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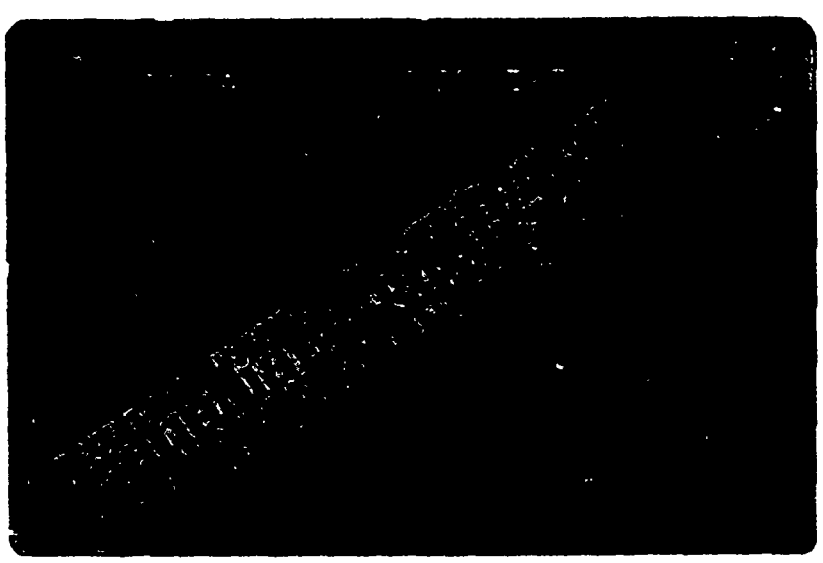

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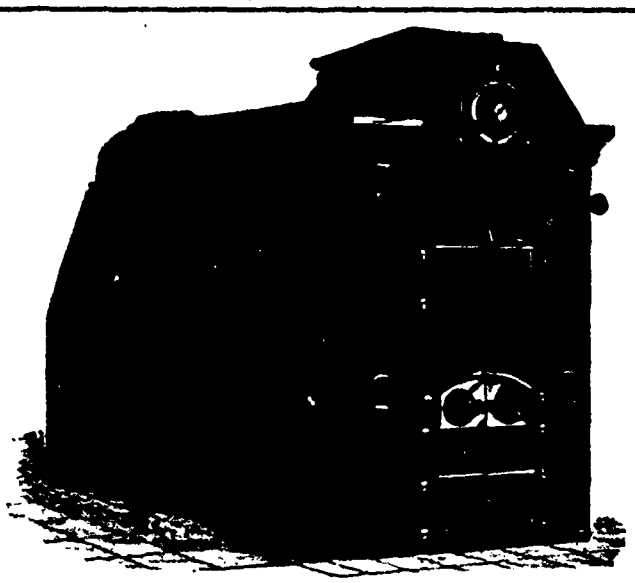

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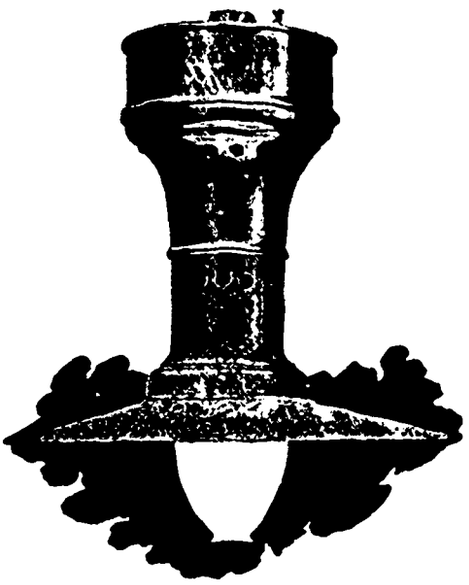

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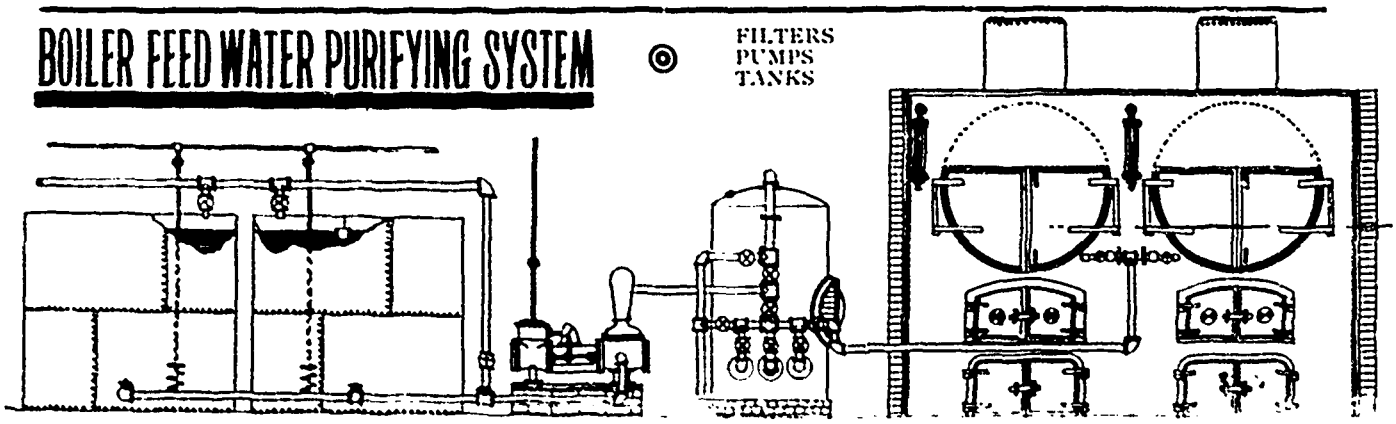

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THE KOOTENAY-ROSSLAND POWER TRANSMISSION.

DESCRIPTION OF THE SUB-STATION AT ROSSLAND APPLICATION OF THE POWER FOR MINING PURPOSES.

IN the ELECTRICAL NEWS of September, 1898, there were published illustrations and a description of the water power, generating station and pole line of the

FIG. 1.—THE SUB-STATION AT ROSSLAND.

West Kootenay Power and Light Company, of Rossland, B.C. By the plant of this company power is transmitted from Bonnington Falls, on the Kootenay river, to Rossland, a distance of about thirty miles. Below will be found a very complete description of the sub-station at Rossland, and of some of the installations at the mines, for which we are indebted to the Journal of Electricity :

The transmission line enters the sub-station at Rossland through portholes lined with eight-inch terra cotta piping similar to those provided at the power house. As one enters the door of the sub-station the standard General Electric lightning arresters used are placed on a marble board in a corner at the left. The choke coils used are an innovation, in that each consists of a core twelve inches or so in length turned in the center of a stick of kiln dried and well filled timber about five inches square by from six to eight feet long. About this core insulated wire is wound until the space is filled, so that the choke coil thus formed resembles an exaggerated form of spark coil with its terminals carried out to the respective ends of the timber on which it is wound, these timber ends being strapped to the top of high tension insulators through which the choke coil is cut into the line. Such choke coils are placed in every line, not only at the sub-station but at every power service. Originally the Rossland sub-station contained but six 250-kilowatt step-down transformers, although six others, each of equal capacity, have since been installed, together with a new 1,500-kilowatt generator. The line wires are carried to the high tension switchboard at the rear of the station on high tension insulators supported by framings that hang from the roof girders, and the usual facilities are provided to afford safety and celerity in the handling of both the high and low tension sides of the transformers. These latter are of the same type and size as those installed at the power house, with the exception that the primaries take either 9,600 or 16,600 volts, according to whether connected in delta or Y, while the secondaries deliver 2,200 volts in three-phase current, which is the potential used on all the lighting and power distributing circuits in and about Rossland.

Here may be explained the very meritorious method which the electrical engineer of the West Kootenay Power Company, has devised for applying the air blast to the transformers at the power house and at the Rossland sub-station. As in the power house, the blast is supplied by three sixty-inch blowers, each driven by belting from a two horse power 100-volt induction motor. Instead of carrying this air blast to the transformers through small air ducts as is usually done, the engineer of the Kootenay plant has provided subways large enough for a man to enter and move about in. The manner in which the blowers supply air to these subways is shown in the end elevation of the sub-station, while the subways themselves, as is shown in the side elevation, extend in line with and directly under each row of step-down transformers. The idea of this arrangement will be understood when it is stated

FIG. 2. INTERIOR OF SUB-STATION AT ROSSLAND.

that each week the transformers are cut out of service one by one and the air ducts in them are each and every one examined and cleaned by a man who enters the subway in order that he may have access to the lower end of the air ducts in the transformer. His

work in cleaning the transformers is facilitated by the use of compressed air, which is obtained in both the power house and the sub-station from a single drill compressor driven by an induction motor. It is safe to say that so long as this method of transformer examination and cleaning is faithfully carried out the Kootenay transmission will never lose a transformer from the choking of its air ducts. Slides for regulating the amount of air to be delivered to each transformer are provided, and of course the subway is always air tight, and the man who cleans the transformers is under the

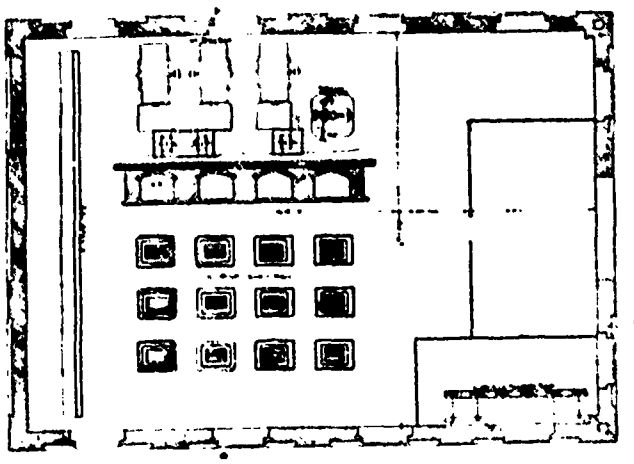


Fig. 3. Floor Plan of Sub-Station at Rossland.

increased atmospheric pressure of the air blast while at his work.

The photograph showing the interior of sub-station was taken shortly after the plant started operations, and since then important additions have been made. The distributing switchboard at the right in the rear has had new panels added to it to accommodate other circuits. The third blower has been added, and immediately in front of it, as shown in the floor plan of the sub-station in Fig. 3, has been placed the induction regulator by means of which the potential of the outgoing lighting service is controlled by the sub-station attendant in-

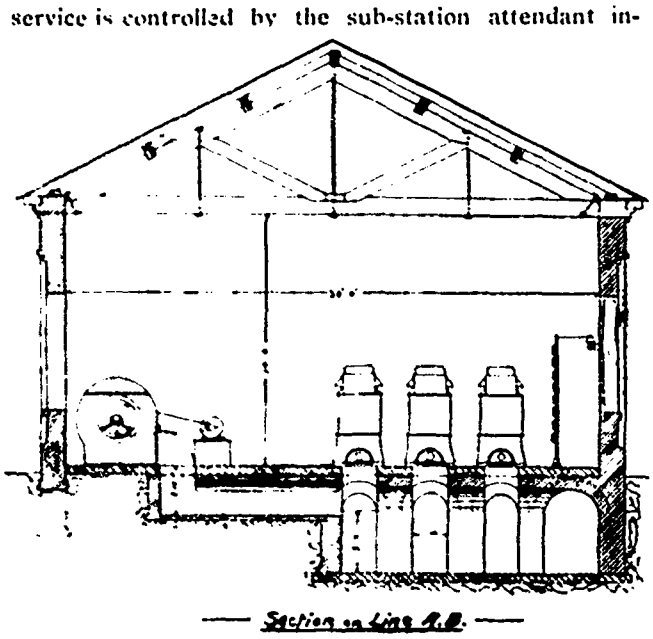


Fig. 4. End Elevation of Sub-Station at Rossland.

dependent of the power house. This is a new device of the General Electric Company, bearing the designation "type I. R. T., class 4-20-60, form A." It is wound for seventy amperes per phase at 2,200 volts, and has a range of 220 volts in either direction. It is described as consisting of an induction motor with a vertical shaft, which is connected through bevel and worm gearing to the shaft of a pilot motor placed on top of the case so that the rotor of the induction regulator may be made to turn a given arc in either direction, and in so turning raises or lowers the electromotive force in the primary mains passing through the stator windings as desired. The pilot motor is manipulated from a single double-pole, double-throw

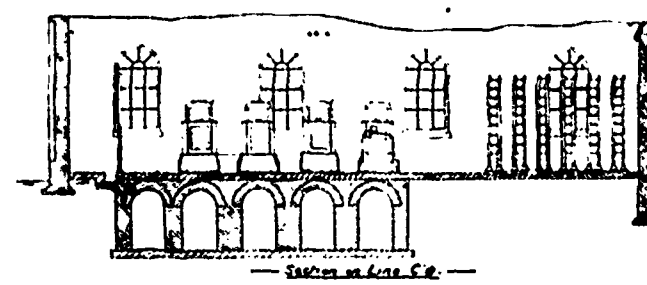


Fig. 5. Side Elevation of Sub-Station at Rossland.

reversing switch placed on the switchboard; and this motor too is an induction motor. All details of this novel regulator, together with those of the limiting switch placed thereon, are given in Fig. 11. At present this regulator is used only on the lighting circuits, nor is its use contemplated on the power service.

All the electric lighting in Rossland, in both arc and incandescent services, is rendered from alternating circuits, and indeed the only use to which direct currents are put in the Kootenay plant is for the excitation of generators and synchronous motors. The electric lighting load reaches a maximum of nearly 400 horse power. Enclosed alternating arc lamps are used exclusively, and these are burned from the 110-volt

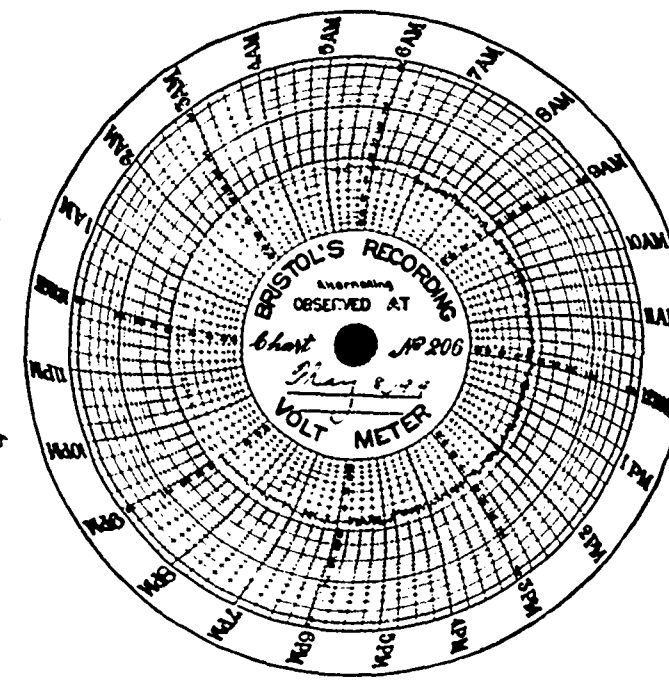


Fig. 6.- Tytical Chart of Voltage Regulation.

commercial circuits. The ultimate distribution is on the Edison three-wire system through the use of type H transformers, taking either 1,400 or 2,080 volts on the primary and delivering 230 volts across the outsides of three-wire service. The utmost care has been exercised in preserving the balance on the three-wire distribution circuits as well as in balancing the primaries of the commercial transformers on the three-wire, three-phase, 2,200-volt circuits, and this balancing has been carried out so well that it has never been observed that the phases of the 2,200-volt circuits have been more than 10 amperes out of balance.

As stated heretofore, the principal interest in the Kootenay-Rossland transmission centers in its applica-

tion of electric power for mining and milling purposes, the most notable installations being in the properties of the War Eagle Mining and Development Company, the British Columbia Bullion Extracting Company, the British American Corporation, and the Gertrude, Big Three and Iron Mask mines. These six properties alone consume about seventeen hundred horse power in the operation of hoists, compressors, crushers, conveyors, ventilating blowers and in electrolytic work. The bulk of this power is delivered by induction motors, for, as a general rule, synchronous motors have been applied only to the driving of compressors.

Fig. 7 gives a general view of the controller of the War Eagle hoist, which will be seen to be a standard General Electric induction motor. It is a three-phase equipment operated at 2,300 volts, has twenty-four poles and delivers three hundred horse-power at three hundred revolutions per minute. Its technical designation is, therefore, "I 24-300-300 form A." The rotor shaft is geared to a Ledgerwood type double drum hoist through double reduction gearing, having a ratio of reduction of 300 to 40. The War Eagle shaft is at present down a little beyond the 600-foot level and the maximum load raised amounts to eight tons, including the load, cage and rope, the speed being 720 feet per minute for this load.

