr. Ira G. Hedrick of the firm is also well known in the engineering professions.

The B. F. Sturtevant Co., announce the removal of their entire plant from Jamaica Plain near Boston, to their new works at Hyde Park, Mass. With nine acres of floor space and all the modern appliances, they will continue to manufacture the well-known Sturtevant products. Blowers, engines, motors, economizers, forges, steam heating, ventilating and drying apparatus, etc.

Announcement is made that the Packard Electric Co., St. Catharines, Ont., have located a permanent office in Winnipeg, at 31 Canada Life Building with G. A. Powell as north-western representative. This new branch, it is understood, opened with splendid business and already is augmenting the reputation which the Packard company have earned for progressiveness.

The Globe Machine & Stamping Co., Cleveland, Ohio, inform us that they have acquired the good-will in business, machinery, etc., of Otto Konigslow, that

city, who has heretofore been engaged for many years in a similar line of business. Mr. Konigslow will be a stockholder in the Globe Machine & Stamping Co., of which he will be a director and superintendent. The plant of machinery and other facilities of the company are being greatly increased, and they will be better than ever equipped to execute orders in their line. The factory will remain as before at 970 Hamilton street, Cleveland.

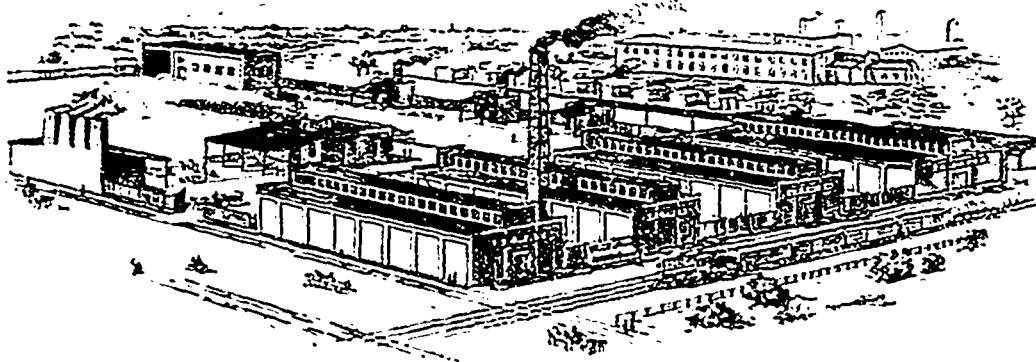
The Athabaska Fish Co., Selkirk, Man., have been incorporated with a capital of \$100,000, to carry on a fish packing and canning business, and to manufacture fish and animal products, etc. The provisional directors include J. K. McKenzie, R. Smith, and H. C. Ray, Selkirk.

Messrs. C. W. Bongard & Co., Toronto, have been appointed western agents for the Wire & Cable Co., Montreal.

### INDUSTRIAL PUBLICATIONS.

(The publishers of THE CANADIAN MANUFACTURER solicit in advance, if possible catalogues, circulars, and other industrial publications issued by manufacturers. We wish to review such literature, and bring the principal points to the attention of our readers.)

"Imperial Preferential Trade, from a Canadian Point of View," is a very timely pamphlet by Adam Short, M.A., professor of political science in Queen's University, Kingston, Ont., published by Morang & Co., Toronto. It is a valuable contribution to one of the most important controversies in the Empire's history, and while



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since we commenced to make Varnish. During this period we have acquired a knowledge not only of Varnish, but of the varied needs of varnish consumers that nothing but time can impart, and have also learned how to cater successfully to every varnish want.

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Safest goods to handle, surest and most reliable goods to use.

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**BERRY BROTHERS, Limited, - Walkerville, Ont.**



it would be too much to say that it settles the question against the new fiscal proposals, it certainly should help to correct the attitude of many people, who openly espouse their cause, with but a very loose understanding of the real and manysided question at issue. Price, 25 cents.

The J. H. Woods Advertising Co., Mail Building, Toronto, have issued an attractive folder calling attention to the work of the company. Another booklet recently issued by them and published in English and French, sets forth in "Pen and Picture," the industrial and commercial features of Toronto.

