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CANADIAN
ELECTRICAL NEWS
AND ENGINEERING JOURNAL

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NEW SERIES, VOL. IX No.

AUGUST, 1899

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CANADIAN
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AND
ENGINEERING JOURNAL.

VOL. IX. AUGUST, 1899 No. 8.

CABLE LAYING FOR CHAMBLY TRANSMISSION LINE.

THE accompanying photographs illustrate a somewhat novel method of laying cable under unusual conditions. As may be known to the readers of the

FIG. 1.—VICTORIA JUBILEE BRIDGE, MONTREAL—VIEW LOOKING EAST.

CANADIAN ELECTRICAL NEWS, the Royal Electric Co., of Montreal, for the Chambly Manufacturing Co., have installed the electrical equipment in the power house of the hydraulic development of the Chambly Manufacturing Co. at Richelieu village, on the Richelieu river, 16 miles from Montreal. They have also erected the transmission line between the power house at Richelieu and the city of Montreal.

The hydraulic development will amount to 20,000 h.p., with a head of 28 feet. There have been installed four generators of 2,000 capacity each, so designed and wound to generate 12,000 volts, the latter voltage being the pressure at which the power will be transmitted to Montreal by means of a duplicate pole line, each line consisting of 16 copper wires of No. 00 B. & S. gauge. Before reaching Montreal, however, it is necessary to cross the St. Lawrence river, which is spanned at this point by the recently completed Victoria Jubilee bridge. This bridge, with approaches, is approximately 8,750 feet in length.

The transmission cables for this section of the line are laid in a wooden box placed on the sleepers, on a level with and four feet out from the steel rail. (See Fig. 2.) Each box is designed to contain sixteen cables.

In placing these cables, the somewhat unusual method of laying them by means of a locomotive and flat cars was used (see Fig. 4). Four flat cars were loaded with reels, each reel containing 1,000 feet of cable, and then jacked up into position, ready to pay out. The cable was paid out over a specially designed cast iron sheave 22 inches in diameter, which was carefully shrouded to avoid any injury to the lead sheath. This sheave is shown in Fig. 3, which also shows the cables, two in number, being paid out. The ends of these cables being securely lashed in position in the cable box, the locomotive and cars were then started and kept moving at the rate of about four miles an hour. The cable paid out over the cast iron sheave, ran back to the rear end of the car and over two wooden rollers, suitably placed, then dropped into the cable box on the floor of the bridge.

Two reels of cable (2,000 feet) were laid in five minutes, by actual count, and in eight hours 26,000 feet of cable was placed in position and ready for jointing. The major part of the time was consumed in loading and unloading cable reels and running backwards and forwards for laying cables. A section of the type of joint used is shown in Fig. 5. Great care had

FIG. 2.—TRANSMISSION LINE OVER VICTORIA JUBILEE BRIDGE, SHOWING BOX FOR CABLE.

to be used in making these joints on account of the high voltage of transmission. The cable was made by the Washburn & Moen Mfg. Co., of Worcester, Mass., and consists of a core of 37 tinned copper wires of a cross-section equal to No. 00 B. & S. gauge, insulated with 8-32 of rubber compound. This cable is made to withstand a test of 20,000 volts for one hour, and a breakdown test of 35,000 volts.

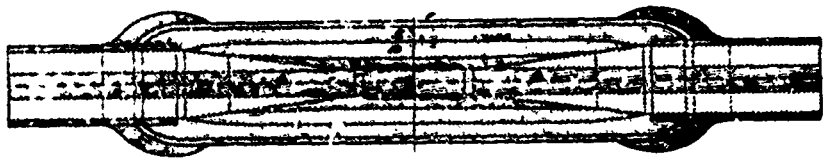

Fig. 3 Washburn and Moen Cable Joint Used.

A Copper conductor
B Tinned copper sleeve connector
C Pure jointing rubber
D Jacket jointing rubber
E Compound poured in.
F Lead sleeve
G Wiped solder joint

The cable is protected by a pure lead sheath 3-32 thick, no alloy of tin and lead being used as is ordinarily done, for the reason that a sheath of pure lead would not be so liable to crystallization from vibration of the bridge structure as would be one composed of tin and lead.

We are indebted to Mr. J. A. Burnett, of the Royal Electric Company, who personally superintended this installation of cable, for our illustrations.

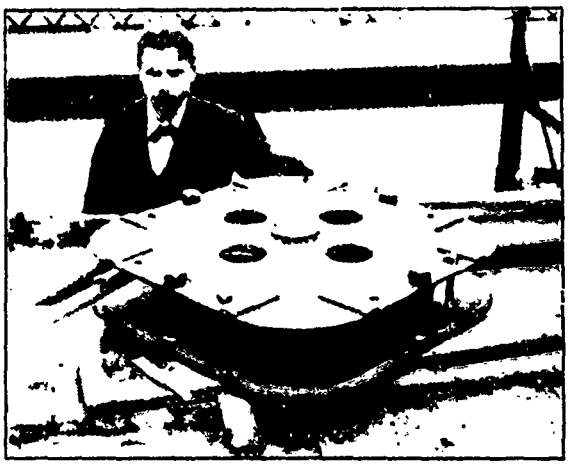

Fig. 5. Showing Sheave on Car.

ANNUAL MEETING OF OTTAWA ELECTRIC LIGHT COMPANY.

The annual meeting of the Ottawa Electric Light Company was held last month. There was a large attendance of shareholders.

The annual report of the directors stated that the revenue from all sources for the year ending April 30, 1899, was $101,615. The expenses of operation and maintenance, with interest on the bonds, etc., amounted to $113,268, leaving a net surplus of $48,346.

From this surplus a dividend of 6 per cent., or $44,053 for the year 1898-99, was paid on the capital stock of $705,800, leaving a balance to go to credit of profit and loss of $3,602.

During the year $57,878 was expended on new plant. The total plant is now valued in the company's statement at $1,200,438. The report was adopted, and the board of directors re-elected as follows: T. Ahearn, president; Hon. E. H. Bronson, vice-president; J. W. McRae, managing director; Hon. F. Clemow, Denis Murphy, John Coates and F. P. Bronson.

The number of incandescent lights increased by the largest figure for any year in the company's history, namely, by 14,142. The total number of incandescent lights now in use is 77,255. The arc lights number 621.

It is interesting to note the growth of the number of lights in use, notwithstanding which the gas company has continued to flourish. The following shows the growth in the electric company's business since the start:

	Incandescent Lights.	Arc Lights.	Heaters.	Motors.
1894	42,152	440	11	81
1895	48,707	468	15	81
1896	53,331	497	19	81
1897	57,240	550	30	87
1898	63,113	599	32	96
1899	77,255	621	23	103

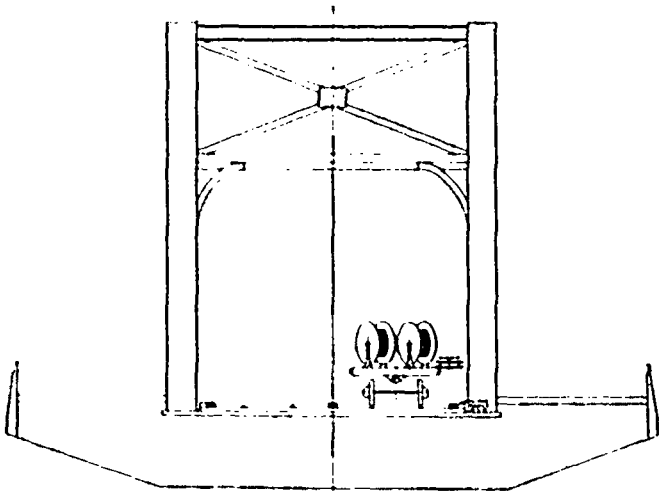

Fig. 6. Cross Section of Victoria Jubilee Bridge, Showing Apparatus Used for Laying Cable.

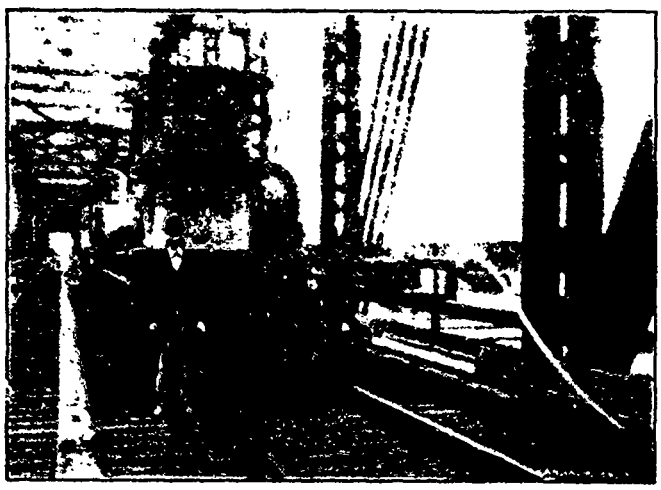

Fig. 4 Showing Cables Being Paid Out.

An electric plant owned by Mr. Keith and stored in the building of the Iroquois waterworks at Iroquois, Ont., was burned on June 27th. The loss is about $2,000.

Of the many catalogues which reach our desk, none are more attractive and carefully compiled than those issued by the Sprague Electric Company, of New York, and sent us by their Canadian agents, Messrs. Jack & Robertson, of Montreal. These include the Lundell Motor Catalogue No. 65, the Lundell Fan Motor Catalogue No. 66, Catalogue No. 63 of the Greenfield Flexible Metallic Conduit, Catalogue of Electric Motors for Printing Establishments, and the Architects' and Engineers' Electrical Bulletin. Besides the numerous illustrations of the many lines of electrical goods manufactured by the Sprague Company, these booklets contain valuable tables and articles of interest to all users of such apparatus.

MONTREAL

Branch Office of the CANADIAN ELECTRICAL NEWS,
New York Life Building,

MONTREAL, AUGUST 5, 1899.

ANOTHER TRANSMISSION PROJECT.

A RUMOR is abroad to the effect that a syndicate is to be formed for the purpose of installing an electric plant at Beauharnois to generate and transmit current for light and power to Montreal. Level-headed business men express the opinion that there is no room at present in this city for additional enterprises of this character.

STREET RAILWAY ENTERPRISE.

The Montreal Street Railway Co. have organized a band of musicians to accompany trolley excursions, which are a favorite form of pleasure-taking in this city on summer evenings. The band occupy a car specially suited to their requirements, and head the procession. Another innovation is a car with the words "Baseball To-morrow," formed of incandescent lamps, appearing in three lines across the front.

THE LACHINE RAPIDS HYDRAULIC AND LAND COMPANY.

This company are fitting up a building on Chenneville street as a sub-station, with steam boilers, engines and two rotary transformers, from which both direct and alternating current will be supplied. Direct current is required for lighting the Temple building. The steam plant will not be used except in the event of the operation of the generating plant at Lachine being interfered with by ice, as was the case last winter. The wind blowing in a direction contrary to the flow of the water caused the blocking up of the tail race with ice. This, in conjunction with the frazil ice which formed on the surface, greatly reduced the head of water and in like degree the supply of current. To avoid a recurrence of this difficulty, the company are now constructing a groin, which is expected to prevent the blocking of the tail race by ice. Steps are also being taken to overcome the difficulty arising from anchor ice.

MEETING OF ROYAL ELECTRIC SHAREHOLDERS.

The annual meeting of the shareholders of the Royal Electric Company was held in Montreal on July 18th. The manager, Mr. W. H. Browne, made some explanations in regard to the operations of the company since its inception and during the past year. He explained that, in the electrical business, inventive genius was so prolific that the plant or apparatus for manufacturing electricity soon became obsolete. Hence, during the existence of this company $1,800,000 of equipment had become useless, or superseded by improved machinery and methods. The whole of that $1,800,000 had not been written off, but $600,000 to $800,000 had, and, while there was certainly a million dollars in the nominal assets which was really not in existence for any practical purpose, he thought the proper thing to do was to distribute the loss over a number of years, as they had been doing. Speaking of underground conduits, Mr. Browne said the time was coming, and soon they must meet the necessity. The cost of total conversion from pole wiring to conduits would be $1,500,000, but entire conversion was not necessary, as in some of the residential quarters it was not called for. He explained that, notwithstanding the large outlay for conduits, the expenses of maintenance would be sufficiently reduced to pay the interest on the outlay. He said the atmosphere of Montreal had been filled for some years not only with electricity, but with the idea that electricity would be made for almost nothing, especially when the Lachine Rapids commenced doing their work. However, this idea had been, to some extent, exploded. The Lachine Company were stiffening their prices.

The annual statement presented showed the gross receipts for the year to be $1,113,770.87, and the expenditure for labor $791,486.58, leaving a balance of $322,284.29. After deducting interest and fixed charges amounting to $54,600.11, the net revenue for the year was $267,684.18. During the year $38,603.33 was spent on factory equipment and $84,782.03 on lighting stations, lines and general construction. The report stated:

"With contracts now in hand for motive power and the increasing favor with which the use of electric power is regarded, it seems reasonable to anticipate that during the coming year there will be fully, if not more than, 2,500 horse power in capacity additional demand for current for motors from the alternating current system. Since May 31st, 1899, there has been connected with the alternating current system and now in continuous service, an electric motor of 450 horse power capacity operating a pump in the St. Cunegonde pumping station of the Montreal Water and Power Co., for the supply of water to the citizens of the municipalities adjoining this city. This is the largest electrically driven pumping plant so far established in the world. The "S.K.C." motor performing this work was built in the shops of and supplied by this company. A large number of contracts for lights and motors at present in hand are for periods of five or more years. The alternating current system for lights and motors is now operated by electric current obtained from the water power generating plant, recently completed, of the Chambly Manufacturing Company, on the Richelieu river, opposite Chambly Canton. This plant, both at the generating station and receiving station, has all been equipped by "S.K.C." apparatus made in the shops in this city of this company. The four "S. K. C." generators installed in the power house at Richelieu, each of 2,650 horse-power capacity, the largest machines of the kind ever made anywhere, indicate the extensive character of the equipment and the great manufacturing capacity of the factory."