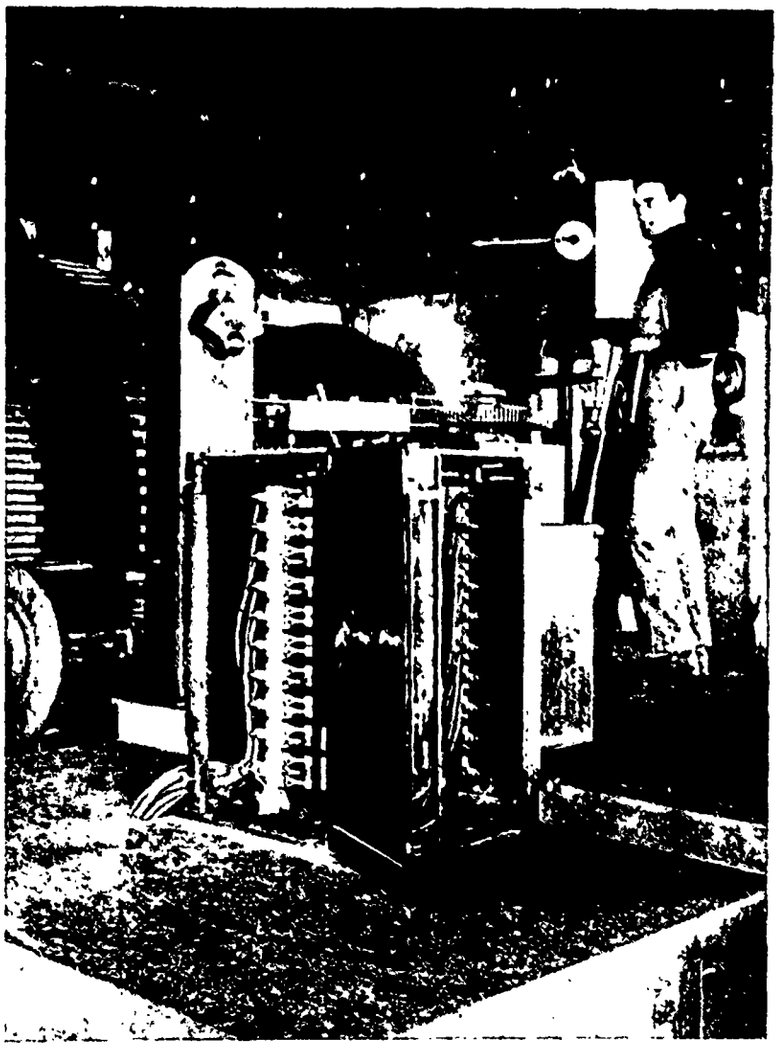


FIG. 7.—VIEW OF CONTROLLER FOR INDUCTION MOTOR FOR WAR EAGLE MINE.

Interest, of course, centres in the method of speed control, each technical detail of which is fully shown in the accompanying illustrations. Secondary control is used exclusively; that is, no effort whatever is made to control the primary current, while the secondary current, or that induced in the rotor circuit, is varied by the introduction of external resistance. The controller proper, shown in Fig. 7, is a duplex one, inasmuch as the movement of the controller handle manipulates both the primary and secondary circuits of the motor, the former for making, breaking and reversing, and the latter for the control of the variable external resistance. The controller on the high tension or stator side operates in a bath of mineral oil. The secondary windings are led to three collector rings placed on the shaft with the rotor, and upon these rings bear carbon brushes which cover about 90 degrees of the surface of the rings, this being a necessary procedure because of the heavy ampereage to be taken off. The maximum secondary electromotive force obtained is in the neighborhood of seventy volts. From the rotor brushes the current is carried to the low tension side of the controller, through which resistance may be cut in or out of the rotor windings in ten steps. The resistance consists of cast iron grids arranged upon a large slate resistance board as shown in Figs. 8 and 9. With the maximum load of eight tons gross at a speed of 720 feet per minute the current reaches a maximum of 110 amperes per phase, dropping back to 90 amperes as the load decreases by reason of the cage nearing the surface. With a load of men the maximum current is 70 amperes per phase.

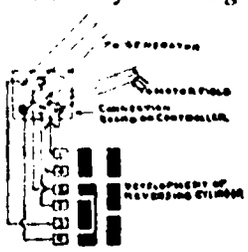
FIG. 8.—FRONT VIEW OF EXTERNAL RESISTANCE BOARD.

The principle under which variable speed is attained in the operation of this induction motor is found in the fact that while in the synchronous motor exact synchronism between the motor and the generator must always be maintained, yet the induction motor is so constituted as to be nearly independent of any magnetic slippage that may exist between its stator and rotor. When under full speed the motor is practically in synchronism with the generator, but with the generator speed constant a variable speed in the motor is best

attained by the introduction of methods that will provide variable slippage as desired, for the greater the slippage the slower will be the speed of the rotor. The equipment at the War Eagle hoist is so controlled that the speed of the motor may be varied from forty revolutions or less per minute to its full speed of three hundred revolutions.

It will be seen that the high and low tension controllers are geared together, this being done in such a manner that both are actuated at proper intervals by the manipulation of a single controller handle. The only function of the electrical equipment is that of hoisting, for as the cages are balanced one against the other, it is the rule that power is applied for either direction of rotation. Braking is done through the application of band brakes by means of the hand levers shown in the illustration.

The subjoined diagram of circuit connections shows the development of the reversing cylinder as applied to the high tension controller. The head board of this controller has six terminal lugs, those numbered 1, 2 and 3 being for the service leads, while those numbered 4, 5 and 6 are carried to the motor.



The controller applies the full line potential of 2,300 volts to the stator, and it serves not only as a make and break switch but also as a pole changer for reversing. The short circuiting of terminals 1 to 4, 2 to 6, and 5 to 3, causes a given direction of rotation, while the short circuiting of terminals 1 to 4, 2 to 5, and 3 to 6 causes an opposite direction of rotation, all as shown in the attached circuit diagram. Mineral seal or any high grade transformer oil may be used for the bath for this high tension controller, which gives perfect satisfaction in operation.

The connections of the circuits by means of which external resistance may be cut in and out of circuit with the rotor windings through the low tension controller are outlined in Fig. 10, and in Fig. 13 is given the assembly diagram of the stationary cast iron resistance as mounted on the slate resistance board shown in front and back views in Figs. 8 and 9. It must be understood that the terminals at the bottom of the slate panels appearing in the upper portion of Fig. 10 are the same as those shown at the bottom of Fig. 13. The

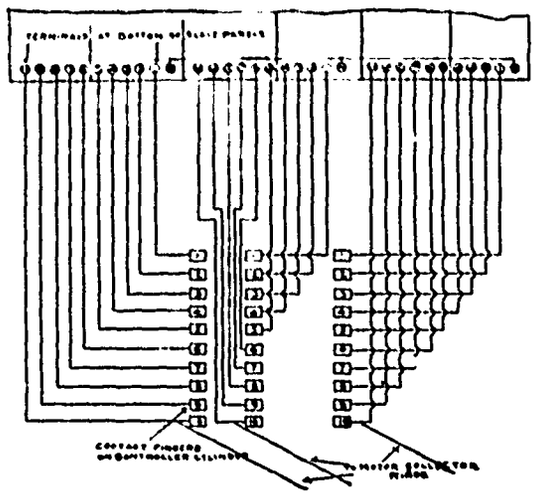


FIG. 10.—CONNECTIONS OF INDUCTION HOIST MOTOR AND CONTROLLER.

resistance strips shown so clearly in Fig. 9 consist of cast iron grids, each in three waves, having a sectional area of about $\frac{1}{8}$ by $\frac{5}{8}$ inches and which have a running length of about sixty inches. These grids stand out from the board about 14 inches and they are in 23 vertical rows by 18 horizontal ones, and while the average cross section is as given, it varies slightly above and below that figure according to the amperage carried.

Reverting to the scheme of low tension controller and

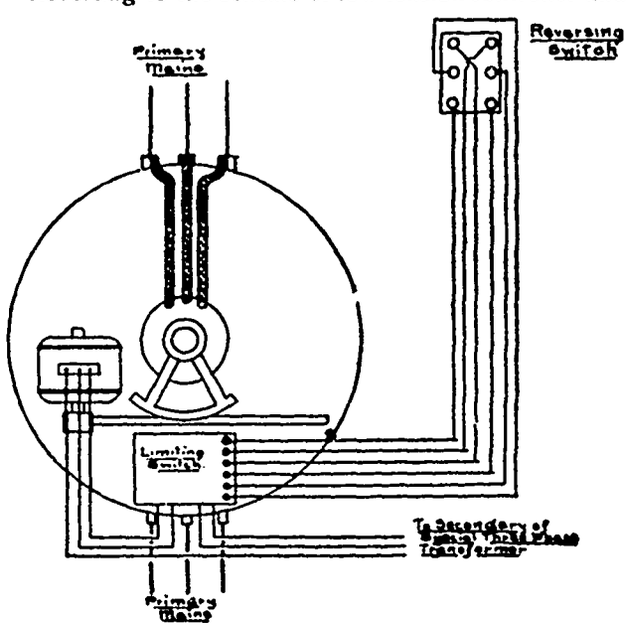


FIG. 11.—CONNECTIONS OF INDUCTION REGULATOR.

resistance switchboard connections outlined in Fig. 10, the leads from the slip rings on the shaft of the motor are carried to three sets of contact plates placed on the controller cylinder in ordinary arrangement, and upon these contact plates play the contact fingers which carry current successively to the resistance. Three posts are erected in the controller, each of which carries a set of ten contact fingers, and two of the sets are shown in Fig. 7. As stated, the maximum potential broken by the low tension controller is about seventy volts and the sparking is inconsequential.

FIG. 9.—BACK VIEW OF EXTERNAL RESISTANCE BOARD.

One who is interested could spend hours in watching the operation of this hoist. It is easily handled by one man, who finds himself with much less to do than has the motorman on an electric railway. In fact, the operation of the War Eagle hoist finds greater resemblance to street railway practice than one would imagine. The controller is manipulated with the same ease and celerity that attends the handling of a street railway controller, and it is more simple than the modern street railway controller in one regard, and that is the fact that reversal is accomplished by the moving of the controller handle in a reverse direction rather than in the throwing of a special lever. At times when men are on the cage the hoist is "kicked" along by the momentary application of power to the motor, which enables it to be run at much slower speed even than that possible with the controller on the first notch. At other times, in hoisting ore, a dead load of five tons of which is almost always carried, the motor will be brought up to speed in a very few seconds and this without any abnormal inrush of current, for, as stated, during the writer's observations of the operation of the equipment under all conditions of service, the motor intake did not exceed 110 amperes per phase. The motor has an efficiency of 92 per cent. and a full load power factor of 88 per cent., while at the slowest speed the power factor may drop to possibly between sixty and seventy per cent., but of this last statement no direct data is available at present. Current for the operation of the entire War Eagle equipment is sold by contract, i.e., on flat rates.

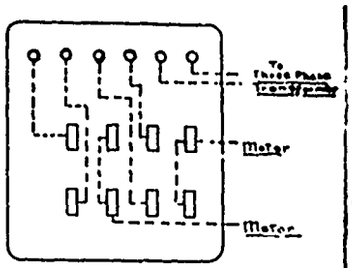


FIG. 12. CONNECTIONS OF LIMITING SWITCH.

The next feature of interest in the electrical installation at the War Eagle mine is found in the 300-kilowatt synchronous motor operating the 40-drill compressor illustrated in Fig. 15. Three-phase current at 2,300 volts is applied to this motor, which runs at 200 revolutions per minute. It is of the revolving armature type, has thirty-six poles, and, consequently, bears the designation "A P 30-300-200." A General Electric multipolar exciter, not shown in the illustration, is driven from a large pulley on the free end of the motor shaft, and this exciter has an output of nine kilowatts at 125 volts when operated at 1,450 revolutions per minute. The compressor, which is of a double duplex type, is driven through independent ropes applied direct as shown in the illustration.

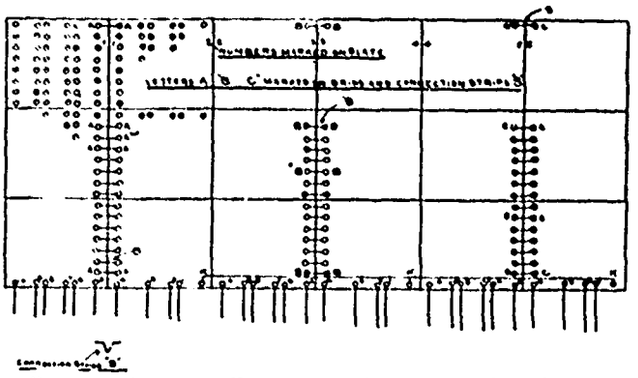


FIG. 13.—ASSEMBLY DIAGRAM OF STATIONARY CAST IRON RESISTANCE.

The method originally installed for starting the synchronous motor is also shown in the illustration given, and it consisted of a thirty horse power induction motor belted to a counter shaft through a friction clutch, this shaft carrying a spur gear by means of which the armature was brought up to speed. It can not be said that this equipment has been satisfactory, although it is in practical operation. The difficulties in its use rest, first, in the fact that in bringing the armature up to synchronism the compressor must, as well, be brought up to speed; and second, the 30 horse power motor is too small for the duty required. It takes most exactly eight minutes to bring the motor up to synchronism, in

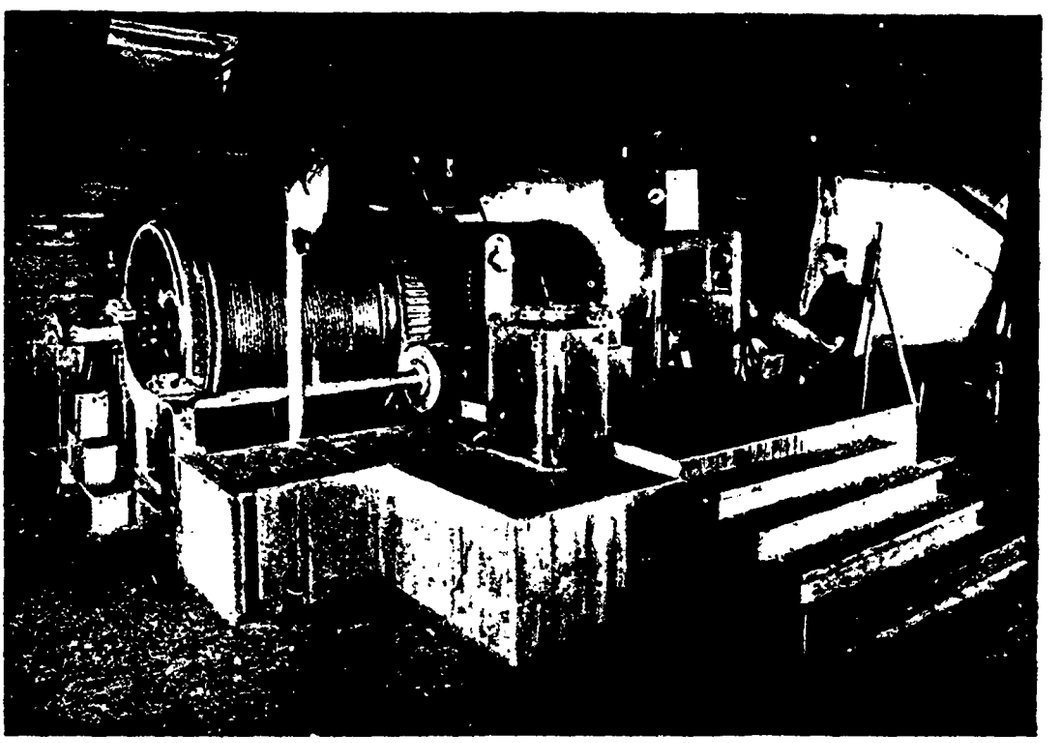


FIG. 14.—GENERAL VIEW OF INDUCTION HOISTS AT WAR EAGLE MINE.

doing which the 30 horse power induction motor delivers from 120 to 130 horse power, and, incidentally, has its temperature raised to a point somewhere above that conducive to a ripe old age. Although the small motor was still in service at the time of the writer's visit to the mine, it was shortly to be replaced by one having more than double its capacity. It should be stated in justice to the engineer of the Kootenay company that the starting device here discussed was not of his design or sanction. With the exception of the time consumed in starting, the equipment gives the best of satisfaction. A number of small motors ranging up to 20 horse power in capacity are used in and about the War Eagle mine for ventilating purposes, driving conveyors, etc., and all these motors are of the induction type except that on the compressor.