Graphite as a lubricant, scientifically and practically considered; notes upon its manifold usefulness as an accessory for engineers, eighth edition revised. This is, as the title purports, a scientific publication, and in 52 pages are found many items of value and interest to the worker in iron and steel. It is published by the Joseph Dixon Crucible Co., Jersey City, N J, and a copy will be mailed on application.

Mr. David Sleeth, Montreal, Que., sole agent for Canada for Lord's boiler compounds, writes in answer to an enquiry as follows: Lord's boiler compounds are in dry powder form, free of acids or anything injurious to iron or packing. They prevent pitting or corrosion in any form, and will reduce the hardest scale to sludge which is easily blown off. When boilers are free of foreign matter, engineers know how much easier they make steam, and also the great saving in fuel bills. Analyses are always made free of

charge on samples of boiler feed water or scale. Individual treatment by the company's expert chemists give clients a guarantee bond to this effect.

The Chicago Pneumatic Tool Co., Chicago, whose Canadian offices are in Temple Building, Toronto, have issued a new catalogue relating to air compressors. The original patterns of Franklin compressors and the new type G compressors recently introduced by this company are illustrated and described. The catalogue contains much valuable information relative to the erection, care and adjustments of air plants, and many tables and formulas interesting to those interested in pneumatics.

The Canadian General Electric Co., Toronto, have issued bulletin 831, relating to meridian lamps.

The Laurie Engine Co., Montreal, describe their line of Corliss engines and feed water heaters.

"Heavy Duty Engines," is the title of the latest publication of the Goldie & McCulloch Co., Galt, Ont.

The Toronto Electrical Works Co., Toronto, have issued a folder of the Premier Canadian time recorder, which they now manufacture.

The Philadelphia Textile School of Industrial Art of the Pennsylvania Museum have sent us their circular relating to their twenty-eighth season. What the book calls an "Historical Sketch" of the museum and the school, constitutes a most interesting illustrated description of the establishment.

The Cassella Color Co., New York, are sending to the trade supplement No. 17 to their book of "Colton Dyeing," relating to immedial dark brown D. conc., and supplement No. 19 to same book, relating to immedial bordeaux G. conc.

The Dodge Mfg. Co., Mishawaka, Ind. have sent us a copy of their "Power and Transmission," published by them. It is an illustrated review of factory economies and power transmission, etc.

The Canadian Casualty & Boiler Insurance Co., Toronto, of which Mr A.G.C. Dimick is managing director, have issued an attractive folder calling attention to the sound business principles of the company which have been an important factor in the enomonal growth of the company ever since their formation. Offices have been opened in Hamilton, Montreal, Ottawa, and other Canadian industrial centers.

We are in receipt of the 1904 edition of the American Trade Index, published by the National Association of Manufacturers of the United States, whose head offices are at 170 Broadway New York. It is a descriptive and classified membership directory of the association, arranged for the convenience of foreign buyers. The primary object of the book is to acquaint importers in foreign countries with the leading makers in the United States who are members of the association of all classes of goods which they make suitable for the export trade. We are told that the edition comprises 12,000 copies, of which 7,500 are for foreign distribution. This foreign distri-



Boyer Long Stroke Riveting Hammer.



Chipping Hammer.

## Chicago Pneumatic Tool Co.

GENERAL OFFICES, Fisher Building, CHICAGO.  
 CANADIAN OFFICE, Forester Temple Bldg., TORONTO, ONT.  
 EASTERN OFFICES, 95 Liberty St., NEW YORK.



"Little Giant" Wood Boring Machine.