The following directors were elected: President, Lieut.-Col. J. A. Strathy; vice-president, Mr. R. Forget; directors, Messrs. J. R. Meeker, James Wilson, A. Brunet, F. L. Beique, David Morrice, H. B. Rainville.

NOTES.

Owing to the illness of Mr. Rough, who is in charge of Mr. R. E. T. Pringle's shipping warehouse on Craig street, Mr. A. E. Payne, travelling representative, has recently been temporarily discharging the duties of the position.

The names of three of the leading hotels, formed of incandescent lamps, shine out conspicuously every night from the tops of the buildings. Several of the stores show attractive signs of the same character. In fact, electricity is coming more and more into use in this city for advertising purposes.

Messrs. Fred Thomson & Co., who make a specialty of repairing electrical apparatus, have recently removed from Chenneville street to No. 744 Craig street. They now occupy improved premises and a better location. They have entered into a contract with the Wagner Co. to keep in repair several hundred Wagner transformers installed in this city.

Mr. R. E. T. Pringle has recently opened a new shipping warehouse on Craig street—a four-story building which has been fitted up for this purpose, the stock being carefully classified and compactly arranged. The retail store on St. James street will be continued as heretofore. The Craig street establishment is in charge of Mr. Rough, who, I regret to say, has of late been incapacitated through illness.

PERSONAL.

Mr. Henry W. True has resigned his position as manager of the Peoples Light, Heat & Power company, Halifax, N.S., and has been succeeded by Mr. Robert Baxter.

Mr. Donald Robertson, who has been identified with the Grand Trunk Railway for some time, has resigned, to accept a position with the Montreal Street Railway as assistant to Mr. F. L. Wanklyn, the manager.

Mr. Harry Dalton, who at one time resided in London, Ont., has recently been appointed superintendent of the Akron Traction & Electric Co., which operates lines between Cleveland and Akron and from Akron to Kent.

Mr. Nelson Graburn, assistant superintendent of the Montreal Street Railway, is about to remove to Glasgow, Scotland, having accepted the position of superintendent of the Glasgow Corporation Tramways. Mr. Graburn had charge of the electrical equipment of the Montreal road. He has recently invented a system for thawing frozen water pipes by means of electricity.

Major John Williams, gas and electric light inspector for the London district, who died at London on June 24th, was in his 73rd year, and was widely known and much esteemed. He was born in Birmingham, Eng., and served twenty-one years in the Royal Artillery. He came to Canada in 1865, served during the Fenian Raid of 1866, and was promoted to the office of Major, retiring nine years ago. Mr. Williams served the city of London as an alderman, retiring in 1880, when he was appointed gas inspector. When the electrical inspection department was organized, he undertook these duties for his district in connection with that of gas.

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Automobiles in Postal Service.

We observe that the Dominion supplementary estimates contain an appropriation for an automobile mail service between the post-office and the Union depot in Toronto. It is understood that a test has been made of a wagon propelled by electricity with a view to adopting that motive power, and that the results were very satisfactory. In the past the advocates of automobiles have experimented more with gasoline and oil than with electricity, probably owing to the greater simplicity of the former. At the present time it would appear as though electricity was about to take the lead, and that it would become more generally used for the propulsion of street vehicles. The former heavy battery has given place to one which is much lighter in construction and at the same time more rigid. It is worthy of note that the battery invented by Mr. Still, of Toronto, has been favorably commented upon by experts as meeting all the requirements equally as well, if not better than any yet invented. This battery is used in the vehicles manufactured by the Canadian Motor Syndicate.

Electrically Propelled Barges.

The great amount of space occupied in steam barges by the boilers and engine has caused British merchants to turn their attention to the substitution of electricity for steam for their propulsion. A Birkenhead manufacturing firm has, as a result, recently equipped a new vessel with electric power, and has thereby greatly increased the carrying capacity of the vessel. The vessel is claimed to be the largest one electrically propelled in the world, being 75 feet long. The battery consists of 112 Headland storage cells, each of 29 plates, 9¼ in. high by 12 in. broad and one-half inch thick, separated by ebonite separators and placed in a lead-lined box, 16 x 21 x 14 inches. The complete cell weighs four cwt., and has a capacity of 2,000 ampere hours at a nominal discharge rate of 300 amperes. The vessel is propelled by a twin-screw propeller worked by two 40 h.p. electro-motors, each taking a current of 150 amperes at a pressure of 200 volts. A Hopkinson series-parallel controller is used for varying the speed of the vessel. This is manipulated by the steersman, and has five notches from slow to full speed. A reversing switch permits the vessel to proceed ahead or astern at each speed as desired. There is a winch or small crane on board, worked by an 8 h.p. electric motor, and taking 30 amperes at 200 volts. It has a separate controller with three speeds. It is said that the vessel greatly surpasses in speed boats of equal size propelled by steam.

The Orillia Power Plant.

More than ordinary interest has been shown in the project to transmit electric current from Ragged Rapids to the town of Orillia, for two reasons—first, that it is the first long distance electrical power transmission in America, if not in the world, to be undertaken by a municipality, and, second, in view of the original intention to use aluminium wire for conducting purposes. The contract for the entire plant was let in January last, since which time very little progress has been made. A few weeks ago the contractors, finding themselves unable to carry out the work, withdrew from the field, and placed the council under obligation to re-let the contract. Just as we go to press it is learned that the award has been made to Mr. P. H. Patriarche, of Toronto, at the sum

of $71,000, while the original contract price was $65,000. Mr. Patriarche has given ample security, and has agreed to have the plant ready for operation by December 1st next and to substitute copper for aluminium wire. *In all probability the electrical and hydraulic apparatus will be of* Canadian manufacture. The progress of the work will now be watched with keen interest, as the contractors have little enough time in which to complete the undertaking, more particularly as the transmission line must necessarily pass through a rough section of country. The members of the council are no doubt well satisfied that copper is to be substituted for the proposed aluminium wire, as the efficiency and utility of that material is a known quantity; on the other hand, it is to be regretted that this opportunity to prove the advantages or otherwise of aluminium conductors is to be lost. With copper steadily advancing in price, the electrical interests should foster any step looking to the substitution of a cheaper material with equally good conducting qualities, and thus encourage the development for electrical purposes of the many valuable water powers of Canada.

Niagara Falls Power Development.

ATTENTION is again directed to Niagara Falls, owing to steps having been taken during the past month which are likely to result in the further development of that immense power. Upon representations made by the Ontario government, the Canadian Niagara Power Company agreed to surrender the monopoly held under the agreement of 1892, in return for certain concessions. That agreement, as is generally known, gave the Canadian Niagara Power Company a monopoly of the water power for practically one hundred years, at a rental of $25,000 per year for the first ten years, afterwards gradually increasing to $35,000 per year. During the intervening seven years absolutely nothing was done towards developing the power. A new agreement with the Canadian Niagara Company has now been entered into, the advantages of which are that it does not embody an exclusive franchise, and that in place of an annual rental a tariff of rates has been decided upon. The company is to pay, for the first 10,000 horse power developed, $15,000 per annum; for the next 10,000 horse power, $1 per horse power per annum additional; for the next 10,000 horse power, 75 cents per horse power per annum additional; for the remaining power developed up to 100,000 horse power, 50 cents per horse power per annum additional. The agreement, which is to remain in force for 50 years, contains clauses giving to the government the right at the end of that period to re-adjust the rental if such a course is considered advisable. Should the government and the company fail to arrive at a satisfactory agreement on this point the change in rental is to be decided by arbitration. At the end of the 50 years the agreement may be continued for two further periods of 20 years, the rentals, in the event of the government not demanding a change, to remain as fixed at present. It will thus be seen that should the company develop only 20,000 horse power, the revenue to the government would be equal to that stipulated in the former agreement, namely, $25,000 per year. The company claim, however, that it is their purpose to develop 100,000 horse power, from which the annual revenue to the government would be $67,500. From the standpoint of the government, therefore, the new agreement would seem to be preferable to the old one. Another point which must be considered is the interests of the cities, towns and villages which might be benefitted by the development of the power. Will the new agreement hasten or retard the commencement of operations? It would seem only reasonable to suppose that the competition which is now made permissible would tend to cause the company first in the field to complete its works, and thus, by supplying the demand for current, shut out competition which otherwise would be encouraged. It is a source of congratulation to learn that within the past week Professor George Forbes, F.R.S., the distinguished electrician of London, Eng., who was consulting electrical engineer for the Cataract Power Company during the construction of its works on the American side, has been in consultation with Mr. Rankine and other members of the Canadian Niagara Falls Power Company relative, it is said, to the transmission of power to Toronto. The statement is given out that it is proposed to develop 100,000 horse power, at a cost of between two and three million dollars, although it is improbable that any definite decision has yet been arrived at. Mr. Forbes has just returned from Egypt, where he spent eight months preparing plans for the development of the water power of the Nile river. He is about to leave for India on a similar mission.

ELECTRICAL MACHINERY IN JAPAN.

THE United States consul at Osaka says that the manufacturers of electrical apparatus in the United States control the Japanese market.

"Electrical engines are imported from the United States, and they are giving general satisfaction. Telegraphic machinery was imported into Japan during 1897 as follows:

United States	$2,301
Great Britain	1,102
Germany	691

"But little came from any other country. The Japanese government owns both the telegraph and telephone service.

"It is said that considerable delay has frequently occurred in the execution of orders from Japan for electrical machinery in Europe, and that, in consequence, the American market has been given the preference, with the result that the superiority of such machinery has been fully established. The more direct communication between the United States and Japan, together with the lowering of overland freights, should stimulate *manufacturers of machinery to increased effort for this* market."

LIGHTING THE PYRAMIDS BY ELECTRICITY.

A PLAN is now said to be under consideration by the British government for the lighting of the pyramids by electricity, and the installation of an electric power transmission plant of 25,000 horse-power. The plan involves the erection of a power generating plant at the Assouan Falls on the River Nile, and its transmission over a distance of 100 miles, through the cotton-growing districts, where, it is thought, the provision of cheap power from this source will permit the building of cotton factories. Part of the scheme contemplates the lighting, from this source, of the interior corridors of the pyramids, and also the operation of pumping machinery for irrigating large areas of desert lands along the Nile. It is also stated than an American company is likely to receive the contract for this work.

TELEGRAPH and TELEPHONE

REPAIRS TO SUBMARINE CABLES.

By F. A. Hamilton, M.I.E.E., M.Can.Soc.C.E.

One of the most unsatisfactory features in connection with the repair of submarine telegraph cables, more especially in deep water, is the lack of any means of knowing if the line is intact after the two ends of the conductor are connected and whilst the joint and final splice are being made. Unless special precautions are taken, the danger of the cable becoming kinked and broken whilst the operation alluded to is being performed is imminent. To slip a final splice in deep water some hundreds of miles from land, and on arriving in port to find the cable broken, where it was supposed to have been repaired, is mortifying in the highest degree. Happily, such cases are not of frequent occurrence, but the fact of their happening at all is sufficient to suggest the necessity for some preventive measures.

A special type of cable, or the ordinary kind specially prepared, should be provided, a length of which could be kept in readiness to be spliced on to the sea end when the cable is lifted and found O. K. to the shore, when, instead of buoying the old cable, a piece of the special type should be spliced on and paid out to a sufficient distance to insure a good riding cable, which should be buoyed "end up."

Communication with the shore on the other side of the fault being established, and whilst the process of filling in the gap is being proceeded with, the cable in the tank might be cut a flake or two down and the end passed up and spliced to the special cable, so that the latter would take the bottom before the ship reached the cable buoy. The final splice would then be made on the two parts of special cable, which should be free from the springy, objectionable features of the ordinary types that are so liable to become kinked.

A strand cable, such as the 1869 Atlantic type, with a hard serving of spun-yarn applied over the manilla covered wires, would afford an excellent form of special cable and one that could be buoyed "end up" with perfect safety.

As an instance of what has been done in this direction, it may be mentioned that the writer's suggestion in respect to preparing a cable for buoying in the manner indicated was successfully carried out during a deep sea cable repair in 1888.

The cable was a hempen one and was buoyed "end up" in 1800 fathoms and in 1960 fathoms to the westward of longitude 26. On one occasion the buoyed cable was left for three days, during which period it rode out a fresh gale with lumpy sea, conditions which would have told hard on the ordinary type of cable.

If the details of a former repair to the same cable—to the westward of the position named above—during the year 1882 were given, the evidence would amply substantiate the statement here made, that the dangers and difficulties experienced in repairing operations in deep water are due in a very large degree to the type of cable employed.

That the subject is of no ordinary importance is evident from the fact that the repairs to the 1869 Atlantic cable during the year 1882 cost over £120,000.

An account of those repairs would be an interesting and instructive story, but as the subject of the present paper is not of an historical character, the particulars of the operations mentioned can be reserved for a more convenient occasion. The question now is whether the fact of a cable breaking whilst the final splice is being made can be known on board the ship.