At the Iron Mast mine is a 75-kilowatt "S.K.C." synchronous motor, made by the Royal Electric Company, of Montreal. It is a two-phase motor, with connections altered for three-phase service, and is started through an "S.K.C." induction motor and water rheostat, both of which appear in the illustration shown in Fig. 10. The water rheostat consists of three fan-shaped blades plunged edgewise into a three-compartment tank of water, thus enabling the water resistance cut into each leg of the three-phase circuit to be varied according to the depth of immersion. The 75-kilowatt motor is belted to a jack shaft in the manner shown, which drives two double-acting compressors having a combined capacity of ten drills. This is the only Stanley equipment on the West Kootenay circuit, and its service is most reliable.

In the Big Three mine is a 75-kilowatt General Electric synchronous motor, driving a seven-drill compressor in the manner shown in Fig. 17, while at the Gertrude mine is a 50 horse power induction motor operating a hoist. The British Columbia Bullion Extraction Company has one 50 horse power induction motor driving a rock breaker, and one 75-kilowatt synchronous motor operating all machinery about the mine, including generators for electrolytic work.

These motors, as well as all others referred to hereafter, are of Canadian General Electric manufacture. In the properties of the British-American corporation are four 150 horse power induction motors, each operating a double drum hoist through equipments which are in every way similar to those at the War Eagle mine. All underground work in and about Rossland is operated at 220 volts. Aside from mining work, the principal power installation is that of the general machine shop of Cunliffe & Ablett, where a 30 horse power induction motor is installed. There are many small motors ranging from one to five horse power in size for furnishing of light power in different industries in Rossland.

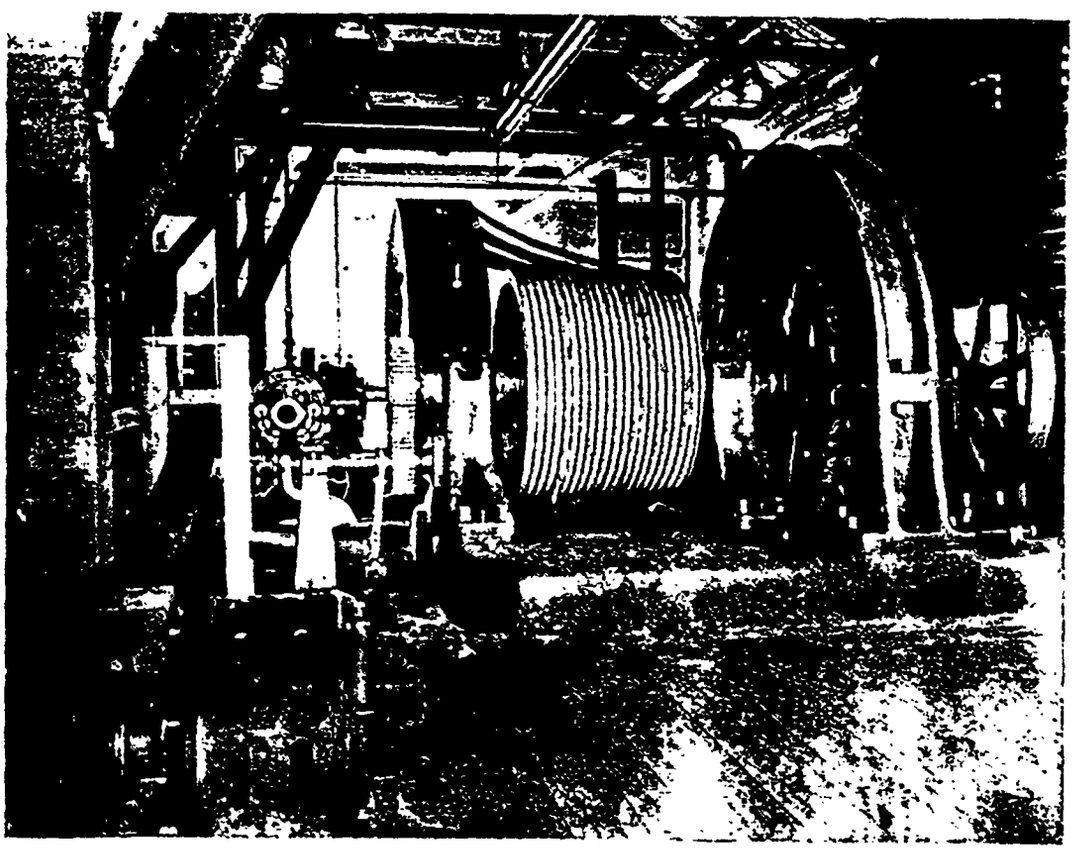


Fig. 15. View of 400-H.P. Synchronous Motor, Driving 40-Drill Compressor at War Eagle Mine.

One of the most interesting points to be brought out by the Kootenay-Rossland transmission is the demonstration of the fact that the operation of synchronous and induction motors in large units for the driving of hoists and compressors will not necessarily create serious disturbance in the voltage of the distribution circuits, provided high voltage, ample fly-wheel effect and capacity prevails. During daylight the power and lighting circuits are operated in parallel, although they are separated and operated independently from the power house by night. The War Eagle hoist, however, is operated on an independent circuit by day, but at night it is cut into the power circuit at the Rossland sub-station. The result of this arrangement is shown in the reproduction of the recording voltmeter chart shown in Fig. 6, which is that of the lighting circuit. From 6:45 p.m. to 5:00 a.m. the chart shows the regulation of the lighting circuit when

on an independent line from the power house. At 5:00 a.m. the War Eagle hoist is taken from the power circuit and put on an independant line to the power house, and the remaining power load is coupled in with the lighting load and carried on the second line to the power house. The voltmeter curve, therefore, from 5:00 a.m. to 6:45 p.m., shows the regulation of the plant when all power with the exception of that for the War Eagle hoist is in parallel with the day lighting load. The chart given is that for an ordinary day, and, indeed, the charts run so evenly from day to day that each almost duplicates the other. The day in question there were in operation from 5:00 a.m. to 6:45 p.m. three 100 horse power syochronous motors with an average load of 280 horse power on compressor work; five 50 horse power induction motors with an average load of 210 horse power on the same, three of which were on hoists; three 30 horse power induction motors with an average load of 76 horse power, and one 40 horse power induction motor carrying an average load of 32 horse power. The lighting load consisted of 300 horse power, which is high in proportion to the night lighting load because of the heavy 24-hour load carried. The report from the generating station for the same day shows that the variation reached 108 amperes at 110 volts, or an approximate variation of 205 horse power, considering which the regulation is remarkably good. The secret of this is stated to lie in always maintaining a high voltage in relation to the motor ratings, with ample generator and wheel capacity.

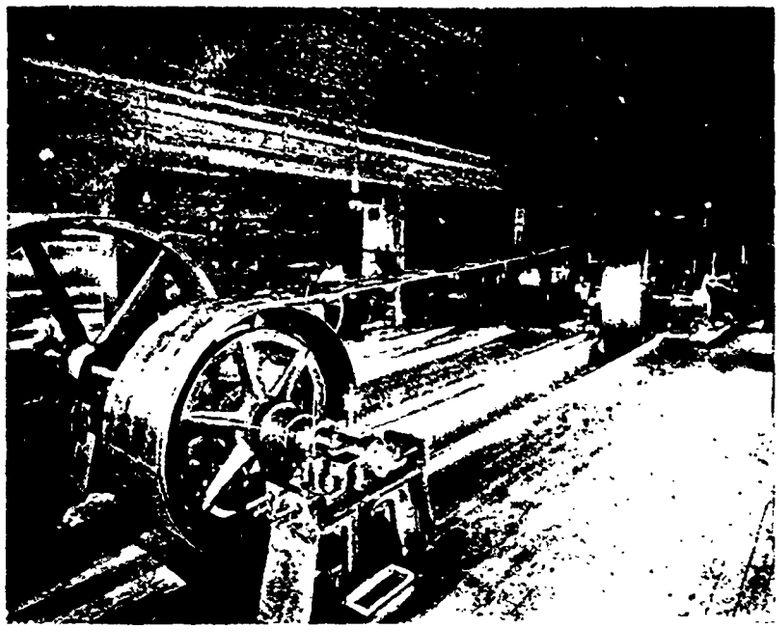


FIG. 16. STANLEY 100 HORSE POWER SYNCHRONOUS MOTOR, DRIVING 10-DRILL COMPRESSOR AT THE IRON MASK MINE.

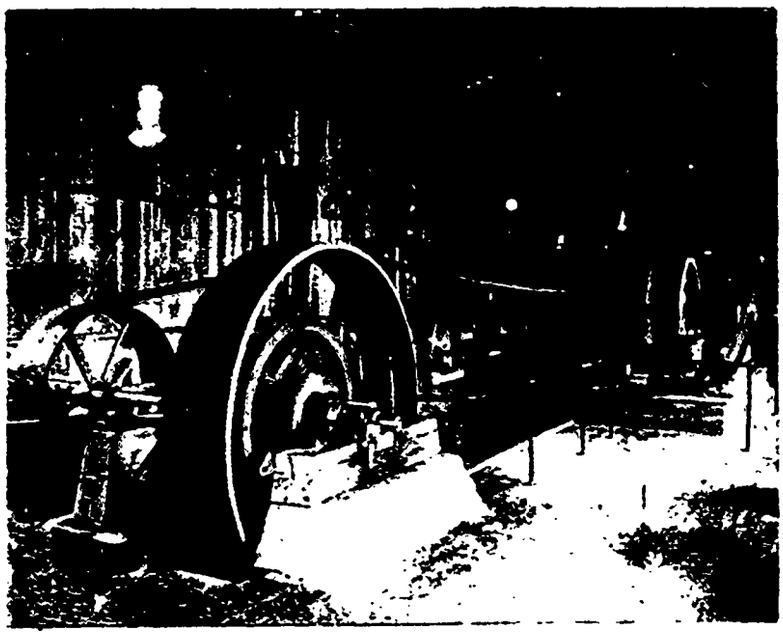


FIG. 17.—100 HORSE POWER SYNCHRONOUS MOTOR, DRIVING SEVEN-DRILL COMPRESSOR AT THE BIG THREE MINE.

The construction of electric railways in Chatham and Sarnia, Ont., is being advocated.

THE CANADIAN ELECTRICAL ASSOCIATION.

UNDER the direction of the new president, Mr. A. A. Dion, a meeting of the Executive of the above Association was held at the Russell House, Ottawa, on September 14th. Besides closing up satisfactorily all matters in connection with the last annual convention, the committee discussed at some length the work which should engage the attention of the Association during the present Association year. This work has been allotted to various committees, which will be called together at an early date.

The Committee on Meters has been requested to devise some satisfactory scheme for the re-inspection of meters which will entail less expense upon the lighting companies than is imposed by the existing regulations. The Government Inspection Department is understood to be desirous of meeting the wishes of the companies in this regard, if a satisfactory scheme can be propounded. The view urged by the Association, as representing the companies, is that the present inspection fees should cover the cost of re-inspection during the period for which the meters are sealed, or that if a second fee be necessary, it should be for a nominal amount. Experience is said to have demonstrated that watt meters do not accumulate as much dust and consequently are less liable to disarrangement with the alternating as with the direct current.

A public meeting was held in the village of Erin, Ont., recently to discuss the question of installing an electric plant for lighting the streets. A committee was appointed to ascertain the cost of lighting in other places.

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Correspondence is invited upon all topics legitimately coming within the scope of his journal

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Steam Ploughing.

An illustration of the growing application of steam power for agricultural purposes was given last month at Morden, Manitoba, where a test was made by the Canadian Pacific Railway Company of a steam plough. The machine moved at a speed of one and one-quarter miles per hour, and dragged after it a gang of ten ploughs, which turned over a width of twelve feet of earth, of the depth of four inches. The fuel used was the herbage which had grown on the prairie common to the western country, and which had been cut down a few days previously. We are told that the fly-wheel moved at the speed of 203 revolutions per minute, and the driving wheel of the machine at four and one-half revolutions. At the speed at which the test was made, the ploughing done in one day would be about 20 acres. As the price paid for ploughing in the North-West is said to be about three dollars per acre, it would seem that from the point of economy the steam plough is a success. That they will come into more general use is almost a certainty. In Germany, for instance, steam ploughing is said to be very largely adopted.

Fixed vs. Moveable Coils.

In dynamo design, a debatable question at the present time is the relative superiority of moving or fixed coils. Elsewhere in this issue Mr. W. A. Johnson presents arguments in favor of the type of machine with stationary wire, contending that the two coil inductor alternator overcomes the objections of bad regulation and over-heating which may be made against the single coil machine. In European countries this question is also receiving some attention, and it has by no means been decided which method of construction possesses the greater merit. Although the idea of the inductor alternator was conceived twelve years ago, it is only recently that a machine of this pattern became one of the standard types of the Brush Company. They have now been installed in some of the largest electrical works, and are said to be giving satisfaction. On the other hand, a correspondent writes to a British exchange that there is a tendency on the part of Swiss dynamo makers to return to the revolving coil machine. We are not told, however, whether or not more than one field has been employed.

The Storage Battery.

Dr. N. H. Edgerton, of Philadelphia, is building a factory in the city of Hamilton, Ontario, for the manufacture, on a somewhat extensive scale, of the high tension battery of which he is the inventor. Considering the limited demand as yet in Canada for the storage battery, this is a strong indication of the faith of Dr. Edgerton in the future of storage batteries generally and of his invention in particular. As it is said to be the intention to employ some fifty workmen, the question of a market for the output of the manufactory suggests itself. This is in part answered by the fact that the Cataract Power Company, which has already secured control of several electric railways in and around Hamilton and contemplate building other new roads, are very likely to install a storage battery system as an auxiliary to their railway power plant. From this it may be judged that the promoters of this manufactory anticipate a much greater use of the storage battery for railway purposes, not for direct operation, for which they have not been found satisfac-

tory, but as an auxiliary plant. If the storage battery should be employed in this manner by the Cataract Power Company and be found satisfactory, it will undoubtedly result in other companies following in their footsteps, and will give encouragement to the storage battery industry in Canada.

Extension of Canadian Telegraph System.

THE Dominion government is about to undertake the construction of two quite important extensions to its telegraph system, both of which will involve rather uncommon engineering features. One of these is a line from Lake Bennett to Dawson city, in the Yukon district, for which three hundred and thirty thousand pounds, or one hundred and sixty-five tons, of iron wire will be required. The second is the extension of the Gulf of St. Lawrence telegraph system from Big Roumaine, Quebec, to Chateau Bay, Labrador, opposite Belle Isle, a distance of 315 miles, and which has been frequently asked for by the shipping interests. In connection with the latter extension, it is not improbable that wireless telegraphy will be employed to communicate between Chateau Bay, on the Labrador coast, and Belle Isle. It is said that the experts are as yet undecided as to how the connection will be made. The laying of a cable would be the most simple method, but it is feared that it might be broken by the grounding of icebergs in this narrow strait. About the only alternative, therefore, seems to be the adoption of a system of wireless telegraphy, and this course is understood to be under consideration. The demonstrations that have been made of this system would seem to place its practicability beyond question, and its adoption in Canada to a greater or less extent may be expected to follow in the near future.

Pumping Water by Electricity.

THE Cataract Power Company have made another proposition to the city council of Hamilton to pump the water supply of the city by means of electricity, instead of steam, now employed. The revised offer is said to be more favorable than the previous one, and there is a probability that eventually satisfactory terms for performing the service will be reached. The Cataract Power Company contends that by the introduction of electric power a considerable saving in cost of operation can be effected. The pumping of water by electricity, not a new idea, opens up another field for the central station manager to exploit in his search for a market for the output of his station. Where the water supply is pumped by electricity, it may be found expedient by some cities and towns to adopt a system of water purification by means of the electric current. We observe that in St. Louis such a method has been adopted with satisfactory results. The system consists in admitting the water to be purified into a tank divided into small compartments. In each of the latter a pair of electrodes are located, the positive being attached to the bottom of the compartment, while the negative floats upon the surface of the liquid. As these receptacles are presumably non-conductors of electricity, when the current is turned on it naturally passes through the water from the positive to the negative electrode, and by decomposing it liberates hydrogen, which escapes to the surface, carrying with it all foreign matter and impurities. In Paris, France, the Tindal system is in use. This consists in forcing air that has been subjected to the action of a high tension electric current, and thereby ozonized, into the water to be purified. The cost is given as .028 of a cent to sterilize one cubic yard of water, which certainly seems very reasonable.

The Record of Acetylene.