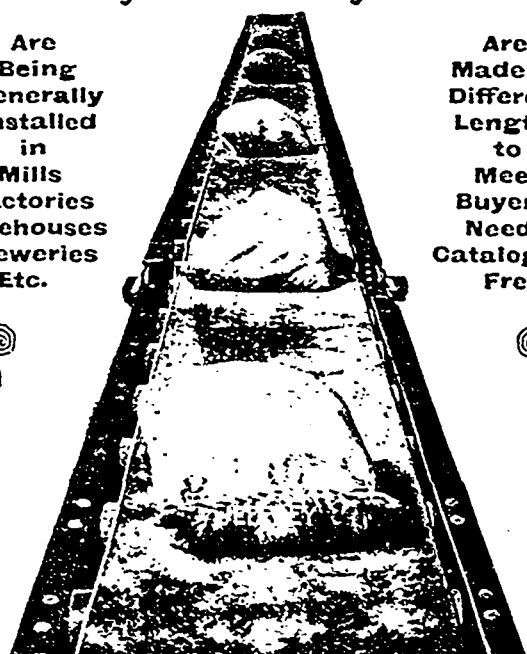
*We Manufacture Air Compressors and Pneumatic Appliances of every variety and highest quality.*

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**THE JEFFREY MFG. CO., Columbus, Ohio, U. S. A.**

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butter is gratuitous to importers and manufacturers in countries outside the United States who are or may be interested in purchasing American goods. The association is supported wholly by the annual fees of its members, and devotes its energies to the cultivation of its members interests.

The D. Van Nostrand Co., 23 Murray St., New York, have sent us a copy of their recently published work regarding the inadaptability of the proposed system of metric weights and measures, the title of which is "The Metric Fallacy," by Frederick A. Halsey, and "The Metric Failure," by Samuel S. Dale. The first part of this book by Halsey, is an outgrowth of a paper presented to the American Society of Mechanical Engineers at its meeting in December, 1902, the points raised in the discussion having been rewritten. The list of countries in which it was shown in the paper that the old units continue in use has been about quadrupled, while new chapters are added on the "Reasons for the Failure of Compulsory Laws" and other important points. That part of the book devoted to a discussion of "The Metric Failure in the Textile Industry," by Dale, has also been entirely rewritten, and is believed to be the first critical anti-metric analyses of the system from the standpoint of the textile industry that has been made. The book cannot but be of exceeding interest to all manufacturers; and the price \$1.00 in cloth binding; places it in easy reach to those who may be interested.

The Canadian Rand Drill Co., with head office and works at Sherbrooke, Que. have sent us a copy of their new illustrated catalogue having reference to the Air Hoists, Jacks, Jib Cranes, Trolleys and Pneumatic Machinery manufactured by them. The illustrations show the general appearance of the articles more fully described in the text. The book is printed with good ink in heavy coated book paper, and the descriptions are exhaustive. It will be sent on request.

The Toronto Industrial Exhibition prize list has just been issued, and is now in course of circulation. It is a rather better production than usual, the covers being slate color, with embossed lettering, setting forth that the Canadian National Exhibition, the name chosen by the directorate for this year, will be held from August 29 to September 10. The title page announces that \$35,000 will be given in premiums open to all the world, distributed between 261 classes, comprising about every conceivable industry. The days of the Exhibition are slated as follows:—Monday, August 29, preparation day; Tuesday, August 30, opening day; Wednesday, August 31, press and school children's day; Thursday, September 1, Scotland's day; Friday, September 2, manufacturers' day; Saturday, September 3, commercial travellers' and pioneers' day; Monday, September 5, Labor Day; Tuesday, September 6, farmers' day; Wednesday, September 7, stock breeders' and fruit growers' day; Thursday, September 8, American day;

Friday, September 9, society and review day; Saturday, September 10, citizens' day; Monday, September 12, get-away day. Every class has been thoroughly gone over, and all the conditions, rules and regulations revised and put in such language that the simplest can understand. In previous years there has been some misunderstanding as to terms, but this year the directorate are confident that there will be no room for argument. The premiums have been added to, compared with the years previous to 1903, when the Dominion grant made an increase of 20 per cent. all round possible. Upwards of \$25,000 is given for live stock, being more than the total offered at any annual fair on the continent, world and international fairs of course being excepted. The division of live stock premiums is as follows: Horses, \$10,196; cattle, \$7,615; sheep \$2,724; swine, \$2,240, making a total of \$22,775, to which has to be added between two and three thousand dollars for poultry and pet stock and dogs and cats. Copies of the prize list can be obtained from J. O. Orr, 70 King street east.

\$30.00 TO COLORADO AND RETURN

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# Canadian National Exhibition

— OF —

1904 TORONTO 1904

Aug. 27th

\* The National Show of Live Stock, Agricultural and Horticultural Products, Art and Manufactures.

