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MISSING

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VOLUME X.

PORTRAITS.

OBITUARY.

The Canadian Engineer

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CONTENTS OF THIS NUMBER :

The articles now running in the Canadian Engineer on the Electrical Power Developments of Canada, will be reprinted in book form, with diagrams and folding plates. Price $5.00 per copy Advance orders received.

INDEPENDENT TELEPHONY IN CANADA.

Up to very recently, practically all the telephone business in the Dominion was controlled by the Canadian Bell Telephone Company, a licensee of the American Bell Telephone Company, of Boston, Mass. The latter company for many years held exclusive patents on the telephone and had a complete monopoly in almost every country, excepting Germany, France, Norway and Sweden. The Boston company was not an operating company in itself, but held the patents and furnished the instruments to sub-companies, organized for the purpose of operating exchanges in certain territory assigned to them. The telephone instruments were not sold to the sub-companies, but were leased at an annual rental of from two to ten times their cost, and upon a condition that no other make of instrument or appliance should ever be used in connection therewith. The sub-companies were required to purchase the switch-board and central office equipment from a manufacturing company controlled by the members of the Boston company. Besides paying a high price for their switchboard apparatus originally, they were usually required to pay a large annual royalty on each line equipment. The parent company, having practically a perpetual contract with the sub-companies, that all future apparatus must be secured from their allied companies, are in a position to demand almost any price and terms for their later appliances and prevent the adoption of other makes of apparatus, even if it should be more modern, more convenient and efficient.

In view of these conditions in the past, it plainly can be seen why it was necessary for the Bell operating companies to charge exorbitant rentals, especially when taking into consideration the large amount of watered stock in their own organizations, in addition, on which they aimed to pay dividends. Under their present capitalization and their arrangements with the parent and manufacturing companies, to which they are tied by contract, it is scarcely possible to bring their rates down to a legitimate basis and give first-class service.

Since the expiration of the fundamental patents early in 1894, and the opening of the Independent telephone business in the States, there has been a greater development in this line there than in any other country. There have been more independent exchanges established in the States and more telephones put into use during the past five years, than were used for the twenty years previous. Competition among the various independent manufacturers has also been a remarkable influence to develop the highest class of equipment and the simplest and most convenient and efficient systems possible in the art.

It is true that the Bell Company have made progress and are gradually modernizing their antiquated apparatus, but the cost of remodeling is heavy. The makers of independent telephone equipment on the other hand, are able to supply the most perfect instrument at the start, and their equipment will therefore pay a dividend on a lower annual rental of instruments. By starting an independent telephone system in a centre from which a group of towns in a radius of about 50 miles can be covered, most of the practical benefits of a long distance service can be secured. As companies can then be started in neighboring centres, the area of independent systems can thus be widened and the extortions of the present monopoly can thus be neutralized. The remarkable growth of independent systems in the States is just beginning to be understood in Canada, but there is still a craven fear of the Bell Company in many quarters. As more light dawns

upon local capitalists and the public, this fear will be replaced by confidence, and the future of independent telephone enterprises will be assured. This emancipation is, in fact, already taking place, for there are at the present time forty independent telephone companies in Canada, chiefly in parts of the country to which the Bell have been either unable or unwilling to extend its system. One of the latest and most important enterprises of this sort is the system just put in at Port Arthur and Fort William, described in detail in this issue.

The ideal solution of the telephone problem in Canada is the nationalization of the service and the extinction of the Bell monopoly by purchase by the Dominion Government, the control of this service being placed in the hands of a commission, independent of politics and irremovable by a party. This plan is carried out in Australia in the management of the Government railways, with the most satisfactory results, and such a plan would succeed equally well in this country, if not only the telephones, but the railways and telegraphs were taken over by the State. The hope of getting any effective control of Bell rates by a parliamentary committee is utterly vain; and if public opinion is not yet ripe for nationalizing the telephone service, then the only alternative is the extension of the system of local independent companies, as in the United States.

—The glass in York Cathedral, in England, which dates from the 13th and 14th centuries, has recently given evidence of a curious "disease." Small holes have made their appearance, and it is losing its transparency. It would be interesting to learn whether this phenomenon has been observed anywhere else, and what the cause may be.

—It is rumored that Governor Odell, of New York, will recommend in his message to the State Legislature that the Lake Ontario route be adopted in preference to the Erie Canal route for a 1,000-ton barge canal from Lake Erie to the Hudson. This route will, it is stated, effect a saving of $20,000,000 in the cost.

—Is granite a mineral? will have to be decided by the courts in a suit brought by the Northern Pacific Railway against J. A. Soderberg, of Washington State. When a land grant was given to the railway, all minerals were reserved, hence the action. Most persons would say that granite is a rock, not a mineral, but the Century Dictionary defines a mineral as any constituent of the earth's crust.

—Capt. McKay, chairman of the committee on aids to navigation, of the Lake Carriers' Association, in reply to an enquiry by F. H. Clergue, states that no experiments with acetylene gas for buoys have been made in the United States, though several schemes have been proposed. The light-house department will test any working model which promises success. As the Engineer has already stated, the Canadian Government has been experimenting, using Pintsch gas with about 20 per cent. of acetylene to increase the brilliancy of the light. The difficulty seems to be to find a reliable burner, as they all become defective after a very short service.

—The coal production of the world for 1901 was 866,165,000 short tons, of which Great Britain produced 28 per cent., Germany, 19.2 per cent., and the United States, 34 per cent. These three nations, which have 10 per cent. of the world's population, produced 81 per cent. of the total coal mined. The output represents the labor of over 3,711,000,000 men during one year. This is more than double the population of the globe. The calculation is based on the assumption that the combustion of a pound of coal produces energy equal to the work of one horse for one hour, and that one horse is equal in power to seven men.

—During the past three or four years the demand in many branches of manufacturing has exceeded the supply. Especially is this true in the iron and steel trades. The result is the establishment of many new plants. Caution should be exercised, for when a time of depression comes, as necessarily it must, many of these plants will be idle. It is better that the demand should exceed the supply than that over-production should be unduly stimulated.

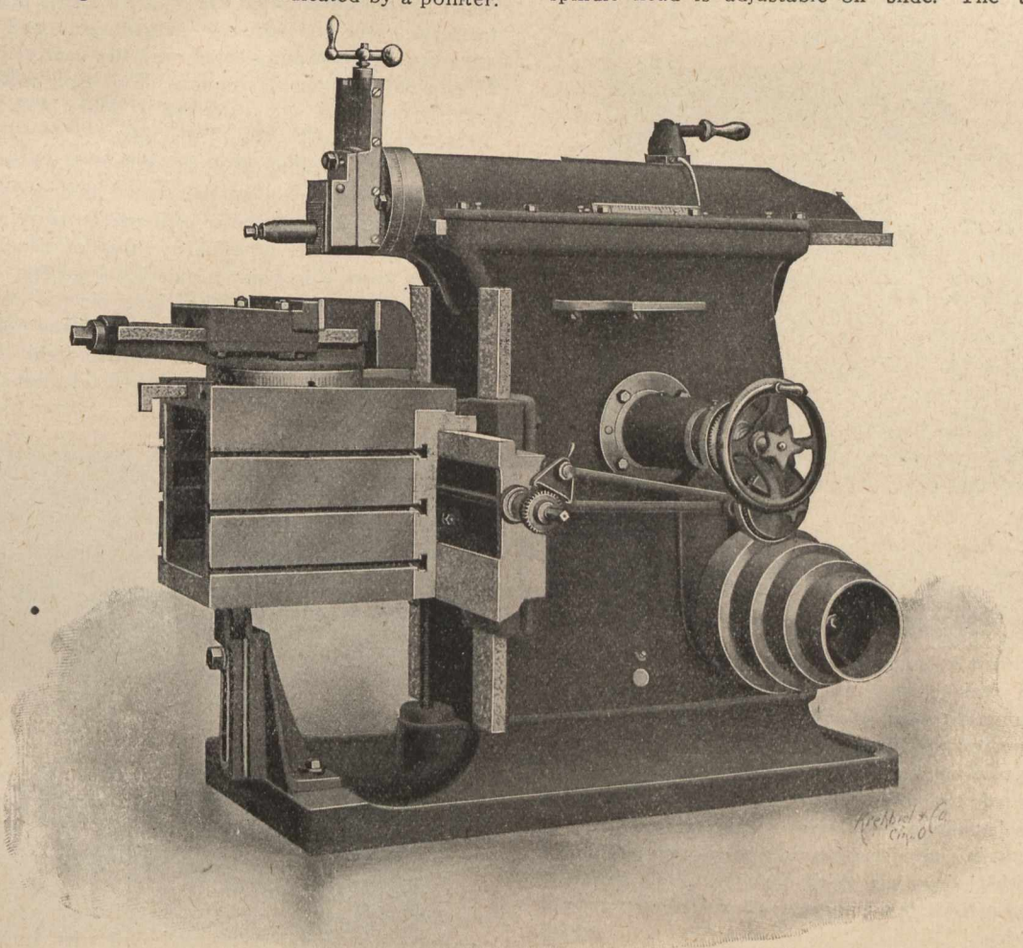
—The breakage of steamer screw shafts is one of the most puzzling of current engineering problems. These accidents are generally attributed to combined bending and torsional action. A ship not being a rigid body, wave action may produce a bending strain on the shaft, which, added to the torsional stress, due to the action of the engines, may cause a break. An increase in the diameter of the shaft might only increase the difficulty. The Engineering News speaks of another theory recently put forth, which attributes shaft failures to torsional vibrations of the shaft. This will have its effect in a heavy seaway, where the screw is alternately in and out of the water. Investigations made in Germany show that in some cases the momentary torsional force is nearly three times the average. In some cases the torsional stress is reversed, and the propellor actually drags the engine along. The torsional deflection of the shaft was found by the electric chronograph. The practical application is that to keep the vibrations within safe limits the speed of the engines must be regulated with reference to the natural period of vibration of the shaft.

—An interesting application of electrical energy, which furnishes an object-lesson to electrical companies in Canada and the British Colonies, is now developing in California, where the Northern California Power Co. now has a Westinghouse generating plant, at Cow Creek, a station situated in the high Sierras, and which is typical of the many transmission plants recently installed in that State. Besides furnishing current from this and another station for ore smelting, for operating air compressors, and for town lighting and waterworks, a large amount of current is applied to the irrigation of land. A number of towns lie along the rich valley of the Sacramento river, and

irrigation is necessary on most of the land in the valley. Electrically driven centrifugal pumps are employed to raise the water to the irrigating ditches. This cheap method of placing in the hands of the farmer the ability to obtain water away from streams and creeks has made him independent of the great water companies, and has rendered it possible to develop large areas of land which would otherwise be practically desert wastes. Many thousands of motors are already in operation in California driving pumps for irrigation work, and immense developments are yet to ensue from this application of electric power. The same thing can be done in many districts of Western Canada, where ordinary canal irrigation cannot be carried out.

BACK GEARED CRANK SHAPER.

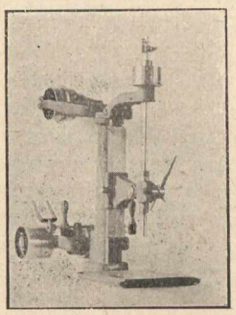
The accompanying cut is an illustration of a 16-inch back geared crank shaper now placed on the Canadian market by the Fairbanks Co., of Montreal, who have gone more largely than heretofore into machine tools. This tool is of new design, and has a number of valuable features. The column is of unusual depth, and is strongly braced internally. The ram is very long and wide, its position can be changed while in motion, through the hand wheel shown near the head of the ram. Various lengths of stroke are indicated by a pointer.



The tool head is graduated, the down feed screw is also marked with graduations. It has a single gear crank, and can be instantly changed to a back geared machine by means of a lever located at the rear of the column. The table has T slots on the top and either side, giving ample opportunity for securing the work. The vise has tool steel faced jaws and centre points, the base of the vise being graduated. Key-seating of the shaft and similar work is provided for by an opening through the column, all the gears are cut from the solids, and accuracy of alignment is a special feature, it is also fitted with self adjustable feeding machine.

MANUFACTURERS' BENCH DRILL.

This drill is designed to meet the requirements of manufacturers who want a thoroughly well made tool at a moderate price. They are carefully made in large lots, with special tools and fixtures for their manufacture, and each machine is thoroughly inspected before leaving the works. The spindle is a special forging, made from high-grade spindle steel, as hard as can be worked and is carefully ground on dead centres. It is driven by a 1½ inch flat belt,



has three speeds, cut steel rack and pinion feed, and an adjustable stop to gauge depth of holes. It is entirely relieved of belt strain and is counter balanced by a weight inside the column, which makes it extremely sensitive and uniform to the touch. It is also provided with means for taking up wear or lost motion, and is fitted to No. 1 Morse taper. The spindle head is adjustable on slide. The table has an oil groove entirely around it. A thoroughly well-made reliable counter-shaft is securely bolted to the machine. The shifter is very conveniently arranged, having two handles, whereby it can be manipulated from either side of the machine. Drill chucks and drill shanks can be supplied if required. This drill is made by the Hamilton Tool and Optical Co., Hamilton, Ont.

A 100-h.p. Wheelock tandem engine has been installed by the Brussels Electric Light Co.

PORT ARTHUR AND FORT WILLIAM INDEPENDENT TELEPHONE SYSTEMS.

References have been made in past issues to the new independent systems of telephone exchanges in the twin towns of Port Arthur and Fort William, Ont., and as these systems are now in successful operation a description of the equipment will prove interesting since they are among the first important independent telephone exchanges established in opposition to the old Bell Company in Canada. The possession by these towns of progressive, public-spirited business men, and their practical isolation from other large cities have been the main incentives that have spurred them to establish the large public utilities under the control of the municipalities. Port Arthur owns and operates about seven miles of electric street railway, running through and connecting both towns. It has its own shop where the electric cars are built. The Current River Falls are being utilized by the town for generating electricity for the street railway system, electric lighting, heating and manufacturing purposes. Both towns own their respective electric lighting plants, water

Fig. 1.

systems, and now have just completed their own telephone plants for public service.

In establishing these exchanges, it was the aim of the officials of the towns to place the plants upon such a basis that the cost of maintenance and operation together with payment of interest on the investment would be covered, allowing a fair percentage for depreciation. This was done to leave tax-payers who were not subscribers, free from any cost or expense of the plants, and to avoid taxing subscribers for the benefit of non-users. Taking into consideration the saving in the cost of construction and operation in connection with their other allied systems, the rates were fixed at $1 per month for residence service, and $2 per month for business service.

The proposition was submitted to the ratepayers at an election in April last. The old company having, for a number of years past, neglected to give any attention to the repeated requests from the towns and subscribers to improve their system, and give efficient service, the proposition for a new plant of a modern system at reasonable rates, was adopted almost unanimously and sufficient funds appropriated to construct and equip the exchanges.

The Fort William plant is constructed with the lines entirely independent from the other electric systems, while the Port Arthur exchange is built with its lines occupying poles in conjunction with the electric lighting plant and street railway system. Both exchanges are with an immediate capacity for 600 lines with provision for increasing above this number at any time, as required. Both towns having in view to secure the best possible plants that money could buy, all known makes of equipment and construction material were thoroughly investigated and tenders were rceeived from the principal foreign firms as well as the home companies. A large part of the outside construction material was secured from home companies, the principal line wire from Germany, and the telephones and central office equipment from the United States.

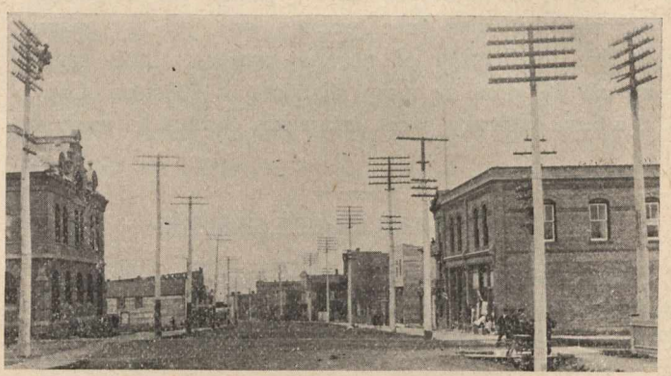


Fig. 2.

The line construction work and the connecting of the instruments with the central office, was done by the towns under the supervision of the Electric Light and Power Commissions. The telephones, switchboards and central office apparatus were manufactured, and the central offices installed by the International Telephone Mfg. Co., of Chicago.

Fig. 1 shows the town hall at Fort William in which is located the central office of that plant.

The central office at Port Arthur is in the second floor of the building shown on the corner in front at the right, in Fig. 2. This building is in the exact centre of distribution. Four leads of wires of equal number of circuits run in each direction from this point along both streets. The municipal plant's lead is shown at the right side of the street. The telephone wires are placed at the top of the pole lines and the 2,000 volt alternating current electric light circuits are attached about 8 feet below the lower telephone wires.

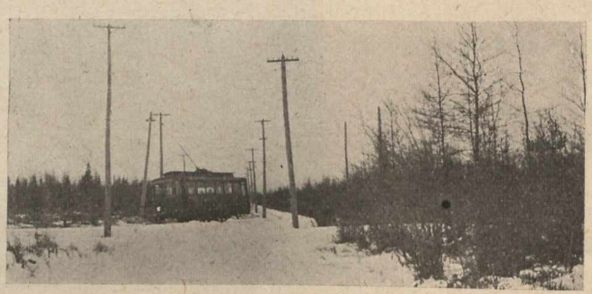


Fig. 3.

Fig. 3 shows the trunk lines between the two towns. The telephone wires are placed on the same poles with the 500 volt direct current street railway feeders. They are about 6 feet above the feeders, and are properly transposed to avoid induction.

The switchboard (shown in Fig. 4) is a strictly central energy lamp signal trunking board with double supervisory clearing-out signals, pilot lamps, etc. It is built in a regular multiple switchboard frame and cabinet, and so arranged that when the number of subscribers increase and extensions are required above the number that two operators can handle, necessary multiple jacks may be installed and the board readily made into a full multiple switchboard without discarding the original installation. The board shown is equipped with 280 subscribers' lines, with one hundred and forty (140) to each position. It is arranged so that 60 lines, or even more, may be added to each operator's position and additional positions or sections added at any time. The key-shelves

are made of a veneer of five layers of wood, securely glued together. The ringing and listening keys are mounted on the bottom of the shelf with the levers extending through nickel-plated swivel escutcheons mounted on the top. All terminals of the International key being at one end, makes it possible to have all wires made up in one cable form, leaving the platinum contact points free and open for inspection. The signal lamp holder is an opaque insulating tube with an opal set in a brass cap. It is provided with slots at the opposite end from the opal, leaving the terminals of the lamp exposed when inserted. The opaque tube with lamp is very easily placed in the bank of lamp jacks direct from the front of the board. The lamp being enclosed, confines all the light to the one opal and prevents any possible chance for a mistake in knowing the right signal.

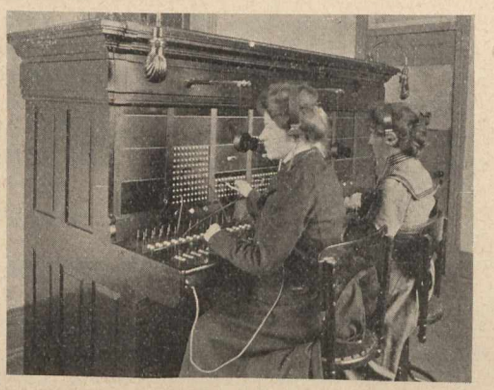


Fig. 4.

The line lamps are mounted in jacks built in strips of ten. The springs of the jacks are made of the best sheet spring German silver. They are provided with a formed projection so that they make a good point connection with the base of the lamp when inserted. The springs are set into a hard rubber strip and firmly clamped with a brass strip insulated with mica. The spring block is fastened to the front piece with heavy brass studs. The front piece is a heavy brass rail faced with hard rubber with the proper holes for receiving the lamps with holders. Each end of the front rail forms a flange which is set into the iron switchboard frame, and to which the banks are clamped from the front with a bolt and nut.

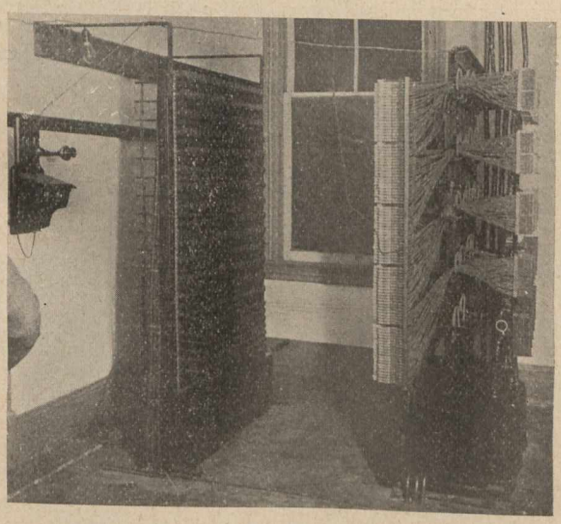


Fig. 5.

The spring jacks, which correspond in number with the line lamps are also mounted in strips of ten. The front piece of the bank of jacks is made of a veneer of hard rubber front and back with a brass rail for its centre. The holes in the brass rail are of sufficient size to receive a hard rubber bushing before inserting the jack ferule. The brass rail provids a means for firmly clamping the banks of jacks to the iron frame and also makes the banks strong and durable.

A pair of supervisory signals are placed in the plug board directly in front of each pair of cords. The clearing-out lamps are mounted in tubes similar to the line lamp holders. These tubes are provided with an opal holding cap on which is placed a small arched wire guard which prevents the opals

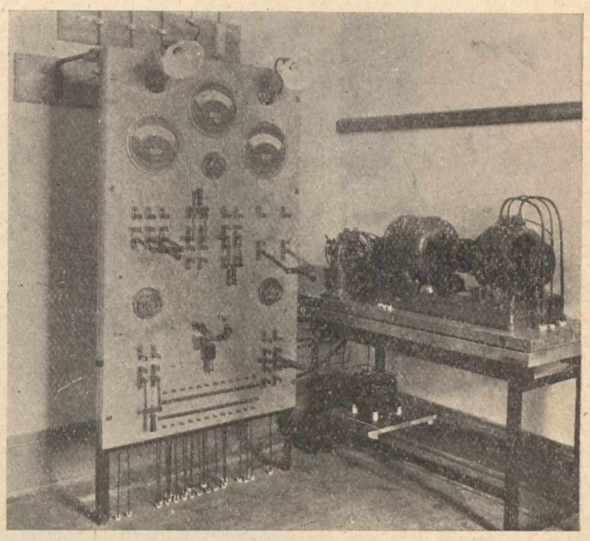


Fig. 6.

being broken by impact from the plugs, and also serves as a means for conveniently taking the tube, with lamp, from their socket. The plug board and the pilot lamp panel located back of the plugs are covered with heavy belt leather. In the centre of the board, between the two operator's positions, are mounted the trunk signals and trunk jacks connecting the two exchanges. The board is provided with a key so that at night, when but few

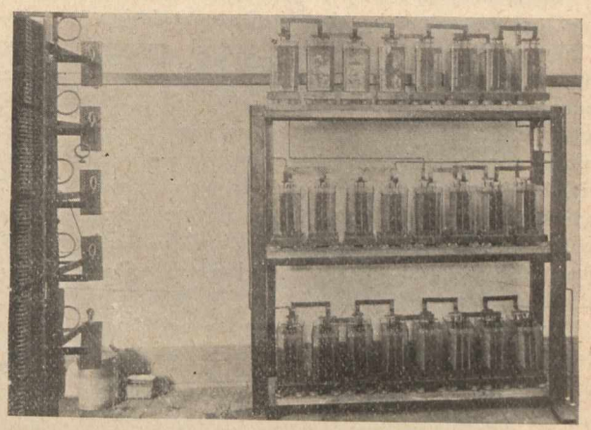


Fig. 7.

calls are received the battery power ringing generator may be switched on at any time and operated only when required.