THE Canadian Manufacturer, apparently with the object of securing the favor and incidentally the advertisements of the manufacturers of acetylene gas machines, charged this journal with having misrepresented the extent of the development of acetylene lighting by publishing statistics compiled by the Canadian Electrical Association. Our answer showed clearly that no responsibility attached to us for the correctness or otherwise of these statistics, which were published as a part of the proceedings of the Canadian Electrical Association convention. The Manufacturer, evading entirely this, the main point, in our reply, returns to the attack in this manner: "Our esteemed contemporary gives itself away, for in the very letter that it alludes to from a manufacturer of acetylene gas machinery, data is given that disproves the assertion that there are only 155 machines in use in Canada. If the Electrical News desires to verify its unverified statement, we will have pleasure in giving it the names of a few Canadian concerns whose annual output each is in excess of the gross number mentioned in the statement alluded to." As to the correctness or otherwise of the statistics published, the editor of The Manufacturer should have addressed himself to the Canadian Electrical Association, under whose direction the figures were compiled and given to the public. Incidentally it might be mentioned that the editor of The Manufacturer "gives himself away" when he alludes to data given in the letter of a manufacturer of acetylene apparatus, mentioned in our previous reply, which letter, through an oversight, was not published in our September number.

LIQUID AIR.

PRIOR to 1887, says the Engineer, air was thought to be a permanent or incondensable gas, but it was liquefied simultaneously by Messrs. Pictet and Caillete at that time, though at an enormous expense. About 200 years ago the lowest temperature thought to be obtainable was produced by a mixture of snow and ice, and was used by Fahrenheit in establishing a zero for his thermometric scale. Since that time scientists have reached a temperature some 400 degrees below the lowest point ever reached by Fahrenheit. Of the three known methods for producing cold, the first, i.e., by the rapid solution of a solid was used entirely up to 1820 and yielded a temperature of 50 degrees below zero centrigrade. The other two methods are the rapid evaporation of a volatile liquid and the rapid expansion of a cooled and compressed gas. By a combination of pressure and refrigeration, Faraday in 1823 liquefied all except six of the existing gases, but it was not until 1869 that it was discovered that these gases must first be cooled to a critical temperature. By subjecting hydrogen to an enormous pressure and at the same time lowering its temperature it was found possible to liquefy it. Hydrogen has a critical temperature only 33 degrees C. above the absolute zero of temperature. From the experiments performed, the conclusion was drawn that solids, liquids, and gases were but different forms of matter through which any substance could be made to pass by the addition or withdrawal of heat and pressure.

THE DIRECT CURRENT MOTOR.*

By L. A. Herdt, Ma. E., I. E.

Dynamo electric machines belong to the class of machines which are called reversible. This does not mean that they can be run backwards, but that the transformation of energy which goes on in the machine is reversible.

If we apply mechanical energy to a dynamo so as to make it rotate, it will generate a current of electricity. This current we can send to a distance through conductors, let it enter a machine, another dynamo, and this machine will start to rotate and convert the current or electrical energy supplied to it into mechanical work the motion of visible masses of matter. In this accomplishment we started out with mechanical energy, and come back to it far from its first application. Electricity in the transformation has only been a link, a means of transmitting the power. Motion is necessary to produce the current, and the dynamo or motor is merely a device for transforming what is called energy from one form to another.

A motor is therefore the same machine as a dynamo, or a dynamo to which a current is supplied. Therefore, in studying the inner working of a motor, we must deal with exactly the same principles that we find at work in dynamos. The main parts which are to be considered in a dynamo are the field magnets and the armature. The field magnets, which produce the magnetic field, are usually stationary; the armature, the part in which the currents are induced, revolves.

A commutator is also required, either to carry the current generated in the conductors of the armature to the line, as in a dynamo, or to conduct the current from the line to the conductors on the armature, in the case of a motor.

If a conductor forming a loop is moved across a magnetic field, a current will flow in this conductor; this current will be gener-

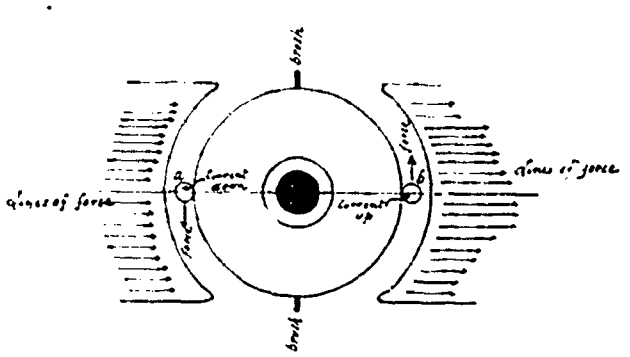

Fig. 1.

ated as long as the motion lasts, and the moment that it stops the current will vanish; also, if a conductor carrying a current is placed in a magnetic field in a plane at right angles to the magnetic lines, it experiences a force urging it to move in that plane. The motion will last as long as the current is flowing in the conductor and as the conductor is still in the field. Motion is therefore necessary to produce the electric current, and the electric current will in turn produce motion.

The armature, as found in dynamos, is simply a collection of loops of wire so arranged that each conductor in its rotation between the field magnets is carried past these field magnets, and current is generated in these conductors. In a motor, the conductors carrying current and placed in a magnetic field are subjected to a force which, as will be presently explained, produces a rotation of the armature.

Fig. 1 shows a section of an armature and pole pieces of a dynamo. This section is in a plane at right angles to the shaft; a and b are two conductors forming a part of the same loop, the currents in these being in opposite directions. It will be found that conductor (a) will be subjected to a force acting downwards, while the force on (b) will be upwards, the effect of these two forces, as will readily be seen, being to turn the armature about its axis. If any number of conductors are arranged on the surface of this armature, the forces acting on these conductors will be all downwards on one side of the brush plane and upwards on the other side. These forces, acting on the conductors at a certain distance from the axis of the shaft, results in a twist, so that the shaft will be turned. If we were to rotate by hand the armature of a small dynamo, we would find that as long as the dynamo is not made to generate any current, the resistance to turning the armature would be very small. As a matter of fact, this resistance is that simply due to the friction of the shaft in its bearings, and the friction due to the pressure of the brushes on the commutator. But if we should now close the circuit of the dynamo so that the machine will generate a current, the force that we shall have to exert to keep the machine rotating is many times greater, for since the conductors are now carrying current, the force which we find acting between magnetic fields and conductors carrying current is acting against the imparted motion of the dynamo.

In a motor this force is the one which causes the machine to rotate, and is therefore acting in the direction of rotation.

It seems puzzling to the mind of the unacquainted observer how it is that so much force has to be exerted to drive a dynamo under load; the armature revolves between the polar pieces quite freely, the mechanical friction can absorb but very little power, then what becomes of the surplus power which is mechanically imparted to the machine. The answer is, that there is a force which the magnetic field exerts on the conductors of the armature since they now carry current; this force or drag opposes the rotation, the larger the current in the armature the greater this drag and the more the power which is required to keep the machine revolving.

In a motor this drag is the driving force, and is the one which produces the rotation.

THE STARTING OF ELECTRIC MOTORS.

In starting an electric motor from a stand-still, it will be found necessary to introduce a resistance in the armature circuit of the motor, this resistance to govern the current and reduce it to any desired flow. At starting, or when the motor is running slowly, the current has to go through a resistance box called starting box, and then through the conductors of the armature; the field coils are either connected directly to the line as in shunt-wound motors, or in series with the starting box and armature as in series-wound motors. The current strength is therefore given by the ratio of the electro-motive force of the line and the total resistance introduced in the circuit. In order to speed up the motor, the resistance of the starting box is gradually taken out, until the motor is placed directly on the line and is then running at its rated speed.

Without this resistance at the start, the current that would go through the motor would probably be excessive and prove injurious to the insulation of the armature; besides it would not be doing useful work, for useful work is only done when the armature revolves. The current at start should be large enough to start the rotation, but not large enough to injure the motor.

If the resistance in circuit is now cut out gradually the motor will speed up, and it will be found that the faster the motor runs the weaker the current becomes. This is due to a generating action taking place in the motor itself on account of its speed, in fact the motor by its rotation is now working as a dynamo on its own account and tends to generate a current in the circuit in the opposite direction to that which is driving it. As the production of current is due to an electro-motive force, this generating action taking place in the motor will be found to be due to an electro-motive force acting as soon as the machine is rotating. This electro-motive force, which is called a counter electro-motive force, varies with the speed, that is, increases or decreases with the speed. The current now does not depend on the electrical resistance of the circuit alone, but is checked by this electro-motive force of reaction which is working against the electro-motive force of the line. Therefore, whereas in a generator there is only one electro-motive force acting, in a motor there must always be two as soon as the machine is developing work, that is, as soon as the machine is rotating.

The electrical energy supplied to a motor is measured by the product of the voltage on the line into the current flowing; this product is expressed in watts, and if divided by 746, will give the electrical horse power delivered to the motor. This energy, usually called the electrical input, is, however, not wholly converted into useful work, and only a portion of this (happily a large one) will be available on the shaft.

The energy supplied is expended in two ways, in heating the circuit and in doing work. The expenditure of energy in the form of heat is the product of the resistance of the circuit into the square of the current. This product is expressed in watts, and may be termed heat watts. This amount of power is lost and simply heats up the machine; to reduce this loss will be to make the resistance of the armature as small as possible. The difference between the total watts supplied to the motor and the heat watts may be called the mechanical watts, that is, it is this part of the total energy which will be transformed in the machine from

* Abstract of a lecture delivered before the Y. M. C. A. Electrical Club, Montreal, by L. A. Herdt, Ma. E., I. E., Lecturer in Electrical Engineering at McGill University.

electrical to mechanical energy. These mechanical watts, however, may be divided into two, those which are utilized in doing useful work, and those which are required to overcome the internal resistance to motion.

For example, in all motors a certain amount of work is required to overcome the friction of the bearings, the friction of the brushes on the commutator, the resistance of the air, and such effects known as hysteresis and eddy currents. The energy required to overcome these must evidently be drawn from the supply, and amounts to a certain loss, and the aim of the designer is to reduce these to a small value. The rest of the mechanical watts, usually called the useful watts, are available for useful work; that is, the energy available on the shaft of the motor.

"En resume," we see that, of the electrical horse power delivered to a motor, only the useful mechanical watts are available for doing work; the ratio of these to the electrical input in watts is called the efficiency of the motor. The electrical input is easily measured by means of an amperemeter and of a volt meter.

The mechanical output can be measured in different ways, one method being by a brake, such brake to be in the form of a prony brake, which is well-known. This brake consists in clamping on the pulley of the motor a pair of wooden jaws which absorb the power. Sometimes it consists of a rope passing over the pulley, the pull on the rope being measured by means of a scale. If p is the pull in pounds on this rope, and r the radius of the pulley over which the rope is passed, the twist on the shaft retarding the motion is equal to pr. If the pulley revolves at a speed of n revolutions per second, the speed of the periphery of the pulley is equal to $2\pi rn$. Now, the work is the product of the force by the velocity at the circumference, therefore the work absorbed in foot pounds by the brake $= p \times 2\pi rn$. Now, 550 foot pounds per second equals one horse power, therefore the horse power absorbed by the brake is equal to $\frac{2\pi rnp}{550}$. This measures the output of the motor.

INHERENT REGULATION IN INDUCTOR ALTERNATORS.

By W. A. Johnson.

It should not be necessary to call the attention of the buyers and users of electric machinery to the great desirability of having practically perfect regulation in any dynamo, but this important feature is very often overlooked. By perfect regulation is meant that all ordinary changes in load, from the throwing on or off of lamps, should not cause change in pressure of more than 2 per cent. The usual guarantee of engine builders at the best is but a regulation of two per cent., consequently the dynamo builder is limited to this percentage, as the regulation of dynamo can be no better than the constancy of the speed, as governed by the engine or water-wheel, allows of. It is well known that direct current dynamos are turned out by makers of high grade machines that will give a regulation of 2 per cent., but until recently no inductor alternator has been able to show anywhere near the result.

Good regulation means longer life of lamps, greater satisfaction to the customers, less attention to controlling rheostat, and it generally means a cool running dynamo (unless the dynamo is overloaded). Not only is this true of direct current dynamos, but to much greater extent with alternating current can the greater advantages of perfect regulation be claimed as the most essential point to consider in the selection of a machine, as without proper design the false currents generated in the iron of the machine through lack of magnetic balance necessarily result in excessive heat, bad regulation and low efficiency, and especially is this true in the inductor type of dynamo. The principal reason why one or two of the older manufacturers of alternating dynamos have adhered to machines having moving wire instead of adopting the inductor type, is that most inductor dynamos on the market have extremely bad regulation, and necessarily, through hysteresis losses, low efficiency. Therefore, one or two of the larger manufacturers are still adhering to the old type of moving wire machines, obtaining regulation through complicated composite windings, rectifiers, etc., and of course retaining all the attendant disadvantages of such construction. The mechanical and commercial advantages of the inductor dynamos are so obvious, however, that a machine overcoming the objections mentioned should meet with the approval of all users. It is possible to design an inductor alternator of such construction that perfect inherent regulation within two per cent. can be obtained for all ordinary changes in load, such as throwing on or off the lamps in a theatre, church or any large building, say 250 lamps on a 1000 light machine, and proportionally on larger sizes. In fact, fully one-third of the capacity of a machine has been cut off with a momentary fluctuation of but one and one-half volts, the needle setting back in a few seconds to standard voltage.

This is far closer than has been obtained before with inductor alternators, and absolutely does away with constant attention to the rheostat (except for change in speed) after the dynamo and line is at working temperature. This is a stronger claim than can be made for the composite wound machine under the usual working conditions. Now, how can this close inherent regulation be obtained? Only in a machine having magnetic symmetry.

This is the key note of dynamo design, and if lacking in an inductor alternator, then through the irregular action of the magnetic flux the different parts of the iron frame and the armature core will run hot, communicating this heat to the windings of the armature and field coils, rendering them incapable of carrying at a reasonable temperature the full current load that the cross section of copper provided would otherwise allow, and in some machines this wasteful magnetic heat has been communicated to the bearings, causing these to overheat and necessitate shutting down.

A machine without magnetic symmetry will overheat at even light loads, thus proving the rule as to temperature, whereas a machine of proper design will remain practically constant in temperature at all loads or until the capacity of the copper windings is fully attained.

To sum up, the claim is made that the successful dynamo or motor (following in design the present recognized theories of magnetic changes) having but a single magnetizing field coil, it matters not whether the machine be for alternating or direct current, is yet to be designed, and that any single coil machine is and will be defective, inefficient, regulate badly, overheat through hystereris, and that a two-coil inductor alternator of proper design overcomes all the objections mentioned.

This theory was enunciated by us as far back as 1885, and has been reasserted in printed matter we have issued at several later periods, and while it is an extremely simple point not in any case claimed as original with the writer, as it has evidently been recognized by designers of multipolar machines, perhaps, however, inadvertadly, as the use of the multipolar type of field originally arose from the desire to obtain low speed and subdivision of current in commutation of direct current machines, yet in the inductor type of alternator the use of more than one field has been entirely overlooked by all manufacturers.

A machine embodying the very desirable feature of close inherent regulation is now manufactured in Toronto by the United Electric Company, Limited, and the correctness of the theory as herein stated is proved by the fact that this machine has practically no magnetic heating in the ordinary sense of the term in the iron or steel of any portion of the frame, inductor or armature core, in fact, under test at overload, it having been under 30 degrees Fahrenheit above surrounding atmosphere after a previous full load run of fourteen hours.

PERSONAL.

The congratulations of many friends are being extended to Mr. W. A. Martin, secretary of the Toronto Electric Light Company, upon the occasion of his recent marriage to Miss Bowling.

The exhibitors in Machinery Hall at the late Toronto Industrial Exhibition presented Mr. T. Eversfield, chief engineer of the hall, with a bedroom set and an address expressive of his kindness and consideration during the fair.

The news has been received in Montreal of the marriage in England of Mr. Ernest G. Coker, B.B., B.Sc., assistant professor of civil engineering in McGill University. Professor and Mrs. Coker were expected to arrive in Montreal about the end of September.

Mr. John J. York, chief engineer of the Board of Trade building, Montreal, has tendered his resignation, to accept a similar position at the St. Lawrence Sugar Refinery. He has been succeeded by his brother, Mr. B. A. York, who for the past four years has been inspector for the Boiler Inspection and Insurance Company of Toronto.

Mr. W. J. Johnston, late editor of the Electrical World, of New York, is at present on a tour around the world. Mr. Johnston sailed from San Francisco, the first stages of his journey being the Hawaiian Islands and Japan. In the Orient, Korea, China, Manila and Java will be visited, and about six weeks passed in India. The entire trip will occupy about eight months, and comprises visits to Egypt and Turkey.

BY THE WAY.