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Correspondence solicited.



Sept. 10th

Advancement and Improvement in Every Department.

42nd ROYAL HIGHLANDERS' BAND

"THE BLACK WATCH"

in attendance daily.

SPECIAL SPECTACLE EVERY EVENING

The Relief of Lucknow.

Twenty-Sixth Annual

Entries close Aug. 8th

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**CHEAPEST POWER IN CANADA,**

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LIGHT or HEAVY

**BLEACHING POWDER,**HIGH STRENGTH, 35/37% IN  
HARDWOOD CASKS.ALSO CAUSTIC SODA, SALSODA, CONCENTRATED SALSODA  
SALAMMONIAC, Etc.**BRUNNER, MOND & CO., LIMITED, NORTHWICH, ENG.**

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## WIRE WINDOW GUARDS

FOR FACTORIES

— WE KNOW HOW TO MAKE THEM —

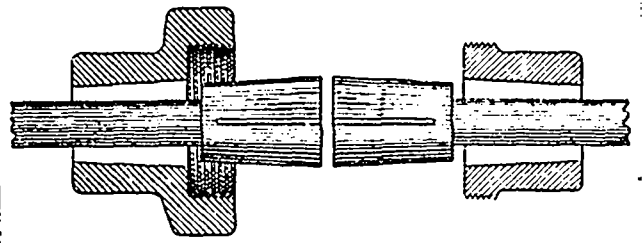
THE

# GEO. B. MEADOWS

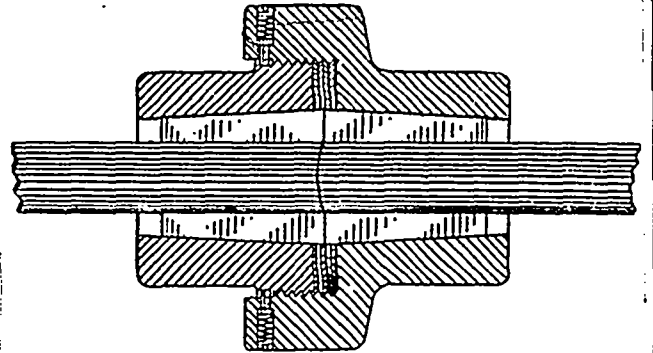
Wire, Iron & Brass Works Co., Limited

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SAFETY



No Bolts. No Keys.  
No Slip.

G. S. SINCLAIR & SONS  
IRON FOUNDERS WARTON, ONT.



# THE GRIFFIN MILL

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Newaygo Portland Cement Co.,	Newaygo, Mich.	Wolverine Portland Cement Co.,	Coldwater, Mich.
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Bonnerville Portland Cement Co.,	Siefried, Pa.	Diamond Cement & Litho. Stone Co.,	Chicago, Ill.
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**Thoroughness of Method**