Fig. 5 shows the relay rack and the combination distributing and lightning arrester rack with heat coil and carbon arresters. On the relay rack are mounted all the line relays, supervisory and pilot relays and coils. The relays are securely mounted on iron strips, supported on an angle iron rack. The relays are securely enclosed in a dust-proof brass shell.

Fig. 6 shows the power switchboard, the charging machine with alternating motor, the main ringing machine with alternating motor, and the auxiliary ringing machine. The auxiliary ringing machine is operated from the storage batteries.

The marble power board is supplied with a charging circuit ammeter, a discharge circuit ammeter, a volt meter, voltmeter switch, starting boxes, field rheostat, circuit breaker, bus bars and all necessary copper knife switches for properly controlling the entire system.

Fig. 7 shows the storage battery plant. The plant consists of a set of twelve cells chloride accumulator, in dupli-

cate. The twelve cells supply all the battery current for the operators' instruments, line, supervisory and pilot lamps, and all the subscribers' instruments. The battery rack is constructed of architectural iron, and is strong and well braced. The shelves are heavy slate slabs. The power tables are

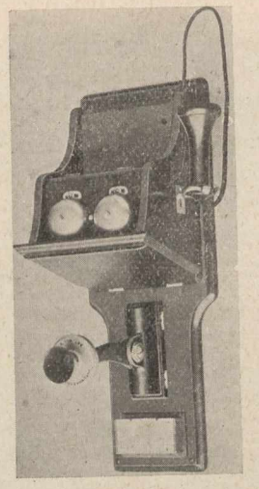


Fig. 8.

made from angle iron and are strong and rigid. The top is of a thick maple slab supported on soft rubber balls, set in a maple frame, mounted on the top of the iron rack.

Fig. 8 is a business wall telephone with shelf. It is equipped with a strictly long distance transmitter, mounted upon an adjustable arm. The receiver is a double-pole, horseshoe magnet type. It is adjustable, and has all parts self-contained and completely enclosed. The switch is of the long lever gravity type, and is so constructed that it has no scraping or rubbing of parts excepting at the contact points, which form a sliding and positive connection at all times. This instrument has all its apparatus mounted in a quarter-sawed oak or walnut backboard of a neat design.

Fig. 9 is a long distance central energy instrument, largely used for residence use. It has all its parts compactly mounted in a small case, without shelf. A portable desk telephone is also in use. Its pedestal is a neatly designed, strongly constructed cast brass stand. The switch is mounted in its head, and has a large and strong restoring spring. It is constructed on the same principal as the wall set switch and has no rubbing of parts excepting the platinum contact points. All exposed parts are of brass, heavily nickel-plated and highly polished.

On all telephones there are no exposed metal parts that form any part of the circuit at any time. All terminal

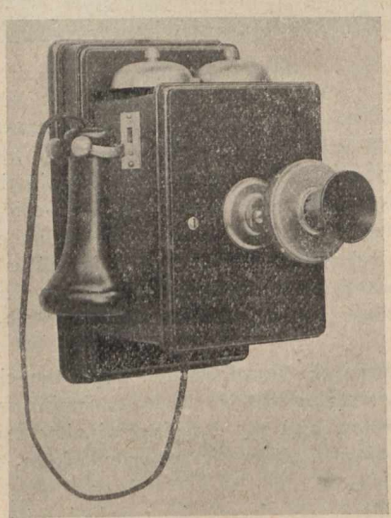


Fig. 9

screws, binding posts and connecting wires are fully concealed. In this system there are no batteries at the local subscribers' instruments, all battery power of the system being obtained from the storage battery plant at the central office. Subscribers signal the central office automatically when taking the receiver from the hook. This lights a lamp on the switchboard in front of the operator, indicating that a connection is desired. The attendant inserts connecting plug in the spring jack immediately below the signal showing, which connects the operator's telephone, when the number of the party wanted is ascertained. When the number desired has been given, the operator inserts the mate plug into the spring jack of the line desired, and presses the ringing key, which throws the power generator in circuit and rings the bell of the subscriber's instrument. The ringing key is automatically restored to its normal position from the ringing side, and is manually restored from the listening side. When conversation is completed, and subscribers replace the receivers on the hook, lamps corresponding with the connecting cords are lighted on the face of the plug-board. These are automatically extinguished when the lines are disconnected. Each position on the board is provided with three pilot lamps which are placed at the bottom of the face of the board, one indicating when a subscriber signals, one when a subscriber is being called, and one when the subscribers have replaced the receivers and until the disconnection is made. This means gives a double signal to avoid any mistake, and in case of any defect at any time in any one part of the equipment.

A NEW TELEPHONE HOOK-SWITCH.

In Figs. 1 and 2 are shown two perspective views of a new hook-switch, recently placed on the market by the Stromberg-Carlson Telephone Manufacturing Company, of Chicago. The hook is one of the long lever type and mounted on a heavy brass frame fastened with bolt and nut. The hook lever forms no part of the circuit, but all con-

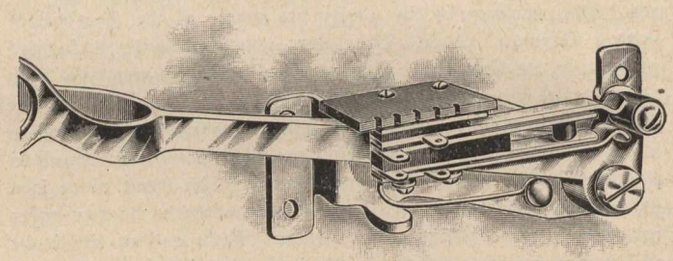


Fig. 1.

tacts are made by the springs mounted upon the lug at the side of the frame, as shown. The downward movement of the hook causes a hard rubber insulated pin, attached to the lever, to be drawn in between the springs, thus disengaging the springs and breaking contact, as shown in Fig. 2, and making contact when the hook is released, as in Fig. 1. A

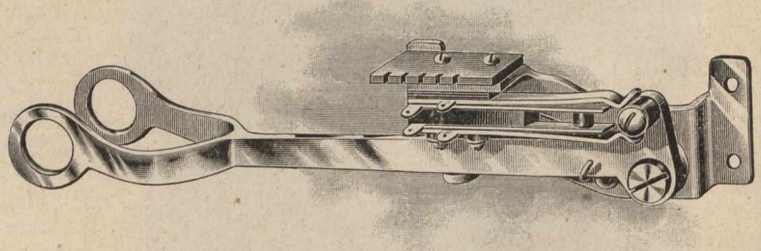


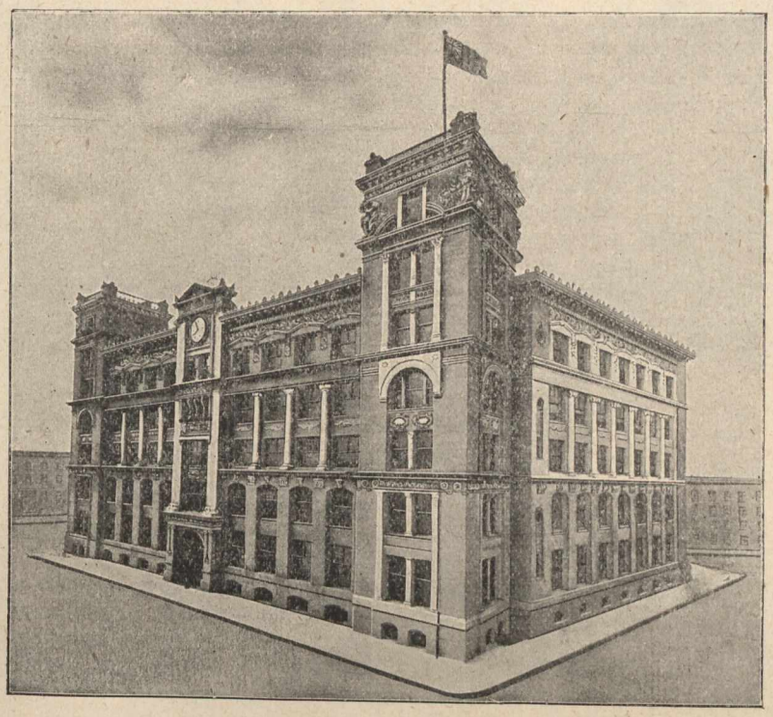
Fig. 2.

stop is provided at the lower edge of the frame to prevent the downward movement of the lever, below the proper point. The springs are made of German silver of good length, and all contacts are pure platinum; pure hard rubber strips are used to insulate the springs from each other and the frame. At the top of the lug, upon which the springs are mounted, is fastened a strip of hard fibre with the front edge slotted, through which the wires are brought down to the springs, thus keeping them separated and reducing the chances of short-circuiting to a minimum.

The Index to the Canadian Engineer for 1902 is now ready and will be mailed to subscribers on application.

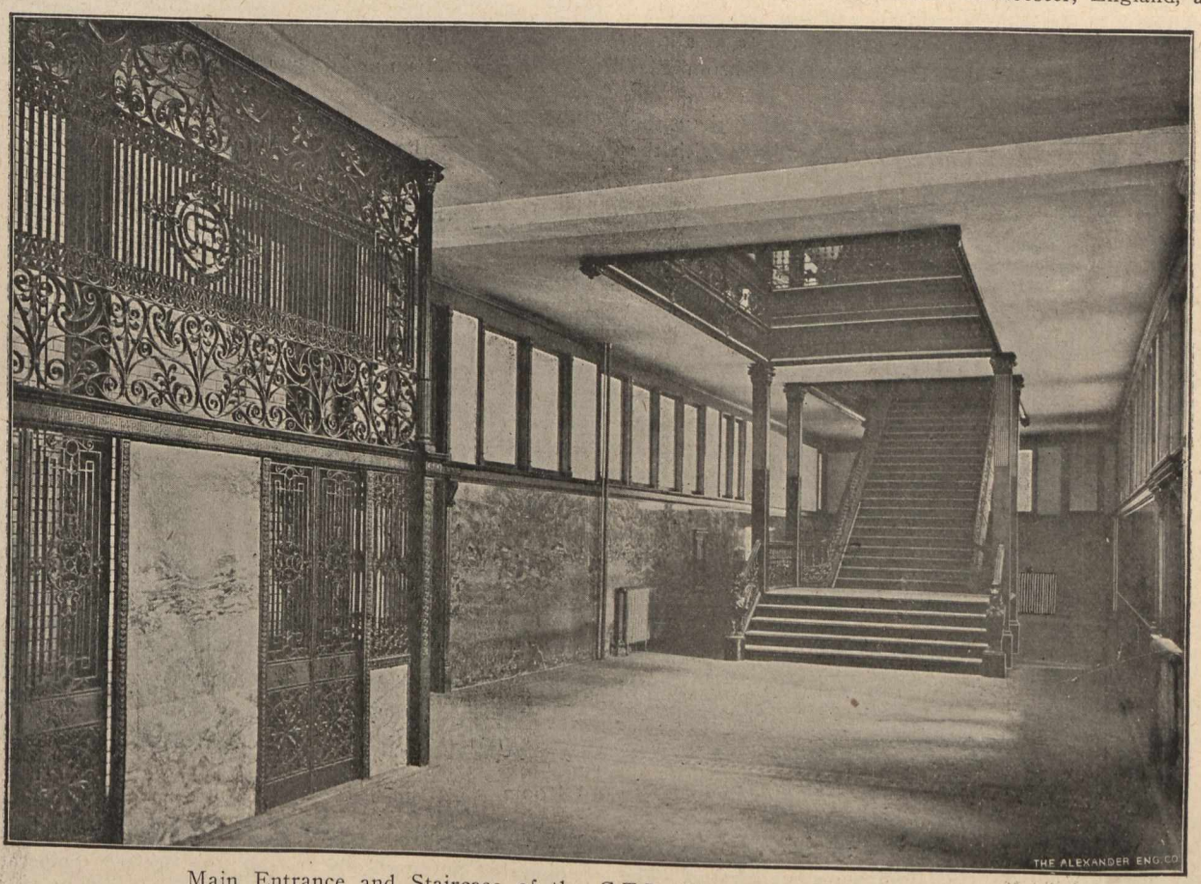
THE NEW GRAND TRUNK OFFICES.

The various departments of the headquarters of the Grand Trunk Railway system have now been regularly installed in the new general office building, McGill street, Montreal, and a short description with the accompanying illustrations will be of interest:



Grand Trunk Offices.

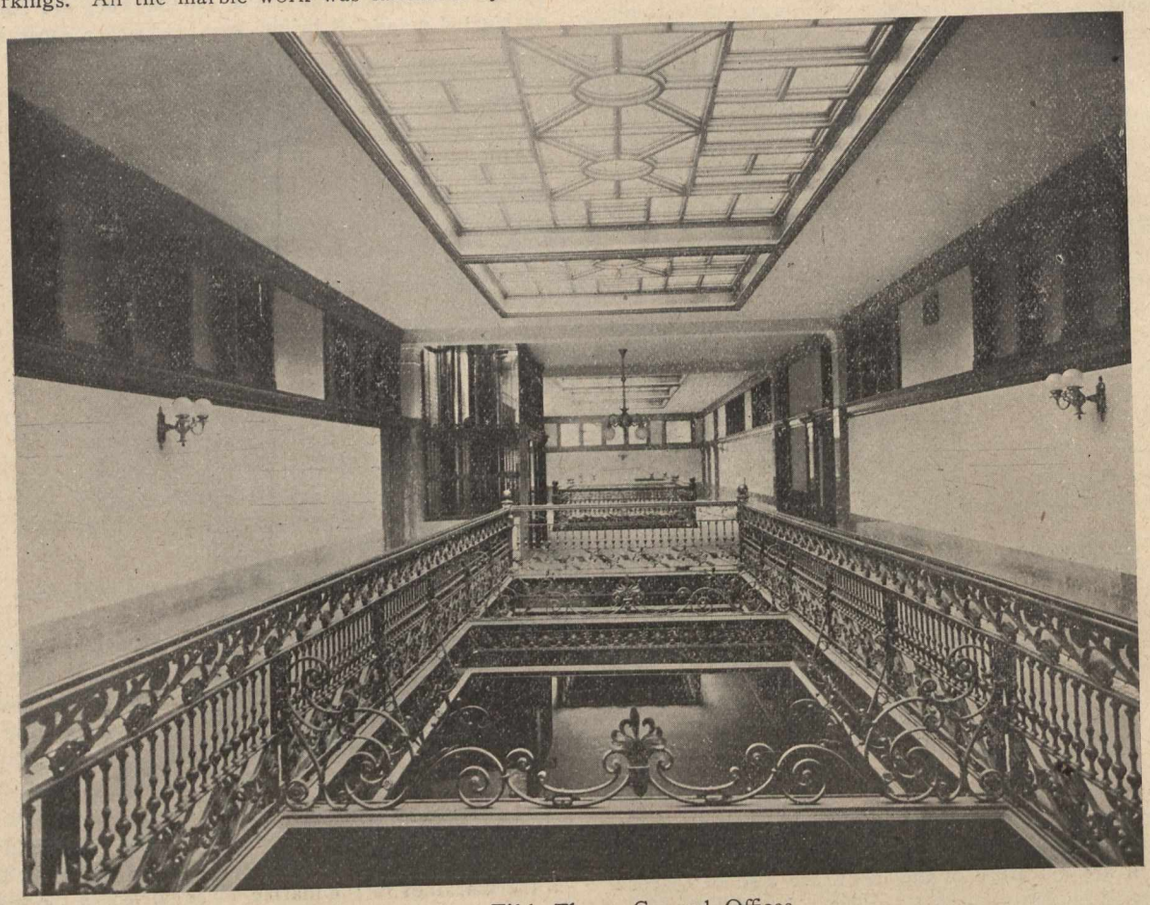
The building is constructed of Bedford (Indiana) limestone, resting on a base of Quebec granite. The polished pillars, which are a feature of the front, are also of Quebec granite supplied by the Stanstead Granite Co., who also supplied the granite for the vestibule entrance. The vestibule is one of the handsomest entrances to a public building on the continent, and is composed of four kinds of rare marble; the lower portion being of black and gold marble from Italy, and green marble from Greece; the rose tint marble is from France, and the large panels were brought from the south side of the Pyrenees Mountains in Spain. The three panels between the doors at the head of the steps are of a very rare species of marble from Nubia, Africa. They are composed of variegated colors of bright hues and are a most interesting study, while the panels on the sides are beautifully marked. Objects of animals and other subjects can readily be discerned in the markings of the marble. The faience of the vestibule is composed of tile work from Gloucester, England, and is a magnificent piece of work, being glazed porcelain embellished with embossed designs which give the appearance of Italian Majolica. The corridor is lined with Belgian marble in large



Main Entrance and Staircase of the G.T.R. New Head Office, Montreal.

slabs 8 feet high, which perfectly match at the joints and present beautiful designs in variegated shades. This marble is used throughout the building for wainscoting, and figures, such as a lion's head, donkey's head, jack rabbits' heads, tiger heads, frogs, snakes and many other objects are discernible in the markings. All the marble work was furnished by the

located in the rear, and is detached from the main building. The system of steam heating that has been installed is of the most modern pattern, and known as the "Webster System," supplied by the Canadian agents, Darling Bros., Montreal, working automatically, and instead of the steam being forced through the pipes it is drawn through by suction, the pipes



Fifth Floor—General Offices.

Forsyth Granite and Marble Co. The elevators are of a high speed hydraulic pattern, and furnished by the Fensom Elevator Co., Toronto.

The various departments have been located throughout the building so as to best suit business relations, one with the

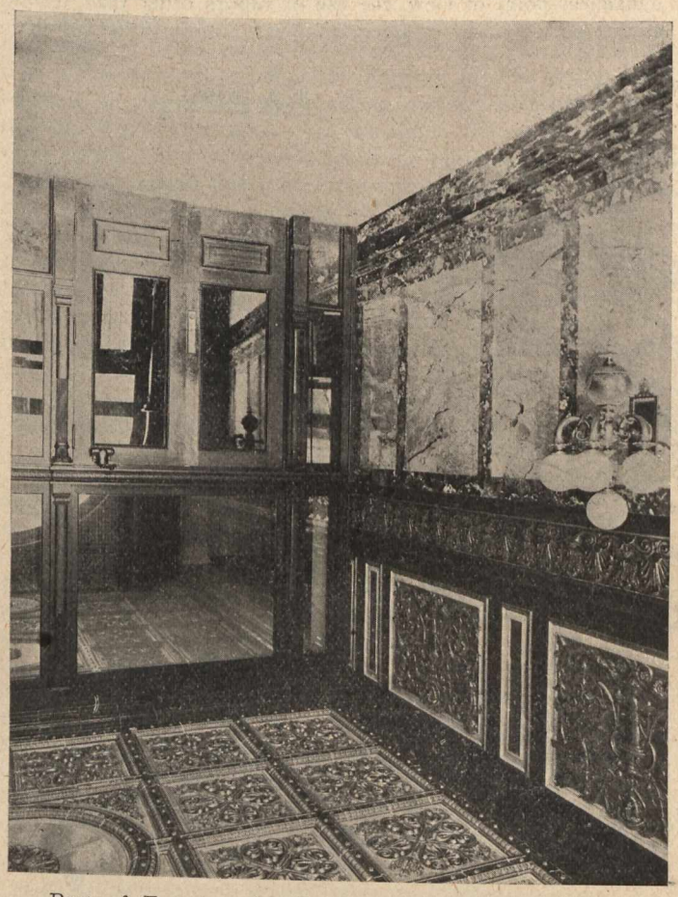
being cleared of water automatically by the pumps, thus creating a vacuum and drawing the steam through. There are about 300 direct Safford radiators, containing over 3,000 feet of heating surface. The supply of steam to these radiators is regulated by the Johnson Automatic Heat Control System.

Directors' Room.

other. On the ground floor the offices of the Canadian, American and National Express Companies are located. The modern mechanical appliances for heating, ventilating, etc., and the two 250-h.p. boilers for the steam heating apparatus that were supplied by the Canadian Heine Safety Boiler Co., of Toronto, are also located on this floor. The boiler house is

A thermostat is placed in each apartment, and the valves operated automatically to suit any desired temperature. In reference to the plumbing work, which was executed by the Bennett & Wright Co., Toronto, all the water pipes, waste pipes, with their fittings, etc., are of extra heavy brass. These pipes are generally of galvanized iron or lead. There are

about sixty water closets of the syphon jet principal, operated by the Kenny flushometer system. There are twenty-five Newport ventilating urinals, also operated by the Kenny system. The eighty wash basins in the public lavatories are all of the Hygeia pattern with patent waste and extra heavy brass traps and standards. The basins in the private rooms are Mott's elliptical solid porcelain basins, with porcelain pedestals. All the brass work throughout is what is known as "red metal," or nearly copper colored, polished in the natural color, and not nickel plated as is usually done. Hot water is supplied throughout the building by Tobey automatic water heaters, which ensure a plentiful supply of warm water at the proper temperature at all times. All the lavatory floors are tiled with the highest grade of vitrified tile, and all the walls are lined and partitions are constructed of Tennessee marble.



Part of Entrance (or Faience) to the Building.

Fresh air is supplied to the different departments by a large electric Sturtevant blower fan, having heaters for warming the fresh air and tempering coils which have a capacity of four thousand feet of heating surface, the air being tempered and admitted to the apartments at the desired temperature.

General Audit Office.

The foul air is removed from the building by Sturtevant electric exhausters, which are situated in the roof. The electric switchboard placed in the engine room is one of the finest samples of marble work of this kind in the country. The lighting plant and the wiring was done by the Western Electric Company, of New York. The power is supplied by the Lachine Rapids Hydraulic and Power Co. The electric fixtures supplied by John Forman, of Montreal, are of a specially chaste design. Ceiling lights are provided for each office, the private offices having suspended fixtures, and one light is provided for each clerk.

On the ground floor is a book bindery in connection with the Audit Department, as well as a well equipped mail room, to handle the heavy mail daily received and distributed in an institution like the Grand Trunk. It requires a corps of clerks to sort and despatch the mails. All the ornamental iron work, of which a sample is here shown, was constructed by H. R. Ives & Co., of Montreal. The floors of each flat are of vitrified tile work. The large vaults for the several departments were supplied by J. J. Taylor & Co., Toronto. The Dominion Bridge Co., of Lachine, were the contractors for the iron work used in the building, while the granite and the stone work as well as the terra cotta brick arching for the flooring, cementing, etc., was performed by the firm of Peter Lyall & Sons, of Montreal.