Careful bearings of the mark buoys will sometimes indicate that the cable has severed on one side of the bight, as the ship may then drift out of line, but this would not occur if the vessel were bow on to a current setting along the line of cable. It has been a common practice with the writer during repairs to cables in which the working current was sufficient to render the conditions favorable, to use a telephone in circuit with a coil of wire—known as Gott's wire finder—the coil being placed longitudinally against the cable, so that the signals in the latter could be read on the telephone whilst the final splice was being made in the cable, and the fact of the line being intact would be known. But on long cables on which the working current is too feeble to produce inductive effects sufficient to render the signals audible on the telephone, some amplification of this method is necessary, and the following suggestion is therefore submitted.

If when a final splice is being made, a long bight of the cable were coiled around a suitable drum, provided with a coil of insulated wire with a sensative galvanometer in circuit, by using a battery power stronger than the ordinary working current, it would be possible, by means of preconcerted signals from each station, to ascertain on board the ship whether the line were intact or not.

With regard to the coil of cable, there would be no difficulty in straightening it out when the time came for slipping the bight.

In offering these suggestions the writer desires to express his regret that circumstances prevent his entering into details at present, but he hopes in a future communication to submit further particulars on the subject.

Halifax, N.S., June 21st, 1899.

SHORT-CIRCUITS.

Pare & Pare have disposed of the business of the Citizens' Telephone Co., at Granby, Que., to the Bell Telephone Co.

The ratepayers of Almonte, Ont., will vote on a by-law on September 25th next to raise $30,000 for the establishment of an electric light plant.

The Dominion government have just awarded the contract for the construction of a telegraph line on the north shore of the St. Lawrence, from the Romaine river eastward to Baie Chateau, Strait of Belle Isle.

The North American Telegraph Company's line along the Kingston & Pembroke and Bay of Quinte railways has been sold to a syndicate, and Mr. W. Banfield has been appointed manager. The company purpose extending their lines.

The business men in the county of Charlotte, N.B., purpose establishing a telephone line, taking in St. Andrews, Pennfield, Beaver Harbor, Deer Island and other points. Messrs. Connors Bros., of Black's Harbor, and Capt. Samuel Dick, of St. George, are behind the scheme.

During the past twelve months extensive improvements to the Great North Western Telegraph building, corner St. Sacrament and St. Francois Xavier streets, Montreal, have been under way. These are now completed. The building was originally constructed in 1872 by the Montreal Telegraph Co., and was considered one of the most substantial and imposing business structures in Montreal. About one year ago the management resolved to remodel and refit the structure in a manner that would put it abreast of the times. The work was done most thoroughly, but without interfering with the company's business. New systems of drainage, plumbing, lighting and heating have been introduced and an electric passenger elevator put in.

MOONLIGHT SCHEDULE FOR AUGUST.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1....	P.M. 7.40	A.M. 1.30	5.50
2....	" 7.40	" 2.20	6.40
3....	" 7.40	" 3.20	7.40
4. ..	" 7.40	" 4.00	8.20
5....	" 7.40	" 4.00	8.20
6....	" 7.40	" 4.00	8.20
7....	" 7.40	" 4.00	8.20
8....	" 7.40	" 4.00	8.20
9....	" 7.40	" 4.00	8.20
10....	" 7.40	" 4.00	8.20
11....	" 8.00	" 4.10	8.10
12....	" 8.30	" 4.10	7.40
13....	" 9.10	" 4.10	7.00
14....	" 9.50	" 4.10	6.20
15....	" 10.50	" 4.10	5.20
16....	" 11.00	" 4.10	5.10
17 ...	" 11.50	" 4.10	4.20
18....	.....	" 4.10	3.20
19....	A.M. 12.50	.....	
20....	No Light.	No Light.	.....
21....	No Light.	No Light.	.....
22....	No Light.	No Light.	.....
23....	No Light.	No Light.	.....
24....	P.M. 7.10	P.M. 9.30	2.20
25....	" 7.10	" 10.00	2.50
26....	" 7.10	" 10.50	3.40
27....	" 7.10	" 11.30	4.20
28....	" 7.10	A.M. 12.20	5.10
29....	" 7.10	" 1.00	5.50
30....	" 7.10	" 1.10	6.00
31....	" 7.00	" 2.10	7.10
		Total.....	163.10

PROF. R. J. DURLEY.

THE portrait on this page is that of Prof. R. J. Durley, B. Sc. (London), who has recently been appointed to the Chair of Mechanical Engineering in McGill University, Montreal, as successor to Dr. J. T. Nicholson. Prof. Durley received his early education at the Modern School, Bedford, Eng., a school whose history goes back for considerably more than three centuries.

PROF. R. J. DURLEY.

Upon leaving, he entered the engineering department of University College, Bristol, and worked there during the session of 1884-85. While here he secured one of the college scholarships. He gained a Gilchrist scholarship at University College, London, in 1885, and studied there under Dr. Alex. B. W. Kennedy during the sessions of 1885-86 and 1886-7, spending a considerable portion of this time in experimental work in the laboratory at the college.

At the conclusion of the course Mr. Durley took a very high position in all the college examinations in professional subjects, and in 1887 he passed the examination for the degree of Bachelor of Science of the University of London. On leaving University College he entered the works of Earles' Shipbuilding and Engineering Company, Ltd., of Hull, and served a term of four years apprenticeship as a mechanical engineer. During this time Mr. Durley spent some months working on board those ships of the Royal Navy then being engined by Earles' company in H. M. dockyards at Pembroke and Devenport. From 1890 to 1894 he remained in the service of the same firm, and was employed in designing marine and other machinery of varied types.

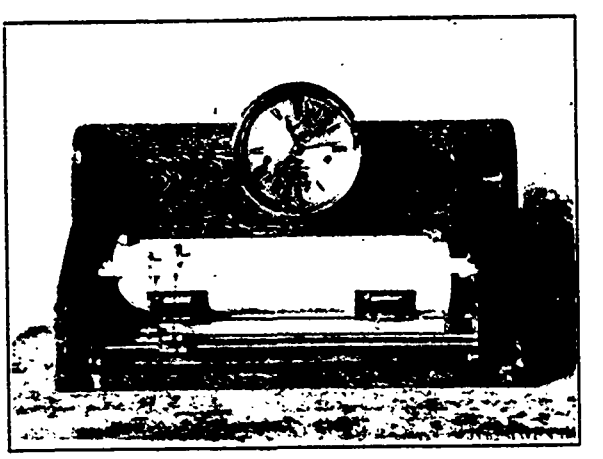
In 1894 Mr. Durley was appointed chief lecturer on mechanical engineering in the Hull Municipal Technical Schools, which were then being established, and he was responsible for the arrangement, organization and equipment of the workshops and laboratories of his department. In 1897, on accepting the appointment of assistant professor of mechanical engineering in McGill University, he came to Canada.

Prof. Durley is a Whitworth scholar and has on two occasions received Miller prizes for papers presented by him to the Institution of Civil Engineers (England), of which society he is an associate member. He is also an associate member of the Canadian Society of Civil Engineers, and has been a not infrequent contributor to the proceedings of that body. The work done for McGill University by Mr. Durley, as Dr. Nicolson's assistant, received academic recognition last year, when the degree of Master of Engineering was conferred upon him by the university.

THE MARTIN AUTOMATIC REGISTER.

THE accompanying cut shows the Martin Automatic Register. It is the invention of Mr. F. W. Martin, station superintendent for the Hamilton Electric Light & Power Co., Hamilton, Ont. The register is for plotting the load curves of the different outputs of a station. The illustration shows two pens working over a scale of amperes. The pens use different colored inks, which makes them distinct and easy to trace. One can be plotting an incandescent while the other is plotting a power load. Besides being a reference for the office and to keep on file, it is a check on the switch-board attendant, as the charts move over a roller which is geared to a clock and keep the charts moving at the same rate as time; the pens resting on the chart record the load, and can be moved from left to right according to the variations. The charts are laid off in 15 minute readings unless otherwise wanted. The attendant cannot record the readings, as is sometimes done, by jotting down several readings from memory, and if the load does not change a key at one side is knocked down, and will mark the chart at that time, proving that he was on duty. The register carries a supply of charts which are on a roller under the large roller, and are either passed out at the back or rolled on to a third roller, if desired, and taken out when putting in a new supply of charts. The register can then be locked up by the foreman or superintendent, and the attendant can only get access to refill the pens, which will run about a week without refilling.

Mr. Martin has given the work of designing the new model to Mr. W. A. Turbayne, and when finished with



THE MARTIN AUTOMATIC REGISTER.

the improvements, it will look very neat and attractive, fitted with a Seth Thomas eight-day clock, and finished in white nickel plate. Patents have been applied for in several countries.

The accompanying cut shows the one that was in operation at the Hamilton Electric Light & Power Co.'s station during the Canadian Electrical Association convention. Its usefulness was readily appreciated, and several orders were placed. As one well known station manager put it, "No station can afford to be without one."

Henry Sheldon, of Aylmer, Ont., is negotiating for the right to manufacture a motor carriage in Canada.

Forms Accompanying Paper on

CENTRAL STATION ACCOUNTING

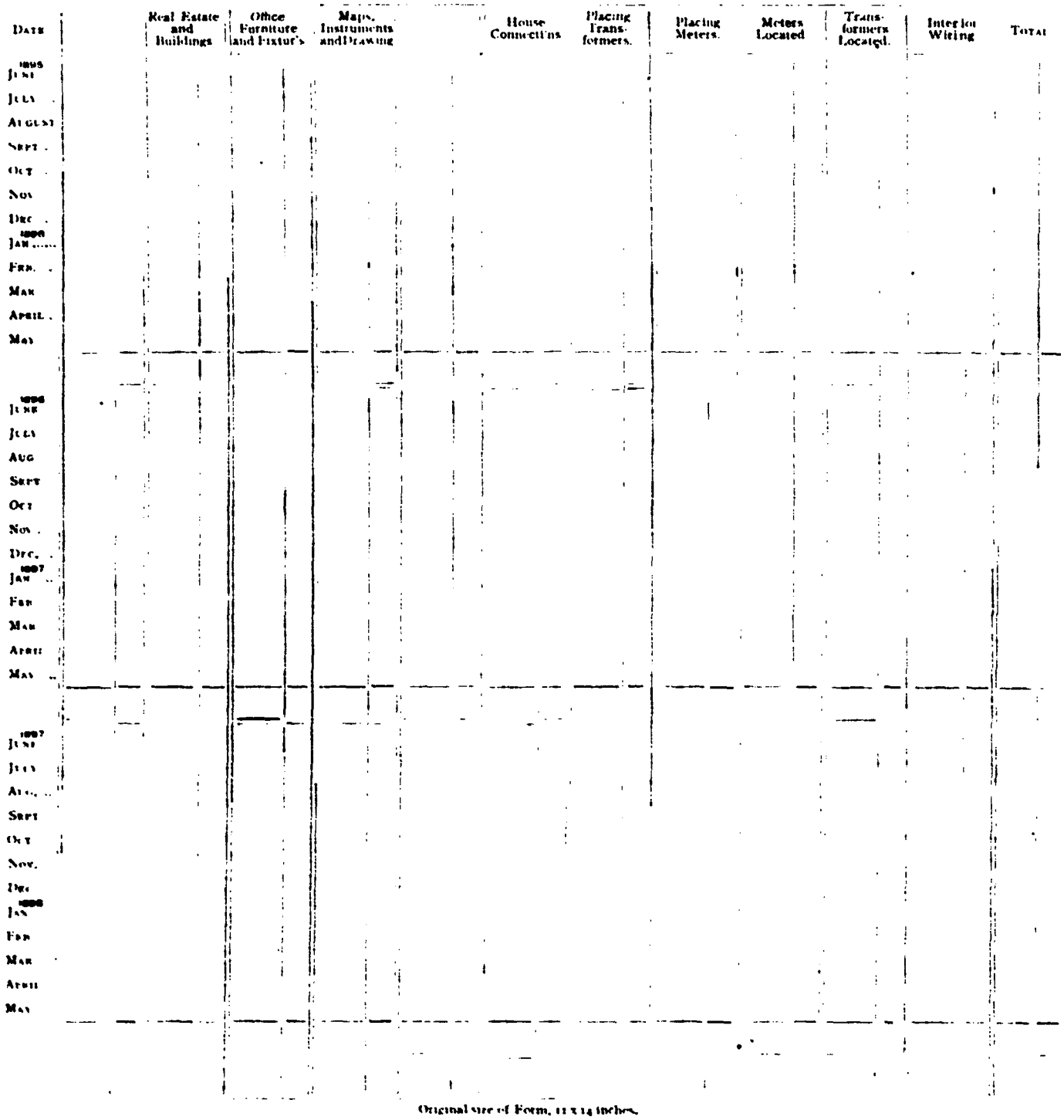
From a Business Standpoint. By P. H. HART.*

SUBSIDIARY LEDGER.

Form No. 1.

GENERAL CONSTRUCTION.

INCANDESCENT INSTALLATION



Original size of Form, 11 x 14 inches.

* This paper was read at the recent convention of the Canadian Electrical Association, and was published in the last issue of the ELECTRICAL NEWS.

Form No. 2

Class of Account—GENERAL CONSTRUCTION.