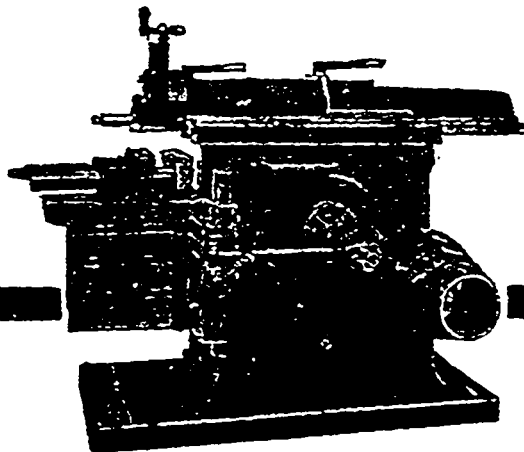
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	<u>WOOD-WORKING MACHINERY</u>			
	<u>SAW MILLS</u>			
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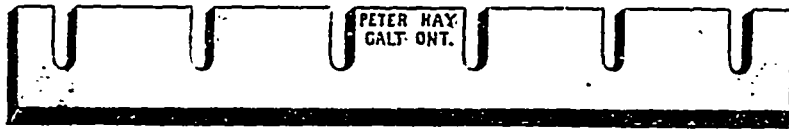
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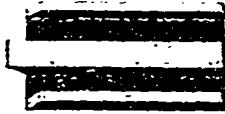
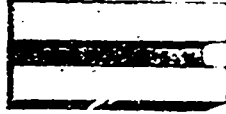
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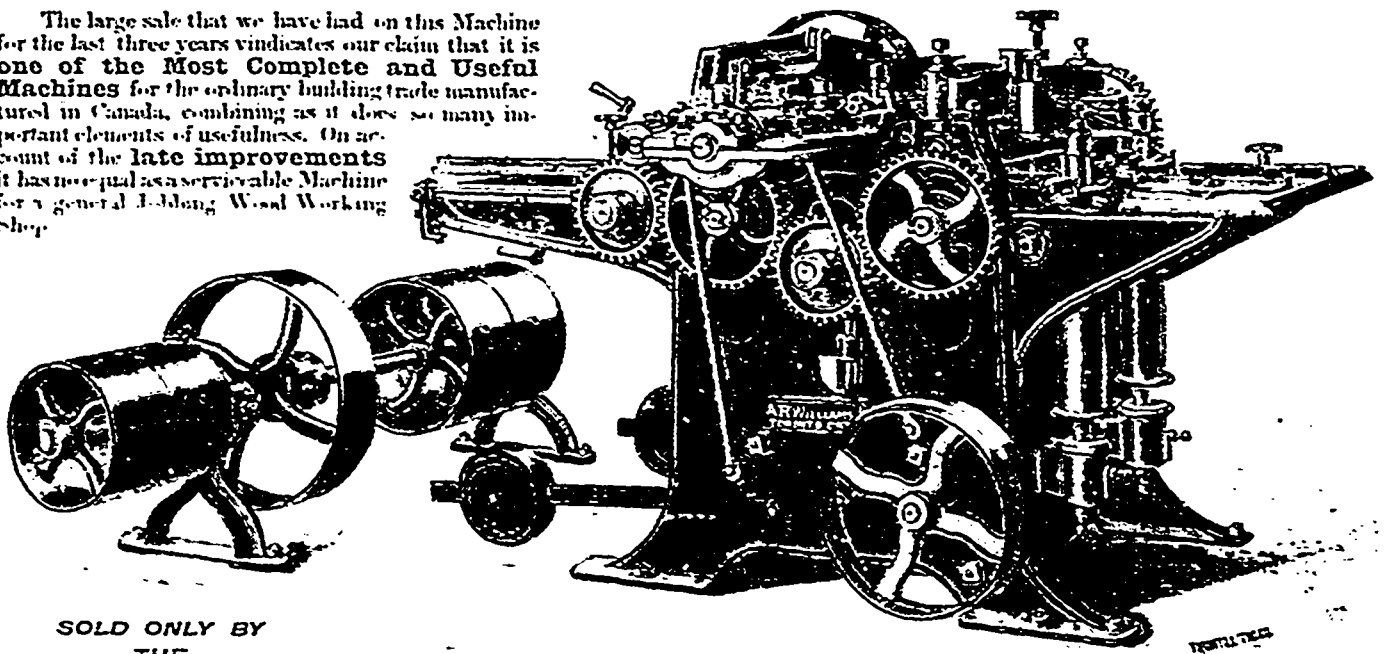
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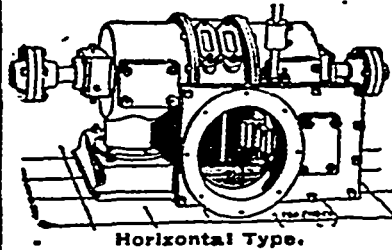
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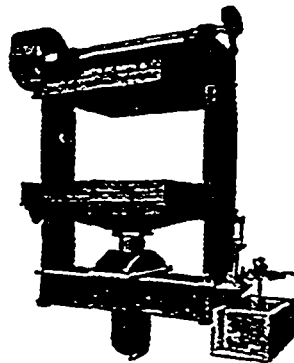
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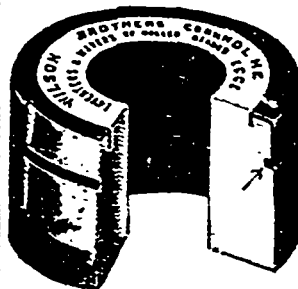