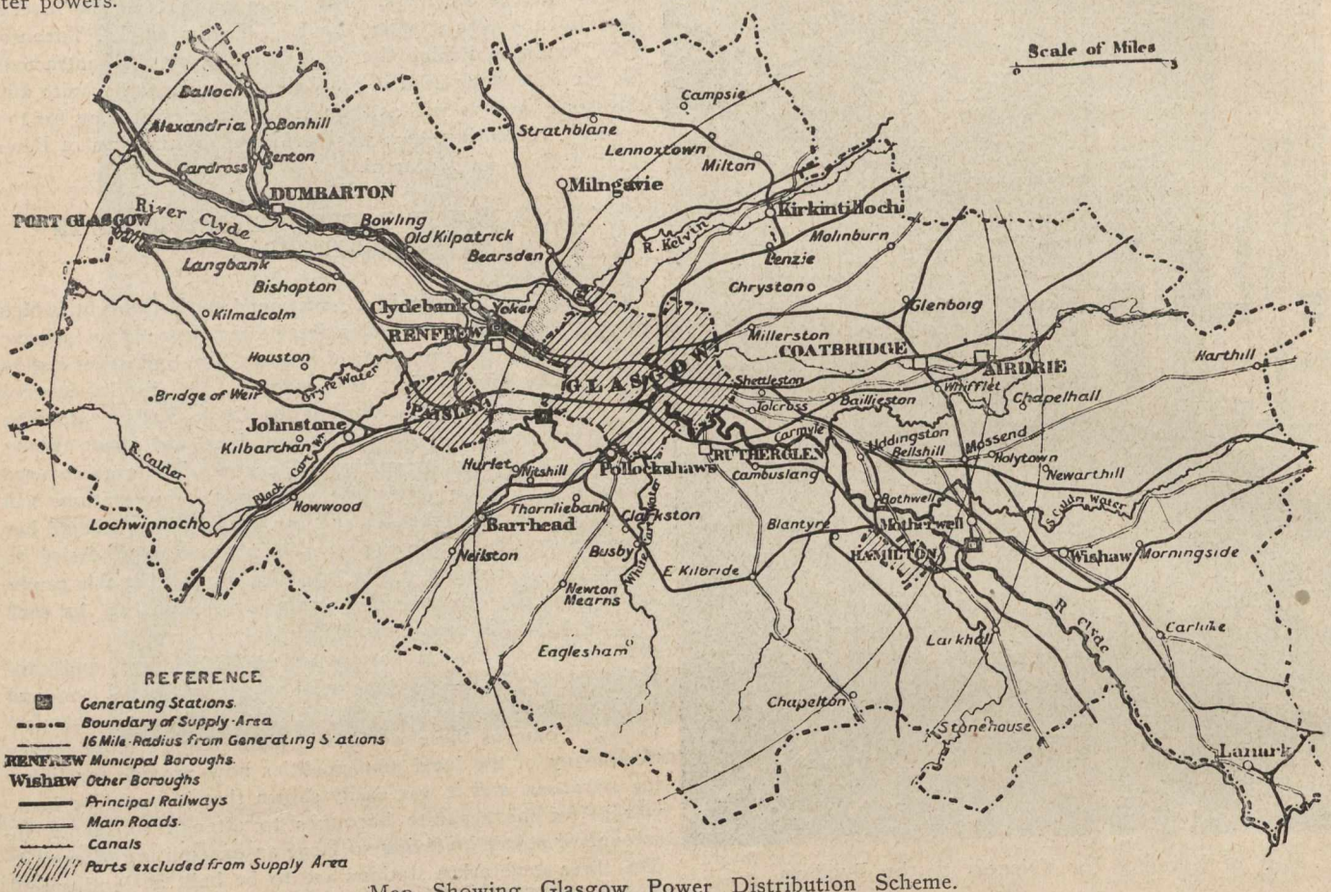
LARGE POWER DISTRIBUTION SCHEME IN SCOTLAND.

A bill has recently been sanctioned by Parliament, which gives authority for an extensive power distribution scheme contemplating the supplying of power to the industrial region of the lower Clyde River in Scotland. The district covered by the bill includes that part of the Clyde Valley extending about ten miles on each side of the river, and about twenty miles up and down stream from Glasgow. The area covered is about 700 square miles, and three generating stations will be erected to meet the demand for power. The scheme has been promoted by a group of manufacturers who desire to obtain cheap electrical power, and who realize that this can be better done by joining in a common system than by each putting down his own generating plant.

This is the busiest part of industrial Scotland, and contains about 1,200 works, many of which are large iron and steel works, coal mines, shipbuilding yards, and chemical works. Some of these works will alone require more power than many of the local municipalities now provide for lighting purposes, and it was easily shown that it would be inadvisable for the separate boroughs to attempt to supply an amount of power involving so large an expenditure of capital. The three generating stations are to be built at Motherwell, Yoker and Crookston. The Motherwell station is located in the neighborhood of a large number of manufacturing works, and in the centre of an extensive coal field and can be connected with the adjoining line of the Caledonia Railway. It is, also, in close proximity to the river Clyde, from which water for steam and condensing purposes can be obtained. The Yoker station is also situated on the Clyde, near the line of the Lanarkshire and Dumbartonshire railway, and is in close proximity to a large number of shipbuilding yards, works and docks. Authority has been obtained to lay cables across the Clyde from Yoker to Renfrew, which will enable the works at Renfrew, and other works on the south side of the river, to be supplied from this station. The third generating station will be situated near Crookston on the Glasgow & Southwestern Railway canal line; but, owing to the arrangement allowing the company to cross the river, it will not be necessary to construct this station immediately.

The works from which the most urgent demands for power have been received are situated in the areas immediately surrounding the first two sites, and it is intended, therefore, to proceed with these stations first, and to install in each a plant of about 4,500-k.w. capacity. They will be so designed that they can be enlarged from time to time, as the demand requires. A radius of 14 miles from these stations covers practically the whole district in which the company will be allowed to distribute their power, but a large proportion of the works are located within a radius of 6 or 7 miles of the stations. When the stations are in operation they will probably be coupled together electrically, enabling them to share the loads and average up their power factors, or to supplement or aid each other in any emergency. The capacities of the respective stations will ultimately be about 10,000-k.w. each at Motherwell and Yoker, and 5,000 at Crookston. By util-

izing cheap sites for the stations outside of towns and near to the coal mines, it will be possible to generate power at a very low cost. Of the 710 square miles covered by the scheme, only 13 are at present supplied with electricity. It is said that over 300 manufacturers petitioned in favor of the proposition, and it is thought that many of the remainder petitioned in favor of the rival Caledonian scheme which was turned down. The carrying out of this mammoth scheme of power distribution will place the manufacturers of Glasgow on a footing to be compared to that of American manufacturers who are so fortunate as to be within range of cheap water powers.



Map Showing Glasgow Power Distribution Scheme.

The authorized capital of the Clyde Valley Electrical Power Company is $4,500,000, with borrowing powers of $1,500,000. The total cost for plant on the transmission lines is estimated at over $2,000,000. The electrical apparatus, which will comprise polyphase alternating-current generators and transformers for high voltage power distribution, rotary converters for the supplying of direct current, etc., has been contracted for with the British Westinghouse Electric and Manufacturing Co. Strain & Robertson are the engineers of the Clyde Valley Electrical Power Company. Robt. Robertson has recently spent a considerable period in the United States investigating its systems and methods of power transmission and distribution, particularly in the large cities, and in such localities as Niagara, Snoqualmie Falls, Wash.; Canyon Ferry, Mont., and other places.

WATERPROOFING BLUEPRINTS.

Those who have experienced the annoyance of having blueprints discolored and blurred by rain, drippings in mines, and moisture in general, will appreciate a simple and cheap method of rendering the prints impervious to water. The waterproofing medium is refined paraffin, and is applied as follows: A number of pieces of absorbent cotton, about a foot square, are dipped in melted paraffin until thoroughly saturated; when withdrawn and cooled, they are ready for use. One of the saturated cloths is spread on a smooth surface, the dry print is placed on it, and a second waxed cloth on top. The whole is then ironed with a moderately hot flat-iron. The paper immediately absorbs the paraffin, and becomes translucent and waterproof. The lines of the print are intensified by the process, and there is no shrinking or distortion. As the wax is withdrawn from the cloths, more can be added by melting small pieces directly under the hot iron. By immersing the print in a bath of melted paraffin, the process is hastened, but the ironing is necessary to remove the surplus wax from the surface, unless the paper is to be directly exposed to the weather and not to be handled.—Ex.

THE USE OF VARIOUS VAPORS IN MARINE ENGINES

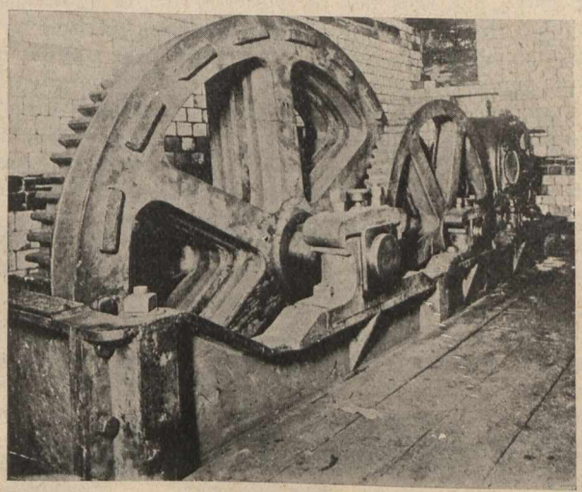
An article in Foreign Abstracts considers, from a thermodynamical point of view, the use of vapors other than steam as the motive power of steam engines. Among other advantages claimed for the use of petroleum vapor, it is stated that the heating value of the fuel is used to greater effect, owing to the fact that the formation of petroleum vapor requires a considerably smaller quantity of heat than is the case with steam. The author indicates the fallacy of such reasoning, and shows that if the original temperature of the liquids be 20° C., the amount of heat necessary for the production of a cubic metre of steam at 6 atmospheres pressure is 2082 calories, while in the case of the petroleum ordinarily used, which is composed of the hydrocarbons C_7H_{16}, and C_8H_{18}, and has a mean molecular weight of 108, 2460 calories are required; for alcohol the corresponding number of calories are required; for alcohol the corresponding number of calories is 2390. The real advantages offered by the employment of such vapors, which make them eminently fitted for the engines of pleasure boats, are cleanliness of working, the use for heating purposes of part of the vapor produced in the boiler, and, finally, the high conducting power of liquids and the consequent possibility of using small boilers. Greater efficiency would be obtained by making use of a liquid of low molecular weight and relatively low heat of vaporization. Such a liquid presents itself in liquefied ammonia, but its use in an engine working with a condenser would be impracticable. Petroleum and similar liquids also find application in lifeboats, in submarine boats both to propel them when at the surface and to charge the accumulators for the dynamos used to drive the boat when under water; in sailing yachts, for auxiliary motors, and for other such purposes. The author considers also those cases in which the steam, after coming from the cylinder, is employed to evaporate a second liquid, the vapor of which is also made use of for driving the engine. When ether is taken as this second liquid, the author shows

that the theoretical amount of work obtainable from a given quantity of steam may be increased by 10.7 per cent. without any increase in the amount of heat consumed; the losses unavoidable in practice would alter this number but slightly. Ether vapor owes its especial value as a means of converting heat into work to a peculiar property, the possession of which is indicated by theory and confirmed by practice—namely, that when it expands and does work, heat must be withdrawn from it in order that it may remain saturated; from this it follows that if the amount of heat passing through the walls of the cylinder be kept within certain limits, no deposition of liquid occurs in the cylinder, a great advantage over steam being thus obtained. Further, for the same yield of work, the temperature of working, and hence also the loss of heat, is lower for ether than for water. These considerations explain the success obtained some years ago by Mr. De Susini, who passed steam at 2.5 atmospheres pressure into a surface condenser, the tubes of which were filled with ether. The ether vapor thus obtained, having an initial pressure of 10 atmospheres, was used to drive an engine with specially constructed stuffing boxes, etc., after which it was condensed and returned to the tubes of the surface condenser. Direct heating of an ether boiler would be attended with danger owing to the great difficulty of regulating the heating.

ELECTRIC APPARATUS IN ENGLISH COAL MINES.

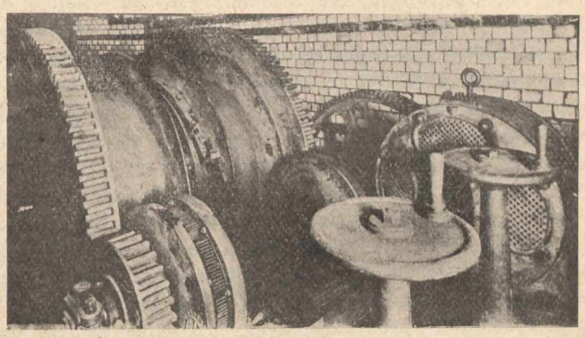
That English coal mine operators should be among the first to take up modern methods, and, moreover, that they should adopt the latest developments in electrical engineering while many United States and Canadian mines are not as yet equipped with electrical machinery at all, is rather surprising in view of the much talked of conservatism and consequent decadence of British industry.

The coal mines of England, the primary source and the essential element of her industrial supremacy, have now been worked extensively for more than a century. Until a few years ago England mined more coal than any other country in the world. However, this is no longer the case. American production exceeds the English, which is now almost stationary from year to year, by a rapidly increasing per-



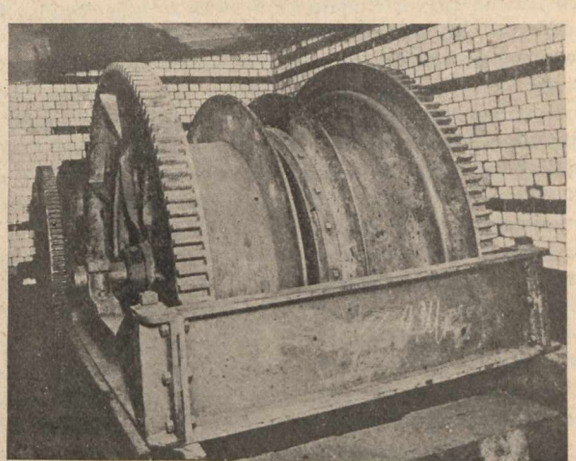
Sneyd Colliery, Induction Motor, Operating Endless Haulage.

centage; American coal competes with English coal on the continent of Europe, and the possibility of some day "carrying coals to Newcastle," is by no means indefinitely remote. It has been estimated that 500 years will see the end of England's coal supply, and long before that the mining of coal must become so difficult and costly, and the price of coal so high, that English manufacturers will be seriously handicapped, or compelled to seek other locations where cheap fuel is to be found. This is beginning to be felt even now. The price of coal in England is steadily rising, shafts are being carried deeper and deeper, and, the richer veins having been exhausted, the thinner veins, containing often poorer grades of coal, must now be developed. These things have put the British operator upon his mettle, and he has taken up the latest and most improved methods of coal mining even more rapidly than his American competitor. Moreover, he has stepped out boldly and adopted for power transmission alternating currents and induction motors, which, for mining work and especially coal mining, have many great advantages over direct-current machinery. The foregoing facts are well illustrated in the following brief description of the electrical plants recently installed at a number of English coal mines.



Induction Motor, Operating "Main and Tail" Haulage.

The Sneyd colliery, at Burlem, Staffordshire, has recently put in a complete alternating current equipment. Current is generated by a Westinghouse three-phase alternator, direct coupled to a Westinghouse steam engine. Westinghouse induction motors aggregating about 1,000-h.p. are used for driving "main-and-tail" and "endless" rope hauling engines, for pumps and for several other auxiliary purposes. The hauling gears with their electric motor equipment are shown in the accompanying photographs. These mines are gaseous and the use in them of direct current machinery would have been dangerous. The induction motor, however, on account of the fact that it has no moving contacts to spark or flash, is entirely adapted for use in such locations.



Induction Motor, Operating "Main and Tail" Haulage.

The Clapwell Colliery, of Chesterfield; the Oxcroft Colliery, of Chesterfield; the Sherwood Colliery, of Mansfield; the Tredegar Iron & Coal Co.'s collieries in Monmouth; the Bolsover Colliery Company, of Chesterfield; the Stanton Iron Works Company, of Pleasley; the Tyrdail Collieries, of Carmarthen, and the New Cross Hands Colliery, of Lanelly, are among the other coal mines that have been installed or are in course of being equipped with electric plant from the British Westinghouse Co., while about 4,000-h.p. of plant from the same company is to be installed in the collieries owned by the Stanley Coal & Iron Co., of Chesterfield.

From the above examples it will be apparent that the British manufacturers are by no means slow to see the economies of electric driving, and when their mines have been thoroughly equipped they may yet for a long time give the Americans a very stiff fight for European markets.

"They are building ships on the Great Lakes without end, but it doesn't worry me, as the immense resources of the Northwest will give them something to do," was the remark made by Thos. Adams, vessel owner, of Detroit.

CENTRAL STATION V. PRIVATE POWER.

Editor Canadian Engineer:—

SIR,—It is a matter of considerable interest to manufacturers located in the Niagara Falls power district, or in other similar power districts, to determine with what relative economy this power may be employed and to what extent in connection with it their own power should be used.

In the first place, considering both economy and convenience, it is now generally admitted that in large plants having numerous buildings electrical drive is essential. The superior economy of the central station, or the Niagara power, aside from its cheapness, is particularly evident in fluctuating and peak loads. Such loads are found in most shops where large machines are continually being thrown on and off. With the private plant, where it is necessary that it should be designed to meet the higher requirements of power, the efficiencies of the boilers, engines and dynamos at the average and low loads are much under the normal efficiencies at their rated capacities. In using central station powers no such decrease in economy occurs. There are, however, other conditions which, within certain limits, effect a greater ultimate economy in the use of the private power plant. In all large factories, it is necessary to have considerable boiler power for heating purposes alone, while most of them require throughout the year some steam for their various processes or tests. The efficiency of the boilers when used for such irregular duty is very low. By using them for generating power as well, they can be run at their full capacity by overloading at the peaks, and their average efficiency greatly increased. Such a use is especially economical when power is developed in connection with the heating plant.

As an illustration of the economy to be obtained by the above methods of operation, I may mention the power equipment of one of the large engineering and manufacturing concerns in the city of Buffalo, N.Y., U.S.A.—the Buffalo Forge Company. In the six shops comprising their plant, and occupying an entire block in the central part of the city, electric drive is employed exclusively. Formerly, Niagara power alone was used on the drive, and the boilers used simply for testing, and for heating the plant. The plant now installed is of sufficient size to enable them to utilize at all times the full steaming capacity of their boilers. The power thus developed is used in connection with that received from the Falls. The boiler plant consists of a battery of two 125 horse power, return tubular Erie City boilers, supplied with induced draught. Furnishing power to the shops and supplementing the Niagara power, are two 100 K.W., D. C. General Electric dynamos, each direct connected to a twelve and twenty by fourteen-inch horizontal tandem, compound Buffalo engine running non-condensing. A 30 horse power air compressor belted to a single vertical engine drives the pneumatic hoists and small pneumatic tools throughout the shops. The offices and shops are heated by a hot blast system. By means of steam-driven fans, the air is drawn through the steam coils of the heater, and distributed through galvanized iron pipes or ducts to all parts of the various buildings. By this arrangement a uniform temperature of 60 degrees in the shops and seventy degrees in the offices is maintained with great economy. The heaters, except in extremely cold weather, require only the exhaust steam from the power plant and their own engines. We see, therefore, that the cost of running both power plant and heating plant together is practically no greater than running either one alone, since the engine is capable of converting only about ten per cent. of the calorific value of the steam into work.

Besides providing for the above uses, considerable boiler power is required at times for the tests. These comprise running and power tests of engines from the smallest fan engines to 300 horse power, high-speed, compound engines, tests of the various types of belted exhaust fans and blowers, and of electric and fan units direct-connected to high speed engines. The demand for power in these tests is very irregular. While on occasions it may reach as high as 300 horse power, the usual peaks are about 150 horse power, and the average load about 80 horse power.

The average load on the boilers is about 300 boiler horse power, with peaks of about 450 boiler horse power, or loads from 120 per cent. to nearly 200 per cent. of the rated boiler horse power. Of particular interest in this connection is the great increase in capacity, and the ultimate economy in operation of the boiler effected by the use of high intensities of draught. The induced draught plant consists of a special 90-inch full housing bottom horizontal discharge exhaust fan exhausting from the smoke breeching and discharging into a short stack. It has an over-hung ballast wheel driven by a 4½ by 5-inch direct-connected, single vertical engine, capable of running the fan at speeds varying from 300 to 600 revolutions per minute, and producing corresponding draughts of from one-half to two and one-fourth inches of water with the flue gas at a temperature of approximately 500 degrees F. A Foster regulator automatically governs the speed of the engine to produce the proper draught to maintain a constant steam pressure in the boilers. By this arrangement demands for steam are readily met to double the rated capacities of the boiler without noticeable decrease in pressure and with no other attention than to proper firing and water supply. Nor does this high rate of driving lower the efficiency of the boiler, as one might naturally suppose. With a ratio of heating surface to grate surface of forty-five to one, which is usual in boilers made at the present time, the loss of heat in the flue gas at double the rated performance is only about four per cent. more of the total heat of the coal than at the rated capacity, while the radiation loss remains practically constant for all rates of driving and is therefore reduced from about twelve per cent. to nearly six per cent. of the total heat of the coal. This shows the total efficiency of the boiler to be about the same. If the maximum capacity of the plant were increased by doubling the number of boilers instead of increasing the performance by increased rate of combustion, twice as much coal would be required in keeping up steam throughout the twenty-four hours of the day. This, in plants having irregular loads for ten hours a day, amounts to a considerable portion of the coal bill, which, we see, is greatly reduced by resorting to higher rates of driving at the peaks and employing fewer boilers.

In the instance of such a manufacturing establishment, as the above, it is seen that the power developed by utilizing at all times, the full capacity of the boiler plant, will cost far less than central station power. Each additional electric horse power within the capacity of the boiler will require but from two and one-half to three and one-half additional pounds of coal per hour. The additional cost of such power will therefore be only about $.0044 per horse power hour for coal, or only about $.0053, including cost of maintenance and interest on cost of engines, dynamos, power house, etc. When generated, in connection with the heating plant, the cost of the additional power will be that of maintenance, etc., or $.0008 to $.0010 per horse power hours plus $.0005 for fuel.

From these considerations it is evident that private power is the cheaper when generated in connection with the heating plant, also that economy is to be obtained by generating sufficient power to utilize at all times the full boiler capacity.

NIAGRIAN.

Niagara Falls, 1st January, 1903.