Date.	ACCOUNT.	SUB-ACCOUNT.	Labor.	Material.	Total.
	Real Estate and Buildings				
	Office Furniture and Fixtures				
	Maps, Instruments and Drafting.				
	Incandescent Installations	House Connections.			
		Placing Transformers.			
		" Meters.			
		Meters Located.			
		Transformers Located.			
		Interior Wiring.			
	Alternating Arc Installations	House Connections.			
		Placing Transformers.			
		" Meters.			
		" Lamps.			
		Meters Located.			
		Transformers Located.			
		Interior Wiring.			
		Lamps and Coils Located.			
	Arc Installations, City	Connections.			
		Lamps and Fixtures Located.			
		Placing Lamps and Fixtures.			
	Arc Installations, Commercial	House Connections.			
		Lamps and Fixtures Located.			
		Placing Lamps and Fixtures.			
	Series Inc. Installations, City	Lamps and Fixtures.			
		Connections.			
	Series Inc. Installations, Comm'l	Lamps and Fixtures.			
		Connections.			
	D.C. Motor Installations	House Connections.			
		Inside Connections.			
		Meters Located.			
		Placing Meter.			
	A.C. Motor Installations	House Connections.			
		Placing Transformers.			
		Transformers Located.			
		Placing Meters.			
		Meters Located.			
		Interior Wiring.			
		Placing Motors.			
	Lines and Poles	Incandescent.			
		Arc, City.			
		Arc, Commercial.			
		D. C. Motor.			
		A. C. Motor.			
		Alternating.			
	Subways and Conduits				
	Cables	Incandescent.			
		Arc, City.			
		Arc, Commercial.			
		Motor.			
	Tools	Incandescent.			
		Arc.			
		Motor.			
		Linemen's.			
		General.			
	Horses and Wagons				

Original Size of Form, 8 × 11 inches.

Form No. 3.

Class of Account—STATION CONSTRUCTION

Accounts for Each Station.

Date.	ACCOUNT.	SUB-ACCOUNT.	Labor.	Material.	Total.
	Real Estate and Buildings				
	Steam Plant	Boilers.			
		Piping.			
		Engines.			
		Pumps, Condensers and Heaters.			
		Shafting and Pulleys.			
		Belting.			
	Electric Plant	Incandescent Dynamos.			
		Incandescent Switchboard and Instruments.			
		Incandescent Switchboard Connections.			
		Arc Dynamos.			
		Arc Switchboard and Instruments.			
		Arc Switchboard Connections.			
		D. C. Motor Dynamos.			
		D. C. Motor Switchboard and Instruments.			
		D.C. Motor Switchboard Connections.			
		Motors (in Station).			
	Station Tools	Steam Plant.			
		Electric Plant.			
		General.			
	Office Furniture and Fixtures.				
	Testing Equipment				
	Interior Wiring				

Original Size of Form, 8 × 11 inches

Form No. 4.

Class of Account—STATION OPERATING

Accounts for Each Station.

ACCOUNT.	SUB-ACCOUNT.
Rent	
Taxes	
Insurance	
Steam Plant	Fuel Cartage of Ashes Boiler Compound Water for Boilers Boiler Room Wages Engine " " Oil and Waste
Electric Plant	Inc. Dynamo Tenders Wages. Arc Dynamo Tenders Wages. D. C. Motor Dynamo Tenders Wages. Incand. Switchboard Tenders Wages. Arc Switchboard Tenders Wages. D. C. Motor Switchboard Tenders Wages. Inc. Dynamo Brushes. Arc Dynamo Brushes. D. C. Motor Dynamo Brushes. Incand. Commutator Segments. Arc Commutator Segments. D.C. Motor Commutator Segments Arc Blower Wings.
Arc Lamps, City	Oil and Waste Carbons Trimming Inspecting.
Arc Lamps, Commercial	Carbons. Trimming. Inspecting.
Alternating Arc Lamps	Inspecting Trimming.
D. C. Motor	Inspecting Testing.
A. C. Motor	Inspecting Testing.
Incandescent	Inspecting. Testing.
Lamp Renewals	Incandescent. Series Inc. City. Series Inc. Commercial.
Incandescent Lamp Changes.	
Lines and Poles (to be subdivided where possible)	Inspecting. Testing.
Removing Lines and Poles	Incandescent. Arc, City. Arc, Commercial. Motor.
Removing Installations.	Arc, Commercial Arc, City. Incandescent. D. C. Motor. A. C. Motor. Alternating Arc. Series Inc., City. Series Inc., Commercial.
Fire Patrol	Arc, City. Arc, Commercial. Incandescent. Motor.
Testing (in Station)	Inc. Lamps. Meters. Alt. Arc Lamps. General.
Accidents	
General Expenses	Clerks. Stationary. General.

Original Size of Form, 5 × 1 inches.

Form No. 5.

Class of Account—STATION MAINTENANCE

Accounts for Each Station.

ACCOUNT.	SUB-ACCOUNT.
Real Estate and Buildings	
Steam Plant	Boilers. Piping Engines. Pumps, Condensers and Heaters Shafting and Pulleys. Belting.
Electric Plant	Arc Dynamos. Arc Switchboard and Instruments Arc Switchboard Connections Arc Lamps in Station. Incandescent Dynamos. Incand. Switchboard and Instruments. Incandescent Switchboard Connections. Incandescent Lamps and Circuits. D.C. Motor Dynamos. D.C. Motor Switchboard and Instruments. D.C. Motor Switchboard Connections. Motors.
Lines and Poles	Incandescent. Arc, City. Arc, Commercial. D.C. Motor. A.C. Motor. General.
Installations Inc.	House Connections. Repairing Meters. Repairing Transformers. Replacing Transformers. Customers' Premises.
Inst. Alternating Arc	House Connections Repairing Meters. Repairing Transformers Customers' Premises. Lamps. Globes.
Inst. Series Inc. Commercial.	Lamp Fixtures. Lamp Connections.
Inst. Series Inc. City	Lamp Fixtures. Lamp Connections. Lamps.
Installations Arc City.	Lamp Fixtures. Lamp Connections. Globes.
Inst. Arc Commercial	Lamps. Lamp Fixtures. Lamp Connections. Globes.
Installations D.C. Motor	House Connections Customers' Premises. Repairing Meters.
Installations A.C. Motors	House Connections. Repairing Meters. Repairing Transformers. Customers' Premises. Motors.
Tools	Steam Plant. Electric Plant. Testing General.

Original Size of Form, 8 × 11 inches.

Form No. 6.

REQUISITION FORM

"Line Construction and Maintenance Dept." No.....

..... 189

Stores Dept. will please CHARGE to..... .....for order No.....

TO BE CHARGED

Blocks, Side
Bolts, Carriage, ⅜ x 4
" " ½ x 5
" " ½ x 7
" Machine, ⅜ x
" " " x
" " " x
" " ½ x
" " ½ x
" " ½ x
Brackets, Cross, 2 pin
" Flat, 2 pin
" Hook, with nut
" Leg
" 3 "
" Straight, 1 pin
" " 2 "
" " 1 " with nut
" " 2 " "
Braces for cross arms
Boxes, Junction
Cable
"
Cement, Roof
Charcoal
Cross arms, 2 pin
4 "
6 "
Cut outs, Film
Globes
Hanging Straps
Hangers, Iron Street
" Goose-neck
Hoods, Series Inc.
Insulators, Guy
Ordinary
D. P.
Porc.
Lamps, double arc, 2000 c.p.
" Single arc, 2000 c.p.
" Series 32 c.p., 9.6 amp.
" " 65 c.p., 9.6 amp.
Naphtha
Outriggers
" Plates
Pins, Oak
Poles, ft.
" "
" "
" "
" "
Rope, Manilla
Resin
Screws, Wood
" "
" "

Forward,

Forward,

Screws, Coach
" "
" Cap
Slings, rope
Solder
Spikes
Tape, Grimshaw
" Kerite
Transformers, Light No.
" " "
" " "
" " "
" " "
" " "
Turn Buckles
Tubing
Tripods
Washers, 5-16
" 7-16
" 9-16
" 13-16
Wire, Rubber Covered
" " "
" " "
" " "
" D. B. 4/0
" " 3/0
" " 2/0
" " 0
" " 1
" " 2
" " 4
" " 6
" " 8
" " 10
" " 12
" " 14
" " 16
" Cable
" "
" "
" Galv'd, 6
" " 9
" " 9 x 2 strand
" " 9 x 3 "

Received
Delivered by
D. B. Folio

Original Size of Form, 8 x 11 inches.

Form No 6

CREDIT

No ..... "Line Construction and Maintenance Dept."

..... 189

Stores Dept. will please CREDIT to ....for order No.....

TO BE CREDITED

Blocks, Side
Bolts, Carriage, ⅜ x 4
" " ½ x 5
" " ½ x 7
" Machine, ⅜ x
" " " x
" " " x
" " ½ x
" " ½ x
" " ½ x
Brackets, Cross, 2 pin
" Flat, 2 pin
" Hook, with nut
" Leg
" 3 "
" Straight, 1 pin
" " 2 "
" " 1 " with nut
" " 2 " "
" Strap
Braces for crossarms
Boxes, Junction
Cable, Lead-concentric
"
"
"
Cement, Roof
Charcoal
Crossarms, 2 pin
" 6 "
" 10 "
Cut-outs, Film
Hanging Straps
Insulators, Glass, Small
" Ordinary
" D. P.
" Porc.
Naphtha
Outriggers
" Plates
Pins, Oak
Poles, ft.
" "
" "
" "
" "
Rope, Manillla
Resin
Screws, Wood
" "
" "
" Coach
" "
Screws, Coach
Solder
Spikes

Forward,

Forward,

Spikes
Tape, Grimshaw
" Kerite
" Okonite
Transformers, Light No.
" " "
" " "
" " "
" " "
" " "
" Straps
" Stays
" Tables
Tubing
Tripods
Washers, 5-16
" 7-16
" 9-16
" 13-16
Wire, Rubber Covered
" " "
" " "
" " "
" D. B. 4/0
" " 3/0
" " 2/0
" " 0
" " 1
" " 2
" " 4
" " 6
" " 8
" " 10
" " 12
" " 14
" " 16
" Cable
" "
" "
" Galv'd, 6
" " 9
" " 9 x 2 strand
" " 9 x 3 "

Received
Delivered by
D. B. Folio

Original Size of Form, 8 x 11 inches.

REQUISITION FORM.

Form No. 6.

Requisition No. B .....

Montreal 189

On General Manager's Order No......

	Class of Account.	Account.	Sub-Account.
For...			
Debit			
Credit.....			

Received by... ..... 189 ..... *Foreman*

Delivered by... ..... *Supt.*

D. B. Folio ..... *For use in*..... *Dept.*

Posted .....

Original size of Form, 8 x 10 inches.

Form No. 6.

CREDIT.

Requisition No. C.....

Montreal..... 189

On General Manager's Order No......

	Class of Account.	Account.	Sub-Account.
For			
Credit.....			

Received by ..... 189 ..... *Foreman.*

Delivered by ..... *Supt.*

D. B. Folio ..... *For use in*..... *Dept.*

Posted .....

Original size of Form, 8 x 10 inches.

Customers' Record Book Form.

INCANDESCENT

For Month Ending June, 1899.

Cir. No.	Led Folio	NAME.	Date.	METER READ'G IN AMPERE HRS Present.	Consumed.			Meter Rental.	Total.	Led. Folio.	Date.

Original size of Form, 23½ x 18 inches.

Form No. 8.

LIGHTING DEPARTMENT.

Ledger Folio.	Ck	Customers.	Discount. Incand.	A. C. Motor	Totals.	Lighting Incand.	Com. Arc.	D. C. Motor Current.	Rental.	Sales.

Original size of Form, 20 x 15 inches

Note.—The Customer's Record Book Form and Form No. 8 should be read across the two pages.

Form No. 7.

CARD .....

INCANDESCENT METER CARD.

LF FOL..... CONTRACT NO ....DATE. .....

DATE OF CONNECTION ..... TERM.....EXPIRES .....

NAME .....

ADDRESS .....

BUSINESS .....

REMARKS .....

METER NO.....CAP.....AMPERES

GAS CERT. ..... PER CENT. OF ERROR.....

CIRCUIT NO. .....VOLTS .....

Lamps Installed.

DATE.	ORDER	5 C.P.	8 C.P.	10 C.P.	16 C.P.	32 C.P.	C.P.	TOTAL Eq. to 16 C.P.

Original size of Form, 8 x 4½ inches.

METER NO..... VOLTAGE..... RATE .....

REMARKS.	DAYS	Current Reg'd	READING.	DATE.	INSP.

Original size of Form, 8 x 4½ inches.
(Back of Incandescent Meter Card).

Manager's Order Form.

NAME..... ORDER NO. .....

ADDRESS ..... DATE.....

THIS ORDER AUTHORIZES AND DIRECTS THAT .....

SIGNED ..... GENERAL MANAGER

Return this Order as soon as completed, and report labor, material and expenses on following accounts.

CLASS OF ACCOUNTS.	ACCOUNT.	SUB ACCOUNT.	Station	No. of Circuit.

TO .....

REPORT HERE, REMARKS, ETC.

WORK COMPLETED, DATE .. ..

SIGNED BY..... .....

Original size of Form, 8 x 11 inches.

LIGHTING ACCOUNTS

July, 1899.

METER READ'G IN AMPERE HRS.								
Present.	Consumed.					Meter Rental.	Total.	

August, 1899.

Led. Folio.	Date.	METER READ'G IN AMPERE HRS				Meter Rental.	Total.
		Present.	Consumed.				

CASH RECEIPTS.

CONTRACT AND SALES.			A. C. MOTOR.			RENTAL.				MISCELLANEOUS.	TOTAL.
Wiring.	Lamp Renewals.	Line Construction.	Current.	Rental.	Sales.	A.A Lamps.	Transformers	Poles.			