When old timers in various departments of the electrical business get together, they are apt to indulge in reminiscences of an interesting character. The old telegraph man by way of illustrating the resourcefulness of the pioneers, will tell how a stove pipe was once utilized to make contact between the ends of a broken wire when nothing better adapted to the purpose was in sight, and how to everbody's surprise it did its duty nobly and well. Another will describe the first insulated office wire as having a covering of hemp and red sealing wax. At this point the electric light man will probably start in to prove that expensive insulation is not as necessary for the prevention of fires as it is supposed to be. By way of experiment he once put up a number of 52 volt incandescent lamps on bare wires placed in contact with wood, then turned on the hose and no fire resulted. The electric light man believes, and there appears to be ground for his opinion, that the fire underwriters' regulations governing the method of wiring, should take the voltage into account. He also thinks that it should be made permissible it not compulsory, as in England, to ground secondary wires, to prevent trouble from contact. These and many other subjects of equal interest engage the attention of the old timers when by chance they meet.

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"An odd institution that has lately come under my notice," said a friend of mine the other day, "is the railway, twelve miles in length, between Grenville and Carillon on the Ottawa river. This railway is employed for the transport of passengers and baggage coming by steamer from Montreal to Ottawa and vice versa. The train, which consists of a locomotive and one car, makes only one trip per day, leaving Carillon on the arrival of the boat from Montreal, and on the return, leaving Grenville on arrival of the steamer from Ottawa. The line runs through fields some distance from the river. The roadbed and rails cannot be seen except at close range, being overgrown with grass. At a glance the engine is seen to be an old timer and probably will not stand a pressure of more than 30 to 40 pounds. It looks very like the first locomotive put into service on the old Northern Railway, and which I understand was built at Good's foundry on Queen street, Toronto. An old gentleman, grey haired and grey bearded, attired in a long black coat, white tie and high collar, and presenting the appearance of a superannuated Methodist preacher, occupies the dual position of conductor and brakeman. Notwithstanding his antiquated appearance, however, he seemed to be rather more than up-to-date in his movements, for on the whistle sounding 'down brakes,' he responded so quickly that the locomotive and car were brought to a stop some distance before the platform which does duty as a station, was reached, and the train had consequently to be started up again to reach its destination." In concluding his description, my friend remarked that the old conductor must have a great task on his hands in making up his daily returns for the railway company.

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The electrical situation at Ottawa is at present an interesting one. Speculation is being indulged as to the outcome of the efforts which are being made to subject to competition the Ottawa Electric Company, which until now has furnished the entire supply of electricity for public and private purposes. The Deschene Electric Co., which failed to secure a franchise, has gained an entrance to the city over government property alongside the canal, in return for lighting the canal. Thus far the company are lighting only one or two of the large buildings, and it seems doubtful whether they will become an important factor in the situation, as they are not allowed the use of the streets. The Metropolitan Electric Company has been organized and has obtained a franchise from the council, to utilize a water power seven miles distant to generate and transmit electricity for light and power to the city. This enterprise involves the construction of a canal at considerable cost. The company are doing some preliminary work in the neighborhood of the water power, but it is said are experiencing difficulty in getting the requisite capital subscribed. The opinion is expressed in Ottawa, that the company would prefer to sell out to the Ottawa Electric Co., if the way should open up for satisfactory negotiations. It is also reported that the Ottawa Electric Company have an option upon an equally good water power situated two or three miles nearer the city. Perhaps the best available water power is one situated on the Ottawa river, about 35 miles above Ottawa. Here a natural dam is formed by several islands with narrow spaces between. This power, which is the property of the Quebec government was recently offered for sale by auction. A condition was that the purchaser must expend the sum of $300,000 upon development work, which had the effect of preventing offers. The fact that Nature has left so little to be done for the development of this power, should have prevented the insertion of such a condition. There are numerous water falls on the Gatineau, but the turbulency of that stream is such that the still water necessary to the avoidance of anchor ice, prevents their utilization for electrical purposes.

SPARKS.

The power house of the Canada Electric Light Co., at Amherst, N. S., was partially destroyed by fire on September 19th. The loss is believed to be covered by insurance. N. A. Rhodes and D. W. Robb are members of the company.

As a result of recent labor troubles in connection with the operation of the street railway at London, Ont., the council is said to be considering the purchase of the street railway property and its operation by the city as the best means of putting an end to the present unfortunate condition of affairs. In the event of being unable to buy out the existing company, a rival road is spoken of.

Application has been made to the Ontario government for the incorporation of the Port Stanley Electric Railway Company, to construct an electric railroad from Port Stanley to St. Thomas and London. The road, it is thought, could be constructed and equipped at an outlay of a quarter of a million dollars. The promoters of the scheme are the London and Port Stanley Gravel Road Company, who talk of having the road completed by May 24th next.

News has come to hand of the death, under distressing circumstances, of Mr. W. A. M. Pollock, electrician at the electric light station at Almonte, Ont. Deceased was engaged in rubbing powdered resin on a revolving pulley to keep the belt from slipping, and was standing in a narrow space at the end of shafting. By some means his right arm was caught in the belt, and he was thrown head foremost between the pulley and the bridge-tree. He was carried half way round the pulley and suspended head down, being wedged in the narrow five inches of space between the pulley and the bridge-tree. When extricated it was found that the arm of the deceased had been wrenched off at the elbow, and that he had received other serious injuries Medical assistance was at once procured, but Mr. Pollock succumbed to his injuries in less than three hours. Deceased was a respected and well known resident of Almonte, and leaves three small children. He had been employed by the Almonte Electric Light Company for thirteen years.

UNDERGROUND CONDUIT FOR ELECTRIC WIRES.

THE City Council of Ottawa, through its Fire and Light Committee, a few weeks ago instructed the city engineer, Mr. John Galt, to report upon the feasability of placing the electric light, telegraph and telephone wires underground. Mr. Galt's report, together with a preliminary sketch showing the proposed method of subway construction, will be found below :

To Chairman and Members of Fire and Light Committee:

GENTLEMEN,—Acting upon your instructions to investigate and report upon the feasability of having all electric wiring underground, so as to obviate the nuisance of the overhead system constructed and carried upon unsightly poles along the streets of the city, I beg to report as follows :

Underground wiring is quite practicable from a civil, mechanical and electrical standpoint, notwithstanding the objections, difficulties and obstacles to be encountered.

The most important feature to be considered from the standard of municipal requirements is the system of underground work. The ideal method, unquestionably, would be separate open subways on each side underneath the sidewalks or along the street roadway, close to the gutter or curbing, large enough in size for the accommodation of water, gas, electric wiring, etc., including facilities for examining, making repairs and house connections.

This seems to be the only suitable plan of subway construction, and will give separate underground space on each side of the street for pipes and wire service to the street line. Of course this, you see, would require duplicate water and gas mains, but there could be no objection outside of the extra cost, because in the central portion of the city this is both desirable and highly advantageous, subway or no subway.

My conclusions are as follows :

(1) In cities overhead wiring is highly objectionable from every standpoint.

(2) Underground systems are practicable for all kinds of service, notwithstanding the serious objection urged, including interference on account of electrical induction.

(3) A single subway in the middle of the street, although practicable, is entirely unsuitable, because connections to house property would require constant cutting up and repairing of streets.

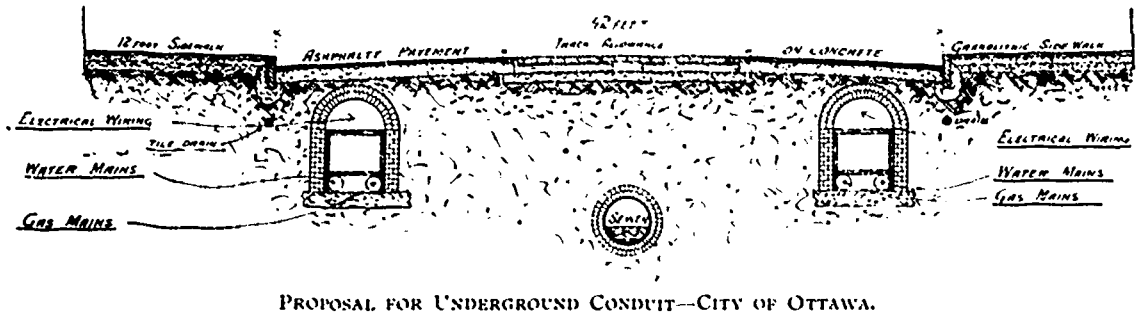
(4) It is more than apparent, without further explanation or illustration, that under municipal ownership the extent and interference in the tearing up of streets will be reduced to a minimum.

(5) In the end the results will be highly satisfactory and economical to all concerned, while at the same time the dangerous, annoying and objectionable overhead system would be abolished.

In conclusion, I submit a preliminary sketch showing a brick lined underground subway 4 ft. wide by 4¼ ft. high, located inside the roadway, close to the curbing.

The total cost for the actual construction of this double subway on the ordinary macadam roadways would be $12 per lineal foot, and on permanently paved roadways $16 per lineal foot, to which, of course, would have to be added all the other large incidental expenses connected with the conversion of the present system into the new. If the subways were placed directly underneath the concrete walks, the cost of construction would be increased 25 per cent., and would still have to cross over roadways at all street intersections and in addition be a serious hindrance to pedestrian traffic during period of construction.

Your most obedient servant,
JOHN GALT, City Engineer.



PROPOSAL FOR UNDERGROUND CONDUIT—CITY OF OTTAWA.

VISIT TO THE CHAMBLY WORKS.

AT the special invitation of Mr. Rudolph Forget, president of the Royal Electric Company, a party, composed of the directors of the Royal Electric Company and their friends, paid a special visit to the Chambly Rapids power house on Saturday, Sept. 9th. A special train carried the party to Chambly Canton, where the power house is situated. Mr. W. H. Browne, the general manager, and Mr. P. G. Gossler, the engineer, showed the visitors through the power house and explained the machinery used in the generating of power. At present there are four huge generators in operation, having a capacity of 3,000 h.p. each, making a total in operation of 12,000 h.p. The ultimate capacity of the power house is calculated at 25,000 h.p. Mr. Browne explained to the visitors that the generators were the largest machines of the kind that had ever been built, even larger than the Niagara Falls machines, and he was especially proud of the fact that they had been made at the Royal Electric Company's works in Montreal. The many interesting features of the plant were explained to the visitors, and the extraordinary precaution which is taken against lightning storms was shown. The visitors were greatly impressed by the machinery and the perfection of all the arrangements.

Among the visitors was Mr. W. R. Eckart, of San Francisco, the representative of the Blue Lakes & San Francisco Electrical Company, which is putting in a plant to supply power from the Blue Lakes, in the State of Nevada, to San Francisco, California, a distance of 150 miles, at a pressure of 60,000 volts, the highest voltage ever attempted and the longest distance transmission in the world. The machinery for this has been ordered from the Stanley Electrical Manufacturing Company, of Pittsfield, Mass., the associate company of the Royal Electric Company, Montreal, and a special object of Mr. Eckart's visit to Chambly was to inspect the machinery. He expressed himself as much impressed with the perfection and completeness of the machinery and arrangements.

The longest distance transmission in Canada is that of the Cataract Power Company, of Hamilton, being 37 miles from the generator to the motor, and the above mentioned plant from the Blue Lakes to San Francisco is the longest and highest voltage in commercial operation in the world. These facts are a strong testimonial to the efficiency of Stanley apparatus for the transmission of power over long distances.

SPARKS.

Early in October the British Columbia Electric Railway Company will commence the construction of a tramway line from Victoria to the Gorge, about two miles distant.

The Ottawa Electric Street Railway Co. have just let the contract to Messrs. Henney & Smith for the construction of a branch line to Britannia, a distance of about five miles. The contract price is $40,000, the company furnishing the rails, poles and ties. The road will be double tracked for the entire length.

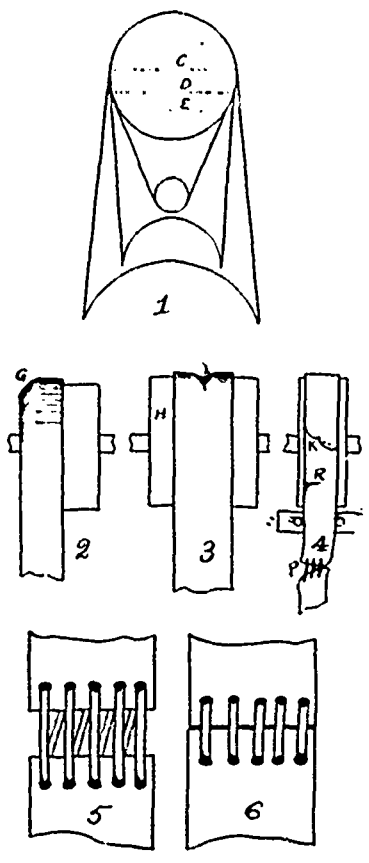
Mr. N. Pinze, of Montreal, has invented a new street car fender, which is to be tested by the Montreal Street Railway Company. The new fender is made of slats of iron or wood fitted on to a frame, which is attached to the front of the car. The slats are concave in shape, but the edge above the track is oblique instead of straight. By an ingenious contrivance the motorman can, when he sees any one on the track in front of him, drop the fender edge upon the track so that its oblique edge will only be a fraction of an inch from the ground. The outside end of the fender is supplied with small wheels or rollers which rest upon the rails and prevent the fender from forming an obstruction to the forward motion of the car by coming in contact with the ground. In addition, the new fender is supplied with springs which relieve the shock of the blow inflicted by a body coming in contact with the fender when the car is in motion.

ENGINEERING and MECHANICS

LUBRICATION OF LEATHER BELTS.

THE consumption of oils and greases for the lubrication of leather belts is much larger than many suppose. There are, of course, a number of special belting compounds which are used for the dressing of leather belts; but most of the manufacturing plants and power consumers adhere to the old way of caring for the belts, which consists in cleaning them at intervals with grease and oil, tallow or the like, then allowing the belts to stand until the lubricants have been absorbed. Belts which are run in dye houses, bleacheries, steam laundries and places were the air is moist do not get dry enough to require lubrication. But belting in wood working, metal working, shoe manufacturing, flour and similar establishments is more or less subjected to the dry, dust-laden atmosphere of the rooms, and in time becomes harsh, dry and stiff.

A little oil, grease or similar substance may be used to advantage in restoring the pliability of the leather. The trouble is that some men use too much of the lubricant. If the oil or grease is flowed all over belt and is not given time to impregnate the fibre, the belt will lose its grip on the pulley, and quickly run off. If,



LUBRICATION OF LEATHER BELTS.

however, the softening stuffs are uniformly and lightly applied and given time to saturate the leather, the fiber will gradually assume a softer and more pliable condition, which will improve the driving qualities of the belt and avoid slipping.

But it is not always lack of a lubricant that causes a belt to slip and run to one side. If a belt is so arranged as to take in but a portion of the pulley, like C, Fig. 1, then much of the arc of contact is lost and the belt will slip with a load, even if the leather is properly lubricated. If the arc of contact is increased to that of D, a fuller grip is obtained of the contacting surfaces, and the belt will not be so likely to slip if it is properly limbered up with the right lubricants. If the arc of contact is brought to F, the bite is still more increased, and the danger of slipping averted, other conditions being right.

The most effectively lubricated leather belts will run to one side if the wheels are incorrectly set. This is illustrated in Fig. 2, in which a sample is given for the condition in which the writer finds very many pulleys. For some reason the local machinists are quick to decide that the belt itself, the lubricant, or anything but the pulley itself, is wrong. The tendency for a belt is to run to the high side of a pulley, except in case where the belt pulls down on the pulley, as in Fig. 2, when the belt rides the lowest edge at G. There is but one remedy, and that is to line up the shafting on which the pulley runs. Then the belt will take the centre of the wheel.

In Fig. 3 is a common case. A tight and loose pulley run together, and the belt shifter is adjusted so that but a fraction of the belt runs on the tight pulley. The result is that the belt constantly slips. Lubrication will not help it. Procure a monkey wrench and set over the belt shifter so that the full width of the belt will run on the tight pulley, and the difficulty will be overcome. Or if the tight and lose pulleys are set so as to permit a space to exist between, the belt will sink down as at I, and, of course, produce slippage.

If the tendency is for the belt to take a side of the wheel, Fig. 4, out of line with the guide pins J of the shifter, much trouble will result. The strain coming on that side of the belt, the edge will be broken as at R and K, and probably the joint opened as at P. The remedy again is to level up the shaft and pulley.

Again, it may happen that a correctly adjusted belt and freely lubricated one slips at certain points. Then examine the splices. If the jointing of the belt is open, like that in Fig. 5, it may be seen that the slipping occurs here when the lace leather is riding the wheels. The only remedy is to draw up the lacings and close the butts of the belt, as in Fig. 6.—American Miller.