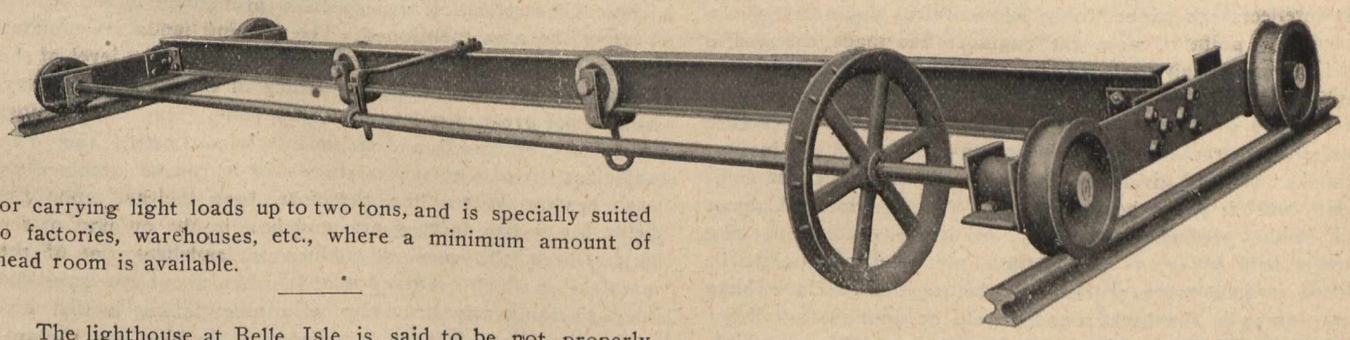
CARBONS FOR DIAMOND DRILLS.

In view of the fact that the diamond drill is used to such an extent in Canada for prospecting the following from Kuhlow will be of interest: In prospecting for mineral deposits no other implement is found so useful as the diamond prospecting drill. After its thorough use for test borings, the prospector knows fairly well what results he may expect before he commences his regular milling operations. The diamond drill has led to the discovery of ore deposits at great depths which would never have been reached nor developed had not this modern machine promised returns for the trouble and outlay in reaching it by regular mining. The main work of the drill is done by a steel bit, hollow in the centre, and pointed at the ends with carbons or black diamonds. These carbons have in combination a hardness and toughness such as no other material possesses. Their prin-

cipal merit as compared with the white diamond lies in the fact that they are without crystalline form, and have no such cleavage as the white diamond. The black diamond of good quality will cut a core of whatever material may be encountered, and give the driller an exact record of the different strata penetrated. Although white diamonds have been found pretty nearly all over the world, these carbons, or black diamonds, are found only in Brazil, where they are gathered in a very primitive way. There are no regular mines, carbons being mostly found in the river beds by the natives, who are not any too industrious. After having made a good find and sold his crop to the agents who travel from one place to the other, ready to buy for cash anything that is offered in the way of carbons, the miner takes a rest and does not start operations again until the dwindling away of his money forces him to resume work. The agents represent dealers in Bahia. After these purchasing agents have bought what is offered, or rather when their ready cash is exhausted, they return to Bahia, deliver their purchases and start again on another trip. Of these employers or exporters there are not over half a dozen who have sufficient capital to do a large business and to supply the ready money to the agents. The purchasing agents have to buy the goods as they are found, whether they are of good quality or bad, and the exporter naturally tries to dispose of them as they run, or if he cannot do that, will charge a higher price for the stones of good quality, and sell the inferior goods at a reduced price to dealers who will buy them because they are cheap. These dealers in turn endeavor by coloring and filling to put them in a salable condition and dispose of them to consumers at a large profit, although underselling dealers who pay considerably higher prices to secure only first class goods. Carbons are very expensive articles, and a consumer is liable to incur great loss by getting a lot of poor stuff. By putting a few inferior stones in a lot of fairly good stones the price of the lot may be reduced by several dollars a carat. Doctored carbons have been made to look so fine that an expert might pass them as first class stones when in reality there was not a genuine carbon among them. As an example of how even a good judge may be deceived, it may be mentioned that a purchaser who had been buying carbons for years was shown by a dealer a paper containing what appeared to be a lot of first-class stones. The buyer became indignant when he was told that as a matter of fact there was not a single genuine carbon in the package, but that all were spurious or imitation stones. So cleverly had they been doctored that it required tests to convince him that he could be so deceived. When inferior stones are put in the drill they go to pieces and time, labor and money are lost.

SINGLE BEAM TRAVELLING CRANE FOR LIGHT WORK.

The accompanying cut shows a light pattern hand power travelling crane of the single beam type, made by the Smart-Turner Machine Co., of Hamilton, Ont. This is designed for carrying light loads up to two tons, and is specially suited to factories, warehouses, etc., where a minimum amount of head room is available.



The lighthouse at Belle Isle is said to be not properly sectored. A change in the chart or the light is required or disaster may ensue.

The steamer Petrel has had steel plates riveted on her hull so that she can stand the ice jams in the Gulf of St. Lawrence while engaged in wrecking this winter.

It is expected that $10,000,000 worth of steel steamships will be built on the United States side of the Great Lakes for service in 1903. Twenty-four freight ships are under contract.

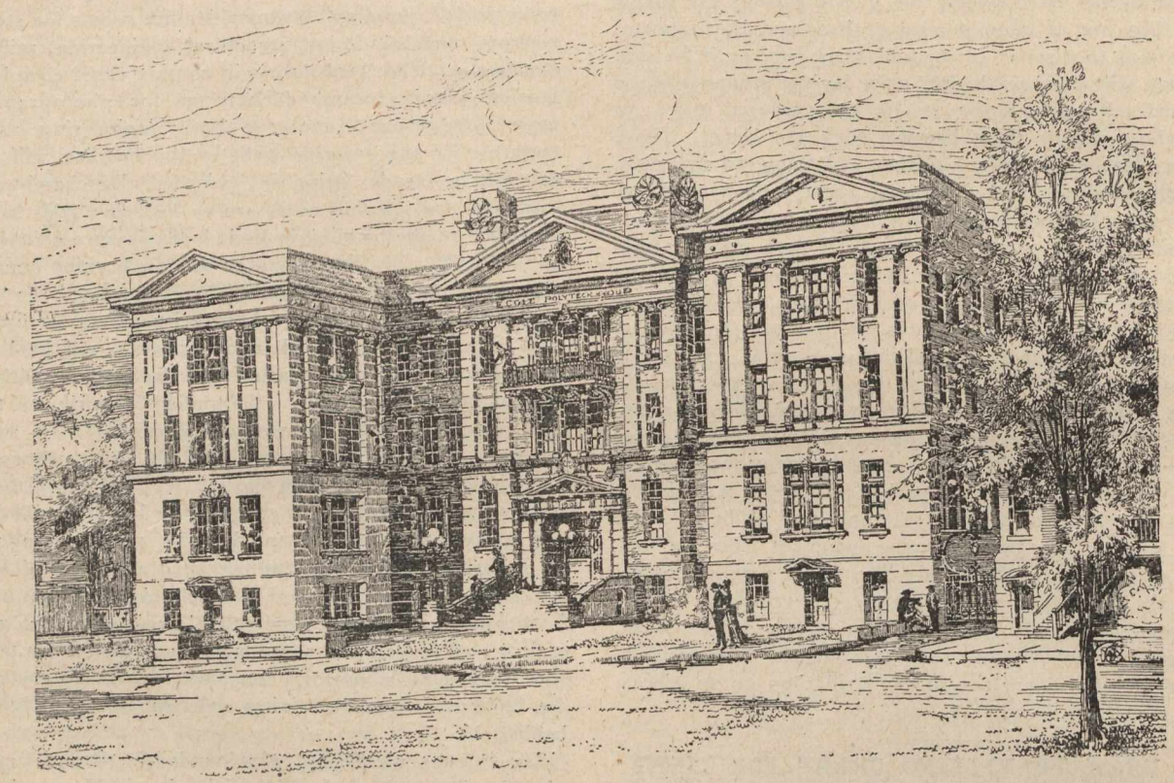
BUILDING FOR THE NEW POLYTECHNIC SCHOOL, MONTREAL.

FROM A DESIGN BY J. E. VANIER, C.E. AND ARCHITECT.

The accompanying sketch represents the imposing structure which will be completed in a few months on St. James Square, Montreal, for the Polytechnic School, which will then have a home that will compare favorably with other similar institutions. The general dimensions of the building are: Depth, varying from 75 to 102 feet; frontage of 152 feet, four stories high. The ground floor will be occupied by the students' room, students' lockers, water closets and lavatories, hydraulic laboratory, cement testing laboratory, a laboratory for the testing of materials, and a room for heating apparatus, coal, etc. The first floor will contain the director's office, reception room, library and reading room, laboratory of physics, lecture rooms for mathematics, physics, hydraulics and the janitor's lodge. The second floor will comprise natural history and geological lecture rooms and museums, lecture room for mining and metallurgy, geodetical and surveying instrument room, lecture room for geodesy and surveying, professor's lockers and lavatory, lecture rooms for steam engineering, machine design, structural engineering, railways and canals, etc. The third floor will contain three chemical laboratories, lecture rooms, dark room for photography, scale room, draughting rooms for both engineering and architecture. All the exterior walls of the building will be stone, that of the facade being in chiselled Deschambault stone, while all the interior walls are to be brick laid in cement. The style of the building is French renaissance soberly treated as to details. The floors will be of slow burning construction, supported on steel beams. The stairs will be fireproof throughout. All chemical laboratories are to be fireproof as well as all lavatories. All exterior walls will be lined with terra cotta, and all the plastering is to be done with selenite cement plaster, which is to be applied directly to the brick wall and terra cotta linings and divisions. The roof is to be made similar to the floors, that is in slow burning construction, and will drain in the centre. There will be electric lighting throughout. The cost of the building will be $100,000, as per contracts awarded. The plans were prepared by J. Emile Vanier, civil engineer and architect, of Montreal, a graduate of the Polytechnic School in June, 1877, Mr. Vanier being the first in the school register of graduates. It is proposed to have, as soon as finances permit, an up-to-date thermodynamic laboratory and electrical laboratory in separate buildings, there remaining sufficient space to build these behind.

The Polytechnic School was founded in 1873 under the title of Scientific and Industrial School of Montreal, by the Catholic School Commissioners of Montreal, with the help of the Quebec Government. The promoter was Professor C. A. Pfister, the well known chemist, who had some time before introduced a course of chemical and physical lectures at the Masson Commercial College at Terrebonne, Que., and who came to Montreal after the college burnt down in 1872. In 1874, the School changed its name to the present one, and a special act of Parliament was passed to that effect, and to approve of its programme, which was then, and is yet, modelled as much as possible on that of the Ecole Centrale of Paris, which is undoubtedly one of the foremost engineering schools in the world. The object of the Polytechnic School is to give courses in civil engineering, mechanical engineer-

ing, chemistry and assaying, and it proposes in the near future to give courses in electrical engineering. Since 1873 the School Commissioners of Montreal have supplied it with a building, that used to be the old house of Dr. Wolfred Nelson of 1837 fame, with an adjoining building for laboratories. For several years the School has been making efforts to improve its modest accommodation, which was becoming inadequate, and with this object in view, it was incorporated as a separate corporation under the laws of the province of Quebec, and also became affiliated with Laval University as its Faculty of Applied Science. This being done, the property on St. Denis street, opposite St. James Square was acquired, and the new building proceeded with. Notwithstanding its humble origin, and its modest means, during the last 29 years quite a number of graduates in civil engineering have been turned out, and mostly all have had success. The number of students is increasing year by year, and the graduates easily find employment at good salaries, and there is certainly a good future in that line. Nevertheless, in this country, the profession of engineering is not appreciated as it should be. In Europe, where education in all lines is far more advanced, all doors are opened to engineers, socially and



otherwise; they lead in all enterprises and industrial organizations, and they are to be found amongst the prominent men of the Old World. This is due to the fact that the learning of the engineer is of the highest grade, and none but the highest intellects can expect to be successful as engineers. From a business point of view, the engineer has made the wealth to be found in all parts of the world. The means of communication on land and sea, as well as all industrial enterprises, are conceived and carried out by him. The Quebec Government recognizing the importance of such an institution, has already given the School some help, but not sufficient, and it is to be hoped that the Provincial Cabinet will in the present opportunity see its way clear to give further help so as to enable the Polytechnic School to be placed a little more prominently before the public. Thirty years or so in the background should be enough to call for a change. Wealthy citizens of Montreal should, we think, follow the example of the late Senator Hon. J. O. Villeneuve, who has left by his will a donation of $25,000, and we sincerely hope that the late senator will have many imitators.

The complete course takes four years of nine months each, the students having to do vacation work besides. U. E. Archambault is principal, and E. Balete is director of studies, the former being the president of the corporation of the Polytechnic School of Montreal, and the latter the secretary.

AN UNRECORDED PROPERTY OF CLAY.*

BY H. J. CAMBIE, M.CAN.SOC.C.E.

Some years ago the writer found that ordinary clay, such as is used in the manufacture of bricks, and commonly spoken of as plastic clay, would, if dried sufficiently to remove nearly all its moisture, lose its cohesive properties, and would, if water were afterwards applied to it in considerable quantities, become an almost liquid mud. On the other hand, clay which has not been so dried will not absorb any more water, and will lose only some of its outside particles in the washing. The writer has been unable to find any reference to this property of the material in question in the text books at his disposal.

It came to his notice under the following circumstances: The main line of the Canadian Pacific Railway runs for nearly 150 miles through a portion of British Columbia, situated between the eastern slopes of the Cascade range, and the western slope of the Gold range. There is no regular rainfall over this area, and crops cannot be grown without irrigation. A good many thunderstorms do occur in the summer, but only over very limited areas, and the rainfall from them runs away quickly without soaking into the ground to more than a depth of one or two inches, and is dried off in a few hours by the rapid evaporation incident to the region. These characteristics are especially pronounced in the central part of the area mentioned. The farming lands are situated on benches, sometimes 200 feet or more above the level of the railway, which runs along the valley of the Thompson river, and at no great distance from the bank. Hay is the most valuable crop raised, and is used to winter cattle, and, with sufficient irrigation, several crops of it can be obtained in each season. Water has, therefore, been lavished upon the fields for nearly forty years, and has, in the opinion of the writer, been the cause of numerous landslides, one of the greatest of which occurred in 1881, when about 100 acres slid forward for nearly a quarter of a mile, falling in that distance about 300 feet, and completely blocking the Thompson river for about three days by forming a dam 75 feet or more in height. Many similar slides on a smaller scale have occurred since that date, but, generally, with slower movement and less disastrous effect. One of these is of large area and includes a portion of the railway line; it has required constant watching and has been a cause of much anxiety to the railway officials, because, although its forward progress

* Read before the Canadian Society of Civil Engineers.

has been slow, it has begun to move, year after year, at a date about three months after the beginning of the irrigation season, and has continued moving for about the same period of time. In 1886 the Canadian Pacific Railway Company took legal proceedings against the parties irrigating the fields above this slide, and it devolved upon the writer to furnish the legal advisers for the company with evidence to prove that the slide was due to the action of irrigation water. An investigation was made by the writer in consultation with Stanton and Schuyler, who were employed by the company, as experts in hydraulic engineering and, particularly, in irrigation practice, and with H. J. Warsap, manager of the Canadian Pacific Railway Portland cement works at Vancouver, an expert in clays. At the slides were found beds of clay so exceedingly dry and hard as to have the appearance of soft sandstone, and still retaining the marks of picks in the slopes of railway cuttings, where dressed many years ago. When a block of this dry indurated clay was placed in a soup plate and water dropped upon it, the clay absorbed 50 per cent. of its own weight without any change of form or other visible effect, but when it had absorbed about 60 per cent. of water, its structure completely collapsed, and it became as fluid as water. This was considered by us as conclusive evidence that the irrigation water which had been poured for weeks and months on these beds of clay had been the cause of the slide, but, in court, this argument was met by a demand from the opposing counsel to be told why the bluffs of this material, which were washed at their base by the river, did not disintegrate and slide. Several ingenious theories were offered to account for this. but were not convincing, and the writer now thinks that it was because these bluffs had never been dried out below high water mark, and the material in them, therefore, did not possess the property of soaking up water and of finally collapsing. In all probability the jury was influenced by the evidence that no slides had occurred before the commencement of irrigation, and that there was irrigated land in the rear of each slide. A year or more after the trial, the writer, while experimenting with Mr. Warsap on some clay, which had been dried for other purposes, found that it gave the very same results as the dry clay from the interior of the province. This led to experiments with other clay, and it was found that they all lost their cohesive properties when the moisture was removed.

It is probable that this property of clay has been the cause of so many of the landslides which have occurred this year in the valley of the Oldman and Belly rivers, between Medicine Hat and the Crow's Nest Pass, for there has been an exceedingly heavy rainfall over these valleys during the year for the first time since they have become known.

SAULT STE. MARIE AND ITS INDUSTRIES.

The financial difficulties which are causing temporary embarrassment to the Lake Superior Consolidated Company, generally known as the Clergue syndicate, can hardly be expected to seriously interfere with the wonderful industrial development which has been going on at Sault Ste. Marie for several years. A tightness in the money market has brought about some inconvenience, but arrangements which are being made for assistance will doubtless afford relief. Too much capital has been expended to permit of any temporary embarrassment putting a stop to the developments which are going on, though it is understood that further expansion will be suspended for a time.

It is due almost entirely to the energy and enterprise of one man that the Sault, where Lake Superior empties its waters through the St. Mary's rapids into Lake Huron, is rapidly developing into a great industrial centre. The name of F. H. Clergue has become known far and wide as one of the great captains of industry, who are seizing upon the forces of nature and making them minister to the comfort and convenience of man. The story of Mr. Clergue's developments at the Sault reads like a romance. Briefly told it is as follows: It had fallen to Mr. Clergue's lot to be associated with certain capitalists who could not find profitable investments, and he set out on a prospecting tour along the basin of the St. Lawrence, extending from the Gulf to Lake Superior, his purpose being to find a site favorable for hydraulic development. Reaching Sault Ste. Marie it seemed to be the ideal spot. The town had built a power canal of about 5,000-h.p., on which about $263,000 had been expended, but it could find no one to use the power. The Lake Superior Power Co. was organized by Mr. Clergue to take over the canal from the town. They enlarged it and made some further improvements. They had in mind to lease the power as is done at Holyoke, Mass., where it is worth from $15 to $30 per horse-power per annum, and where a great manufacturing city has sprung up. No manufacturers signified their intention of coming, and before the work of construction was completed the company had decided to establish industries of their own to use the power.

The Sault rapids are formed by the fall of the waters of Lake Superior over a ledge of sandstone rock about half a mile in width. The total fall is about 20 feet, and the rapids are about half a mile long. The discharge varies, according to the height of the water in the lake, the prevailing wind and other causes, from 3,600,000 to 7,000,000 cubic feet per minute, and is capable of generating from 130,000 to 260,000-h.p. With the completion of the new power canal on the Michigan side about half this power is now harnessed for industrial purposes.

When the Lake Superior Power Company had determined to establish factories it was natural, from the fact that immense forests of spruce lie to the north, that a pulp mill should be the first industry. It was decided to build a mill with a capacity of 20 tons a day. It was scarcely in running order before it was found that the cost of operating was almost as great as for a mill ten times the size. So the mill was enlarged to a capacity of 150 tons a day, making it one of the largest pulp mills in the world. For this output nearly 300 cords of wood are required. But the United States paper makers lowered the price of pulp, and new markets yielding a profit had to be found. The possibility of shipping to Europe was investigated, but as there was a considerable quantity of water in the pulp, and freight would have to be paid on the water, it became necessary to produce a dry pulp. The paper men said this was impossible, but mechanical experts were called in to devise a machine and a design was made. As none of the works would undertake to build the machine a foundry and shop was established, and the machine built on the spot, at a cost of $125.000. This foundry and shop have developed into a large and well equipped concern, and are kept fully employed in building and repairing the engines, locomotives, steamships and machinery belonging to the company, with an occasional outside contract.

The dry pulp difficulty having been solved it was determined to make also chemical pulp, which has a longer fibre, contains less resinous matter, and is used in the manufacture of higher grade papers, besides affording a greater profit. For this purpose sulphur is required. The pulp makers had hitherto imported their sulphur from Sicily, but Mr. Clergue observed that in refining nickel at Sudbury tons of sulphur were allowed to go to waste in the sulphurous acid gas which besides being lost was killing all the vegetation in the neighborhood. The chemists did not see how this could be saved, but Mr. Clergue's experts discovered a process, and he bought a nickel mine and produced his own sulphur. The residue was found to be an alloy of nickel and steel, so superior to anything known, that Krupp, the great German gun maker, made a contract for five years' supply. So reduction works and a ferro-nickel plant were added.

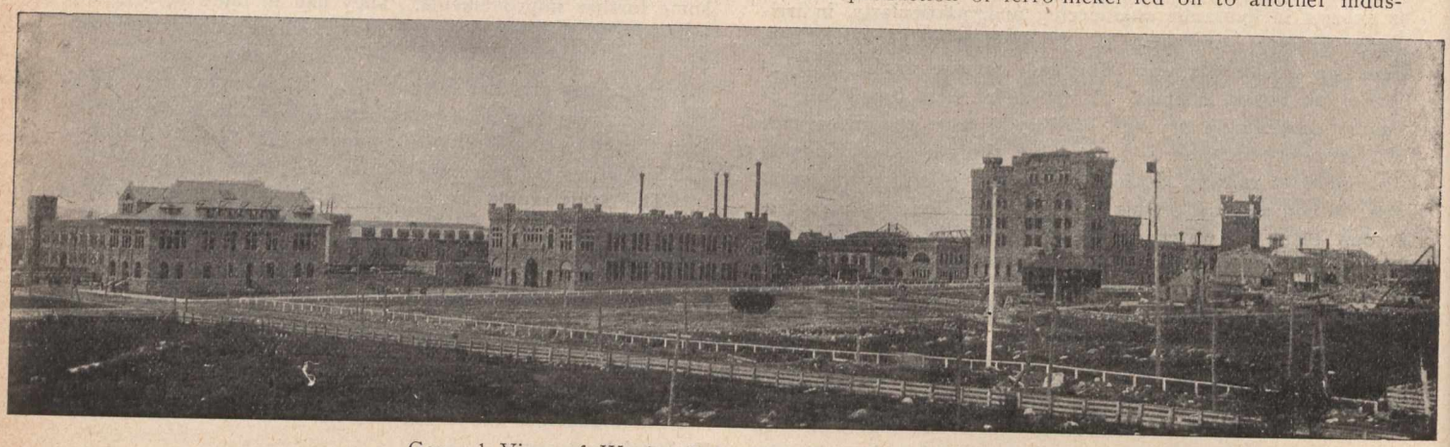
But before either the sulphite pulp mill or the reduction works were in running order a large chemical factory was established, which occupies part of the mechanical pulp building. In the process of refining nickel ores, sodium is required, and to bleach the sulphite pulp chlorine is needed. Common salt is a combination of these, and the immense quantities of salt produced in western Ontario supply the necessary raw material. The Rhodin process for the elec-

trolytic decomposition of salt is that used, and sodium, in the form of caustic soda, and chlorine in the form of bleaching powder, are produced. There are 80 cells, or units, for carrying on the process, and 40 more are to be added, as there is a wide market for the products. This branch is carried on by the Canadian Electro-Chemical Co., which rents the building and power. In the process mercury is used, and a stock of about $100,000 worth from the mines in Spain is kept on hand. The output of the chemical works is about nine tons of bleaching powder and five tons of caustic soda a day.

four inches in diameter and two and a half inches thick. About one hundred tons of briquets are turned out daily.