AN INTERESTING LEGAL DECISION.

Mr. Justice Davidson recently gave his decision in the Superior Court at Montreal in an interesting case in which the Royal Electric Company were plaintiffs and Mr. Maurice E. Davis defendant. His judgment in full was as follows :

The Royal Electric Company vs. Maurice E. Davis, et al — From the 20th of August, 1895, to the 20th April, 1898, plaintiffs supplied defendants with electric light for their premises situate on the corner of Dalhousie and Ottawa streets. Monthly accounts were rendered and paid up to the 25th of December, 1897. About the 1st of February following defendants were notified that a wrong principle had been followed in calculating the meter readings, and that the resulting under-charges amounted to $1,384.35, payment of which was asked for. The accounts for the current and following months were made on the altered basis of calculation. Defendants denied the existence of any error, and positively refused to reopen past settlements. To avoid litigation, however, and in view of the fact that but a short life remained to the contract when the dispute arose, they offered to acquiesce in plaintiff's pretensions as to the future This was refused, and then came the present suit to recover $1,874.05. By way of defence, it is pleaded that the accounts, as closed up to the 25th of December, 1897, were in accordance with the contract, and that the tender of $423 40 made for the sake of peace and now renewed was more than sufficient to cover any lawful indebtedness. By the contract between the parties, defendants agreed to take and use for a term of not less than twelve months 175, or more, incandescent lamps, the installation of which was to be at their expense. The electric company was to furnish its own meter at a rental of 25 cents per month. Then appear covenants in the following words :

" Said lights to be supplied by meter, and we hereby agree to pay for the same at ¼ cent per ampere hour, the bill to be rendered monthly, which we agree to pay upon the 15th of each and every month, for the preceding month's lighting at the company's office in this city. * * * * * Should the meter cease to register through any defect in its manufacture or break in its mechanism, the Royal Electric Company reserves the right to charge for such period of non-registry at the same rate as that at which the meter was registering at the time of such break or interruption." The accounts rendered stated the last and current readings of the meter, and multiplied the difference by ¼ of a cent. The result, plus 25 cents for rent of meter, represented the monthly charge. I take as an example the invoice for the first month :

For electric lighting from August 21, 1895, to September 25, 1895 :

Present meter register	35,800
Previous meter register	33,650
Ampere hours registered.	2,150
At ¼ cent per hour.	$16.13
	.25
	$16.38

Now, according to plaintiff's pretensions, the ampere hours registered ought, in this and all subsequent accounts, to have been doubled before being multiplied by the price. The effect would have been to double all the monthly statements. I take as an example the first account which was tendered after the alleged mistake of calculation had been discovered :

For electric lighting from December 2, 1897, to January 25, 1898 :

Present meter register	34,450
Previous meter register	25,610
Ampere hours registered	8,840
	2
	17,680
At ¼ cent per hour	$132.60
Rent of meter, one month at 25c. per month	.25
	$132.85

How plaintiffs justify this doubling up of the registered ampere hours calls for an explanation of a somewhat technical kind.

A transformer of 104 volts capacity transmitted a secondary current from plaintiff's main wires into the premises covered by the contract. Shallenberger meter within the building registered the ampere hours. Both transformer and meter had been in use during the previous occupancy of a firm of D. Ritchie & Co., among the partners in which were the present defendants. With but few exceptions, the company had in use 52 volt transformers. The company's inspectors, in their reports, made no mention of the voltage, if it were 52 ; they were expected to do so, if it were 104. Presumably from the facts that the transformer was not changed and that while in use by D. Ritchie & Co. two reports had been made of its voltage, the meter readings were returned to the office without special mention of the voltage. The chief clerk of the accounts department states that he, as a consequence, tendered statements on a 52 volt basis, and only in December, 1897, was it reported to the office that a 104 volt transformer was in use. Five or six weeks later the fact and pretended consequences were notified to the defendants. M. E. Davis gives the following account of the interview : " One of the Royal Electric Co.'s representatives came to our establishment one day and told us he had been making a mistake in our accounts for the last two years. I said, 'that is a strange thing ; I only remarked yesterday that I thought you were making mistakes, I have been complaining of exorbitant charges, the bills are large.' 'Well,' he replied, 'It is not that we have not been charging you enough.' 'Well, I said, 'that is strange, you have been tendering bills monthly, and if I had known that I would not have had the lights ; and they rendered another account for the following month, doubling up the price, which we returned, marked 'not correct.

Subsequently, as already stated, defendants, in the hope of avoiding a law suit, offered to acquiesce in the demand for the short time which the contract had still to run. But plaintiffs persisted in the belief that they were entitled to have all past accounts rectified and doubled in amount.

Upon what technical basis the claim rests, and what effect on figures a pressure of 104 volts instead of a supposed pressure of 52 volts produces, may as well be stated in the words of Mr. Gossler, plaintiff's electrical engineer and superintendent. They are as follows :—

" The reason is that if one lamp burned, or a sixteen candle power lamp at fifty volts permits a current to flow, for one hour of one ampere, a sixteen candle power lamp at one hundred volts allows it to flow but one-half ampere per hour, consequently the two lamps giving the same illuminating power will register on an ampere hour meter, in the case of fifty-volt lamps one ampere hour, in the case of a hundred-volt lamp, one-half ampere hour.

The statements do not represent theories, they are well-established scientific facts. But does this full acquiescence entitle plaintiffs to judgment. The answer has to be in the negative, and for a number of reasons.

The contract explicitly says that the lights were to be supplied by meter at ¼ of a cent per ampere hour, and if the meter were to break down, the charge was to be at the same rate at which the meter was registering at the time of such break or interruption.

Plaintiffs now want to base their calculations not on amperage alone, but on voltage also. They want to be paid for the product of quantity, which is called amperes, and of pressure, which is called " volts." The result gives the energy which is called " volts." If this were the true intent of the contract, why was not a constant ratio fixed between voltage and the amperage, as registered by the meter, which was of a standard kind, and in common, indeed, universal use, whatever the transformer might be? Or why not have provided for payment by volts instead of by amperes?

Mr. Lockart, chief electrician of the Montreal Street Railway, states his opinion in this effective way : " If a man came and said he would supply me current at any price per ampere hour, the voltage does not enter into it."

Plaintiff's interpretation of the contract, even if correct, is thus certainly open to legal and scientific controversy. Having for eighteen months not only acquiesced in, but given effect to the amperage meter readings without reference to voltage, they cannot now have specific performance imposed on defendants. To state a principle well known to the courts, relief will not be given to parties who sleep on their rights. Defendants' connection with the dissolved firm of D. Ritchie & Co. does not prejudice their position. Its contract was auxiliary to a local installations, and contains some words not present in the one under consideration, which may or may not be of distinct importance.

Had plaintiffs asserted their present position at the outset, it might have been open to defendants to dispute it more effectively than they can do now, or to have it torn up; or to certainly cancel at the end of twelve months ; or to handle their lights with greater economy of use. The action is dismissed with costs.

There is a movement on foot at Baddeck, C.B., looking to the installation of an electric light plant.

CANADIAN WATER POWER AND ITS ELECTRICAL PRODUCT IN RELATION TO THE UNDEVELOPED RESOURCES OF THE DOMINION.*

By Thos. C. Keefer, C.M.G.

Amongst the many partially developed resources of Canada, perhaps there is none more widespread or more far reaching in future results than her unsurpassed water power. The value of this has been enormously enhanced, first by the expansion of the wood pulp manufacture, and the introduction of electro-chemical and metallurgical industries for which this country possesses the raw material; and, more recently, by the revolution which has been brought about by success in transmitting the energy of water falls from remote and inconvenient positions to those where the work is to be done.

Electrical transmission brings the power to the work, and when the prime mover is water, we have the cheapest power, and perhaps nearest approach to perpetual motion which it is possible to obtain—one which is always "on tap," and, like gravity, maintained without cost and applied without delay.

While water power was at first the only substitute for the windmill in new countries, and its economy as well as superiority has always been recognized, several causes have contributed to limit its more general application. Before the invention of the turbine in the first half of the present century, heads exceeding about seventy feet could not be utilized on account of the comparative weakness and excessive cost of wheels of large diameter. In these days of structural steel, and "Ferris" wheels, this difficulty could be overcome; but, with the turbine the conditions are reversed, the higher the head the less the size and cost of wheels, so that the most valuable water powers were the most cheaply utilized in this respect.

A previous check to the greater extension of water power was given in the latter part of the last century by James Watt's discovery of the steam engine, which by bringing the power to the work, to the city, and to the mine, revolutionized industrial conditions.

A still greater revolution has recently occurred which brings water power to the front again, by its amalgamation with electricity, whereby its economical power is transferred to the work, over many miles of distance upon a single wire.

Within the last ten years high voltage electricity has been firmly established with annually increasing power of extension, and this has brought Canada into the first rank of economical power producing countries. Water is thus represented by a power to which it can give birth, but which is superior to its own, in that, wherever transplanted, it can do nearly all the parent power could do, as well as give light, heat and greater speed; moreover, it has given rise to industries only possible with abundant cheap electricity. What is more important to us is that such industries are those for which Canada possesses the raw material, but which, without water power, she could not engage in.

There are important industries in which we have for some time utilized water power, for which electricity is not indispensable, but which equally require large amounts of cheap power, and are capable of indefinite extension; but while these may not need the intense electric current necessary for electro-chemical industries, they will find electrical transmission of inestimable value in many situations; while, for lighting and heating purposes, water power is invaluable to all.

Heretofore we have cut our spruce into deals and exported it to Europe, and more recently into pulp wood and exported that to the United States, but, manufactured by our water power into paper, the raw material would yield this country ten times the value it is now exported for.

The extension of railways, combined with electrical transmission, will promote the local manufacture of such wood products (including all valuable hardwood) as can bear transportation, thus giving the largest amount of local employment, as well as tonnage to the railway, and delivering us from the position of "hewers of wood" for other countries.

ELECTRICITY.

In order to present more fully the recently enhanced value of our Canadian water power, some reference is necessary to certain properties of electricity, the power which has happily been described as "the most romantic form of energy" by Wm. Henry Preece, C.B.F.R.S., in his recent address as president of the Institution of Civil Engineers.

Inasmuch as the cost of production of electrical energy depends upon continuity of output, water power must be the ideal one for this purpose, at least until some cheaper power is discovered. In some places where steam is now used for electric light, other industries have been added to secure the more continuous use of the power in daylight hours.

The only quality in which any deficiency has been exhibited by electricity is for lighthouse purposes, a lesser power of penetration in fogs, in which respect it is inferior to oil or gas; but even this has in the present year been more than compensated for by the successful application of "wireless telegraphy," by which, in any weather, communication between the ship and the shore can be established. The shores of the St. Lawrence from the Atlantic to the Lakes are lined with water power which can be used to light, in fair, or protect, in foul weather, the passing vessel, to ring the bell or blow the horn.

When water is applied for light and power purposes, its economy is always the important factor, but it is chiefly to its value for electro-chemical industries that Canada will look to reap the greatest benefits, because in these it is not merely a question of competition of power producers, but one in which intense electricity has the monopoly, and in the case of some of them, as in the production of aluminium, calcium carbide, carborundum, etc., their existence depends upon ample supplies of an intense electric current, for the generation of which abundant and cheap water power is indispensable.

Touching electro metallurgical processes, Mr. Preece says: "Every electrolyte requires a certain voltage to overcome the affinity between its atoms, and then the mass decomposed, per minute or per hour, depends solely upon the current passing. The process is a cheap one and has become general. Three electrical h.p., continuously applied, deposits 10 lbs. of pure copper every hour, from copper sulphates, at the cost of one penny. All the copper used for telegraphy is thus obtained. Zinc in a very pure form is extracted, electrolytically, from chloride of zinc produced from zinc blende, in large quantities. Caustic soda and chlorine are produced by similar means from common salt. The passage of electricity through certain gases is accompanied by their dissociation, and by the generation of intense heat. Hence the arc furnace. Aluminium is thus obtained from cryolite and bauxite. Phosphate is also separated from apatite and other mineral phosphates. Calcium carbide, obtained in the same way, is becoming an important industry. Electrical energy can be generated on a coal field where coal, of good carolific value, is raised at a cost of three shillings per ton, cheaper than by a water fall, even at Niagara."

Eastern and Western Canadian coal fields are separated by thousands of miles, but water power is abundant throughout nearly all this coalless region. Our western coal fields are vast and their market at present limited. If coal can be raised cheaply enough and the raw material for the work be discovered in the neighborhood, they may give rise to electro-chemical and electro metallurgical industries without the intervention of water power.

The commercial production of calcic carbide (acetylene gas), by electrolysis, is the discovery of Mr. T. L. Wilson (a grandson of the late Hon. J. M. Wilson, of Saltfleet, Ont.), who has established works on the water powers of the Welland Canal and has shipped this product all round the world.

The electric production, commercially, of caustic soda

* Abstract from Presidential Address read before the Royal Society of Canada, May 23rd, 1899.

and chlorine is under the patent of Mr. Ernest A. Leseur, son of the Secretary of the General Post-Office Department, Ottawa. This manufacture is now being carried on by a Boston company at a New England water power.

MINING.

There is another field nearly as widespread as our water power in which electricity is destined to play a most important role, and this is mining, which is now spreading over the Dominion with the same rapidity as the utilization of our forests for pulp and paper purposes. Over this area minerals have been discovered and in many cases tested and successfully worked, and from recent results we appear to be on the threshold of remarkable developments in this direction, especially as so small a portion of so great an area has been prospected sufficiently for mining purposes.