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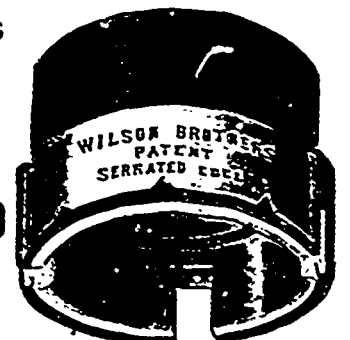
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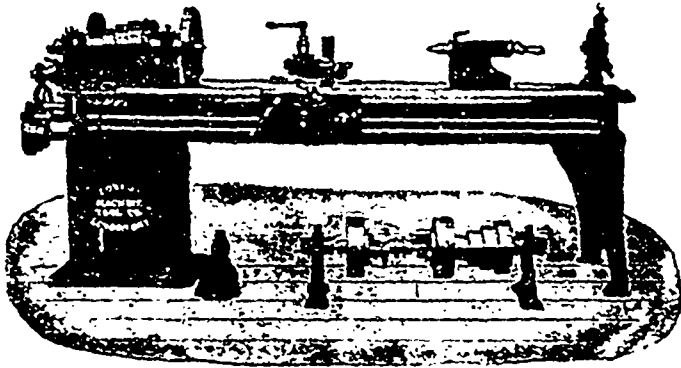
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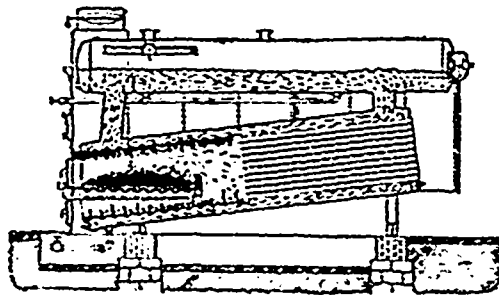
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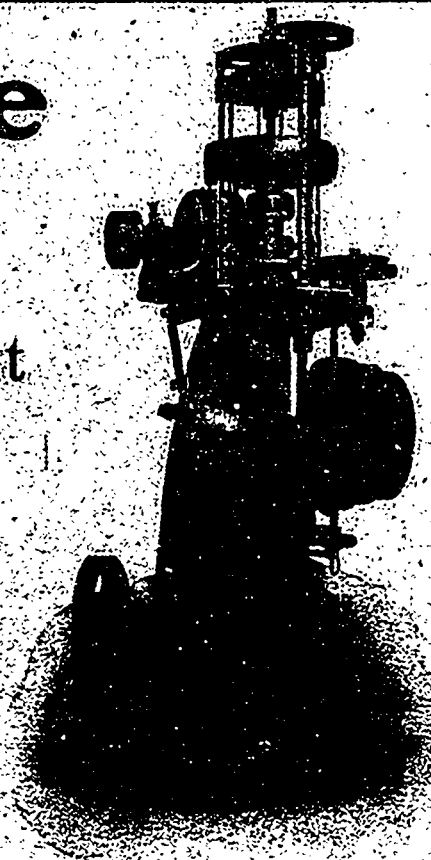