If there is more than one-tenth of one per cent. of copper in the ferro-nickel it injures the steel. A considerable proportion of the ore at the Gertrude mine is copper bearing. This is easily separated and will be converted into matte at the mine, and the matte sent to the Sault, where the nickel and copper will be separated and refined. In this process the iron in the ore is wasted but the sulphur is saved.

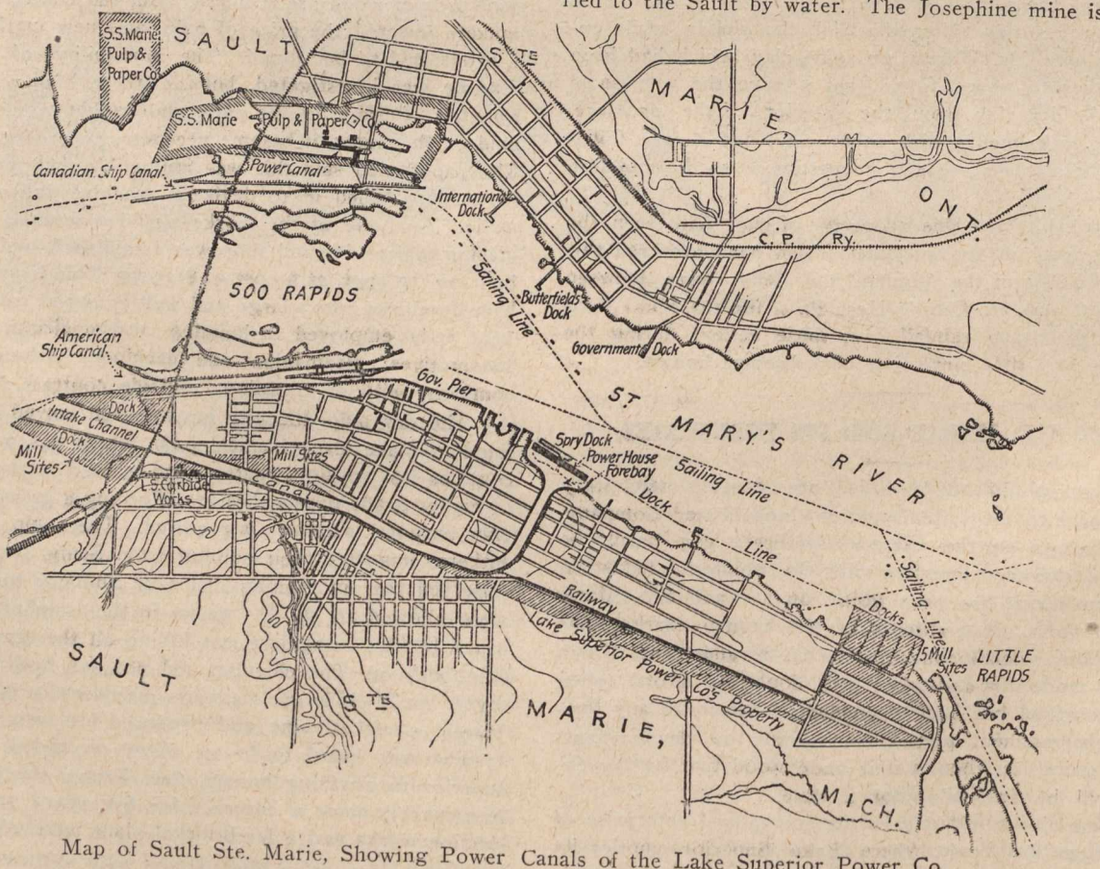
The production of ferro-nickel led on to another indus-



General View of Works, Lake Superior Consolidated Co.

The reduction works, where the sulphur is extracted from the nickel ore, have a capacity of 200 tons a day. The ore is brought from the Gertrude nickel mine near Sudbury, in hopper cars, from which it is dumped into elevator bins. Thence it is carried to crushers, which reduce it to powder. It then passes through a screen and any large particles are put through the crusher again. The powdered ore is then roasted, and the sulphur is driven off in the form of sulphur-

try. The percentage of nickel is about 7 per cent., while the amount required for armour plate is only 3½ per cent.; so a deposit of iron ore was sought to be used with the ferro-nickel. This was found near Michipicoten in the Helen mine, a mountain of rich ore, the wonder of the iron masters. The ore, which contains as high as 64 per cent. of pure iron, is easily quarried, and conveyed by a line of railway 12 miles to Michipicoten harbor, whence it is carried to the Sault by water. The Josephine mine is also very



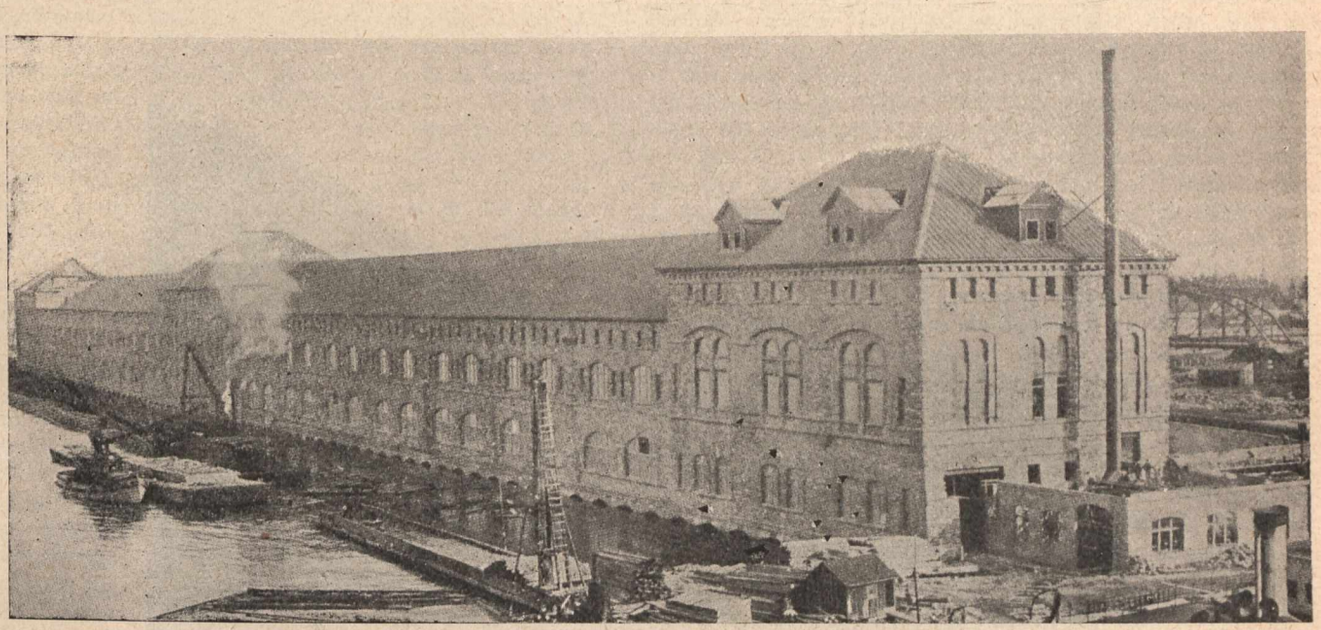
Map of Sault Ste. Marie, Showing Power Canals of the Lake Superior Power Co.

ous acid gas, and carried to an adjoining building, where it is compressed into liquid sulphurous acid for the sulphite pulp mill. There are four huge roasters which never stop work. It takes the ore 24 hours to work from the top to the bottom, where the hot powdered ore, freed from sulphur, is mixed with thick lime water and passed through a briquet machine, and made into briquets of ferro-nickel iron, about

rich, and several other valuable deposits have been located. Blast furnaces are now being constructed at Moore's Point on the Lake Superior shore, about a mile west of the pulp works, where ore docks have been built. The plans comprise four furnaces, two of which are about completed. The ferro-nickel briquet produced at the reduction works, combined with the hematite ore from the Helen mine, will

give a pig iron that will make a nickel steel of the highest value for commercial purposes. Open hearth furnaces will be added as soon as the blast furnaces are in operation. Near the blast furnaces a charcoal plant is being built to produce fuel for the furnaces, and ovens are also being constructed to treat the by-products. A coke plant will also be provided to treat the coal brought to the spot by the company's vessels.

Near the site of the blast furnaces are the steel works, which commenced operations last May. The equipment is of the most modern description, and is said to be one of the finest in America. The plant consists of two Bessemer converters, a blooming mill and rail mill, the latter having a capacity of 350 tons a day, though the plant is intended for 600 tons. The machinery is run by electricity, and the manipulation of the enormous cranes and other devices for reducing the handling to a minimum, calls forth loud expressions of astonishment from visitors. It is surprising with how few men the gigantic plant is run. The power is at present supplied by eight large Sterling boilers, but the power developed by the new canal recently completed on the United States side of the river is to be utilized till a new canal is built on the Canadian side. A monster stand pipe, 150 feet high, supplies hydraulic power, and a pumping station on the river bank keeps the stand pipe filled. Until the blast furnaces are in operation pig iron is obtained from Midland, and also from Hamilton, a large stock being piled in the yard.



Power House, Michigan Lake Superior Power Co.

The process at the steel works is as follows: The ore as it comes from the Helen mine will first be treated in the four charcoal blast furnaces of 150 tons each daily capacity, and the two coke furnaces of 400 to 500 tons capacity. In the cupola building of the steel works pig iron is now decarbonized with a view of converting it into steel, which is done in the convertor department, to which the hot iron is carried in huge ladles. The limestone necessary for flux is obtained from St. Joseph's and Cockburn islands in the St. Mary's River, some 25 miles below the Sault. Next it is taken to the blooming mill. Each bloom is large enough to yield two 30-foot steel rails. The proper amount of ferro-nickel ore is added during this process. Then it is reheated and sent on to the rolling mills. Three eight-foot cupolas have been installed for melting the pig iron for conversion. The Bessemer plant consists of two acid liquid converters of five tons' capacity each. The metal after being blown is handled by pouring into molds on trucks, the ingots being stripped after a few minutes. This stripping is done by means of an overhead crane, which is provided with an auxiliary trolley, used to change the ladles on the ladle crane. The ignots are then taken to the pit furnaces, or soaking pits, consisting of two four-hole furnaces, which are kept at a temperature of 1,200 degrees. The ingots are drawn and charged in these furnaces by an overhead electric crane, which also delivers the ingots on the blooming mill tables. They are then passed through the 32-inch blooming mill, driven by a pair of 28 by 48-inch reversing engines. The blooms are sheared to the proper length in proportion to the section of rail in which they are to be rolled, and next taken to four regenerative heating furnaces. The overhead charging and drawing crane is used in connection with these reheating furnaces for charging and drawing the bloom. This crane also delivers the bloom on rollers which run to a 23-inch mill. There are in this mill three sets of rolls; first and second roughing and finishing. The material is handled and manipulated at the rolls by electrically driven transfer tables. These are covered by an overhead electric travelling crane for handling rods and spindles when changing from one section of rail to another. After leaving the rolls the rails are sawn to the required length, passed through a cambering machine, straightened, inspected and drilled, and then loaded on cars by pneumatic overhead hoists. The plant is laid out for handling rails in 30 or 60-foot lengths, up to 85 pounds per yard. The crane runways are supported on steel columns of plate girder construction, independent of the building. Railway plates are also made, and it is intended to add structural iron, bars, ship plates, and ultimately tubes to the output. A considerable quantity of rails have been made to supply a contract with the Government for the Intercolonial, for the Algoma Central, some electric lines, and now a contract has been closed with the Ontario Government for 8,200 tons for the Temiskaming Railway, which will keep the mills running for some time. This branch of development at the Sault has been stimulated by the bounties offered by the Ontario Government on steel production in Canada, which are to remain in effect till 1907.

In addition to the coke and charcoal plants near the blast furnaces, there are now in operation at Searchmount, on the line of the Algoma Central Railway, a number of bee-hive kilns, where charcoal is made, and the by-products, such as wood alcohol, creosote, guaiacol, acetate of lime, etc., produced in large quantities. The process we have not space to describe in detail.

At Moore's Point another development is to be seen in the form of a large saw-mill, quite recently put in operation. It contains two band saws and a fast gang of thin saws so constructed as to cause as little waste as possible. The mill is also arranged for cutting veneers. It has a capacity of 300,000 feet per day. At Goulais River, on the Algoma Central, there is another mill containing circular saws, with a daily capacity of from 30,000 to 35,000 feet.

On the line of railway a short distance from the Sault,

the company has a large brickyard where a superior quality of brick is manufactured by what is known as the dry process.

In order to reach the stores of raw material necessary for the various industries, railway communication was required. The Algoma Central was projected, running north from Sault Ste. Marie, through lands covered with spruce suitable for pulp wood, and a country doubtless rich in minerals, to Missenabie, on the Canadian Pacific, thence to Hudson's Bay, where valuable fisheries would be tapped, about 500 miles in all. Mr. Clergue promises before many years have elapsed to have through fish trains running from Hudson's Bay to Chicago. Under an agreement with the Ontario Government, and in consideration of a subsidy, the Railway Company binds itself to settle on the lands adjacent to the railway, 1,000 male settlers annually for ten years. The rails are laid and regular trains running for some fifty miles out of the Sault, and the roadbed is graded for a considerable distance further. The construction is of the most substantial character, with heavy rails and steel bridges, and the engines employed are among the heaviest in Canada. In addition to the main line there is a line between the Helen mine and Michipicoten harbor, which will be extended from the mine to the main line.

The company is also building the Manitoulin and North Shore Railway, which will connect Sault Ste. Marie with the Gertrude nickel mine, Sudbury and the nickel region, by a line parallel to the north shore of the Georgian Bay but running through the interior, while the C.P.R. skirts the bay. From near Sudbury the M. and N.S. will run south, cross the channel to Manitoulin Island at Little Current, cross the island, and connect by a ferry with a line to be constructed through the Bruce peninsula from Meaford to Torbermory. There is a possibility that a portion of the Manitoulin & North Shore may form a link in the Grand Trunk Pacific line. These railway lines have been referred to so often in The Engineer that it is unnecessary to speak of them here at greater length.

In connection with the railway the company has a fleet of 18 steamers, which form a semi-weekly line between Toledo, Detroit and intermediate points and Sault Ste. Marie, and a tri-weekly line to Michipicoten. Vessels are also employed in carrying iron ore, pig iron and coal from Midland, Hamilton, Michipicoten, Toledo and other points.

The company has numerous other interests in and about Sault Ste. Marie. The Tagona Water & Light Co., which supplies the Sault and Tagona, a suburb, where many of the employees live, with water and electric light, a ferry service to the Unitd States Sault, the International Hotel at the Canadian Sault, the Algoma Inn at Michipicoten, the street railway system about completed, are all controlled to a greater or less extent by Mr. Clergue and his company.

In addition to the development on the Canadian side, the company has undertaken similar enterprises on the United States side of the St. Mary's river. On the 25th October last, as stated in the November issue of the Engineer, there was inaugurated an immense power canal at the Michigan Sault. The ceremonies in connection with this event, which took place exactly four years from the letting of the contracts, and lasted several days, were of an imposing character, as befitted such an occasion . One of the most attractive features in the parade was a number of floats illustrating the various works carried on upon the Canadian side. It was an object lesson of the great magnitude and variety of the industries which have been built up under Mr. Clergue's direction.

Helen Mine, Michipicoten.

The power canal on the Michigan side is 2⅓ miles long, 224 feet wide, on an average, and 22 feet deep, much of it cut through solid rock. The sides and bottom are smooth finished, with Portland cement, where excavated in rock, and the rest of the way planked with the best hemlock timber to prevent erosion. The entrance is 891 feet wide and 18 feet deep, and has an inflow of 30,000 cubic feet per second. One of the most interesting features from an engineering point of view is the compensating works, which are designed to stop as much of the flow of the rapids as will be taken through the canal. When the canal was planned one of the most serious features was the probable effect upon the level of Lake Superior of opening such an immense waterway. The opinions of the highest engineers were obtained, and the result was the construction of a submerged weir, or dam, built upon timber cribs, secured to the rock bed of the river and filled with concrete. The flow of water is controlled by four Stoney sluice gates, 48 feet long and 15 feet wide. These works, it is expected, will compensate for the loss of 30,000 cubic feet of water per second, 24 hours a day, 365 days in the year. Whether they will really prevent the permanent lowering of Lake Superior is a matter that time alone can prove.

Head-gates near the upper end regulate the quantity of water admitted, and at the lower end the canal widens into

a forebay for distributing the water to the turbines. Suitable ice racks are provided. The river front of the forebay is closed by the power house, which, in fact, constitutes a dam. It is 1,368 feet long, 100 feet wide and 125 feet high. The massive building rests uopn a foundation of piles, on which are placed log sills and caps, covered with Portland cement concrete, to a depth of three feet. The cost of building this foundation represents a large sum The sub-structure consists of 81 masonry walls, 100 feet long, 20 feet high, and 3 feet thick. The stalls or pits thus formed serve to deliver the water from the turbines into the river. There are 80 turbine chambers, and one spillway to carry off ice, logs and other refuse. The remainder of the building is taken up by dynamo and mill floors. Each hydraulic unit is made up of four 33-inch Jolly-McCormick turbines, arranged in two pairs on one shaft, on the end of which, outside the turbine chamber, is coupled an electric generator of 400 K.W. capacity. Each unit is designed to use 391 cubic feet of water per second at an effective head of 16 feet and to develop 568 M.-h.p.

The Union Carbide Co., of Niagara Falls, has contracted for 30,000-h.p., and besides occupying half the power house, is erecting a large building of its own. A large paper mill is to be built, and in the meantime a portion of the power will be used on the Canadian side. The current will also be used for lighting the Michigan Sault, and for its street car line, over which the first car was run on the day of the inauguration of the canal. The chief engineer of this magnificent work, the largest in America, was H. von Schon, and the electrical installation is under the direction of Owen Thomas, E.E. The canal represents an expenditure of about $5,000,000.

To return to the Canadian side. Nowhere can a finer group of buildings, devoted to industrial purposes, be found. They are built in the Norman style of architecture, of a red mottled sandstone, obtained from the excavation of the power canal. The number of men at present employed is about 4,000, distributed as follows: Pulp mills, 400; machine shop, 300; cutting charcoal wood and burning charcoal, 400; cutting pulpwood, saw logs and veneer logs, 1,000; completing blast furnaces and rail mill, 250; extending waterworks and electric light plant, 200; street railway construction, 200; ferro-nickel works, 50; saw and veneer mill construction, 100; Algoma Central Railway, construction and operation, 500; employed at Helen, Josephine, and Gertrude mines, 600; rail mill and blast furnaces, 500. The pay roll is about $180,000 a month or $2,160,000 a year. Then there is the office staff, who attend to business in the luxuriant quarters provided for them, and experts employed in the laboratory. The latter is a very important adjunct, for the company employs a number of expert metallurgists, chemists, etc., graduates of the best universities and technical schools, who test every specimen of any promise which is brought to them, for Mr. Clergue wants to turn to account all raw material of any value in the Algoma district. Every run at the blast furnaces is tested so that the steel produced shall be of the proper quality. The head of the metallurgical-department is Ernest Sjostedt a graduate of the Swedish School of Mines. The laboratory is splendidly equipped and contains a fine collection of minerals from all parts of the world, in which Algoma is well represented. Problems in chemistry and metallurgy, which have baffled leading scientists elsewhere, have been solved in the little laboratory building at Sault Ste. Marie.

To recapitulate. The industries of the Lake Superior Consolidated Company may be summed up as follows: Mechanical pulp mills, 100 feet by 700 feet, capacity 100 tons a day; sulphite pulp mill, 100 feet by 300 feet, and 110 feet high, capacity, 70 tons a day; ferro-nickel plant, 200 feet by 300 feet, capacity, 100 tons a day; chemical works, 300 feet by 500 feet, capacity, nine tons of bleaching powder and five tons of caustic soda a day; machine shop, 200 feet by 300 feet; foundry, 100 feet by 200 feet; Bessemer steel plant and rolling mills, covering 25 acres, with a capacity of 1,000 tons of material a day, and from which 30,000 tons of rails have been turned out; two blast furnaces, with a capacity of 120,000 tons a month, and four more to be built immediately, for the iron industry is the backbone of the works; charcoal plant, with provision for utilizing by-products; two saw-mills at the Sault and Goulais river, with a daily capacity of about 300,000 and 30,000 feet; car shops at which their own cars are built, and in which a rush order of 500 box cars for the Canadian Pacific Railway is being filled; pattern, tinsmith, pipe fitting, boiler and blacksmith shops: brick works; 75 miles of completed railway, with 29 miles of sidings at Sault Ste. Marie, and the Algoma Central and Manitoulin and North Shore, about 1,000 miles in all under construction; a fleet of 18 steamers; Tagona water and light works; Helen, Josephine and Gertrude mines. These enterprises represent an expenditure of about $25,000,000, and ship-building, copper smelting and other industries, the outgrowth of what has already been done, are in course of preparation. The canal on the Canadian side will generate about 20,000-h.p., the new canal on the Michigan side 60,000-h.p., and a new canal on the Canadian side, which the company is bound to build under their agreement with the Ontario Government, 40,000-h.p. This new canal will be proceeded with at an early date. The power house will be 1,000 feet long by 100 feet wide. Nor will the construction of this canal probably end the development, for Mr. Clergue has expressed the opinion that the time is near at hand when the rapids will disappear and not a gallon of water will pass from Lake Superior to Lake Huron without contributing its power to human industry. The Canadian town of Sault Ste. Marie, which has grown during the eight years since Mr. Clergue went there, from a place of 2,000 to an industrial centre of about 12,000 people, will then have become an important city, and the prophesy that the twin cities will contain 200,000 inhabitants may be realized.

The various industries are carried on under different names. There is the Lake Superior Power Co., the Sault Ste. Marie Paper and Pulp Co., the Canadian Electro-Chemical Co., the Algoma Iron Works, the Algoma Steel Co., the International Lumber Co., the Algoma Central Railway Co., the International Transit Co., the Ontario Lake Superior Co., and on the Michigan side the Michigan Lake Superior Power Co., all kept separate for convenience in keeping the accounts and ascertaining the profit or loss in each department, but capitalized and under one management, as the Consolidated Lake Superior Co., or locally known as the allied companies. Associated with F. H. Clergue in the general management is his brother, B. J. Clergue, and each department is under a competent head. The Clergues are bachelors, and live in the old Hudson Bay block house, adjoining the works, which has been carefully preserved as a relic of what the Sault once was. It is an interesting contrast between the old and the new, to see electric light and telephone in the old block house. In the grounds is also to be seen the original lock used by the Hudson Bay Co.'s boats in surmounting the obstruction to navigation, caused by the rapids, and which dates from 1797. Mr. Clergue is a believer in preserving the ancient landmarks. The lock is in strange contrast with the magnificent ship canal on the Canadian side, with its lock, 900 by 50 ft., and the two canals and locks of smaller size on the United States side, through which pass a greater tonnage during the season of navigation than through the Suez Canal the entire year.

Whatever may be thought of the theory of evolution, it is in active operation at Sault Ste. Marie. The power producer has evolved into the manufacturer, the manufacturer into the railway builder, the railway builder into the colonizer, and the end is not yet. The pleasing feature is that it is a Canadian development, despite the fact that United States cash is doing it, for Mr. Clergue's backers are principally Philadelphia men.