For power purposes alone, electricity is invaluable in mines, and its multifarious uses (as enumerated by Mr. Preece) are "for moving trams and for working hoists; it lights up and ventilates the galleries, and, by pumping, keeps them free from water. It operates the drills, picks, stamps, crushers, compressors and all kinds of machinery. The modern type of induction motor, having neither brushes nor sliding contacts, is free from sparks and free from dust. Electric energy is safe, clean, convenient, cheap, and produces neither refuse nor side products." The Canadian mining districts are well supplied with water power, and all the wonderful effects of electricity are available for us upon a larger and more economical scale than elsewhere. In connection with this abundance of water power, and from the fact that a large proportion is at present situated remote from present railways and present settlements, the question of profitable limit of electrical transmission is most important if, indeed, it be now possible to put a limit on anything connected with electricity, with or without the aid of a wire. If, as reported, Lord Kelvin has placed the profitable limit at 300 miles, this is sufficient to utilize the greater part of the water power upon the two watersheds north of the St. Lawrence river.

Professor Elihu Thomson says, "Up to the present time it was practicable to transmit high pressure currents a distance of 83 miles, using a pressure of 50,000 volts. If a voltage higher than that were used, the electricity would escape from the wires into the air in the form of small luminous blue flames." As showing how far we are yet behind nature, Prof. Thomson says the estimated voltage from a lightning discharge ranges from twenty to fifty million volts.

Wherever the raw material for electro-chemical, electro-metallurgical, or other industries, affords sufficient inducement, and the water power is at hand, the forest will be penetrated much more rapidly than heretofore, and settlements advanced in new directions. What can be done in this direction is best illustrated by the development of a single industry in the wilds of Minnesota north of Lake Superior, and adjoining Canadian territory. Over four hundred miles of standard gauge railways have been built, through what was a trackless wilderness in 1885, to reach iron ore beds, the ore from which is shipped to Lake Erie and thence again railroaded 200 miles into Pennsylvania. This one business has, in mines, railways, docks and fleets of steamers, required an investment of $250,000,000, and has led to as low a rate, by water, as 1 cent per bushel for wheat between Chicago and Buffalo, and 20 cents per ton for coal from Lake Erie to Duluth, nearly 1,000 miles. One-half of the charcoal iron, and more than half of the pig iron made in the United States, is smelted from Lake Superior ore.

ELECTRIC RAILWAYS.

The substitution of electricity for steam as the motive power for railways on many roads is regarded as inevitable sooner or later. It has already taken place as regards suburban railways, notably in the case of the Charlevoix road and Hull and Aylmer railway, where water is doing the work which has heretofore been done by coal. The chief obstacles to an early change on the larger roads are the hundreds of millions invested in locomotives, and the very large outlay required to equip existing steam roads with the electric system. The principal inducement would be the passenger service, owing to the increased speed possible, it being confidently stated that, with electricity, a speed considerably over one hundred miles per hour could be attained. Moreover, there would be entire abolition of the poisonous smoke which drops upon the Pullman in preference to any coach ahead of it.

While the conversion of trunk lines would be attended with a cost which is for the present prohibitory, this objection does not apply to new lines, which may be worked independently, or in connection with electric ones. When the time arrives for such railways, water power will have a field of usefulness of which we can at present form little conception. Water wheels and wires would displace the coal docks, the coal-laden vessels, the huge coal yards, and the trains required for distributing their contents over hundreds of miles of lines.

An interior line connecting Lake St. John, on the Saguenay, with Lake Temiscamingue, on the Ottawa, which could ultimately be extended, via Missanabei, Nepigon and Lac Seul to the Saskatchewan, would be a colonization road, removed from the frontier—one which could be worked possibly altogether by water power, and would open a virgin tract in which electro-chemical and electro-metallurgical industries might arise, as well as those connected with the products of the forests and the mine.

SPARKS.

The city of Winnipeg, Man., wants tenders by August 12th for the supply of twenty miles of wire for a fire alarm system.

The Hamilton Brass Works, of Hamilton, Ont., have followed the example of a number of other manufacturers in Hamilton and installed in their factory a 30 h.p. S. K. C. motor, which is operated by current from the Cataract Power Company's lines.

The Nelson Electric Tramway Co. have just closed a contract with the West Kootenay Power & Light Co. for the supply of power for the new street railway at Nelson, B. C. Mr. C. H. Hall has been appointed engineer-in-charge of the construction work.

The Dominion Coal Co., Cape Breton, N.S., are adopting electricity for the lighting of their mines, and have placed an order with the Canadian General Electric Co. for one of their standard 30 kilowatt direct connected generators, together with switchboards and wiring.

Prominent Montreal men have made application for a charter for the Wire & Cable Company. The capital is to be $500,000 and the factory will be located in Montreal. Messrs C. F. Sise, L.B. McFarlane and C. P. Sclater, of the Bell Telephone Co., are among the promoters.

The corporation of Fort William are setting up in their new power and pumping station a new 180 k.w. S. K. C. machine, with switchboard, etc. They are also largely increasing their incandescent lighting. When completed this will be one of the most up-to-date and modern electric light and water power systems in the Dominion.

The corporation of Dundalk, a short time ago, passed a by-law to raise $9,000 for the purchase of an electric lighting plant. The contract for the engines and boilers was awarded to E. Leonard & Sons, of London, and the contract for the electrical equipment, consisting of a 30 k.w. S. K. C. generator, with switchboard, transformers, etc., to the Royal Electric Company, of Montreal. The plant is to be in operation by Sept. 15th.

The town council of Arnprior, Ont., will likely enter into a contract with Robert Anderson, of Ottawa, for lighting the streets for five years. Mr. Anderson's proposition is to furnish twenty lamps of 1,200 candle power at the price of $42 per year, and to light the town hall with 16 candle power incandescent lamps at the cost of 1 cent per hour, 50 per cent. discount. The council have decided to take this step in view of their inability to obtain from the Arnprior Electric Light Company what was considered a reasonable price.

A most complete electric light plant has been installed by the British Columbia Marine Railway Company's ways at Esquimalt, B.C. This enables the company to dock or launch ships just as easily at night as in the day, and makes it possible to carry on work on vessels both night and day, causing a considerable saving to the owners. The plant, which was installed by Messrs G. C. Hinton & Co., consists of a 120 16-candle power light dynamo. Fifty lights have been placed on each side of the cradle, every other lamp being attached to a long insulated cord so that it can be placed wherever required. Five arc lights have been placed on the wharf and mounted on a carriage, so that they can be moved about the yard as a 6,000 candle power search-light. The light from this can be thrown across the harbor to guide ships to the railway, or when ships are on and work is proceeding at night, used to give additional light to the workmen. The company have awarded the contract to Messrs. Hinton & Co. to install a duplicate plant at the railway they are constructing at Vancouver.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

THE ANNUAL CONVENTION.

Arrangements are nearing completion for the annual convention of the above association, to be held in Berlin on Tuesday, Wednesday and Thursday, August 15th, 16th and 17th. The members of the local association are working earnestly to make the convention a success. Besides the usual business, papers will be presented by Mr. E. J. Phillip, of Toronto, and others, and on Thursday evening a banquet will be held at the Walper House, at which it is expected there will be a large number of guests.

From Mr. G. C. Mooring, of Toronto, who is acting executive-secretary, we learn that the reports from the various associations indicate that there will be a satisfactory attendance. The Toronto contingent, which will comprise probably fifteen members, is expected to leave at 8:30 a. m. on Tuesday. Delegates should buy a single ticket, and obtain from the secretary at Berlin, Mr. W. Oelschlager, a certificate stating that they were in attendance at the convention. This will entitle them to return fare at a reduced rate. Following is the programme :

OFFICIAL PROGRAMME.

TUESDAY, AUGUST 15TH.—11 a. m.—Reception of Delegates ; Mayor's Address of Welcome. 2 p. m.—Meeting of Committees.

WEDNESDAY, AUG. 16TH.—9 to 12 a. m.—General Business. 2 p. m.—Reading of Papers and Discussions. Evening.—Open Air Concert by B. M. S. Band in Victoria Park.

THURSDAY, AUGUST 17TH.—9 a. m.—Business of convention continued. 2 p. m.—Election of Officers and other Business. 9 p. m.—Banquet House at Walper to the Officers and Delegates.

TORONTO NO. 1.

At the annual meeting of Toronto No. 1, held on Wednesday, June 21st, the following were elected officers for the year : President, H. E. Terry ; vice-president, J. Huggett ; recording secretary, W. J. Webb ; financial secretary, A. E. Bourne ; treasurer, S. Thompson (acc.); conductor, J. Bannan ; doorkeeper, W. Butler ; trustees, W. Lewis, A. E. Edkins and W. J. Webb ; delegates to convention, A. E. Edkins, C. Moseley, J. W. Marr, W. J. Webb and J. G. Bain.

TORONTO NO. 18.

Toronto No. 18 have elected the following officers : President, J. M. Dixon, acclamation ; vice-president, T. Graham ; recording secretary, Jos. T. Smart, acclamation ; financial secretary, J. J. Richardson, acclamation ; treasurer, P. Trowern ; conductor, R. Riley ; door-keeper, James Hutchins ; trustees, A. W. Vancer, Joseph Hughes and F. W. Fanner ; delegates, Messrs. Dixon, Richardson and Trowern. A few questions relating to engine compounding, boiler construction and heating surface, and the comparative merits of fuel, were asked and satisfactorily answered.

HAMILTON NO. 2.

Hamilton association last month elected officers as follows : T. Clubb, president ; W. Sculthrope, vice-president ; J. Ironside, recording secretary ; J. Carroll, financial secretary ; W. Collins, conductor ; T. Carter, doorkeeper ; trustees, P. Stott, R. Pettigrew, R. Mackie ; auditors, G. Mackie, R. Pettigrew, W. Stevens ; delegates to convention, G. Mackie, J. Ironside.

Mr. Ernest S. Harrison has established business at 191 Thistle street, Winnipeg, Man., and will in future represent the Western Electric Company, of Chicago. He will give attention to electrical construction and repair work of all kinds, and will make a specialty of armature winding and motor repairs. He will also carry a complete stock of supplies.

Just as we go to press it is learned that the contract for the Ragged Rapid transmission scheme for the town of Orillia is likely to be awarded to Mr. P. H. Patriarche, of the Electric Maintenance & Construction Co., of Toronto. After a delay of several months, the contract was thrown up by the Central Construction Company, of Buffalo, the original contractors.

Mr. Ephrem Valiquette, of Montreal, was the winner of the gold medal at the Industrial and Mechanical course at the Monument National. Mr. Valiquette is provincial boiler inspector, president of the Engineers' and Mechanical Mutual Benefit Association, and also a member of the Canadian Association of Stationary Engineers. He is now foreman for Lymburner & Matthews, mechanical engineers, of Montreal.

ENGINEERING NOTES.

As to the causes of the round corners on the admission line of the diagram from the steam cylinder of his air compressor, a writer says that the diagram shows that the release opens late ; the compression is late, and therefore the admission is late, so there is no lead, thereby making the round corners referred to. All the movements are too late ; to overcome this, advance the sheave.

In a recent paper by Mr. T. Messenger before the Northeast Coast Institute of Engineers and Shipbuilders, a method of strengthing steam pipes was mentioned. It consisted in applying a series of clips (in two halves) cottered together, says the Practical Engineer. In a 12 inch pipe, with 100 pounds steam pressure, they have been pitched 6 inches apart. They have a sectional area $\frac{1}{8}$ square inch (2 inches wide by 3-16 inch thick). One advantage that they undoubtedly offer is the restriction of a failure, as usually a rupture produces an opening extending from flange to flange. They can be easily applied to the joints or branch junctions, strengthening the necessarily weak places in a range of piping. We should think that there should be a large field for their use where brazed copper pipes are unavoidable.

Why should the pressure fluctuate more at the end of a long steam main than at the boilers ? is the question which is troubling one of the subscribers of Power. The answer given is that if there were no flow through the pipe the pressure at the far end would be the same as that at the boiler, and would vary as the pressure at the boiler varied. Steam will not flow from one point to another, however, without a difference in pressure, and the greater the rate of flow the greater the difference of pressure required. If the pressure at the boiler, then, were absolutely constant, there would still be a variation at the far end of the main dependent upon the rate of flow, and if the boiler pressure varied we should have at the end of the pipe a variation which would be the combined effect of the changing boiler pressure and the fluctuation due to the varying rate of flow.

FEED WATER.—Treatment of feed water by engineers has not, as a rule, met with any great success, as a number of experiences in this line that have been shown up will testify, but there a few tests that every one having charge of boilers should be familar with. The presence of hard or soft water is easily detected by dropping a few drops of alcohol that has dissolved all that it can possibly hold of good soft soap. The water will turn milky white if it is hard and remain clear if soft. Add to the water from five to ten drops of oxalate of ammonia in a test tube. If carbonate of lime be present the water will in a short time present a clouded or milky appearance, and in a few hours a precipitate will be found at the bottom of the tube. Take some of the feed water and add a few drops of nitrate of baryta or barium chloride. If sulphate of lime or sulphuric acid is present it wil be shown by a milky appearance, and by the formation of a white precipitate. If decomposed animal matter is the cause of all the trouble it will be shown by adding a drop of premaganate of potash, which will color the water a bright violet rose when first added. If decomposed organic matter is present the color changes to a dull yellow ; if present in large quantities, however, the color will in time disappear. If, upon adding a few drops of solution of prussiate of potash, a blue color is produced directly or after some time, it shows that iron is held in solution.

