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CANADIAN

ELECTRICAL NEWS

STEAM ENGINEERING JOURNAL

OLD SERIES, VOL. XV.—No. 6.
NEW SERIES, VOL. VI.—No. 11.

NOVEMBER, 1898

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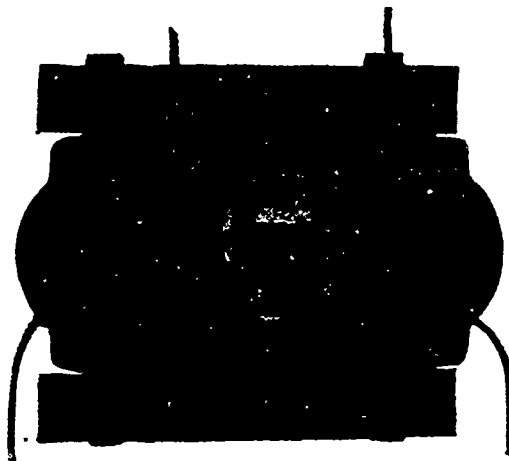
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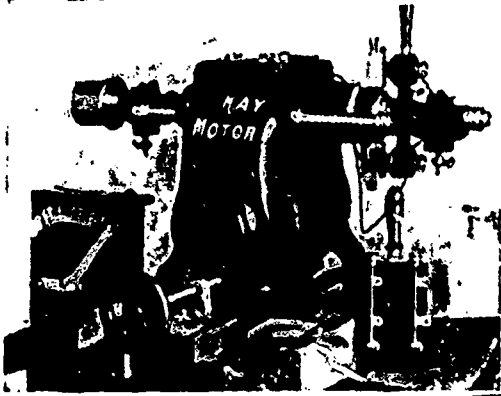
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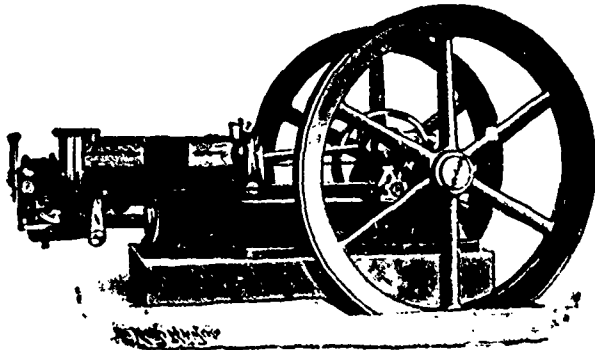
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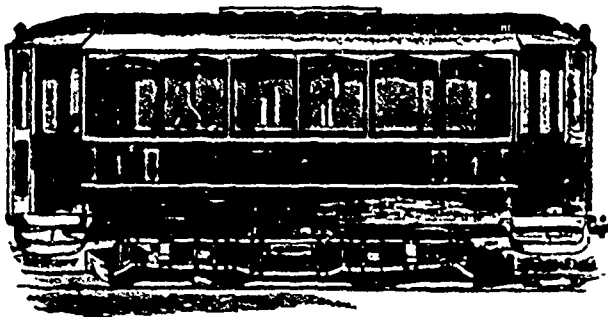
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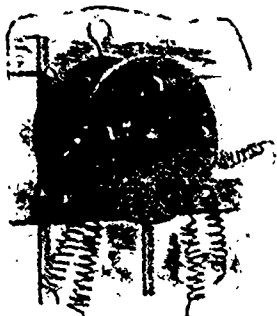


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CANADIAN
ELECTRICAL NEWS
AND
STEAM ENGINEERING JOURNAL.

Vol. VI.

NOVEMBER, 1896

No. 11.

AN OLD FIRE ENGINE.

THROUGH the courtesy of Mr. James Devlin, Chief Engineer of the Kingston Penitentiary, we are enabled to present to our readers an illustration and some particulars of an old fire engine which has found a resting place in that institution, and which was an object of much interest to the delegates to the last annual convention of the C. A. S. E., on the occasion of their visit to the penitentiary. The engine was made by Mr. Perry of Montreal, brother of Mr. Alfred Perry of that city, and took first prize at an exhibition held in Montreal, the finest workmanship being displayed in its construction.