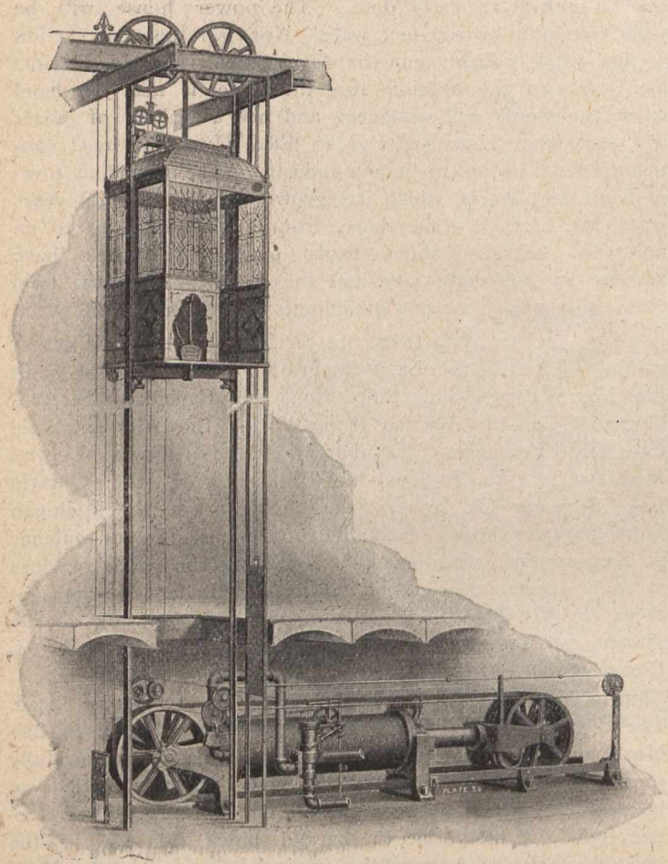
In addition to the Clergues, and others, who have been already mentioned, A. S. Crane, C.E., is chief engineer of the Lake Superior Power Co., operating on the Canadian side; H. von Schon, chief engineer on the Michigan side; W. Z. Earle, chief engineer of the Algoma Central Railway; J. A. Wilde, chief engineer of the Algoma Commercial Co.; E. A. Sjostedt, chief metallurgist; Prof. A. B. Wilmott,

supt., of exploration; E. F. Bradt, supt. of mines; E. V. Rosevear, traffic supt. of railways; D. D. Lewis, supt. of the blast furnaces and steel works. The latter was formerly superintendent of the Lorain Steel Co., and of Tom Johnson's works at Cleveland. He made his first Bessemer steel at the Sault just one year after beginning work on the plant, and is said to have won a wager of $5,000 from the manager by accomplishing this feat.

EVOLUTION OF ELEVATORS.

BY H. P. DOUGLAS, TORONTO.

The subject of elevators is so broad and embraces so much that it is not possible in this article to treat it in any but a very general way. Hoisting devices of primitive kinds have been used by different nations for many years, the earliest form was probably a rope passing on a wheel or block and wound up by a drum or other winding gear. From this crude beginning was evolved the belted type elevator; these were introduced some sixty years ago, and operated by line

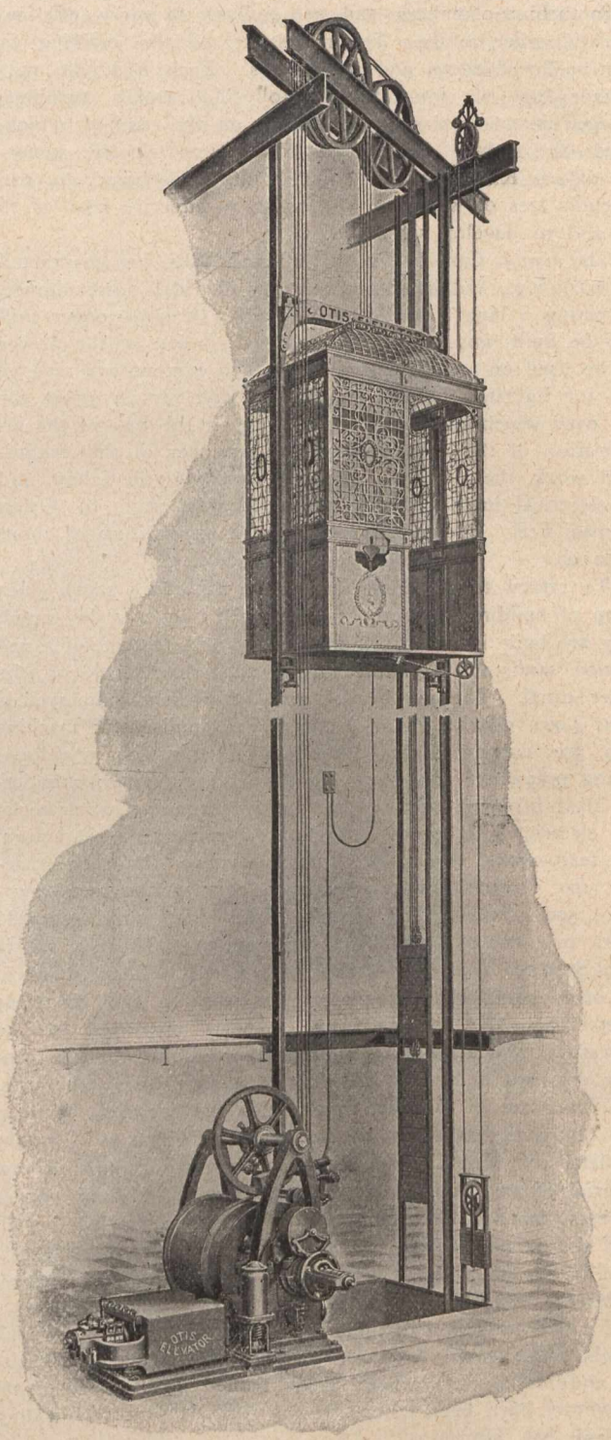


The Otis Hydraulic Elevator Horizontal Cylinder.

shafting, steam soon come to take the place of shafting, and the power to be supplied by direct gearing. About the same time the hydraulic elevator was introduced. First, the plunger or direct lift type, with the plunger fastened to the bottom of the car, and then the vertical cylinder machine with its multiplying sheaves. In 1883 for the first time electricity was used in elevator service, the motor taking the place of shafting and steam to operate a belt machine. It was not until 1888 that the present style of direct connected elevator was placed on the market, and since then the improvements have been many and rapid. The first of these machines consisted of a single winding drum worm, geared to an electric motor, the whole mounted on a heavy base. The control was mechanical, operated from the car by a hand rope. It is interesting to note that this type of machine is accepted to-day as the standard; and of course, many improvements in construction, control and safety appliances have been made, yet the general design and idea of the machine itself remains the same. Several other types of direct connected electric machines have been devised; one, the screw and sliding nut machine, attained some prominence, but has now been discarded owing to the expense of operation, and other reasons, leaving its old competitor the field to itself. Such briefly has been the evolution of the modern elevator as we know it to-day.

The first question that confronts one, when an elevator is required is, first, what kind would suit me best, and secondly, where shall it be placed?

In cities where the direct current is obtainable at fair prices, and where the voltage is reliable, the direct connected electric elevator should have first consideration. Its chief advantages are: Cheapness of operation, costing nothing when not in actual service, small amount of room required for the installation, and its adaptability to private and apartment



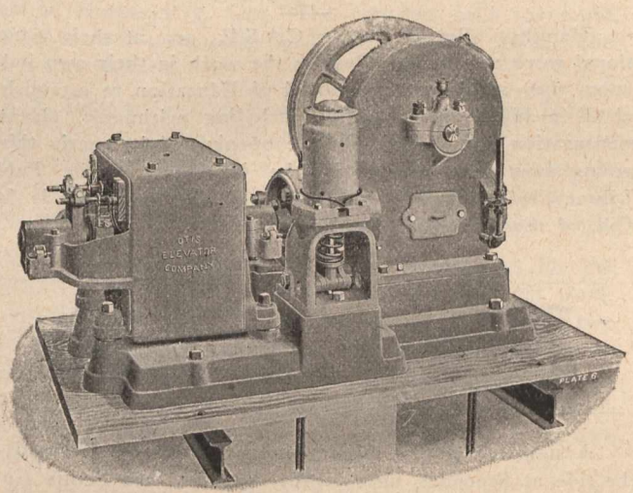
The Otis Magnet Controlled Electric Elevator.

house service by means of automatic push button control. Until recently it was not considered good practice to install electric elevators in large office buildings, owing to their liability to break down under severe and constant running; but thanks to the many improvements in construction and control, they are now fast taking the place of the hydraulic in the United States, and are standing up under the most severe service, and making a grand showing.

When the alternating is the only current available the direct connected alternating current elevator can be used to advantage. This type is at present not manufactured in Can-

ada, but a reliable and thoroughly tried alternating machine will shortly be placed upon the Canadian market, and its coming will supply a long felt want, especially in the cities, where there is such a strong opposition at the present time to selling direct current for elevator use at any but the most prohibitive prices. A large number of these elevators are now in service in the United States and Europe, and where high speed is not required are most satisfactory and economical to operate.

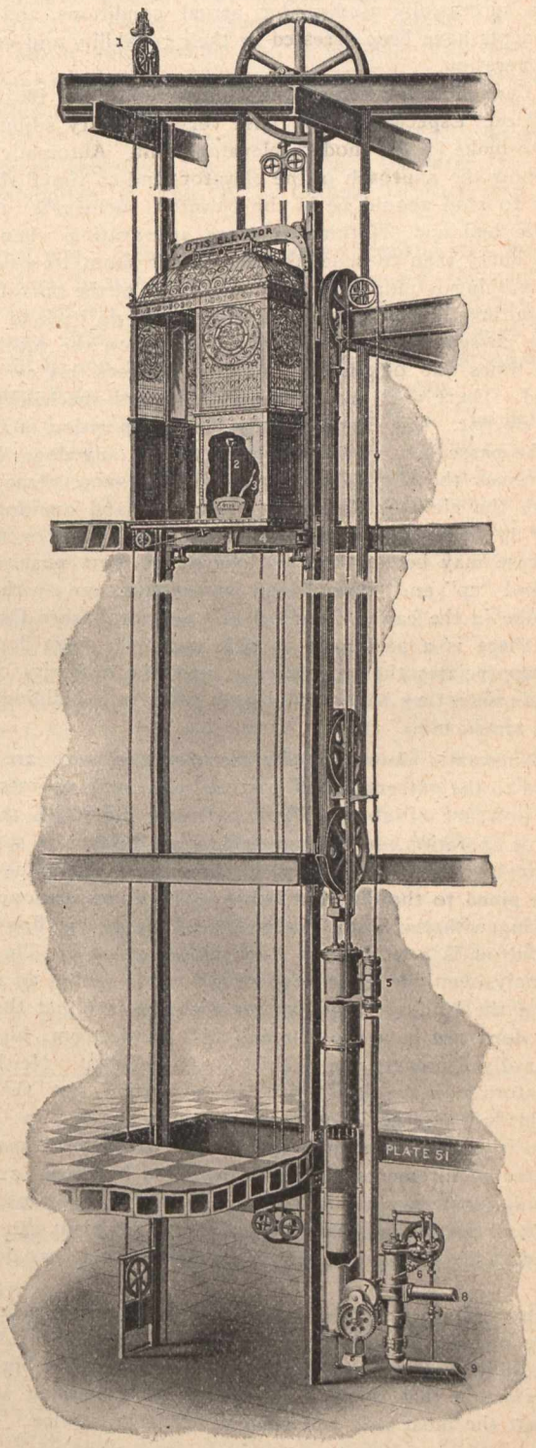
When the current conditions are not favorable, the hydraulic elevator must be installed. Its chief disadvantages are amount of room required for the installation, especially in plants where pumps and tanks are necessary, and the much greater first cost. The simplest type is the plunger or direct lift; its use, however, is almost exclusively confined to side wall or cellar hoists. Where room in the hatchway will permit, the vertical cylinder hydraulic is the best, as they are simpler and less expensive. But room in a modern building is usually at a premium, and the elevator machinery is banished to the basement, and under these conditions the horizontal pushing machine is the proper one. In small plants where a natural supply of water or a sufficient street pressure is available, the cylinder can be connected direct to the main. Such cases are rare, and a pumping plant is almost always required to give good and efficient service. The most economical pumping plant is where the pumps are driven by a direct current motor and the running of the pump is con-



The Otis Electric Engine for dumb-waiter service. Built for placing over shaft. With electric push-button and mechanical control.

trolled by the height or pressure of the water in the tank, so that practically the pumps only run when the elevators are in service. The new Guardian Assurance building, Montreal, will have a plant of this description. If an alternating current motor is used it is necessary to pump continuously, and employ a by-pass valve to take care of the surplus water.

Of secondary importance are the belted elevators; they should never be used for passenger service, or for speeds over sixty or seventy feet per minute. The spur gear is much more economical, and cheaper to operate, and simpler in construction, but it is noisy, and not adapted to use in buildings where this will be noticed. The screw or worm gear machine makes a first-class warehouse or factory elevator, and in Canada is largely used in connection with alternating current motors. Speaking in general, circumstances alter all cases, and especially in the elevator business, no set rule can be made to hold good, and the safest plan when in doubt is to ask the advice of the best elevator manufacturer. If architects would ask the advice of the elevator builder as to where and how to place their elevators, much subsequent expense would be saved. Good elevators are as important to a building as good engines to a ship, in the latter the most care and thought is spent in planning and laying out this department, while too often in the former they are sadly over-looked until the last moment, and then it is up to the manufacturer to make the best of it. To give the best results the machinery must be located in a good place, one that is light and dry, with plenty of air and room. In planning for an electric elevator, if possible, put the machine directly over the shaft; it is out of the way, no sheaves are required and the cables will last much longer. In one of the largest department stores in the world, operating some 45 elevators, they are placed over the shafts, and much valuable space in the basement is utilized for other purposes. There is another most important point that is too often overlooked. Allow plenty of room at the top and bottom of the shaft. When



The Otis Hydraulic Elevator Vertical Cylinder.

the car is at the top landing, there should be at least four feet clearance between the highest point and the overhead work, and a pit of never less than three feet should be provided at the bottom. It is impossible on a fast electric machine to adjust the limit stops so that the car will stop exactly at the top and bottom with varying loads. For passenger service, planed steel guides should always be used, and the smooth running of the car more than makes up for the difference in price. The overhead beams should also be of steel, and the sheaves, as large as can be used, mounted on covered boxes.

Of the various safety devices in use the Governor type is

the best and most reliable. This consists of a two ball governor at the top of the shaft connected to the safety itself by a ⅜-inch wire cable. When the car exceeds its maximum speed the balls fly out, and the cable is firmly gripped, which pulls in the safety clutches holding the car firmly to the guides. The safety itself for steel guides is preferably the toggle or wedge pattern, and is fastened to a heavy steel beam running under the bottom of the car. A trap in the floor allows the car to be released from the guides after the safeties have been thrown in. Many times these safeties have been successfully used under actual conditions, and serious accidents have been arrested by their reliability and quickness of operation.

Canada is far behind the United States in its elevator practice. Especially so in those very necessary adjuncts that go to make up the modern elevator plant. Automatic signals to show the approach of the elevator, and to signal the operator to stop should be in the elevator enclosures of every public building. Nothing is more aggravating when one is in a hurry than to suddenly see the car shoot by your floor, and nothing is more trying to the temper of the operator than to continually have to reverse his car and go back to pick up some passenger. It is also most severe on the machine, as nine times out of ten the operator reverses his car at full speed. There are three kinds of indicators, mechanical, fluid and electric. The first two only give the position of the cars to the passenger, while the electrical not only does this, but also gives the signal to the operator to stop. Two globes above the elevator doorway, one for up and one for down, light up when the car approaches the landing, up or down as the case may be; on the enclosure are two push buttons marked "up" and "down," and by pressing one or the other a globe in the car in front of the operator flashes the signal that there is a passenger to pick up at the next floor. No one appreciates the convenience and the necessity of these signals until they have occupied an office in a building where they are in use.

Automatic doors on the elevator enclosure are a safeguard to the passenger and a great help to the operator. Air at a pressure of about fifteen to twenty pounds is the medium of operation, and is supplied by an electric or steam air compressor, placed usually in the engine room, and from there piped to the different floors. The doors are opened by pressing with the foot a button placed on the car floor, when the button is released the door closes at once. The doors can only open when the floor of the car is within an inch or two of the landing, this together with the fact that the operator does not have to remove his hand from his lever materially decreases the liability of an accident. Neither the indicators nor the doors are so expensive but that they should find a place in every large office building in Canada. There is a great tendency in Canada to underestimate the elevator requirements, especially in office buildings, and it is not only most aggravating to the tenants, but also most unfair and hard on the machines themselves, as no plant can be expected to do so satisfactorily more work than it was designed for.

In closing, remember that the commercial success or failure of a building largely depends on its elevator service, and to-day the modern elevator has reached such a high state of perfection that there is no excuse for a building to offer any but the most safe and efficient elevator service.

CO-OPERATIVE TELEPHONY.

As bearing on the prospects of independent telephony in Canada, discussed editorially in this issue, the following evidence given before the industrial commission at Washington, by a witness, on the co-operative telephone company at Grand Rapids, Wis., will be instructive:

There is a co-operative telephone there which operates on the same principles as the public system, namely, for the benefit of all who are concerned in the service and wherever the voluntary co-operative plan is possible. I believe it is preferable even to the public system in the present state of our civilization, so that I regard this example as one of the finest that we have. I have kept track of the enterprise for several years. Here is a letter just received a week or so ago. The present condition of things, in brief, is this: They have about 300 lines; the average cost is $42 for construction; the cost of maintenance and operation is about 75 cents a month for each line. The prima facie charges are $1 a month for a residence and $2.25 for a business telephone per month. Each subscriber has a right to take one share of stock, and is urged to do so, $50 per share; and nearly all, over four-fifths, do take one share each. One and one-half per cent. dividends per month are paid back upon these shares, amounting to 75 cents for each shareholder. So that the actual charge for a residence 'phone is 25 cents a month, and the actual charge for a business 'phone is $1.50 a month. The actual cost to the subscriber is $3 a year for a residence 'phone, and $18 a year for a business 'phone. They are continually reducing their rates, and even after paying these dividends they have a surplus fund for improvements. The former Bell Company was charging $36 a year for a residence 'phone, and $48 for a business 'phone, and refused to reduce their rates. They said, just as they say now in Washington, that they could not afford to reduce rates. Yet the people of Grand Rapids are now receiving telephone service at one-third to one-twelfth of the former monopoly rates.

HAMILTON BRANCH STATIONARY ENGINEERS.

Hamilton Branch No. 2, C.A.S.E., are at their educational work this winter. Besides the work in their own lodge room they applied to the Board of Education to establish a class in higher mathematics, including arithmetic, algebra, mensuration and Euclid. On the opening night nearly thirty young men were present in the basement of the Public Library building. The fee is $1, and the instructor is Jas. Gill, of the Collegiate Institute.

Municipal Works, Etc.

A new bridge has been constructed across the head of the tide at Freeport, near Digby, by the Nova Scotia Government.

The Canada Foundry Co. has been awarded the contract for a new iron bridge across the Don river at Thornhill to cost $6,602.

Chicago has planned for subways, extending from curb to curb under every street, to accommodate the ever increasing traffic.

J. O. A. Laforest, engineer, Montreal, has been awarded the contract for the Levis waterworks. Work will be commenced in the spring.

It is proposed to make a carriage and foot bridge across the Restigouche at Metapedia by adding an extension to the present railway bridge.

The Consumers' Gas Co., Toronto, has installed an additional water gas plant with a capacity of 800,000 cubic feet, to meet the increased consumption.

Montreal Road Committee ask for an appropriation of $2,376,788 for next year. Double the usual amount is required for street cleaning, and the number of street sweepers will be trebled on the principal streets.

In recognition of City Engineer Ker's services in bringing the main drainage work to a successful completion well within the estimated cost the Ottawa council has been recommended to grant him a bonus of $1,000 and a month's holiday.

Belleville is dissatisfied with the administration of its waterworks department by commissioners, and will vote on a proposal to transfer them to the council. With 800 takers the consumption is 319,000,000 gallons. The flat rate is $19, the highest in Ontario, yet the works are run at a loss.

Each year about £10,000 is expended in sprinkling the streets of London with sand to prevent horses from slipping.

Carleton Place council turned down a $10,000 by-law for granolithic walks. They will probably be built on the frontage plan.

The Dominion Government proposes to build iron bridges at McLeod and Lethbridge, Alta., the former to cost $20,000 and the latter $40,000.

Hamilton ratepayers will be asked to vote $100,000 for water main extensions, macadam roadways, sewage disposal works and other city improvements.

A Vagen-Baden smoke helmet is in use by the fire department of Victoria. B.C. When protected by it the firemen can penetrate thick smoke without danger.

Toronto city council has determined not to submit a sanitary system by-law at the municipal elections. The by-law to provide $175,000 for a 15,000,000 gallon pumping engine will be voted on.

Frontenac is making a determined move to have free roads under the Ontario Government plan. The example of Hastings is being held up, which has for some years had over 200 miles of free gravel and macadamized roads in good condition.

Mr. McLaughlin, contractor for the Eganville bridge, has been awarded the contract for a waterworks and sewerage system at Hawkesbury, Ont. The contract calls for eight miles of sewers, principally in hard clay and rock. The price is over $70,000.

F. S. Dennis, who has been studying the problem of irrigating Canadian Pacific Railway lands in the west, has prepared a plan for irrigating a large tract east of Calgary, in which there are about 2,500,000 acres of good land. W. Whyte will have the general direction of the irrigation work.

M. P. Davis, of Ottawa, who had the contract for the sub-structure of the Quebec bridge, has completed his work. The contract called for the building of two main piers, two anchor piers and two abutments, and this involved 80,000 yards of masonry. The price was a little over $1,000,000. The Phoenix Bridge Co. has the contract for the superstructure. It is expected the bridge will be completed within two years.

An experiment is being made in New York in the form of a steel wagon road now being laid on Murray stret, the material for which has been presented by Mr. Schwab, president of the great steel corporation. The traffic is very heavy, frequently amounting to 180 wagons per hour. The track upon which the wagon wheels will run will be laid in the middle of the street, and consists of a flat plate or rail twelve inches wide with a ridge on each edge one-quarter inch high as a wheel guide. Beneath the plate, to strengthen it, is a ridge two and three-quarter inches deep. The parallel plates, or rails, which are forty feet long, are connected by means of steel rods beneath the road surface, and rest on broken stone with the drainage.

A trial section of bituminous macadam pavement has been put down at London, Ont. It is 3,620 feet in length, 26 feet wide, with 15 inch gutter and 6 inch curb. Over 1,000 cords of stone have been used in its construction. The foundation is composed of 5 inches of coarse broken stone. This is poured with bituminous cement, and on top is placed a bituminous macadam mixture in which the stones range from two inches to the finest powder. This is thoroughly rolled, and it is claimed to be impervious to water, that great enemy of asphalt pavement. Over this is placed the "squeeze coat," a coat of bituminous cement that fills up the last remaining unevenness, and is the final protection. A top dressing of crushed screenings is added which give the pavement a rough finish. It is a clean, comparatively noiseless pavement, affording plenty of grip for horses' feet, and is claimed to have the wearing life of the crushed stone that is in it. There are 11,000 surface yards, and the cost was $24,000. It was put down by Warren Bros., of Boston, and is the first work they have done in Canada.