QUESTIONS ON STEAM ENGINE OPERATION.

A writer in Modern Machinery asks the following questions: 1. How shall I proceed in order to equalize the load on the two pistons of my compound engine, 16 and 30 inches in diameter respectively? At present the high pressure piston does much more work than the low pressure and I wish to remedy the evil. 2. What is meant by re-evaporation in the cylinder of a steam engine? 3. Is it a source of gain or loss in economy? 4. How can it be prevented?

The answers given are as follows: 1. If you have an adjustable cut-off on your low pressure valve gear, shorten up the point of cut-off. This will increase the back pressure on the high-pressure piston, and raise the initial pressure on the low pressure, thus giving more expansion and a better distribution of the steam. If you have no cut-off on the low pressure valve-gear, or if it is not adjustable and you cannot have it made so, lower your boiler pressure and carefully note the effect. This will raise the terminal pressure in the high pressure cylinder, and send more steam to the low pressure? 2. There is always more or less water in the cylinder when running, either from a boiler that furnishes wet steam, from a steam pipe that is not well protected, or on account of initial condensation. After the cut-off has taken place the pressure falls rapidly, and if it is very low near the end of the stroke it so reduces the boiling point that the heat in the walls of the cylinder causes it to evaporate into steam again, but too late to be of any service? 3. It is a source of loss, because it takes heat from the cylinder without producing steam in time to be of value. The result is that when another charge is admitted, some of it is condensed, and this loss frequently is heavy, although often unsuspected by engineers. 4. Measures should be taken to furnish the cylinder with dry steam, it should be well lagged to prevent condensation, and as the pressure cannot fall too low unless the load is light and the cut-off short accordingly, the boiler pressure should be reduced until the terminal pressure is raised. If this is not practical on account of the necessity of maintaining a high pressure for other purposes, a reducing valve may be placed in the steam pipe. These changes will also increase the economy by reducing the loss from other sources.

The District Assembly No. 18, Knights of Labor, Montreal, at a recent meeting, discussed the advisability of petitioning the government to appoint experts to examine electrical plants, it being claimed that accidents resulting in loss of life and limb had taken place through the neglect of the government in not appointing an inspector for this purpose.

ENGINEERING NOTES.

The temperature of water in a boiler is the same as the temperature of the steam. Water cannot be heated higher than 212 degrees in the open air because it evaporates at that point; but in a closed vessel such as a boiler where there is pressure this tends to retard the boiling and the temperature of the water is always the same as that of steam.

WATER HAMMER.—If steam be admitted at the top of a vessel partially filled with cold water, condensation will take place until the surface is somewhat heated, and this, in connection with a cloud which forms above the surface, will retard rapid condensation, so that in due time the full steam pressure can be maintained above water cold at the bottom. This phenomenon is not an infrequent occurrence in boilers in which the circulation is defective. It is therefore perfectly safe to heat up any vessels containing cold water, if the steam can be admitted from the top upon the surface of the water and so maintained.

OIL TESTING.—A home-made oil tester for a shop consists of a shaft and balls with a shell between. The whole rests in half bearings, around which is put an iron strap, the tension being regulated by a set-bolt. The balls run in grooves. To test, apply the oil, run the shaft and if the bearing gives signs, upon cooling, that the lubricating oil is gumming, it is an indication that resins of similar body-giving substance have been used. Resin oil, if properly distilled, does not produce this clogging. These bearings form pretty good oil testers, and they are sometimes found where they will generate heat with one oil and not with another. Such a bearing will determine the special merits of a machine oil.

BELTING.—The ultimate strength of ordniary bark-tanned single leather belting varies from 3000 to 5000 pounds per square inch of cross section. The thickness of single belting varies from 3/16 inch to 5/16 inch, and from 3/8 to 5/8 inch for double belting, and by taking the mean thickness we get the breaking stresses from 750 to 1250 pounds per inch of width for single belts and 1500 to 2500 pounds for double belts. The safe working tension should never exceed one-fifth of the strength of the joint, which is about one-third the above values. From this we find that by taking 1/5 of 1/3 of the breaking stress, or 1/15, the working tensions are, for single belting, 50 to 80 pounds, and for double belting, 100 to 160 pounds. Belts will run with the minimum of attention for many years, if the tensions do not exceed 50 pounds for single and 80 pounds for double belts per inch of width.—From "Smokeless Heat," by General Engineering Company.

"Orillia," writing to Power, asks: What size wire should be used for field magnet coils and armature of a four-pole dynamo of a capacity of two or three 16-candle power lamps at 107 volts, and what size should the armature be? The answer given is as follows: A dynamo of two or three incandescent lamps capacity is not a practical machine. Machines of that size cost almost as much to build as a machine which will maintain eight or ten lamps. The smallest sized machine to be used as a dynamo that we would recommend would be one which would as a motor have a capacity of one-half horse power. Run as a dynamo such a machine would have an output of about seven lamps. The wire to be used on the armature would be No. 21 B. & S. gauge. The size of wire on the field would depend entirely upon the design of the machine, shape of the frame, dimensions and so on. A machine of ordinary design would probably require No. 24 or 25 wire in the field coils, but this is of course a mere hazard. The armature of such a machine should be about 3½ inches in diameter and 3½ inches long.

HIGH EFFICIENCY INCANDESCENT LAMP.

SOME time ago the startling news was published that Maxim, one of the pioneers in the invention of the incandescent lamp, had succeeded in improving the lamp so that there would be a saving of 25 per cent. in the number of watts required per candle. It now appears from London "Lightning" that not only has this efficiency been reached, but even exceeded, and that a factory for making these lamps at a rate of 6,000 a day the largest factory of the kind in England is in course of construction. The consumption of energy of these lamps is said to be only 2.8 to 3.0 watts per candle, as compared with 4 to 4.5 watts in the usual lamps. No further information is given at present, but more is promised soon.

It is rumored that negotiations are under way looking to the extension of the electric street railway at Moncton, N.B.

EXHIBITS AT TORONTO INDUSTRIAL FAIR.

NOTWITHSTANDING that manufacturers are far behind with orders, the exhibit this year in the Machinery Hall of the Toronto Industrial Exhibition was quite up to the average. A number of manufacturers of electrical and steam apparatus were represented, reference to whose exhibits will be found below. The Canadian General Electric Company welcomed many a visitor for the last time to their show-rooms on Front street, the company having since removed to new offices, fitted specially for their purposes, at No. 14 and 16 King street east.

Entering the Machinery Hall from the east, we found the Royal Electric Company occupying a large space. Their exhibit was made very attractive by several hundred incandescent lights arranged in festoons near the ceiling over the company's exhibit. In a space about 50 x 40 feet there were displayed several S.K.C. dynamos, a complete line of direct current motors and S.K.C. alternating current motors, car motors and controllers, transformers, arc and incandescent lamps, lightning arrestors, switches and volt meters, and, in fact, everything necessary for a most complete central station, whether for railway, lighting or power purposes. The exhibit was much admired by visitors generally, and was of great interest to persons connected with the electrical industry.

A 30 h.p. engine of the regular side crank type was exhibited by the Robb Engineering Company, of Amherst, N. S. It was direct connected to one of the United Electric Co's dynamos. The diameter of the engine cylinder was given as 8", stroke 10", and speed 325 revolutions per minute.

The exhibit of the United Electric Company, of Toronto, consisted of one 45 k.w. inductor alternator, built for Bedford, Que., and one direct current, direct driven multipolar dynamo, driven by a Robb engine, built for the McLachlan Carriage Co., of Oshawa. There were also several steel multipolar motors of the enclosed type, designed for direct connection to all classes of machines and mechanical tools. Besides the above, there were shown arc lamps for direct and alternating circuits, arc dynamos, bipolar motors, transformers, etc.

In the Machinery Hall the Goldie & McCulloch Co., Limited, of Galt, Ont., were among the largest exhibitors. Their machinery included one large "Wheelock" engine, which, by the way, was sold to the Toronto Fair Association, and one 10 x 10 and one 12 x 12 Ideal high speed engine. These latter are of handsome design and finish, very compact and take up very little room, and are suited for either direct connection or belted drive dynamo. Their four gas and gasoline engines attracted much attention, one of these being directly connected to a triple pump. These engines are meeting with a large sale. There was also exhibited a number of wood-working pulleys and wood split pulleys and a gyrator, this latter being a flour milling machine of which this firm is the sole Canadian maker. Altogether, this exhibit was greatly admired by machinery men visiting the exhibition.

A display of gas and gasoline engines was made by the Northey Manufacturing Company, of Toronto. The little "Northey Junior" gasoline engine attracted much attention, it being adapted for the lighter work about a farm, etc. A 5 h.p. horizontal gasoline engine was used to run a Fleury 10 inch plate grinder, and during the Fair repeatedly ground 40 bushels of oats per hour, which is regarded as a good performance. This engine was not using its full power at any time when running the grinder, as it was also used for operating a feed cutter with pneumatic elevator, and did the work put upon it with great ease and regularity. Then there were 3 h.p. and 12 h.p. engines. The latter was operating one of the Northey Co.'s large triplex pumping engines, thus affording a good example of what a modern waterworks plant might be. The engine and pump together were shown to be extremely compact, and the absence of firing, handling of coal, smoke, dirt and ashes were very noticeable. These engines are also used for running dynamos direct for the lighting of gentlemen's residences and for other isolated plants. The manufacturers claim that they are the only engines built in Canada which will do direct work on a dynamo successfully, others having to use a storage battery between engine and lights.

The exhibit of the Electrical Construction Company, of London, was very instructive to those interested in the important details of construction of electrical apparatus, they having the parts of machines on exhibition showing the detail of construction and high class workmanship of their apparatus. Their slow speed motor, 12 h.p., running at 250 r.p.m., showed to advantage the adaptability of their motors for direct connection to printing presses and other slow speed machinery under direct electric control of the operator. Their 300-light dynamo, at 500 r.p.m., introduced a class of machines which, owing to their slow speed, cool and sparkless operation, bring forward to particular prominence the life of the dynamo, which is claimed to be almost without limit under these conditions.

TELEGRAPH and TELEPHONE

WIRELESS TELEGRAPHY FOR MARINE PURPOSES.

Mr. F. A. Hamilton, M.I.E.E., M.Can.Soc.C.E., contributes to the Halifax Echo a long letter on the value of wireless telegraphy for naval, military and shipping purposes, and more particularly in connection with the marine interests of the world. Concerning its employment in the latter sphere he says:

"Without soaring in imaginative flight to the realms of speculation and rambling conjecture, let us at once proceed to consider, in a matter-of-fact way, the actual work which this young and promising ariel has accomplished, and what he is ready and eager to perform at the present moment. By means of this messenger a moving object can be kept in telegraphic communication with any other moving object or a fixed station. A ship fitted with the apparatus cannot only keep in telegraphic communication with the shore up to any reasonable distance it has been long since thoroughly tested up to over 30 miles off the shore but ships can also, if thoroughly equipped, be warned of approaching danger or their proximity to dangerous coasts where the signalling appliances are placed. Fog, rain, snow and wind in no way impair the efficiency of this system of telegraphy, and herein lies its especial value for marine signalling."

Mr. Hamilton then takes as an example the case of an ocean steamer bound from a home port to one on our own shores, and shows how, having put to sea under conditions of drizzly weather and freshening wind, she can, by means of the telegraph system, communicate with passing ships and, if need be, give to an incoming vessel the bearing of and distance of the lighthouse or headland she has left behind her.

As showing the field for the employment of wireless telegraphy off the Atlantic seaboard of Nova Scotia, Mr. Hamilton says: "Between Seal Island and Cape Race there are several important lighthouses including those on Sable Island which might, with very great advantage to shipping, be provided with the means of signalling to a distance of thirty miles, or a less distance if desirable; and likewise on the Labrador coast, in the Straits of Belle Isle and in the Gulf of St. Lawrence, where navigation is at times both difficult and dangerous. The establishment of such facilities would be a boon to commerce and a credit to the country, to say nothing of the possibility of its being made a source of revenue, or at any rate self-supporting. There are, of course, details to be considered in connection with such a scheme, such as making some stations signal stations only that is to say, they would simply and automatically signal their number or designation whilst other stations would be equipped for telegraphic communication. Then, again, it might be necessary in some instances to project the signals over a prescribed number of degrees, as, for instance, near the approaches to a harbor, in which case two stations might emit signals over a certain arc, so as to render it possible for a vessel to get a cross-bearing and establish her position."

Then Mr. Hamilton concludes: "The system has been in practical use in the Italian navy for over two years, and for several months has been the means of communication between the South Goodwin lightship and the South Foreland lighthouse, in the Straits of Dover. Telegraphic messages have been exchanged between stations on the coasts of England and France, and communication with passing vessels established. An interesting feature in the experiments is the facility with which Mr. Marconi succeeds in cutting out a third station so that it cannot interfere with the other two. The advances made in the application of wireless telegraphy to practical work have been such as to justify the belief that it will become a sine qua non to every coast and to all classes of vessels, whether on the ocean or in the great lakes."

Mr. H. W. Kent, general superintendent of the New Westminster & Burrard Inlet Telephone Co., is at present on a visit to his home in Peterboro, Ont. It is Mr. Kent's intention to visit Chicago, Cleveland, Toronto, Montreal and other cities for the purpose of inspecting the latest telephone switch-boards and appliances in existence, with a view to adopting the most improved system in the Vancouver Exchange. At present there are on the Vancouver Exchange over 800 subscribers, and the business has grown to such an extent that a switch-board of increased capacity has become a necessity.

SHORT CIRCUITS.

Mr. B. H. Turner will probably introduce a local telephone system at Manitowaning, Ont.

The Hudson Bay Co. are about to establish telephone connection from Fort Smith to Smith Landing, a distance of 160 miles on the Great Slave river.

The Department of Public Works at Ottawa invites tenders up to October 5th for the supply of 165 tons of galvanized iron telegraph wire for the Lake Bennett-Dawson line.

Mr. E. A. Dempster, chief clerk in the Great North-Western Telegraph Company's office at Hamilton, has been moved to Fort William, to accept a responsible position with the Canadian Pacific Railway Company.

The Columbia Telephone & Telegraph Co. is about to construct 50 miles of private telephone lines, extending from Grand Forks, B. C., to the various mines in the vicinity. An order has been given by Mr. J. P. Graves.

Ora P. King, Fred Bonnell, D. H. McNuit and R. B. Harmer are seeking incorporation as the Sussex and Hammond Telephone Co. They purpose erecting a telephone line this fall from Sussex to Jeffries' Corner, N. B., and will extend it to other points later on.

The Bell Telephone Company are making a number of extensions and improvements to their lines along the south shore of the St. Lawrence. Underground conduits have been laid as far as the Victoria Bridge, Montreal, and it is expected to have the line to St. Lambert completed in a short time.

The Dominion government has just let the contract to X. Gendreau, of Quebec, for the extension of the telegraph system from Big Roumaine, Que., to Chateau Bay, Labrador, opposite Belle Isle. The length of line to be constructed is 315 miles. The poles will be supplied by C. J. Bickerdike, of Montreal.

The annual general meeting of the shareholders of the Great Northwestern Telegraph Company was held at the head office in Toronto on September 27th. The old Board of Directors and officers were re-elected, viz: President, H. P. Dwight, Toronto; vice-president, Adam Brown, Hamilton; directors, H. N. Baird, James Hedley, A. S. Irving, W. C. Matthews, Toronto; Richard Fuller, Hamilton; Hon. Wm. McDougall, Ottawa, and Chas. A. Tinker, New York; secretary and auditor, Geo. D. Perry; treasurer, Arthur Cox. The financial statements presented showed a marked improvement in the revenue of the company over the previous year, and it was stated that the outlook for the coming year was still more hopeful.

Mr. M. T. Quigley, manager of the C.P.R. telegraph office a Vancover, B. C., is authority for the statement that his company has made arrangements with the Dominion government for connection with the line now being built in the Yukon district. The system to be be adopted will be that of sending merchants' filing messages in the Vancouver offices of the companies doing business there, the latter to transmit them by special arrangements on all steamers going north. The idea is to have packages of messages go, say, every other day from Vancouver. At Skagway they will be placed upon the line to Bennett, and at the latter place will be transmitted to the line being built by the Dominion government and forwarded to Dawson.

Mr. Chas. Park has been engaged as teacher in Electricity and Steam Engineering at the Toronto Technical School. Mr. Park was one of the four students who took the electrical course at the School of Practical Science, Toronto, in the first year after its establishment. Under his direction it is expected that the electrical and steam engineering courses at the Technical School will become even more efficient than in the past.