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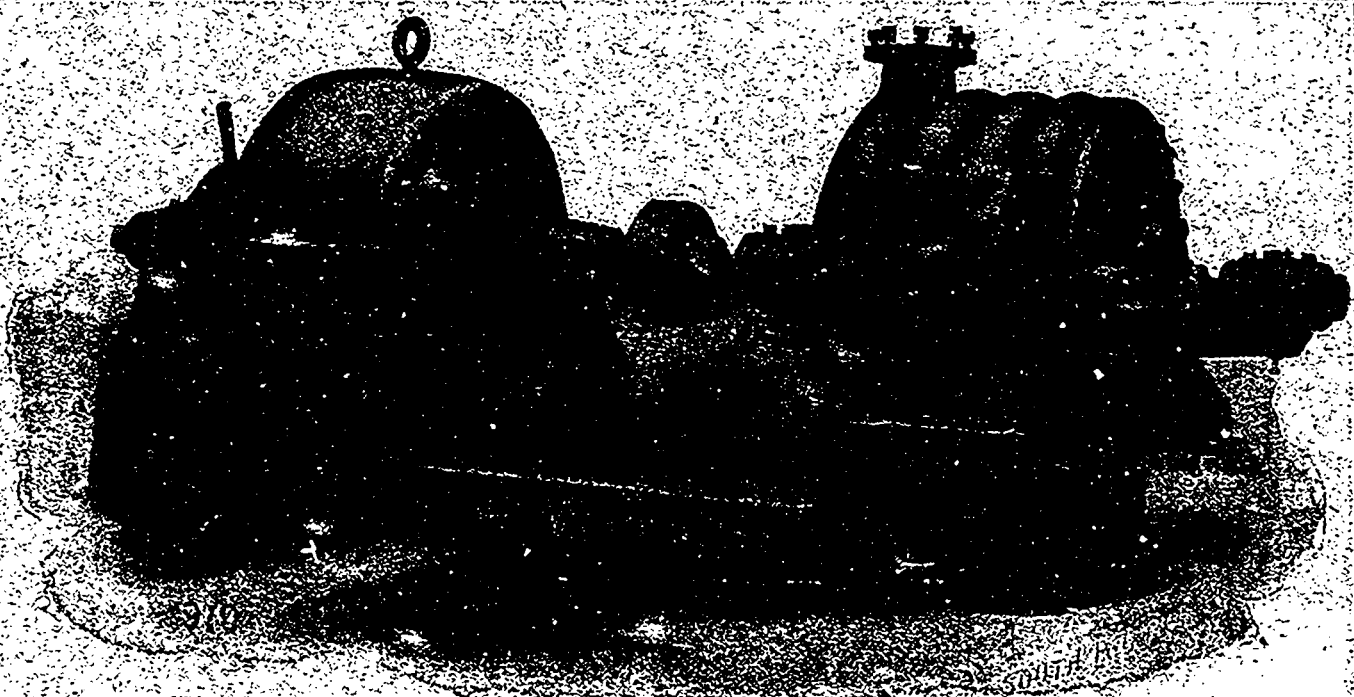
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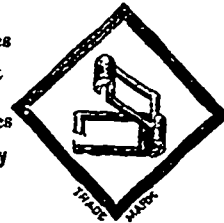
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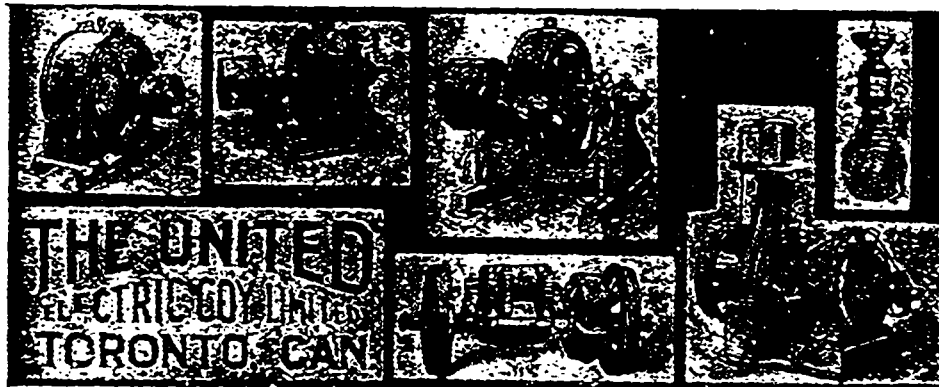
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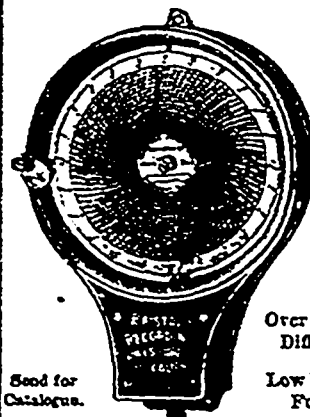


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