The Dundas waterworks have been connected with the well on the Morden farm, and the town has an additional supply of 15,000 gallons a day.

Judge Ardagh, of Barrie, Judge McCrimmon, of Whitby, and A. E. H. Creswicke of Barrie will act as arbitrators in connection with the purchase by the corporation of the waterworks at Midland.

The Walper House, Berlin, which has recently changed hands, is to have a new heating and lighting system installed. Geo. O. Philip, brother of E. J. Philip, of the Dominion Motor and Machine Co., is the new proprietor.

The Engineering Society of Queen's University is manned by the following officers: Honorary president, Prof. Gill; president, W. P. Wilgar; vice-presidents, G. W. Chapfilin and R. L. Squire; secretary, E. E. Wilson; treasurer, E. A. Collins; committee, B. Tett, E. T. Colkell, D. Ross and J. Sears.

A tunnel under Lake Erie to supply Cleveland with good water has just been completed after six years' continuous labor. It is 100 feet below the bottom of the lake, 9 feet in diameter, and 26,000 feet in length. When fully equipped its capacity will be 200,000,000 gallons a day. It cost $1,250,000. Toronto may have ultimately to adopt such a plan.

The De Lano-Osborn Engineering Co., of Cleveland, Ohio, has opened a branch in Toronto, for consulting, designing and reporting on bridges, timber and steel construction, cement plants, mills, water power development and transmission, electric roads, etc. It has inspectors at all the iron centres, who supervise and inspect all waterworks supplies in process of manufacture.

Speaking of irrigation in the Northwest, J. S. Dennis, who has had charge of that work, says: "Irrigation has now passed beyond the experimental stage, and at the present time there are certain very large areas of land, particularly in Southern Alberta, owned by the C.P.R., which only require the construction of irrigation canals to turn them from uninhabited districts into thriving villages. Among these there is in particular a district of some two and a half million acres lying east of Calgary which is traversed by the C.P.R., and which will be irrigated by water taken from the Bow River near Calgary. Its construction will mark a great advance in the development of Southern Alberta, and in large areas lying contiguous to the main line of the C.P.R." The extension of the St. Mary's irrigation canal will bring under reclamation nearly 1,000,000 acres where the rainfall is light, and make Lethbridge an important business centre.

Industrial Notes.

Thirty-three thousand tons of hard coal arrived in Toronto by water between the end of the strike and the close of navigation.

The Niagara Falls Concentrating Co., and the Read Lumber Co., have been licensed to do business in Ontario with A. M. Colquhoun, of Niagara Falls, and G. H. Perley, of Ottawa, as their respective attorneys.

The Malleable Iron Works, at Smith's Falls, Ont., of which W. H. Frost is proprietor, are to be enlarged. A new building, 250 by 66 feet, will be erected. A number of new lines of manufacture will be added.

E. J. Philip and others of Toronto, having been voted a bonus of $15,000 by the town of Essex, Ont., have applied for a charter for a company which will manufacture automobiles, gas engines and steam pumps, for which a new factory is being equipped.

The Garlock Packing Company, of Hamilton, Canada, have opened an office in the Carlaw building, 30 Wellington street west, and have appointed Thos. Christie as their representative in Toronto. They are sole manufacturers of Garlock's engine and pump packings patented, also asbestos sectional and hot water pipe coverings.

The rolling mills, at Belleville, are to resume work.

The Montreal Steel Works will apply for incorporation.

The Dominion Wrought Iron Co. will locate at Orillia.

Walkerton voted a bonus to a biscuit factory by 415 to 16.

The Frontenac Milling Co.'s mill is to be converted into a cereal factory.

The Niagara Falls Machine and Foundry Co. is about to enlarge its premises.

Point Ann quarry, near Belleville, is sold, and the site will be used for a cereal mill.

Blue & Deschamps sawmill, burned at Rossland, B.C., on October 28th, has been rebuilt.

The Dominion Iron and Steel Co. has purchased 300,000 fire bricks in Germany for new ovens at Sydney.

The Nott bicycle factory, of St. Catharines, has been taken over by the Lamb Wire Fencing Company.

A. Dobson, of Beaverton, has invented a peat digger on the rotary principle, like a snow plow on railways.

The Beaverton Foundry and Machine Co. have orders for the construction of two complete peat-producing outfits.

Louis Kauffeld, of Matthews, Ind., claims to have discovered a process of making malleable glass, which will not break.

Goderich ratepayers voted in favor of a loan of $25,000 to enable the Organ Co. to rebuild their factory, recently burned.

Manufacturers of traction engines are finding a large field in South Africa, owing to the shortage in supply of draught animals.

The Sultana-Ophir Mining Co. has been authorized to increase its capital stock from $10,000 to $150,000, and the Ottawa Milling Co. from $40,000 to $99,000.

The London Rolling Mills Co., London, is constructing a new building, which is practically of steel and glass. The Hamilton Bridge Co., Hamilton, has the contract.

The Henderson Roller Bearing Mfg. Co. has been organized, at Toronto, with Albert Ogden, president; John J. Main, vice-president; A. E. Henderson, sec.-treas.; R. I. Henderson, manager.

A. Leitch, manager of the East Kootenay Lumber Company, Cranbrook, has received an order from the C.P.R. for 725,000 railroad ties. The company will put in a tie mill on Moyie lake.

The American Blacksmith has three illustrations of tasteful ornamental iron work to be seen in Toronto—the lamps and standard of the Alexandra gates in the Queen's Park, a fence and gates in front of one of the handsomest city residences, and a window grill in the show rooms of the Nordheimer Piano Co. They were all made at the George B. Meadows Works, Toronto.

Judgment has been delivered in the Exchequer Court, at Ottawa, in the Dominion Iron and Steel Company's claim against the Government for $196,967. The company uses the product of its blast furnaces, whilst in the molten state, for the manufacture of steel. The point at issue was whether they were entitled to the bounty given for the manufacture of steel from pig iron. The judge found that the term pig iron includes that substance in a molten state, as well as in its solid form.

At a meeting of the Dominion Institute of Amelgamated Engineering, held on Dec. 19 at Toronto, the effect of two recent decisions, the one by the judicial committee of the Privy Council and the other by the Supreme Court of Canada, affecting the patent law of Canada, was under discussion, and the following resolution was unanimously adopted: "That the Government be asked to repeal the present patent act, and to substitute therefor an act similar to that of the patent law of the United States." A committee was appointed to take action in the direction of the legislation recommended by the meeting.

The new mill of the Canada Paper Co., at Windsor Mills, will contain the largest paper-making machine in Canada, in fact there are only one or two larger on the continent.

The three largest boilers ever made in Galt have been shipped from the Goldie-McCulloch Co.'s works to the Windsor, Ont., street railway. They are 20 feet long and 7 feet in diameter.

At Ottawa, part of the C.P.R. round-house was burned, and two locomotives damaged.——Hewett's planing mill, at Grimsby, Ont., was burned.——F. H. Wilson & Co.'s foundry, at Yarmouth, N.S., was damaged in the nickelling department.

The Garnet Belt Dressing Co., of Allentown, Pa., have issued a little folder describing their bar belt dressing, belt filler and preserver, and liquid belt dressing, which they guarantee to stop belts slipping, increase power, and preserve the belts.

The Ross-McLaren saw-mills, near New Westminster, B.C., are to be operated again, after ten years' idleness. They have passed into the hands of United States owners, of whom L. W. David, of Blaine, Wash., is one.

Owing to the large demand for their Syracuse babbitt metal and Columbia phosphor tin, the Syracuse Smelting Works have been obliged to run their Montreal plant day and night, and are now increasing their facilities for manufacturing the above metals.

Jacob Jesurun, His Britannic Majesty's Consul at Curacoa, Dutch West Indies, is on a visit to Canada to establish relations with Canadian manufacturers. He is in a position to do a great deal for Canadian trade, not only where he is stationed, but in Venezuela, Colombia, Hayti and San Domingo.

Four thousand employees of the Crane Company shared in the largest Christmas box given this year to any body of men in Chicago, $35,000 having been divided among them as a gift, or 5 per cent. of their annual wages to each man. Richard T. Crane, founder and president of the corporation, knows what it is to work. When in his teens he was a working mechanic. He went to Chicago in 1855 and opened a brass foundry. He is now the head of an immense plant which manufactures more than seven thousand different articles for steam and gasfitters.

M. Beatty & Sons, of Welland, have shipped the following: One hoisting engine to J. O. Labelle, Terrebonne, Que.; one set Ditcher machinery, Dept. Public Works, Strathcona, Alta.; three hoisting engines to Holme, Miller & Co., Dawson, Y.T.; one hoisting engine to Alex. Jeffrey & Co., Montreal; two hoisting engines to J. and R. Miller, Depot Harbor, Ont.; three stone derrick swingers to J. O'Toole, Peterboro; one five-ton revolving and travelling derrick, to New Ontario Dock and Coal Co., Sault Ste. Marie, Ont.; one special derrick car engine, Dominion Bridge Co., Montreal; one hoisting engine to Cleveland-Sarnia Saw Mills Co., Nairn Centre, Ont.; four hoisting engines, three swingers, one 6-in. direct connected centrifugal pump to North Shore Power Railway and Navigation Co., Quebec, for use on their water-power at Seven Islands, Que.

The following new industries are announced: Distillery, packing house and cannery, at St. Hyacinthe; sash and door factory at Lethbridge, N.W.T.; factory for making acetylene gas machines in old concrete works, Dundas, by G. H. Cliffe; plough factory, Winnipeg, by John Clayton, of Minneapolis; manufacture of products of coal tar, at Sydney, by English capitalists, John Craven, agent; co-operative furniture factory, at Berlin, Ont.; biscuit factory, at Stratford, W. J. Mooney, promoter; chopping mill, at Woodstock, Ont., in the old Woodburn mills, by Messrs. Phelps, Beachville, Ont.; packing company, Petrolea, Ont., H. Barington, manager; carriage factory, at Truro, N.S.; saw-mill, at Lakefield, Ont., by the Lillicrap-Tate Lumber Co.; saw-mill, at L'Orignal; sand brick works, at Hamilton, J. H. Land; saw-mill, at Smith's Falls, Frank Hourigan; London Machinery Co., factory for hay forks, hay slings and hardware Specialties, at Guelph; R. L. Mackay, box factory, Norman, Ont.

Electric Flashes.

The Nova Scotia Electric Light Co. has been incorporated.

A long distance telephone has been established between Winnipeg and St. Paul.

The Canada Atlantic railway has established a private telephone line between Ottawa and Depot Harbor.

The Edmonton Street Railway Co. is applying to the Territories Legislature for legislation to aid in its construction.

A charter is asked for an electric railway from Lac Seul to the Mikado mine, passing through Keewatin, Norman and Rat Portage.

Goderich ratepayers have voted to take stock to the amount of $50,000 in the proposed Huron, Grey and Bruce electric railway.

A speed has been attained on the New British Pacific cable of 110 letters a minute, fully 10 per cent. better than was expected by the engineers.

Prof. Pupin, of Berlin, has invented a system by which a message is plainly audible to a person standing over ten yards from an ordinary receiver.

An electric car at Sherbrooke, Que., jumped the track recently on account of the accumulation of ice, and went over a bridge 50 feet high. All on board but the motorman jumped, and he went down with the car, and was badly injured.

The Guelph street railway has passed into the hands of a new company, with A. F. H. Jones as president. Wm. Brown, for some years with the Metropolitan street railway, Toronto, has been appointed manager and superintendent.

Arthur Koppel, Ltd., has issued a neat little album for the pocket, containing information respecting their factory for electric installations and locomotives. The company has branches in New York, Berlin, London, Rome, Paris, Stockholm, Johannesburg and many other places, and does a world wide business.

Offers are asked for an electric railway and lighting service for Manilla, Philippine Islands. The railway lines will be 35 miles long. The franchise is for 50 years, with the privilege to the city to purchase at the end of 25 years. Cannot some of our Canadian capitalists secure this as they have done in other foreign cities? Offers will be received till March 4, 1903.

The Galt, Preston & Hespeler Railway Co. has equipped its freight motor with a Westinghouse automatic air brake. The device consists of a small motor which keeps two air chambers filled with compressed air, and which is automatic in its action. The air chambers supply the power for operating the brakes and can be attached to as many cars as the motor will haul. This is the first of the kind in Canada.

The Hill Electric Switch Co., of Montreal, has placed a switch-board in the store of Henry Birks & Son, made for the Edwin C. Lewis Co., electrical contractors, Montreal; a $1,000 switchboard for Bennett & Moncel, and 28 panel boards for the same firm, in the stores of the S. Carsley Company, Montreal, and is turning out one switchboard for the Robert Mitchell Co., Montreal, one for John Forman and one for Scott & Co., besides a number for the Edwin C. Lewis Company.

Jas. A. Bell, C.E., city engineer, is acting manager of the St. Thomas street railway recently taken over by the city. The road includes a belt line, length about 4½ miles, with two branches, one to the G.T.R., Wabash and Lake Erie stations, and the other running to a park outside the city limits, making a total length of about six miles. At present the Gas Company is supplying the power, but the city council is taking into consideration the erection of a new power house which will combine the lighting of the city and the running of the road.

Minnedosa, Man., will install an electric light plant.

The new stave factory at Sand Point, Ont., is to be run by electricity.

The St. Johns, Que., Electric Light Co., is about to extend its works.

Brantford is about to build new car sheds to hold 24 cars, at a cost of $6,000.

The Huron-Ontario electric railway project at Goderich is being again agitated.

A machine has been invented which will seal 8,000 envelopes an hour by electricity.

The Manitoba Cement Co. will build an electric railway at once from Morden to its works.

Irene Provost, of St. Hyacinthe, has been appointed inspector of electric light and light meters.

Sir Sanford Fleming recently sent a message round the world to Mayor Cook, of Ottawa, in 6 hours and 3 minutes.

An electric machine for stamping letters has been installed at the Ottawa postoffice with a capacity of 45,000 an hour.

The Cascade Power Company, which has developed 3,000-h.p. on Kettle River, 12 miles from Grand Forks, is now supplying power to the Granby smelter.

Lamps in which the carbon filament is replaced by one of osmium are now made. They consume very little current, but can be run only at very low voltages.

The People's Telephone Company, of Sherbrooke, Que., are re-organizing with $10,000 in preferred stock. It is the intention to put in a metallic system, and improve the equipment this year.

The Canadian Niagara Falls Power Co. will extend its wheel pit, now about half finished, to more than double its intended capacity, so as to contain 11 turbines with 110,000 h.p., instead of 5 turbines.

Cornelius Vanderbilt, in an article in the December North American Review, comes to the conclusion that electricity as a motive power on trunk lines of railway is impossible from the financial point of view.

Electricity will be supplied to the Snowshoe and Granby mines at Phoenix for running the air drills and operating the hoists and ore crushers. The power house was badly damaged on Dec. 11 by a broken water pipe.

John J. Gartshore, of Toronto, has recently delivered to the Hamilton, Grimsby & Beamsville Electric Railway, 440 tons new 60-lb. steel rails for their extension from Beamsville to Vineland, which is now being pushed forward.

Marconi has established wireless telegraphy across the Atlantic and congratulatory messages have been exchanged, among others, between the Governor-General and King Edward. It is expected a commercial system will soon be in operation.

B. R. Paine, manager of the Ontario Power Co., promises Toronto 15,000-h.p. electric power from Niagara Falls in a year. A double pole line will be built, so that in the event of one line being disabled the other would be available.

The Toronto Niagara Power Co. have asked the Ontario Government for water power privileges at Niagara Falls to develop 100,000-h.p. The Ontario Power Co. does not object, but the Canadian Niagara Falls Power Co. fears its interests would be injured. Expert opinion is to be called in before the Government takes action.

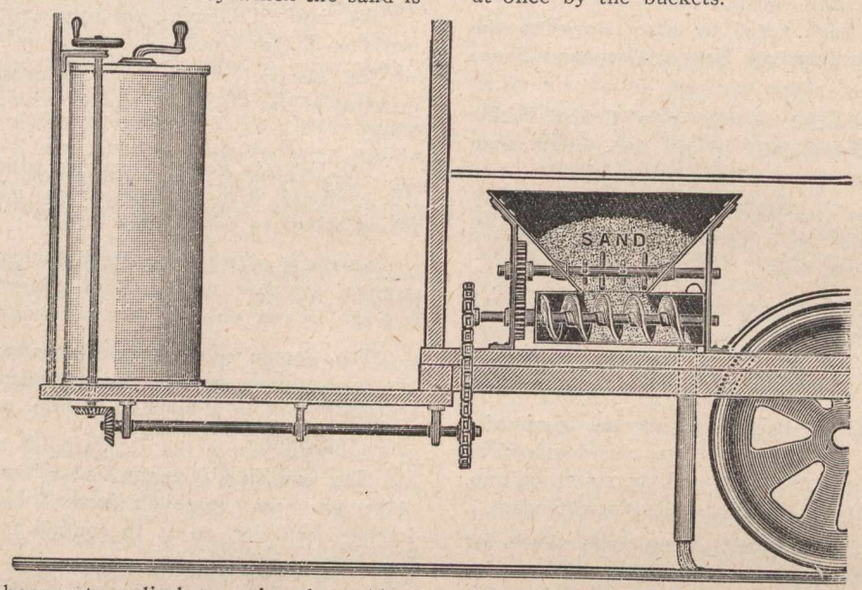
Surveys have been completed for the London, Aylmer and North Shore Electric Railway, to run between London and Port Burwell, a distance of approximately 43 miles. The maps and profiles are being prepared at the office in Aylmer. Grading will begin as soon as the weather will permit. The specifications for the power house and electrical apparatus are about ready. The company is on the look out for contractors who will undertake the work.

A by-law has been passed at Nelson, B.C., appropriating $150,000 to put in a power plant, and extend the city's electric light system.

It is understood that a factory, on an extensive scale, for the manufacture of incandescent lamps and other electrical appliances, is to be established in Canada at an early date.

TRACK SANDING MACHINE.

A new track sanding machine for electric cars has been invented by D. N. Miller, of Hamilton, Ont., and was first publicly shown at the recent convention of the American Street Railway Association at Detroit, where it attracted a good deal of attention. As will be seen by the cut the sand box is placed under the car seat just forward of the front wheel. When sand is required on the track the motorman turns a feed wheel; this actuates a screw by which the sand is



moved along from the hopper to a discharge pipe that makes a straight drop to the track just in front of the wheel. It is claimed for this machine that "green" sand can be fed from it and does not require to be kiln dried as in other machines. Being under the seat of a heated car, moist sand should not freeze. The sand can be fed as lightly or heavily as required, and without waste; and the feeding can be done by the motorman's left hand, which is free after shutting off the current. This machine has been tested on the Hamilton street railway and favorably reported on.

Mining Matters.

A discovery of gold is reported from White Bay, Newfoundland.

There is great revival in mining in the Cariboo district, British Columbia.

A copper lead over two feet thick is being opened at South Harbor, Aspy Bay, C.B.

The Canadian Smelting Works, which owns a lead refinery at Trail, will, it is said, erect a new and much larger plant.

A two foot vein of albertite is reported to hve been found at Albert Mines N.B. The property has been bonded to United States capitalists.

The Slocan, B.C., miners expect to derive much benefit from a ruling of the United States authorities placing zinc ore, calamine and zinc blend on the free list.

Indiana capitalists, under the name of the Portland Mining Company, have purchased the mining property of J. E. Bate and others, near Nicola Lake, and will put in a large plant. The ore averages 15 per cent. copper, with $7 silver and $3 gold to the ton.

The cost of treating the Rossland ores is expected to be reduced one-half by the use of the Pohle-Croasdale process.

A company of Sydney and North Sydney capitalists has been organized to develop deposits of splendid granite at White Head, Guysboro county, N.S.

The Folgers of Kingston have sold their copper property at Round Lake, near Port Arthur, to Cleveland and Pennsylvania capitalists. It is to be actively developed.

The Nova Scotia Steel & Coal Co. recently took over some valuable limestone quarries at Point Edward. The stone is of an excellent quality, and there is lots of it.

The new Dodge coal hoist at Rondeau, recently opened for business, cost $35,000, and is the largest on the continent outside of Pennsylvania. It is made entirely of steel, and the tower stands 60 feet high. Two and one-half tons are lifted at once by the buckets.

The Helen iron mine has shipped 350,000 tons the past season.

Rat Portage Mining and Development Company of Arizona has been licensed to do business in Ontario, with C. G. Pennock, of Rat Portage, as its attorney.

The Crow's Nest Pass Coal Co. has expended $1,000,000 in improvements during the past year. The present daily output is 2,000 tons of coal and 600 tons of coke.

The Sawbill mine in Northwestern Ontario, idle since 1899, has been sold and will be re-opened. The Foley is also to be again worked.

A two days' clean-up on Boulder Creek, Atlin, resulted in $3,000. Atlin district has had a good year. Hydraulic mining has been successful and so has quartz mining, although this latter branch is only in its initial stages.

The Nickel Copper Co., of Hamilton, the ten million corporation intended to rival the Canadian Copper Company, of Sudbury, is to be wound up. It was floated to use the Hoefner process of nickel refining and had a lease of the Hoefner works.

Expert medical evidence taken before the commission on the great coal strike is that the miners' lives are shortened by their work in the mines. Fully 99 per cent. are anaemic, and have miners' asthma caused by inhaling coal dust. Rheumatism, lumbago and sciatica are very prevalent.

W. G. Miller, of the Ontario Bureau of Mines, has returned from a six months' tour through the district between Sudbury and Rat Portage. He is quite optimistic as to the prospect. There is great activity in iron, both on the Clergue properties and along the line of the C.N.R. Several copper properties are being worked, and shipments are being made from the Rock Lake mine north of Bruce Mines. A local smelter is wanted as the concentrates are now shipped to New York. Nickel is being worked actively, and some twenty gold properties are being developed in the Rat Portage district, on Manitou Lake, Eagle Lake and around Lake of the Woods. Most of the development is being done with United States capital.

New coal discoveries continue to be made in Cape Breton.

A number of places in British Columbia are putting in zinc smelters.

The Dominion Coal Co. has purchased the manganese deposits on the Magdalene Islands and will develop them.

A find in Cape Breton which was supposed to be the rare mineral libethenite, turns out to be molybdenite. It is thought to be a valuable deposit.

A Victoria correspondent describes in glowing terms a mining district in the interior of Vancouver Island, which, he claims, will put the Klondike in the shade for wealth of production.

The ore crusher sent from Sherbrooke, Que., and recently set up at the Granby mines, B.C., has a capacity of 3,600 tons per 24 hours, and is the largest of its kind in Canada. It will be operated by a 100-h.p. electric motor.

Sir W. C. Roberts-Austen, who died recently in London, will be remembered as the scientist who delivered a very interesting lecture on metals and alloys when the British Association met in Toronto several years ago. He was hon. secretary of the British Association, and president of the Iron and Steel Institute.