Messrs. McManus Howe & McManus, Sydney, C. B., are installing for the Nova Scotia Steel & Iron Company, a complete electric lighting plant, consisting of one 75 k. w. S.K.C. two phase generator and a complete equipment of 60 alternating current enclosed arc lamps. This, we believe, is the first installation in Canada where an alternating current generator has its capacity entirely taken up with arc lamps alone, and speaks well for the future of alternating current arc lamps and also of the progress being made along these lines. The entire plant was furnished by the Royal Electric Co., of Montreal.

TRADE NOTES.

The Robb Engineering Co., Amherst, N. S., are supplying the town of Neepawa, Man., with a steam plant for their new electric lighting system—a 100 h.p. compound engine and two 75 h.p. Mumford improved boilers.

The corporation of the city of Winnipeg, through its Water and Light Commissioners, have awarded the contract for their incandescent electric lighting plant to the Royal Electric Co., of Montreal, the plant to consist of a 60 k.w. S.K.C. two phase alternating generator, with the necessary transformers, etc. The order for the arc apparatus was placed with the Western Electric Co., of Chicago.

Over five thousand letter carriers visited Scranton, Pa.., on Labor Day, and took part in a parade which preceded the business session of the tenth annual convention of the National Association of Letter Carriers. In honor of the occasion, the business houses of the city were handsomely decorated and electrical devices were freely used. The International Correspondence Schools had a large monogram, I. C. S., with letters composed of red, white and blue incandescent lamps, in front of their building, making a very fine display. This institution has over one hundred thousand students, and as its mail is handled by carriers in all parts of the country, they were much interested in inspecting the home office at Scranton. A constant stream of visitors went through the building and on Friday evening an informal reception was given the letter carriers. Hundreds of them visited the building and saw how the work of the largest school in the world is conducted. The instructors, text book writers, correspondents, bookkeepers and other employees were at their desks, and the printing department was also in operation. Over 500 people are employed in the building, which is one of the finest in the city, having been erected especially for the International Correspondence Schools at a cost of $250,000.

The United Electric Company, Limited, of Toronto, have been rushed with orders recently, necessitating the operation of their factory 13 hours per day for the last two months. The following are some of the recent sales of their apparatus: R. E. T. Pringle, Montreal, two 6 h.p., two 8 h.p., and one 2 h.p. motors; J. & G. H. Young, Montreal, one 6 h.p. motor; Dominion Bridge Co., Montreal, two 10 h.p. motors; Kootenay Electrical & Construction Co., Nelson, B. C., 10 k.w. generator direct connected; McEachern Heating & Ventilating Co., Galt, one 5 h.p. motor; McGregor & McIntyre, Toronto, one 8 h.p. motor; John Turner & Sons, Toronto, one 10 h.p. motor; B. V. Naylor, Nayor, Que., 5 k.w. dynamo; Bourque & Poulin, Ottawa, one 12 h.p. motor; Auburn Power Co., Peterboro, one 4 h.p. motor; Darling Bros., Montreal, one 6 h.p. and one 8 h.p. motors; Toronto Lithographing Co., Toronto, one 8 h.p. motor; Royal Mfg. Co., Toronto, one 10 h.p. motor; Crompton Corset Co., Toronto, one 6 h.p. motor; E. S. Stephenson, St. John, N. B., one 2 h.p., one 5 h.p., and one 4 h.p. motors; Rat Portage Lumber Co., Rat Portage, one 15 k.w. dynamo; Alex. Dobson, Beaverton, Ont., one 4 h.p. motor; J. W. Skinner, Mitchell, Ont., a 60 light dynamo; Goderich Organ Co., Goderich, a 100 light dynamo; Dominion Bridge Co., Montreal, 25 arc lamps; C. T. Young, Beaverton, one 2 h.p. motor; Miller Bros. & Toms, Montreal, two 8 h.p. motors; Northey Mfg. Co., Toronto, one 4 h.p. motor.

SPARKS.

Mr. Edward Campbell, electrician, of Toronto, died in St. Michael's hospital recently.

The ratepayers of Weston, Ont, have voted in favor of installing an electric plant, at a cost to the municipality of $7,000.

The Nova Scotia Electric Light Co., which purposes supplying light and power on a somewhat extensive scale, have engaged an engineer to report on various water powers. Their options include the head waters of the Gaspereau river and the Currell brook at Bridgetown. Mr. J. W. Beckwith, of Bridgetown, N. S., is interested.

Mr. F. A. Cheney, of St. Catharines, states that arrangements are completed for the extension of the road to Port Dalhousie, and an effort will be made to convert the existing twelve miles of road into an electric line this fall. It is expected that the passenger service will be run by electricity this fall, but the freight business will be operated by means of steam until next spring.

Again the council of the city of Ottawa are discussing municipal ownership of the electric plant for civic lighting. Two companies have now to be dealt with, the Ottawa Electric Company and the Metropolitan Company, the works of the latter being only under construction. The Ottawa Company has named the following figures as the value af their assets: Capital stock, fully paid up, $;65,800; debentures, bearing interest at 5 per cent., $320,000; accounts owing, bills payable, etc., $155,940.41; total, $1,241,740.41. The general opinion is that municipal control of electric lighting in Ottawa is yet far distant.

MOONLIGHT SCHEDULE FOR OCTOBER.

Day of Month.	Light.	Extinguish.	No. of Hours.
—	H.M.	H.M.	H.M.
1....	P.M. 6.10	A.M. 3.50	9.40
2....	" 6.10	" 4.50	10.40
3....	" 6.10	" 5.00	10.50
4....	" 6.10	" 5.00	10.50
5....	" 6.10	" 5.00	10.50
6....	" 6.10	" 5.00	10.50
7....	" 6.10	" 5.00	10.50
8....	" 6.30	" 5.00	10.30
9....	" 7.30	" 5.00	9.30
10....	" 8.30	" 5.00	8.30
11....	" 9.40	" 5.10	7.30
12....	" 10.40	" 5.10	6.30
13....	" 11.00	" 5.10	6.10
14....	".....	" 5.10	5.10
15....	A.M. 12.00	.....	
16....	" 1.10	" 5.10	4.00
17....	" 2.20	" 5.10	2.50
18....	No Light.	No Light.	.....
19....	No Light.	No Light.	.....
20....	No Light.	No Light.	.....
21....	P.M. 5.40	P.M. 8.00	2.20
22....	" 5.40	" 8.50	3.10
23....	" 5.40	" 9.50	4.10
24....	" 5.40	" 10.50	5.10
25....	" 5.40	" 11.50	6.10
26....	" 5.30	A.M. 12.50	7.20
27....	" 5.30	" 1.00	7.30
28....	" 5.30	" 1.50	8.20
29....	" 5.30	" 2.40	9.10
30....	" 5.30	" 3.40	10.10
31....	" 5.30	" 4.40	11.10
		Total.....	209.50

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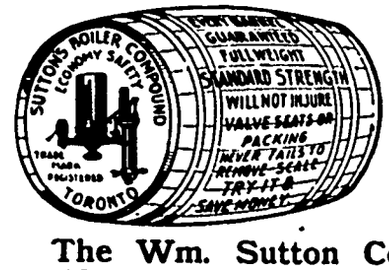

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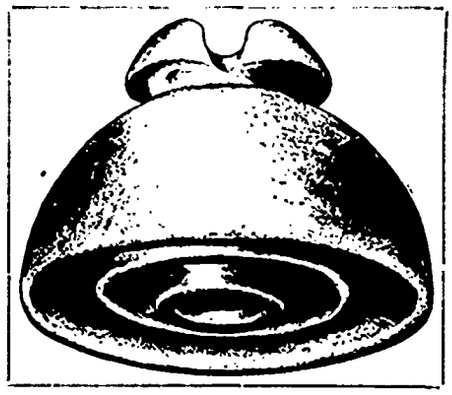

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Address all Correspondence to—

C. L. Knowles

General Agent, 7 ARCH STREET, BOSTON, MASS.

SPARKS.

The electric light commissioners of Thorold, Ont., have been empowered to purchase a transformer.

The Coaticook Electric Light & Power Company, of Coaticook, Que., is now at work on a new power house on the old beet factory site.

Little Dorothy (greatly surprised at seeing a horseless carriage go by), "My, there's a carriage that's walking in its sleep!" Youth's Companion.

Mr. John E. Wilson, city electrican of St. John, N.B., has recommended improvements to the fire alarm system, at an estimated cost of $7,000.

A stationary engineers' association has been organized at Regina, N. W. T. Geo. Cook is president, T. S. Hiscox secretary, and P. Gilchrist treasurer.

The present contract for electric lighting in Midland, Ont., expires at the end of this year, and the question of renewal will be taken up at an early council meeting.

The Kay Electric Company, Hamilton, is about to be wound up. At a recent meeting of creditors the assets were shown to be $2,312.24 and the liabilities $1,721.03.

"I wish to see some of the current magazines, please." "Current magazines? Certainly. John, show this lady the Electric Spark and the Storage Battery. Ex.

The Stratford Electric Light Company are erecting a smoke stack 100 feet high and 14 feet at the base. It is not improbable that another boiler will be installed in the near future.

The Ottawa Power Company has been formed, with a capitalization of $250,000. The members thereof are W. C. Perkins, A. W. Fraser, M. C. Edey, J. R. Armstrong and John Fraser.

Wm. Brown McLean, B. A. Sc., of McGill University, Montreal, has been awarded a science research scholarship of £150 a year, tenable for two years, by the London Exhibition of 1851.

The J. H. Ashdown Mfg. Company, of Winnipeg, have purchased from the Electrical Construction Company, of London, Ont., one of their 500 volt, slow speed, multipolar 10 h.p. motors.

Thomas Hocking, F. W. Drake, John Henry McIntyre, Wm. McLandress and J. B. Crawford, of Dutton, Ont., have been incorporated as the Dutton Electric Light Company, with a capital of $15,000.

The Cataract Power Company have made a proposition to the council of Hamilton to operate the sewage interception works by electricity. Another offer has also been made to pump the city's water supply.

Mr. Geo. C. Robb, inspector for the Boiler Inspection and Insurance Company, of Toronto, has inspected the boilers in the various fire stations in the city of Ottawa, and has recommended that some of them be replaced by new boilers.

The Sturgeon Falls Pulp Co., of Sturgeon Falls, Ont., has asked the town for another bonus of $12,000, in return for which they agree, among other things, to renew the electric lighting contract for a term of 21 years, and to install a telephone system.

The Electrical Construction Company, of London, Ont., have recently closed with the E. Girardot Wine Company, of Sandwich, Ont., for a new 6 h.p. motor. This company have had one of the same motors for the last five years, and express themselves eminently satified with it.

The Brantford Electric & Operating Company, Brantford, Ont., are rapidly increasing their power business. The Keys, Somerville Printing Co. have installed a 3 h.p., two phase S.K.C. induction motor with which to operate their new printing presses. This is the second printing establishment that has put in alternating motors.

The Electrical Construction Company, of London, Ont., in their recent deal with the Winnipeg Street Railway Company for the exchanging of 500 volt motors for the 250 volt system previously in operation there, will have in the course of a few days 80 second hand motors of all sizes, which they will be able to place on the market at very reasonable figures.

The Electric Maintenance and Construction Co., of Toronto, Limited, advise us that they are extremely busy with contracts outside of house wiring and the Orillia contract. They have several large jobs on hand, including the contract for the entire installation of the electric lighting plant for the Gerhard Heintzman Piano Co., Toronto, this being a plant of 250 lights, with 20 k.w. generator, switchboard, etc., complete. It is proposed to use a Canadian General Electric dynamo.

The St. Catharines Cold Storage & Forwarding Co., Limited, are replacing their direct current power service in use in their warehouse with a 15 h.p., two phase S.K.C. induction motor. The current for this machine is supplied by the St. Catharines Electric Light & Power Co., who have recently installed in their power house a 200 kilowatt two phase S.K.C. generator for both lighting and power purposes.

Messrs. Brewder & McNaghton, contractors for the power canal of the Metropolitan Electric Company of Ottawa, have thrown up the contract, for the reason, it is said, that they tendered too low. It is the intention of the directors of the Metropolitan Company to complete the work themselves, a large number of men being now at work, under the direction of the chief engineer, Mr. Aylen.

The Electrician, of London, Eng., publishes a short description of the Desaymar lamp. The principle of it is that the filament is wound in the form of a coil around a specially prepared cylinder of a body which is brought to incandescence, apparently from the heat of the filament. The lamp is said to be brighter, and it is claimed that only half the energy is required to produce the same candle power, the saving therefore being about 50 per cent.

The Demarara Electric Company has been organized in Montreal, for the purpose of doing business in Demarara, West Indies. The franchises of the British Guina Light & Power Company and the Georgetown Tramway Company have been secured, and it is proposed to convert the latter system into an electric road. Engineers have completed the surveys. Messrs. W. B. Chapman, James Hutchison and B. V. Pearson are the provisional directors of the company.

At a recent meeting of the Vancouver city council, a letter was read from the secretary of the Board of Fire Underwriters, stating that that body had appointed Mr. A. K. Snelling to the position of electric wiring inspector, vice Mr. McMicking, resigned. The letter embodied a request that the council pass a by-law enforcing the inspection of electric wiring, the Board of Fire Underwriters to pay the inspector by fees, and the wiring to be done satisfactorily to that official. This was agreed to by the council.

At the last meeting of the council of Greenwood, B. C., the question of the extension of the electric light franchise was considered. Messrs. W. A. Campbell and J. McGregor have an option on the Boundary Falls for power purposes and the electric light franchise for the city. The latter expires on October 15th, and unless a steam plant is put in to generate power, it was stated that it would be impossible to complete the deal. The promoters agreed to put in a steam plant at once, although in a couple of months they expect to have their water power in operation.

A fatal accident occurred at Sherbrooke, Que., when a lineman named Benoit, employed by the Sherbrooke Gas & Water Company, was killed by coming in contact with a live wire. Another man named King was also rendered unconscious, but he will recover. The men in question were about to put up a lamp. They proceeded to lower the brace to which the lamp was attached, and not having a crank handy to work the small windlass on the pole, Benoit and King took hold of the windlass wire rope so as to undo the "dog." The former had both his hands on the wire, while King only used his right hand. Immediately King cried out, but so strong was the current that Benoit never spoke, and before assistance arrived he was dead, having received a current of 2,000 volts. His hands were burned to the bone, and the side of his face was badly scorched through coming in contact with the wire, in his struggle to free himself.

The Parry Sound Electric Light Co. held its annual meeting last month. The election of directors resulted as follows: S. Armstrong, J. F. Mosely, W. B. W. Armstrong, E. J. Vincent, Dr. Walton, Rev. W. Evans and John Clark. Mr. E. Pirie moved, seconded by J. F. Mosely, and carried unanimously, that we, the shareholders in the Parry Sound Electric Co., Limited, at the annual meeting assembled, desire to place on record the esteem in which we have always held our retiring manager and secretary-treasurer, Mr. W. B. W. Armstrong, and to express our confidence in his integrity and ability which he has so steadily displayed in the conduct and management of the company's affairs; and while we regret exceedingly that Mr. Armstrong has decided to sever his connection with this company, we heartily wish him every success in the profession he has decided to enter. The directors have elected Dr. Thos. S. Walton president; E. J. Vincent vice-president; J. H. Knifton auditor; and J. W. Easton secretary-treasurer and manager.

THE ELECTRIC PLANT OF THE MONTREAL COTTON COMPANY.

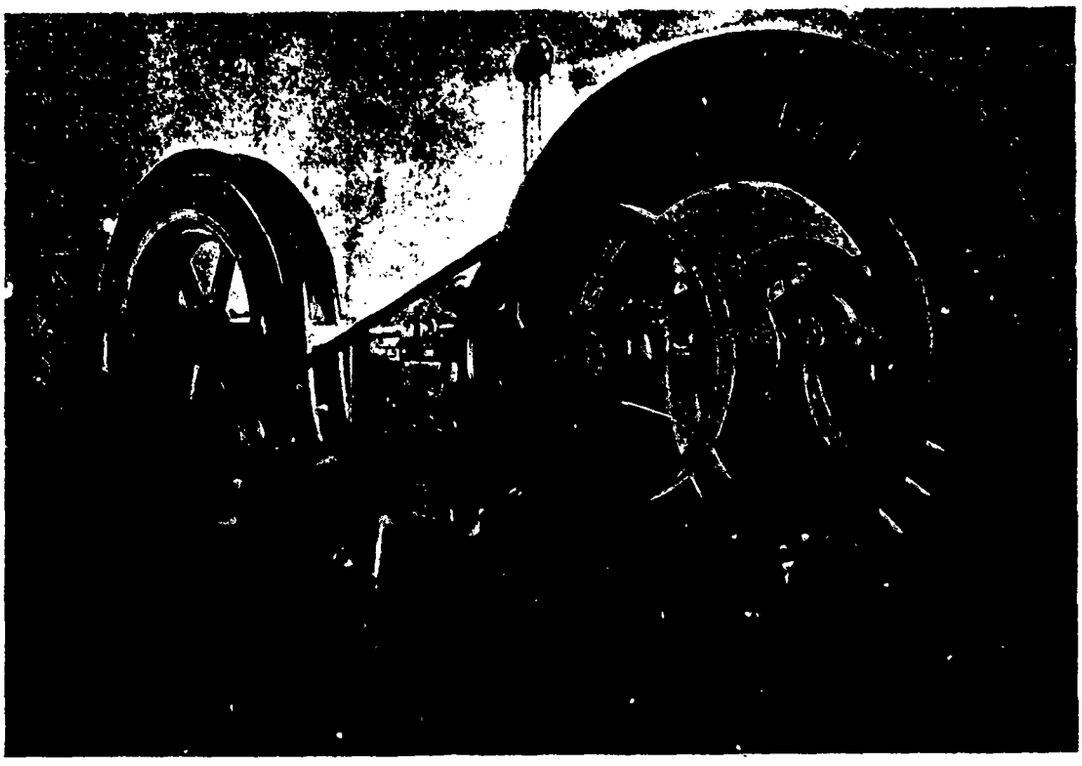
VISIT OF INSPECTION BY THE NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION.