TO COVER IRON PULLEYS WITH LEATHER.—With a given tension of belt nearly three times as much power can be transmitted by a leather-covered pulley as with a smooth iron surface. It is a comparatively easy matter to cement leather to the face of a pulley so that it will stay for an indefinite length of time—in fact, until the latter is worn out or is forcibly torn from the pulley. It is an easy matter to make such a cement joint as it would be if cementing to wood or other porous substance. Any good glue can be used if suitably prepared and carefully spread on the iron surface. For such purposes a given amount of glue should be covered with an equal weight of water, and the whole let stand for twenty-four hours until the water is completely absorbed by the glue. The mass should then be heated in a water bath until the glue is melted. This makes a concentrated glue solution. This is to be spread on the surface of the pulley after the leather has been suitably prepared. A strong solution of tannic acid should be used for moistening the leather before it is applied to the glued surface. The solution should be applied warm. The surface of the pulley should be roughened by cross-filing, or the use of acid before the glue is applied, and the glue should be warm when the application is made. The leather used for covering pulleys may be pieces of old belting or split leather. The size of the pulley can be increased considerably by the use of the leather covering.

ELECTRIC RAILWAY DEPARTMENT.

MECHANICAL TRACTION BY ELECTRICITY.*

By Granville C. Cunningham, M.I.C.E.

In the installation of mechanical traction by electricity on tramway systems, the point to be considered is how this form of traction compares in cost of construction and working with that it displaces, and what are the conditions that make for a high or low cost of working. It will doubtless be admitted that unless such form of traction were financially superior to other forms it would not be adopted; but it will be useful to inquire wherein this particular superiority lies, as this indicates the direction in which the skill and resource of the engineer should chiefly be turned. The cost of constructing and equipping an electric tramway system is very much greater than the cost of a horse system. The receipts per car-mile may not be much greater, and with the largely increased mileage run may possibly be even less; therefore, unless the expenses per car-mile of the electric system are very much less than the expenses of the horse system, whence can be obtained the large additional net revenue required to pay interest and sinking fund on the greatly increased capital invested? It is accordingly to this lowering of the cost of electrical working that the attention of the engineer should be chiefly directed, and the best results in this respect can be obtained only by care in construction.

In the first place, on what item in working cost may a saving be looked for?

In the matter of wages of men on the car no saving can be effected, two men would be needed on the electric as on the horse car, and the electric employees may even be expected to require higher wages. The maintenance of car-body painting, repairs, etc.—would be practically the same in either case; the maintenance of the electric equipment of the car is an addition to any expense of the horse system; so also is the overhead wire and feeder system; the maintenance of the track would be greater for the electric system, including therein the bonding. In all thesee items the cost in the total would be greater for the electric than for the horse system. There would be some advantage to the electric system in being able to run at a higher speed, thus distributing the wages of motormen and conductors over a larger mileage in a day and reducing the amount of that item per car-mile. But this is not a large amount and would not compensate for the increase in the other items mentioned.

The only item remaining to be considered is the power used in the service, and it in in this item also that the saving can be effected. For this reason the power house on an electric system is the point to which the intelligence and skill of the engineer should be mainly devoted. It is upon this that the financial success of the undertaking depends. If it is carelessly constructed, with engines, boilers and appliances that do not insure a low cost of working, then it is certain that but a small profit—and perhaps no profit at all—will be realized. It is certain that no great financial success will be secured. Everything that will reduce the cost of producing the electric current should be sought out and applied in the construction of the power house.

The cost of horse traction—and by this is meant the cost of horse-keep, wages of grooms, shoeing, veterinary expenses, but exclusive of drivers' wages—may be taken as varying from 3½d. per car-mile in an easily-worked town such as Glasgow, to 5d. per car-mile in a hilly and more difficult town, such as Liverpool. This is the cost of horse traction arrived at from the working of fairly large systems showing 7,000,000 car-miles annually in Glasgow and over 4,000,000 in Liverpool. The cost of electric power for traction on the overhead trolley wire system should, with enonomical engines, boilers and heat-saving appliances, be under ½d. per car mile for an easily-worked level town, and for a more hilly town with steep gradients slightly over ½d. per car-mile. The cost here meant is the cost of all wages, fuel, water, oil, etc., in the power house, together with the cost of maintenance, repairs and up-keep of the plant. The cars driven by this power are those weighing about 6½ tons when empty and capable of seating 26 passengers inside. In order to insure this low cost of working every care must be taken in the power house. In choosing its site it should be placed close to a plentiful supply of water, where all that is requisite for condensing purposes may be had at a nominal charge, or merely for the cost of pumping. A river, canal, pond or the sea would afford what is needed. It should be conveniently situated for the supply of coal from railway line, canal or wharf, so as to save the charges of handling fuel. One shilling per ton saved in cartage would amount to a very considerable sum in a year in a large traction station.

But, needless to say, the most important matter is the type of engines, boilers and heat-savers to be used. The writer favors low-speed (70 revolutions) compound condensing engines, such as are built by numerous English firms, boilers of the Lancashire or Galloway type, with Green's economizers. A plant of this character was constructed and worked under the writer's charge on the Montreal Electric Street Railway, with the result that the cost of producing current was a little under one farthing per kilowatt-hour, and the cost per car-mile less than half-penny in the open months of the year, when coal could be obtained for 9s. per ton. The consumption of coal was 3.48 lbs. per kilowatt-hour, or 2.60 lbs. per e.h.p.-hour, and this was maintained during the months of working. The average for a whole year was only 2.75 lbs. per ehp.-hour. It is not pretended that this is a phenomenally low rate of consumption. On board many of the large ocean-going steamers as low as 1.50 lbs. of coal per h.p.-hour has been reached with triple expansion engines; but the writer believes that few electrical power-houses have been able to show better results than those mentioned. Nor is the result to be attributed to a very large output; precisely similar results can be obtained by using similar appliances on a smaller scale. In the Montreal house there were six 800-h.p. engines, and the daily output of current averaged 43,000 units. But the author has recently obtained similar results with a small cable plant on the Birmingham cable system. In 1897 this plant consisted of a pair of single cylinder engines running at 53 revolutions of 287 maximum h.p., with Galloway boilers, and no special heat-saving appliances. It was necessary to increase the engine-power to meet increased traffic. The author put in a pair of superposed compound condensing engines of 400 h.p. running at same speed as before, and obtained condensing water from a well in conjunction with a tank and cooling tower. The result was that the consumption of fuel was reduced from about 325 tons per month, or 8.9 lbs. per car-mile, to 6.5 lbs. per car-mile; and the introduction of Green's economizers has further reduced the consumption to 4.7 lbs. per car-mile, or to about 3 lbs. per h.p.-hour. On the Birmingham small cable system, the saving does not amount in money to a large sum, but on a great electric system running, say, 7,000,000 car-miles in the year, 4 lbs. of coal saved per car-mile, at 9s. per ton, amounts to £5,625 per annum; and it is this consideration that gives emphasis to the plea for an economical power-house plant.

To return to the previous argument. Note what a large saving is effected when a cost of ½d. per car-mile for power is substituted for 5d.; on a car-mileage of 7,000,000 it means no less a sum than £131,250 per annum! and indicates the source whence the increase of net earnings may be obtained to pay for the heavy cost of electrical installation. The whole cost of working a large electric system, including working charges of all kinds, should be under 5d. per car-mile; but this can only be obtained with a carefully constructed power-house, where the works-cost of the current is cut down to a minimum.

The limits to which this note had to be confined prevent the introduction of any more elaborate figures or statistics than those given; but enough has been said to indicate that, in the writer's judgment, it is to the power-house that the chief attention should be directed in order to ensure the financial success of an electric system. Other parts of the system claim attention, but it is on this that success or failure mainly turns. More money can be lost on the one item of power than would pay all the other working charges, and whether the high potential system with transformers or the multiple unit system be adopted, the successful working ultimately depends upon having engines and boilers that will do their work with a low consumption of fuel.

*Read at the Engineering Conference, Section VII, of the Institution of Civil Engineers, London, Eng., June 8, 1899.

It is believed that the council of the town of Woodstock, Ont., will accept the proposition made by Messrs. Ickes & Armstrong, of Harrisburg, Pa., for the construction of an electric railway in that town.

SPARKS.

Robert Surtees, C. E., of Ottawa, has estimated the cost of an electric light plant for the village of Shawville, Que., at $4,000.

The Canada Atlantic Railway Co. will this fall commence the erection of additional car works at Ottawa, to be operated by electricity.

The Hull Electric Co., at a meeting held last month, elected directors as follows: Alex Fraser, David McLaren, W. J. Conroy J. B. Fraser, R. H. Conroy and T. Viau.

Figures are being taken on developing the power of the Current river at Port Arthur. It is said that the work will cost about $5,000 and will include four turbines of 75 h.p. each.

Messrs. Corey & Campbell, of Bedford, Que., have given the United Electric Company, of Toronto, an order for one of their 1,000 light inductor alternators for street and commercial lighting.

Two buildings are being erected at Waverly, N. S., for the company which has been formed to manufacture electrical apparatus, fuses, etc. There will be five buildings in all, and the industry will employ a large number of hands.

The Dominion Electrical Works, Limited, has been formed at Halifax, N.S., for the purpose of manufacturing electrical apparatus and supplies. The capital stock is placed at $30,000. B. F. Pearson and Harold Covert, of Halifax, are among the promoters.

The new steamer "Argyle," plying between Kingston and Ontario Lake ports, is one of the palace steamers of Lake Ontario, its fittings being of the finest. It is lighted throughout by electricity and also has a search-light. The entire electrical plant was installed by the Royal Electric Co., of Montreal.

The Eastern Townships Electric Company, of North Hatley, Que., has been granted incorporation, with a capital stock of $300,000, to generate electricity and construct necessary works for the purpose. Andrew J. Gordon, of North Hatley, and F. E. Lovell, of Coaticook, Que., are members of the company.

Mr. Moise Paquin, of Maskinonge, one of the promoters of La Societe Industrielle du Comte de Maskinonge, is negotiating with American capitalists for the sale of St. Ursule Falls, on Maskinonge river, in the province of Quebec. It is said that these falls are equal to the Shawenegan Falls for power purposes. They have a decline of 180 feet and no less than seven cascades, at the foot of each of which industrial establishments could be erected on solid rock foundation.

Ottawa capitalists are said to be considering a scheme for the harnessing of the entire water power of the Chaudiere Falls. The idea is to build a large canal from near the head of the falls down through a suitable channel, the water to be directed into this by means of a dam, and a large power house to be built at the lower end of the artificial waterway. The electrical power thus developed would be employed for the running of saw mills, carbide factories, electric light plants, etc. It has been calculated that the falls would produce over 160,000 h.p.

The city council of St. Thomas, Ont., have renewed the contract for street lighting with the St. Thomas Gas Co. The company are to supply the same number of lamps as at present in use, all night, on a ten years' contract, at 25 cents per lamp per night, or 26 cents per lamp per night for moonlight schedule, with the provision that when the number of lamps reach 100 or more the price is to be reduced one cent per lamp per night. Incandescent lights for public buildings are to be supplied at 58-100 of a cent per lamp per hour.

It is announced that the company controlling the water power at Shawenegan Falls, Que., has induced the Pittsburg Reduction company to establish works there for the manufacture of aluminum. Aluminum, as is known, is extracted from a particular clay. Chome is to be found in quantities in Canada, and this, with a mixture of 94 per cent. of aluminum, will produce a metal said to be as strong as steel. If such works are established in Canada, it is probable that aluminum wire will be used to a greater extent for the transmission of electricity.

The City of Georgetown, British Guiana, has recently introduced the electric light. The arc lamps became centres of attraction to cockles, a species of small beetle, which swarm in myriads along the coast and river shores at the commencement of the Guiana rainy season, and each lamp was speedily filled to the brim. The front ranks of the insects then came in contact with the current, which set their bodies on fire. The immediate result was that the lamps were rendered useless for illuminating purposes, and vast clouds of intolerably noxious fumes emanated from them and floated into the neighbouring houses, the inmates of which were driven nearly frantic.

The Electric Light Co. which recently secured a contract for lighting the town of Merritton, and which have about 400 incandescent lamps installed in houses, and 20 enclosed arc lamps on the streets, have began operations with their own water power and apparatus. They have, however, made an arrangement now by which the St. Catharines Electric Light Co. are to furnish them current from their station, which is about four miles distant. The plant of the St. Catharines Electric Light & Power Co. is being considerably changed and enlarged. One side of their new 200 k.w. S.K.C. generator will supply the town of Merritton and that district lying south of their power house, and the other phase that portion of the city of St. Catharines north of their power house. During the hours of day-light this polyphase machine will be used for supplying power to the different industries in and about St. Catharines.

Rules for automobiles have been adopted in France to secure safety of passengers, pedestrians and other vehicles. These require that the operating mechanism, steering gear and brakes meet the approval of an inspection board, and are, in brief, that: Each vehicle must bear the maker's name, the type of the machine and the number of vehicle in that type, also the name and address of the owner. No one shall drive the automobile who is not the holder of a certificate of capacity from the Prefect of the department in which he resides. The driver of an automobile must always have the regulator of speed well in hand. In case of narrow or crowded thoroughfares, the speed must be reduced to a walking pace, and in no case must it exceed 18½ miles in the open country or 12½ miles an hour while passing houses. Racing is allowed, providing authorization is obtained from the Prefect and the mayors are notified. In racing speed of 18½ miles an hour may be exceeded in the open country, but in passing houses the maximum of 12½ miles must not be exceeded. The approach of an automobile must be signaled by means of a horn. Each automobile must be provided with two side lights, one white and the other green.