One hundred and fifty specimens of copper ore, collected by Principal Dresser, of St. Francis College School, have been sent to Germany that sections may be cut out of them for examination under the microscope. These specimens were all collected by Mr. Dresser in the eastern townships. He has made a spcial study of three belts of copper bearing rocks which are largely developed in that vicinity. It is considered that the research shown in the study of these prospects will be of great benefit to the renewed activity of copper mining in this district.

Railway Matters.

G. Strevel has secured a contract for 250,000 ties for the C.N.R.

Sir Sandford Fleming says, from personal observation, that the country through which the Grand Trunk Pacific will pass is rich in spruce forests.

The average railway spends more for paper than for rails. This may appear incredible, but tons of paper are required for stationery, time tables, reports, etc.

The directors of the Pere Marquette Railway have approved of the purchase of the Lake Erie and Detroit River road, and will add seven boats to its ferry equipment.

The Michigan Central Railway has planted 60 acres of catalpa trees on its Canadian division, to supply ties and fence posts, which the railways in some places are finding it difficult to obtain.

A patent has been granted in the United States for increasing the adhesion of wheels to rails by passing a magnetic flux through wheel and rail, and thereby increasing the tractive power of any motor.

Mackenzie & Mann's road, which they are building in Nova Scotia, is now located from Halifax to Mahone Bay. It runs through a fine scenic route. It is expected that section will be completed in the fall.

As soon as the Grand Trunk obtains the necessary legislation for its trans-continental line, four parties of engineers will be started to work, one from North Bay, one from Winnipeg, one from Edmonton, and one from the Pacific Coast.

The Medicine Hat and Northern Alberta Railway announces its intention to build a system of branches and extensions. The chief will be from Medicine Hat to the international boundary at Milk river, and from Battle river in a northwesterly direction to Hudson Hope.

It is understood that the C.P.R. has obtained control of the White Pass and Yukon railway.

The Canadian Pacific is preparing specifications for another 400,000 bushel steel and concrete elevator at Port Arthur.

The contract for the blacksmith shop at the new C.P.R. shops at Hochelaga has been let to Lessard & Harris, of Montreal.

A survey party is running a line for a railway from Macleod to connect with the Great Northern system in Montana.

A branch of the C.P.R. from Kleinburg to Sudbury is proposed, giving independent connection between Toronto and the main line.

The worst wreck in the history of the I.C.R. occurred 70 miles from Halifax on December 6. Seven persons were killed. The accident was caused by the pilot becoming loose and falling in front of the engine.

The traffic on Canada's two leading railways is so great that it is no uncommon thing for either of them to despatch 1,000 cars of freight from their terminals in one day. Eighty-four passenger trains run out and into Toronto daily over the two roads.

The Canadian Northern Railway hopes to reach Edmonton by the end of 1903. The surveys and locations are complete to that point, but there is 500 miles to build. The road has the right to reach the Coast either by the Yellow Head, the Peace River, or the Pine River pass.

A company is being formed, under the name of the British Columbia, Northern and Mackenzie Valley Railway Company, to build a railway from Nasog or some other point near the mouth of the Naas river, by way of the Naas and Stikine to the confluence of the Liard and Mackenzie rivers, thence to Dawson City.

The Manitoba & Northwestern Railway Company is about to build a branch from some point on its main line between Yukon and Prince Albert, to Battleford, thence to Wetaskiwin on the Calgary & Edmonton Railway. A junction will be effected with the Pheasant Hills branch of the C.P.R., near Esterhazy, by means of a line south from Churchill.

Plans are being prepared for new Canadian locomotive works, which are to be erected at Montreal, and of which Sproatt & Rolph are the architects. Mr. Rolph will visit Philadelphia, Belgium, and other places, where they build locomotives, to get ideas for the new works. This company has no connection with the Kingston Locomotive Works.

The Cape Breton Railway is building a mammoth bridge at River Inhabitants. It consists of four deck plate girder spans, 80 feet, and one through plate girder span of 55 feet, set on masonry piers and grounded on piling. Three other deck plate girder span bridges are to be set up at Shoal Lake, Bear Creek and River Tillard. R. W. Leonard is chief engineer.

The incorporation in New York of the Niagara Transfer Company, of Buffalo, to build a steam railway from Buffalo to Tonawanda and the application to the Dominion Government by the Niagara Grand Island Bridge Company, for an extension of time in which to complete its work, have given rise to rumors that a western United States road is about to seek entrance to Buffalo by way of Ontario, that a new bridge will be built across the Niagara river at Tonawanda, and that the Niagara Transfer Railway will be the connecting link with an eastern road, thought to be the T. H. & B.

—We have to acknowledge the receipt of a copy of "Metallurgical Laboratory Notes," by Prof. H. M. Howe, of Columbia University. This is the first text-book ever published on experiments conducted in a metallurgical laboratory, and it undoubtedly fills a long keenly felt want. The competency of the author to deal with the subject will be universally acknowledged.

Marine News.

Steps are being taken to place a steamer on the Saskatchewan at Edmonton.

The Esquimalt dry dock will probably be enlarged so as to accommodate a warship of 14,000 tons.

It is announced that the Bertram Co. will establish extensive shipbuilding yards at Sandwich, Ont.

Capt. Roys, of Gananoque, has sold the steamer Jubilee to be taken to Lake Temiscaming next season.

The Anchor Steamship Co. has ordered another twin screw steamer of 10,000 tons, similar to the Columbia.

The theory now accepted at Kingston is that the boilers of the steamer Bannockburn, which recently disappeared, must have burst.

The steamer Regulus broke her shaft recently and had to be towed to Louisburg. A new shaft was ordered from New Glasgow.

The Society of Naval Architects and Marine Engineers for the United States held its tenth annual meeting in New York, the last week in November.

A sand bar has formed 150 feet off the harbor at Port Credit, Lake Ontario, with only 6½ feet of water on it, and the depth is rapidly getting less.

The Alaska Steamship and Puget Sound Navigation Company are about to build three new steamships, one of them intended for the Victoria-Puget Sound route.

F. A. Knapp offers to establish a plant for building his tubular steamships at Sydney, C.B., if the town will give a free site, and subscribe $60,000 stock in his company.

The loss of the steamer Sylvanus J. Macy, off Port Burwell, on the north shore of Lake Erie, at the close of the season, resulted in 13 deaths, doubling the number this season up to that date.

Hope is expressed of saving the steamer Owen from the Gull shoal near Long Point, Lake Ontario. If the vessel is raised she will be, between two light vessels, towed to Kingston for repairs.

There has been launched at Wallsend-on-Tyne the steel screw steamer Dominion, for the Louisburg and Boston route. She has been chartered by the Dominion Iron and Steel Co. for the coal carrying trade.

The Upper Ottawa Pier and Boom Co. has decided to build this winter, two large steel tow-steamers on Lake Temiscaming, and two more next winter. All will be of the most modern description and of great power.

Frank Lovitt, of Yarmouth, N.S., has purchased the schooner yacht Columbia at New York. She is 60 feet long, 13 feet wide, 8 feet 2 inches draft, measures 26 tons, and was built by Lawley, Boston, five years ago for Col. Pope, of the Columbia Bicycle Works.

The new C.P.R. steamship, Princess Victoria, recently launched at Wallsend by Swan & Hunter, is 300 ft. long, 40 ft. 6 in. beam, 18 ft. 6 in. depth, moulded, and is for the company's mail and passenger service between Vancouver and Victoria, B.C. She will have an average speed of 18 knots per hour.

Canada leads in the matter of dry docks on the Great Lakes. The U.S. steamer Hecla recently underwent repairs at Kingston, and when the United States authorities levied a duty on the repairs the owners protested on the ground that there is no United States dry dock on Lake Ontario large enough for the Hecla. But they had to pay the duty.

The trustees of the Carnegie Institute of Washington, D.C., have voted Dr. Frank D. Adams, Logan professor of geology and palaeontology, at McGill, the sum of $25,000, to enable him to continue his experiments in the flow of rocks.

Personal

Oliver McClary, of the well-known McClary stove manufacturing company, London, Ont., is dead.

E. L. W. Saunderson, lately with the J. C. McLaren Belting Co., has joined the Montreal Belting Co.

L. J. Houston has taken the position of resident civil engineer for the C.P.R. at Fort William, vice R. Elmsley, resigned.

Capt. W. R. Lang, professor of chemistry at Toronto University, who is in command of the Toronto company of engineers, is promoted to be major.

G. T. Jennings, of Toronto, who is taking a course in engineering at McGill College, Montreal, is appointed to a commission in the Royal Canadian Artillery.

B. J. Saunders, C.E., of Regina, formerly of Brockville, has been appointed chief engineer of irrigation in the Northwest, by the Ottawa Government, in succession to J. S. Dennis

A. M. Wickens, engineer of the Ontario public buildings, who was suspended recently, has been re-instated, and will give his entire attention to the Parliament buildings, Toronto.

Joseph Ironsides, assistant engineer at the pump house, Hamilton Asylum, has been appointed chief engineer to fill the position vacant by the death of John Martin. Thos. Lawlor, of Hamilton, has been appointed assistant.

The name of Capt. A. C. Joly de Lotbiniere, deputy chief engineer of Mysore, and a Canadian, appears as one of the designers of the great Canvery Falls hydro-electric power plant, constructed by the Government of Mysore, India.

Locomotive engineer Murphy, of the G.T.R., who lost his life recently at Morrisburg, was driver on the train carrying a number of the Press Association members on their return from the Maritime Provinces, in 1901, when it collided west of Montreal. His courage saved their lives, and they gave him a purse of $50.

J. E. Botterell, of the Fairbanks Company, Montreal, has gone to Vancouver, B.C., to become manager of the new branch in that city, which the growth of the firm's business has rendered necessary. Mr. Botterell has been connected with the Fairbanks Company for the last four years; first, as their representative in the Maritime Provinces, and latterly as sales manager in the Montreal house. Before leaving he was presented by the staff with a handsome piece of jewelry as a souvenir.

The council of the Institution of Civil Engineers of Great Britain has awarded the Watt gold medal to Dr. William Bell Dawson, M.A., for an able and valuable paper upon "Tide gauges in northern climates and isolated situations." Dr. Dawson is chief engineer of the tidal survey of Canada, and his paper is the result of exhaustive researches into the tides and currents along the coasts of the Dominion. He is a son of the late Sir William Dawson.

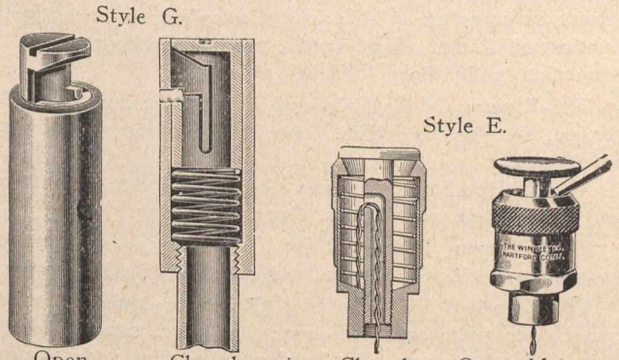
Donald Locke has been appointed to the Government service as metallurgist, and for the present will be attached to the Geological Survey. He is associated with Dr. Barlow in an enquiry into the resources of the nickel district at Sudbury. While the latter is investigating the geological features, Mr. Locke is examining the methods of treating the ore. The results of their investigation will be embodied in a report. Mr. Locke is a New Zealander, and won an important scholarship at the Sydney School of Mines. He is a graduate in metallurgical engineering of the Friborg School of Mines.

Frank Dillinger, of Ottawa, has been appointed superintendent of the twentieth district and terminals at Winnipeg, on the Canadian Pacific Railway, succeeding Superintendent Arundel, who has resigned to accept a position as divisional superintendent with the Canadian Northern Railway. Mr. Dillinger came from Philadelphia five years ago, where he was train despatcher for the Pennsylvania road. He was a year in Winnipeg with the C.P.R., and was then moved

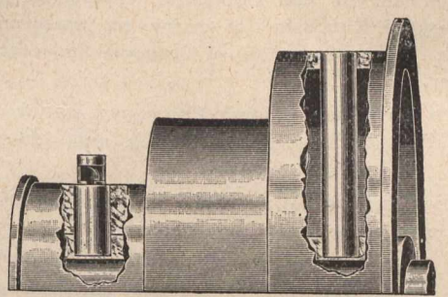
to the despatcher's office at Ottawa, where he has made a record for clearing the line and moving trains. He is one of the youngest railway superintendents in Canada, and will now have charge of a division 450 miles long, and 47 miles of terminals.

OILING DEVICES.

The Winkley Co., of Hartford, Conn., claim that until they brought out their oiler for cone and loose pulleys and flush surfaces, manufacturers were without a suitable means of protecting oil holes in the face of pulleys, except where



loose screws were used. Screws, however, are soon lost, and the oil holes become a receptacle for all grit and dirt carried to them by the belt. These oil cups are simple and effective, requiring only one-fourth turn to release them, when they pop out, exposing a large opening to receive the oil. A



Oil Cups Applied to Pulley.

simple push down, with a slight turn latches the cup shut, and no serious result follows if the oiler is forgotten and left open, as the belt will simply push it in if made to revolve over it. They are made any length to suit the diameter of the pulley.

ENGINEERS' CLUB OF TORONTO.

The December meetings of the Engineers' Club of Toronto, were three in number. At the regular meeting on the 2nd the Engineers' bill came up for discussion. On the 10th a smoker and social evening was arranged, at which those present enjoyed a good time. On the 19th a discussion took place over Engineering Education, and some amendments to the constitution and by-laws were considered.

CANADIAN SOCIETY OF CIVIL ENGINEERS.

The Canadian Society of Civil Engineers, Montreal, held two meetings in December—on the 4th and 18th. At the former H. J. Cambie, M. Can. Soc. C.E., read a paper on "An Unrecorded Property of Clay," which will be found elsewhere in this issue. On the 18th, discussions came up on papers formerly submitted by C. H. Rust, on Sewage Disposal, and A. W. Robinson, on the Economy of Large Ships. The annual meeting will be held on January 27th and following days.

After formal opening of the convention on Tuesday morning, 27th January, a reception will be held in the afternoon, and in the evening the president's address will be delivered. The morning of Wednesday, 28th, will be devoted to the reception of the reports of committees, and the afternoon to technical papers. The annual luncheon will take place in the evening. Thursday, 29th, will be taken up with the reading of papers and unfinished business.

ELECTRIC AND GAS LIGHTING IN CANADA.

The report of the Inland Revenue Department of Canada for the fiscal year which ended 30th June, 1902, has just been received. It contains some interesting figures showing the continued rapid growth of electric lighting. There are now registered in Canada 315 electric lighting companies, of which 200 are in Ontario, 49 in Quebec, 11 in New Brunswick, 24 in Nova Scotia, 3 in Prince Edward Island, 12 in Manitoba and the Territories, and 16 in British Columbia. The report for 1899 showed 276 companies, so that within three years 39 new companies have commenced business. The then existing companies have greatly extended their business, as the number of arc lamps increased during the three years from 10,960 to 12,884, and the number of incandescent lamps from 546,672 to 984,956. Estimating that one arc lamp is equal to ten incandescents, there were in use in 1899 the equivalent of 656,200 incandescents, and in 1902 the equivalent of 1,113,796 incandescents, an increase during three years of over 75 per cent. The comparison of meter tests shows that the meters are more efficient than they were three years ago, the proportion rejected on inspection having materially decreased, Montreal presented 2,895 meters for inspection; Ottawa, 2,036; Toronto, 1,069; and Quebec, 1,029. Inspecting electric meters is a new function for the Inland Revenue Department.

There were 20,765 gas meters presented for inspection, of which 20,598 were verified, and 67 rejected. The tests of the illuminating power of gas showed, as a rule, well over the standard of 16 candles. In Woodstock, Ont., it reached an average of 23.62; Owen Sound, 22.55; Kingston, 21.81; Ottawa, 21.47; Ingersoll, 21.15; Berlin, Ont., 21.01; Belleville, 21.01; Sarnia, 20.43; Peterboro, 20.42. In other places it was under 20. In Toronto it was 19.85; Montreal, 19.29; Hamilton, 17.93; St. John, N.B., 16.45. There are 45 towns and cities in Canada lighted by gas.

ADVANTAGES OF SMOOTH-ON GASKETS.

A smooth-on gasket connection may take a little longer time to make than when using an ordinary steam packing, but when once made it will be more durable and seems to improve with age. Difficult flanged connections can easily be made with smooth-on, as it is applied in a plastic state, and adapts itself to the flanged faces, whether parallel or not. For high temperature and high pressure work, the following show its value: It has been tested to 1,500 degrees Fah., and withstood 400 pounds steam pressure without injury. Smooth-on, when hard, expands and contracts the same as iron, keeping the joint tight at all temperatures, and it will withstand steam, water, fire or oil. The cements are packed in 5, 10, and 25-pound tins. The Smooth-On Mfg. Co., Jersey City, N.J., will send an illustrated book, with full information, free.

LITERARY NOTES.

In these days when so many ordinary partnerships are being converted into joint stock companies, the book just issued by David Hoskins, principal of the British American College, Toronto, entitled "Book-keeping for Joint Stock Companies," will be welcomed as a valuable guide and text-book in accounting. Forms and instructions for all ordinary transactions are given, including form used in organization, the keeping of records, annual statements, allotment and transfer of stock, ledger and dividend books, accounts, etc., with extract from the Ontario Joint Stock Companies' Act. The author is a vice-president of the Institute of Chartered

Accountants of Ontario, and one of our ablest commercial educationists. The work is published by Warwick Bros. & Rutter, Toronto. Cloth, 158 pages, $1.50.

CALENDARS RECEIVED.

We have to acknowledge with many thanks the receipt of calendars for 1903 from the following firms: American Steam Gauge & Valve Mfg. Co., Boston; Mutual Life Insurance Co., New York; Imperial Life Insurance Co., Montreal; Morton, Phillips & Co., manufacturing stationers, Montreal; Hale Bros., Orillia Packet.

ENGLISH V. AMERICAN MACHINERY IN CHINA.

In the early part of the year, an announcement, under the above heading, went the rounds of the English and Colonial newspaper press bearing upon the unjustifiable practice of a section of the English press of constantly belauding, at every opportunity, the American manufacturer and his methods, to the detriment of the British manufacturer, and an instance was then given to illustrate the ability of the Britisher in one branch of industry at least to hold his own, and to beat his American rivals. The instance was that of a large flour mill contract, secured in China by an old firm of English milling engineers, in competition with American makers, in which case the English firm was better both in price and time for delivery. We now learn that the whole plant was delivered within the time spcified, ten weeks; and that the proprietors were so pleased with the results obtained that they have placed the contract for another similar mill, also for North China, with the same English firm, viz., Messrs. E. R. and F. Turner, Limited, of Ipswich. In the meantime the same firm has scored again in the same market over their American rivals, having recently secured a complete flour mill contract for another firm of Chinese millers, in the competition for which the American was beaten on all counts. In the face of the examples such as the above perhaps some of our friends of the English press, who have shown such readiness to advertise the excellence of their competitors, and to decry their own manufacturers, will begin to realize that there may be a reverse side to the picture.

IMPORTANT PATENT DECISION.

Under the patent law of Canada a patentee is required to commence the manufacture of the article patented within two years. The commissioner has, however, the power to grant an extension. The practice for the past twenty-eight years has been to grant more than one extension, but the Supreme Court has just decided that more than one is invalid. This decision is fatal to a large number of Canadian patents, and special legislation will be necessary to rehabilitate them. The Canadian Engineer would like to hear from any person holding patents thus affected.

—The Page-Hersey Tube & Iron Co., whose incorporation was recently mentioned, are getting on well with their new tube mills at Guelph, Ont. These mills will draw iron tubes of from ¼-in. to 2-in., and will have a capacity of from 70 to 80 tons per 24 hours. The motive power will be an 80-h.p. engine. The works will be ready for operation about March. — Near, of Montreal, will be general manager; A. M. Mosley, superintendent, and J. Mosley, foreman.

—The Taylor-Forbes Co., of Guelph, Ont., have spent about $48,000 on buildings and machinery for their new works, which are devoted to the manufacture of hardware specialties, cider mills, emery grinders, chilled rolls, gear wheels and malleable iron castings. Additions to the iron foundry department are now being planned, which will make it 400 by 65 feet, and a new malleable iron foundry, 70 by 200 feet, will be added to the present one in the spring, when other new specialties will be made.

NEW COMPANIES.

Brantford Screw Co.; capital, $150,000; Brantford. L. Harris, and others. Ontario charter.

La Fonderie de Victoriaville; capital, $30,000; Victoriaville. Thomas Buleau, and others. Quebec charter.

The Victoriaville Furniture Company; capital, $60,000; Victoriaville. Paul Tourigny, M.P.P., and others. Quebec charter.

La Compagnie Electrique de Lorette; capital, $50,000; St. Ambroise de la Jeune Lorette. Raoul Shehyn, and others. Quebec charter.

La Compagnie de Telephone de Kamouraska; capital, $10,000; to carry on an electric and telephone business in the counties of l'Islet, Kamouraska and Temiscouata. C. A. Desjardins, and others. Quebec charter.

The Riviere Ouelle Pulp and Lumber Company; capital, $100,000; St. Pacome. Hon. John Sharples, and others. Quebec charter.

The J. Hoodless Furniture Co.; capital, $40,000; Hamilton. Thos. Bell, and others. Ontario charter.

The Hatton Patent Right Company; capital, $50,000; Owen Sound. T. C. Hatton, and others, Ontario charter.

The Standard Ideal Sanitary Company; capital, $100,000; Port Hope; to manufacture enamelled-ware, sanitary, water, steam and other pipes, plumbers' supplies, gas and oil appliances, machinery, etc. H. T. Bush, and others. Ontario charter

The Canadian Trinidad Association; capital, $300,000; Walkerville; to produce and refine petroleum oils, etc., and to operate tramways, etc. J. S. Lovell, and others. Ontario charter.

The Silicate Brick Company of Ottawa; capital, $50,000; Ottawa. Daniel O'Connor, and others. Ontario charter.

John Fenderson and Company; capital, $25,000; Sayabeck, county of Rimouski; to carry on lumbering, electric works, etc. John Fenderson, of Oswego, and others. Quebec charter.

Eastern Townships Mining Company; capital, $1,000,000; Quebec. Frederic Barsalou, of Natick, and others. Quebec charter.

Dominion Belting Co.; capital, $50,000; Hamilton. C. T. Grantham, and others. Ontario charter.

North Shore Reduction Company; capital, $1,500,000; Toronto. H. M. Garwood, of Chicago, and others. Ontario charter.

The Chatham Oil Company; capital, $20,000; Chatham, Ont. Geo. Stephens, and others. Ontario charter.

The Canadian Heating and Ventilating Company; capital, $200,000; Owen Sound. V. A. Harshaw, and others. Ontario charter.

The Forged Steel Car Wheel Company; capital, $700,000; Perth. G. A. Burgess, and others. Ontario charter.

The Haggas Gas Engine Co.; capital, $40,000; Toronto. H. W. Petrie, and others. Ontario charter.