On October 5th and 6th the New England Cotton Manufacturers' Association assembled in convention at the Windsor Hotel in the city of Montreal. The forenoon of the second day was devoted to a trip to Valleyfield, upon invitation of the General Electric Company, of Schenectady, N.Y., the Canadian General Electric Company, of Toronto and Peterboro, and the Montreal Cotton Company, to inspect the extensive works of the latter company. The main object of the visit, however, was to view the magnificent power house and to witness the application of electric power for cotton manufacturing purposes.

A representative of the ELECTRICAL NEWS accompanied the party. At 9:00 o'clock a special train of five coaches, furnished by courtesy of the above named electric companies, pulled out of Bonaventure station, and about one hour and a half later the town of Valleyfield, some forty miles from Montreal, was reached. Going direct to the power house, the party was taken charge of by representatives of the General Electric Company and the Canadian General Electric Company, who explained the points of interest concerning the electric plant. Not a few of the cotton manufacturers from the Eastern States expressed surprise at the extensive character, efficiency and economy of operation of the plant, which is one of the most complete in every respect in Canada.

This plant was described in the ELECTRICAL NEWS of March, 1897, but since then important additions have been made, the total capacity of the power house being now taken up. Introductory to some brief details of the electric plant, and to give an understanding of the industrial application of the power, it might be stated that the works of the Montreal Cotton Company comprise eight large buildings, none less than three storeys in height and some reaching five storeys. The works are situated on Lake St. Francis, an expansion of the St. Lawrence, on a canal about twelve miles long, excavated by the Dominion government, a dam being constructed between an island and the mainland to maintain a sufficient supply of water in the canal. At this dam a head of fifteen feet at high water and eleven feet at low water is obtainable. For the cotton mills a head race has been excavated 1,000 feet long and tapering from 230 feet at the entrance to 165 feet wide at the exit, the walls being constructed of concrete faced with cement. By the arrangement of the head race the formation of anchor ice has been avoided.

In the power house, a substantial stone structure, 100 x 55 feet, with solid concrete foundation, there are two wheel-pits, each containing four McCormack 60 inch vertical turbines, making eight in all, built by the S. Morgan Smith Company, of York, Pa., each capable of developing 268 h.p. at 68 revolutions per minute under a 13 feet head. The turbines are directly coupled to four separate jack shafts, two wheels to each, placed in two rows extending the entire length of the power house. The wheels are governed by a Replogle's relay governor belted to each jack shaft.



MONTREAL COTTON COMPANY'S ELECTRIC PLANT.—TWO OF THE 400 K. W. GENERATORS.

THE ELECTRICAL EQUIPMENT.

Directly connected to four jack shafts are four generators of a capacity of 400 kilowatts at 600 volts, of the Canadian General Electric Company's well known three-phase 60-cyle alternating current type. Two of these generators are shown in the accompanying illustration, although it might be erroneously inferred from the illustration that the generators are not parallel in size. For field excitation two 4-pole 17 k.w. machines are belt connected to two of the four generator shafts.

The current is applied directly to the motors without the inter-

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RECENT PLANTS INSTALLED:—Lachine Rapids Hydraulic & Land Co., Montreal, Que., 12,000 h.p.; Chambly Manufacturing Co., Montreal, Que., 20,000 h.p.; West Kootenay Power & Light Co., Rossland, B.C., 3,000 h.p.; Dolgeville Electric Light & Power Co., Dolgeville, N.Y.; Honk Falls Power Co., Ellenville, N.Y., Hudson River Power Transmission Co., Mechanicsville, N.Y.; Cataract Power Co., Hamilton, Ont.

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position of transformers, and up to date there are about forty of these in use in sizes from 30 to 200 horse power, with several more in process of manufacture. The motors are of the induction type, self starting under all conditions of load, and without collector rings or brushes. At present about 2,300 horse power is utilized to drive electric motors and supply arc and incandescent lighting in all parts of the works. The majority of the motors, excepting those greater than 75 h.p., are suspended from the ceiling on solid supports, thus economizing floor space, and are belted to line shafting, doing away with the long belt drives previously necessary.

In a new mill just completed all the machinery will be operated by induction motors ranging in size up to 250 h.p.

SWITCHBOARD.

In one end of the power house is situated the switchboard, of which a view is shown. It consists of ten white marble panels mounted on an angle iron frame. The two outer panels at each end are the machines panels, each containing the necessary instruments and switches for operating the generators. From the remaining six panels the complete installation of motors and incandescent lights are controlled. If space permitted, more might be said of the interesting features of this switchboard.

DIRECT CURRENT PLANT.

In another building is situated a direct current plant supplying a small portion of the lighting. There are seven Edison generators belt connected to a line shaft driven by a 54-inch vertical Hercules wheel, developing 165 h.p.

PROPOSED ADDITION.

Excavating was in progress for a large extension to the main power house, and it was learned that it is the intention to install two 1200 kilowatt Canadian General Electric three phase generators similar in type to those already installed. These will also be direct connected to McCormack turbines. For this increased installation the head race will be extended and two wheel pits constructed. An extension will also be built to the power house which will contain the switchboard. From this switchboard the entire installation throughout the works will be controlled.

When completed this will be one of the most extensive electric industrial installations on the continent, having a total capacity of 5,400 horse power. The complete electrical apparatus was manufactured and supplied by the Canadian General Electric Company, of Toronto, to whom great credit is due. Prominent engineers have pronounced the use of electricity as applied at the Montreal Cotton Company's works to represent the foremost progress in electrical science.

After a cursory inspection of the manufacturing plant of the company the party were invited to partake of luncheon which had been provided in an adjoining building. About 1 o'clock the train was again taken for Montreal, after the thanks of the association had been tendered to the Montreal Cotton Company

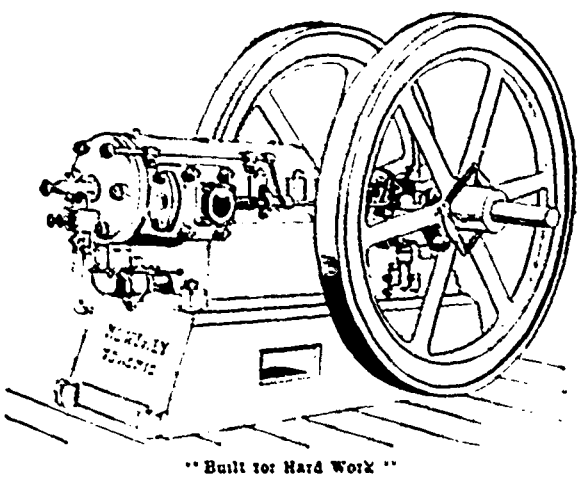
MONTREAL COTTON COMPANY'S PLANT—GENERATOR AND FEEDER PANELS.

General Electric Company and the Canadian General Electric Company.

The Standard Chemical Company, of Deseronto, Ont., have recently installed an electric lighting plant in their factories. The apparatus was supplied by the Canadian General Electric Co.

The Canadian General Electric Company are installing one of their standard 120 kilowatt single phase alternators for A. Gagnon & Co., of Victoriaville, P.Q. This is the second machine of this size and type which this company have installed during the past year.

The Toronto Branch No. 1 of the Canadian Association of Stationary Engineers will hold their Thirteenth Annual Banquet at Webb's Parlours, Yonge and Melinda streets, Wednesday evening, October 18th (Thanksgiving Eve). Tickets $1.00; for sale by Committee, A. M. Wickins (chairman), Geo. Thompson (sec.-treas.), G. C. Mooring, J. Huggett, A. Stour, H. E. Terry, and any of the members.



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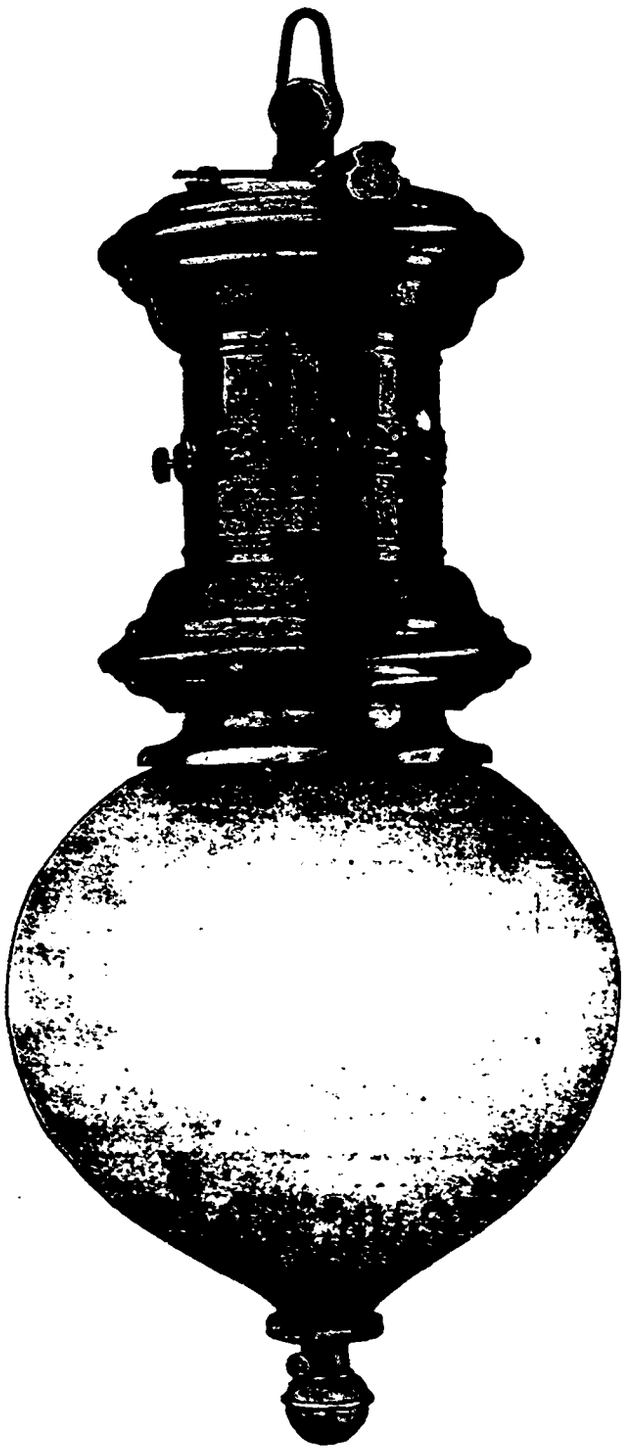

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SPARKS.

Mr. J. E. Taylor, manager of the St. Thomas street railway, has resigned and has been succeeded by J. H. Still, president of the company.

The work of preparing to utilise the Boundary Falls water power at Grand Falls, B. C., for electrical purposes has been resumed. Last fall a substantial dam was constructed above the fall, raising the water about 30 feet, added to the head available. Now a tunnel is being driven through the rock which rises sheer above the top of the falls to connect the dam with the flume which is to be built to convey the water to the power house. The tunnel will be 130 feet in length and the flume 1,800 feet, with about 1,100 feet of the latter on trestles. Mr. Francis McLean is in charge of the work. It is intended to use the electric power to be generated for lighting and power purposes, and it is probable that connection will be made with several of the mining camps in the district, so as to supply electricity for mine purposes. At the present time the Mother Lode in Deadwood camp is the only mine in the district using electricity for lighting and blast-firing.

The board of governors of the Hamilton Hospital have appointed Mr. Geo. W. Epps chief engineer.

Mr. R. Anderson, of Ottawa, has purchased a site at Arnprior for his proposed power station for the supply of electricity.

Buffalo capitalists are said to be considering the construction of an electric railway from St. Catharines to Wellandport, Ont.

The council of the town of Newcastle, N.B., is considering the installation of an electric light plant, and may engage an engineer to report on the cost.

The annual meeting of the Montreal Park & Island Railway Co. was held a fortnight ago. The statements presented show a net revenue of $42,007. The old board of directors was re-elected.

Incorporation has been granted to the Midland Power Company, Limited, of Midland, Ont., for the purpose of supplying light, heat and power. James Playfair, Geo. Chew and D. L. White, lumber merchants, are interested in the company.

Messrs. Brewder & McNaughton have issued a writ against the Metropolitan Electric Co., of Ottawa, claiming $50,000 damages for breach of contract and for wrongful deprivation of plant and other material. This is the outcome of a dispute between the contractors and the company, the result of which was that the contract for the construction of the company's works was taken from the contractors.

Mr. Ernest S. Harrison, 191 Thistle street, Winnipeg, Man., has been awarded the contract for the complete equipment of the Hudson Bay Co.'s stores in that city, consisting of one 40 k.w. dynamo direct connected to a 60 h.p. Robb-Armstrong engine, 50 arc lamps and 404 incandescent lights, together with all necessary wiring. When completed this will be one of the largest isolated plants in the west.

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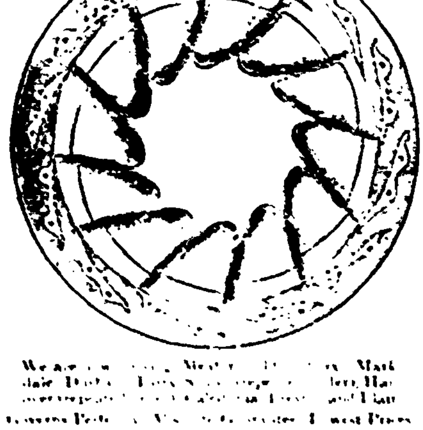

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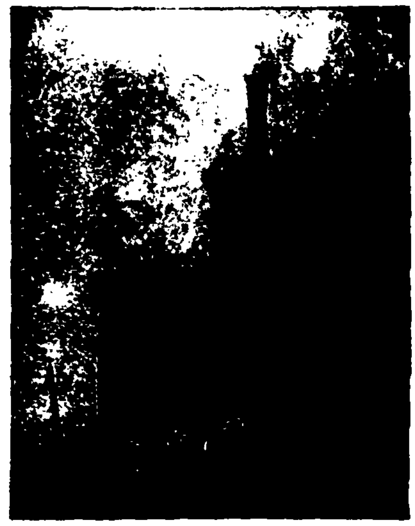

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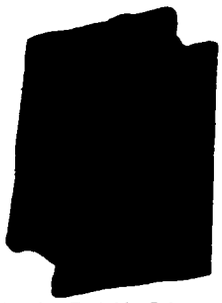

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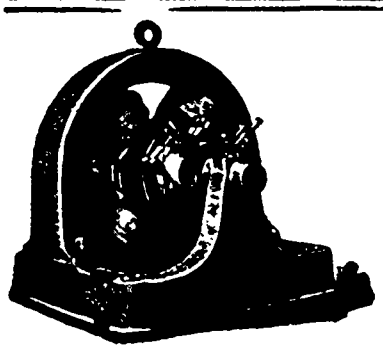

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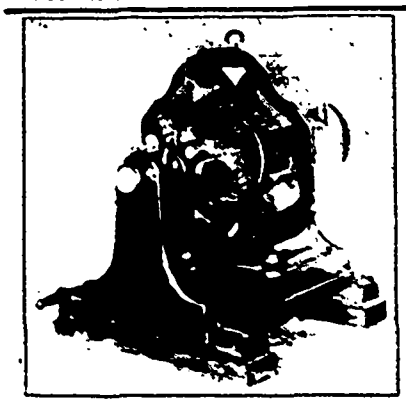

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