TRADE NOTES.

The Canadian General Electric Company are installing a 50 horse power three-phase induction motor at St. Elmo mine, Rossland, B.C., for the James Cooper Mfg. Co.

The McLaughlin Carriage Company, of Oshawa, have placed an order with the United Electric Company, Ltd., for a 25 k.w. direct connected generator and engine, with complete accessories for operating same.

The Canadian General Electric Co. have recently sold the Wm. Hamilton Mfg. Co., Vancouver, B.C., one of their standard compound wound multipolar generators for direct connection to Pelton water wheel.

The large 176 barrel mill of the Dowling Milling Company, at Edmonton, N.W.T., is being furnished throughout by the Goldie & McCulloch Company, Ltd., Galt, Ont. This includes engine and boiler, as well as mill machinery.

The corporation of Bothwell, Ont., have placed an order with the Canadian General Electric Company for all the additional material required for extending their plant recently installed by the Canadian General Electric Company.

The United Electric Company, Ltd., Toronto, have closed a contract with the Kingston Hosiery Company for a 30 h.p. direct connected generator, switchboard, engine, and the installation of lights throughout their mills at Kingston, Ont.

The Goldie & McCulloch Co., Ltd., Galt, Ont., have just completed the placement of two large cross compound Wheelock engines at Bond Lake, in the power house of the Metropolitan Street Railway Company. The engines are from 400 to 450 h.p. each.

The Robb Engineering Company, of Amherst, N. S., has recently received the following orders from British Columbia: City of Kamloops, a 150 h.p., and the Hastings Exploration Syndicate a 60 h.p. Mumford improved boiler; Hugh C. Baker, Rossland, a 15 h.p., and Robertson & Hackett, Vancouver, a 50 h.p. Robb-Armstrong engine.

Messrs. Steinhoff & Gordon, of Wallaceburg, who are erecting a stave and heading mill at Tweed, Ont., have decided to add an electric lighting plant to light the town of Tweed. The order for the electrical apparatus, consisting of a 40 k.w. S. K. C. generator, with switchboard and complement of transformers, has been given to the Royal Electric Company, of Montreal.

SPARKS.

The city council of Montreal is again taking steps to compel manufacturers to install smoke consuming apparatus.

The Standard Chemical Co. are installing a new electric plant at their works at Deseronto, Ont. The Canadian General Electric Company are supplying the apparatus.

The Montreal Street Railway Company have placed an order with the Canadian General Electric Company for 10 additional 2 motor equipments of their standard G. E. 1000 type.

Messrs. W. D. McNair, of New York, and J.S. Clark, of Ayr, are promoting an electric railway from Ayr to Berlin. They have made application to the council of North Dumfries for right of way.

A 40 h.p. S. K. C. induction motor has been installed by the Cataract Power Company in the works of the Hamilton Tack Co., which will add another smokeless chimney to the "Electric City."

Senator Proctor, of Vermont, who is interested in the proposed pulp and electrical works at Grand Falls, N.B., states that surveys have been made and that Montreal engineers are now at work on plans of mills, dams, canals etc.

The United Electric Company, Toronto, have received an order from the Kootenay Supply & Construction Company, of Nelson, B. C., for a 100 k.w. generator direct connected to Pelton water wheel, to operate under 360 feet of water head.

The ratepayers of Niagara Falls, Ont., have voted in favor of purchasing the plant of the Niagara Falls Electric Co., at the price of $71,000. It is proposed to utilize the power during the day time for operating the works of the Ontario Silver Plate Co.

The Dominion Government is calling for tenders, up to August 18th, for the supply of 330,000 pounds, or 165 tons of galvanized iron telegraph wire; also for delivery with above of 10,000 pounds of soft annealed galvanized iron tie wire. Particulars may be obtained from E. F. E. Roy, secretary Public Works Department.

The city of Hull Que., recently invited tenders for an electric light plant, but as yet the council has not awarded any contracts, on account of the pending law suit between the Ottawa and Hull electric companies. The city solicitor gives it as his opinion that the city has a right to establish its own plant, notwithstanding the privileges given to the electric companies.

The Gowans, Kent Co., of Toronto, have given a contract to the United Electric Company, Ltd., Toronto, to equip their new wholesale warehouses with a complete electric plant, consisting of 30 k.w. generator, direct connected to high speed engine, also boiler, switchboard, three elevator motors, and the installation of lights and fixtures throughout their five-story building and basement.

The recent introduction of series enclosed arc lighting from alternating current systems by the Canadian General Electric Company is meeting with the approval of all central station managers. The Sherbrooke Gas & Electric Co. was the first to adopt this system in Canada, and will shortly have their new installation completed. The Halifax Tramway Co. have just placed an order with the Canadian General Electric Company for 100 of these lamps, with transformers.

The city council of Winnipeg, Man., recently accepted the following tenders for supplies and apparatus in connection with the electric light plant: Electrical supplies, Canadian General Electric Co., $140.22; one 100 h.p. high speed eng . E. Leonard & Sons, London, $1,246; leather belting, Sadler & Haworth, Toronto, $4.90 per lineal foot for 42 inches in width, and $1.45 for 14 inches; shafting, pulleys, etc., Dodge Manufacturing Co Toronto, $1,700. For wiring the city hall the tender of H. Rose was accepted, at $318.45.

On June 14th last judgment was given at Ottawa by Mr. Justice Burbidge in the patent case of the General Engineering Co., of Toronto, vs. The Dominion Cotton Mills Co. and the American Stoker Co. The plaintiffs claimed that the defendants had infringed their patent for improvements in furnaces, etc., by making and erecting for use, at the works of the Dominion Cotton Mills Co., furnaces with a system of fuel supply the same as that covered by the plaintiff's patent. Judge Burbidge upheld the validity of the patent and gave judgment for plaintiffs.

The contracts are said to have been let for the electrical machinery and water wheels for the calcium carbide works at Ottawa. The entire plant will cost about $225,000. The electrical apparatus will be supplied by the Canadian General Electric Company, of Toronto, and will consist of two single phase generators, directly connected to horizontal turbines, without gearing. There will also be two 400 h.p. 225 volt direct current machines for operating motors for crushing, mixing, etc. The switchboards will be grey marble, containing all the necessary instruments for controlling the heavy currents incidental to the operating of such large generating units. The current will be conveyed from the generators at a potential of 2,300 volts to the transformers, where it will be reduced to 75 volts for the furnaces.

CANADIAN GENERAL ELECTRIC CO'Y

LIMITED

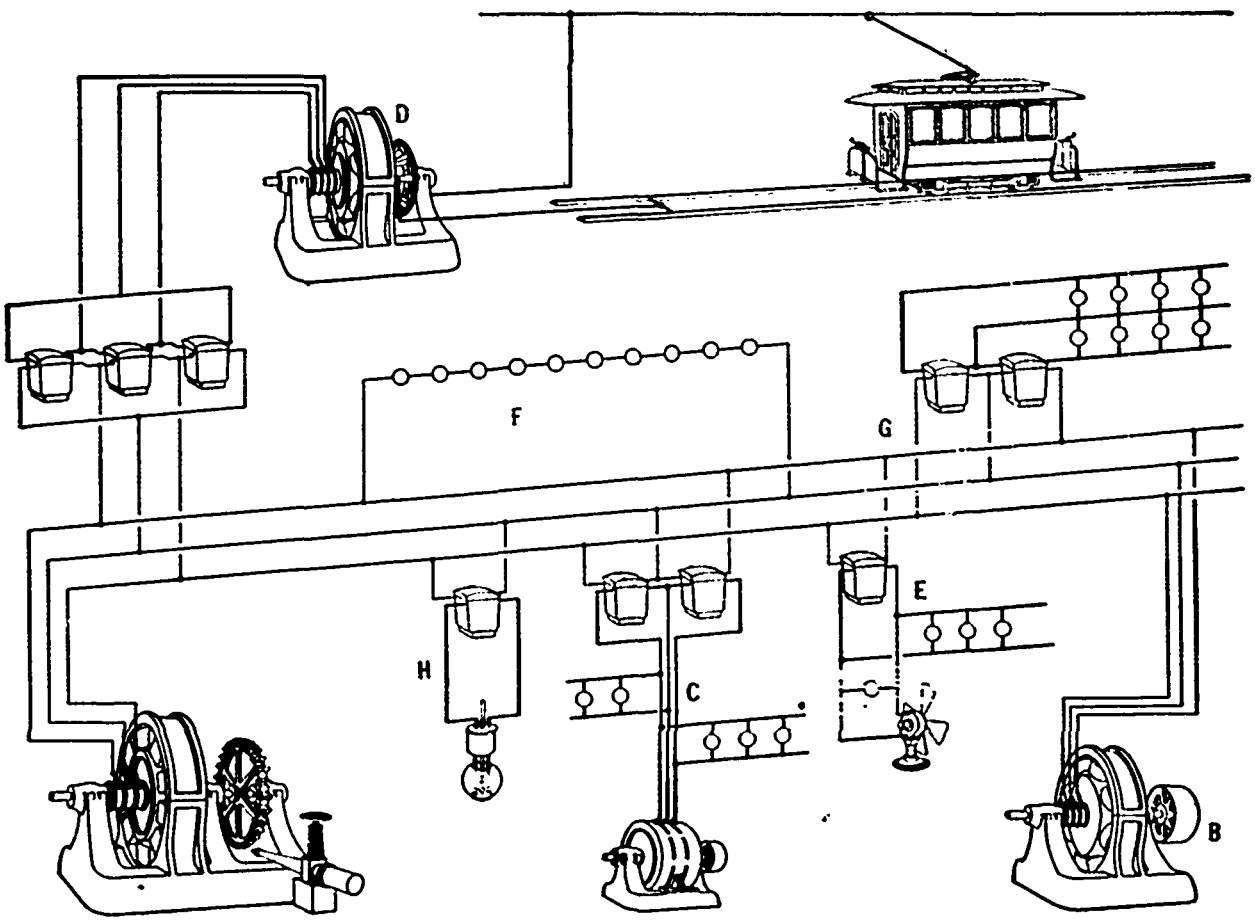
The Largest Manufacturers of Electrical Apparatus under the British Flag.

HEAD OFFICE:
TORONTO, ONT.

FACTORIES:
PETERBORO', ONT.

BRANCH OFFICES:
HALIFAX MONTREAL WINNIPEG ROSSLAND VANCOUVER

LONG DISTANCE POWER TRANSMISSION



This Company was the first to introduce Long Distance Power Transmission in Canada, and as evidence of the superiority and success of the apparatus installed, we append a partial list of Power Transmission Plants in operation and under construction, contracted for during the past few years, viz:

Lachine Rapids Hydraulic & Land Company	Montreal, Que.	12,000	H.P.,	6 mile Transmission.
Montreal Cotton Co.	Valleyfield, Que.	4,000	"	Short "
St. Hyacinthe Electric Light Co.	St. Hyacinthe, Que.	500	"	4½ mile "
Department of Railways and Canals	Soulanges Canal	700	"	14 " "
Trenton Electric Co.	Trenton, Ont.	400	"	12 " "
Lunenburg Gas Co.	Lunenburg, N.S.	150	"	9 " "
J. R. Scott & Co.	Napanee, Ont.	150	"	8 " "
J. R. Booth, Esq.	Ottawa, Ont.	500	"	4 " "
Auburn Power Co.	Peterboro', Ont.	400	"	2½ " "
Hanover Electric Light and Power Co.	Hanover, Ont.	100	"	8 " "
Durham Electric Co.	Durham, Ont.	100	"	4 " "
Light, Heat and Power Co.	Lindsay, Ont.	600	"	14 " "
B. C. Electric Railways Co.	Vancouver, B.C.	1,000	"	12½ " "
West Kootenay Power Co.	Rossland, B.C.	4,000	"	39 " "

FOR INFORMATION ADDRESS NEAREST DISTRICT OFFICE

The Standard Light & Power Co., of Montreal, is building a new station on Chenneville street. For the necessary machinery to be installed therein, contracts have been let as follows: Rotary converters, Canadian General Electric Co., Toronto; Engines, Westinghouse Co., Pittsburg; boilers, Babcock & Wilcox Co.

Prof. L. A. Herdt, Lecturer in Electricity at McGill University, Montreal, has written a letter to the Board of Trade on the subject of lighting the channel of the St. Lawrence river, with a view to carrying on navigation at night. He proposes to place a projector or search light on the bow of every ship. This would cast light upon a double row of white buoys defining the channel. If the steamer had a dynamo on board, the matter would be more simple; if not, a compact storage battery would accompany the apparatus. The matter has been referred to the harbor engineer for a report.

CANADA'S GREATEST FAIR.

This year will mark the coming of age of Canada's Great Fair and Industrial Exposition, which will be held in Toronto from August 28th to September 9th. It is just twenty-one years since Toronto Exhibition was established as an annual institution under the present management. During that time it has *increased five-fold in every direction*, and today can fairly lay claim to have assumed a national character. Last year upwards of 300,000 people attended, and this year such arrangements are being made as will warrant the expectation of a still larger attendance. Many entirely new features will be presented, while the exhibits, with an increased amount given in prizes (totalling $35,000), will undoubtedly crowd the six hundred thousand dollars' worth of buildings to their utmost. The usual brilliant military spectacles will be given, illustrating recent famous feats of arms on land and sea by both England and America, and arrangements have been made for an illustration of wireless telegraphy, wireless telephoning and the improved X rays. In short, the Exhibition will be more than ever up to date.