The engine was purchased by the government of Upper Canada upwards of forty years ago for the sum of \$1,100, and is to-day in all its working parts quite as good as new.

The large number of torpedo boats now being built for the U. S. navy brings forth some features in machinery exceptionally interesting and novel. On some of these boats of this kind recently launched, the equipment of steam pumps, as well as the main engines, are run without the use of oil in the steam cylinders. While this is not a new idea so far as vertical steam engines are concerned, it has never been the practice to run steam pumps without oil. The pumps are arranged without any oil holes whatever, so that it is impossible to get oil into the steam cylinders. These pumps were given an exhaustive test for several days by the manufacturers and they operated with entire satisfaction, and without using a drop of oil. The doing away with the use of oil in the steam cylinder of a vessel is a matter of considerable importance, as there is no necessity of carrying feed water filters and no anxiety about oil injuring the body.—Scientific Machinist.

The Canadian Customs authorities have lately given a decision to the effect that all electric bells imported into the country are subject to a duty of 25 per cent. ad valorem.

**IMPROVEMENTS BY THE TORONTO
ELECTRIC LIGHT CO.**

THE Toronto Electric Light Co. have erected a new incandescent and power station, adjoining their other stations on the Esplanade. The new station is constructed entirely of brick and iron, so that there is nothing for fire to feed upon. The work on this station has been considerably delayed owing to the failure of the contractors to furnish the galvanized iron roofing material as promptly as required. Inability to roof in the building has prevented the installation of the machinery.

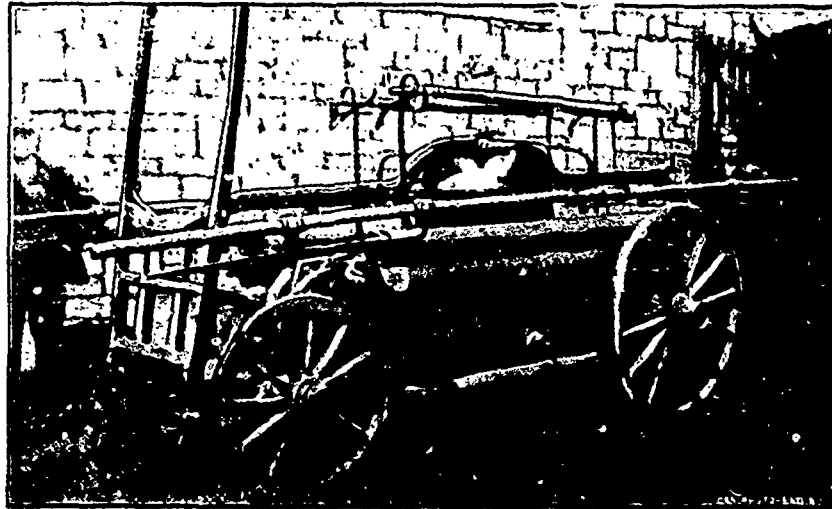
An immense foundation of concrete has been put in to carry the required steam and electrical plant. A large

vertical engine is now being put in position, and it is expected that the entire equipment of machinery for this new station will be in operation before the close of the year.

In the large station adjoining there has just been put in a new condenser operating vertically and driven by a small direct connected verti-

cal engine. This condenser was built under the direction of Mr. J. J. Wright, the manager. It is of much heavier construction than most of those we are accustomed to see, the object being to avoid the many break-downs which have been experienced from the constant operation of lighter machines. Mr. Wright is a believer in the wisdom of putting a sufficiency of cast iron into steam and electrical machinery for use in the electrical business, to give it the strength necessary to withstand the strain of constant operation.

The most economical point of cut off in an engine, says the *Boston Journal of Commerce*, is not that point that will expand the steam down to the atmospheric pressure, but is a point between three-tenths and one-third cut-off. A variation of a slight amount either side of this point makes but little difference, and we would not call an engine with eight pounds terminal under eighty pounds pressure as overloaded.



AN OLD FIRE ENGINE—KINGSTON PENITENTIARY.

THE LACHINE RAPIDS HYDRAULIC & LAND COMPANY'S WORKS.

It is barely a year since we first announced that a company was being formed, whose object it would be to harness the Lachine Rapids to utilize its dormant power for electric purposes.

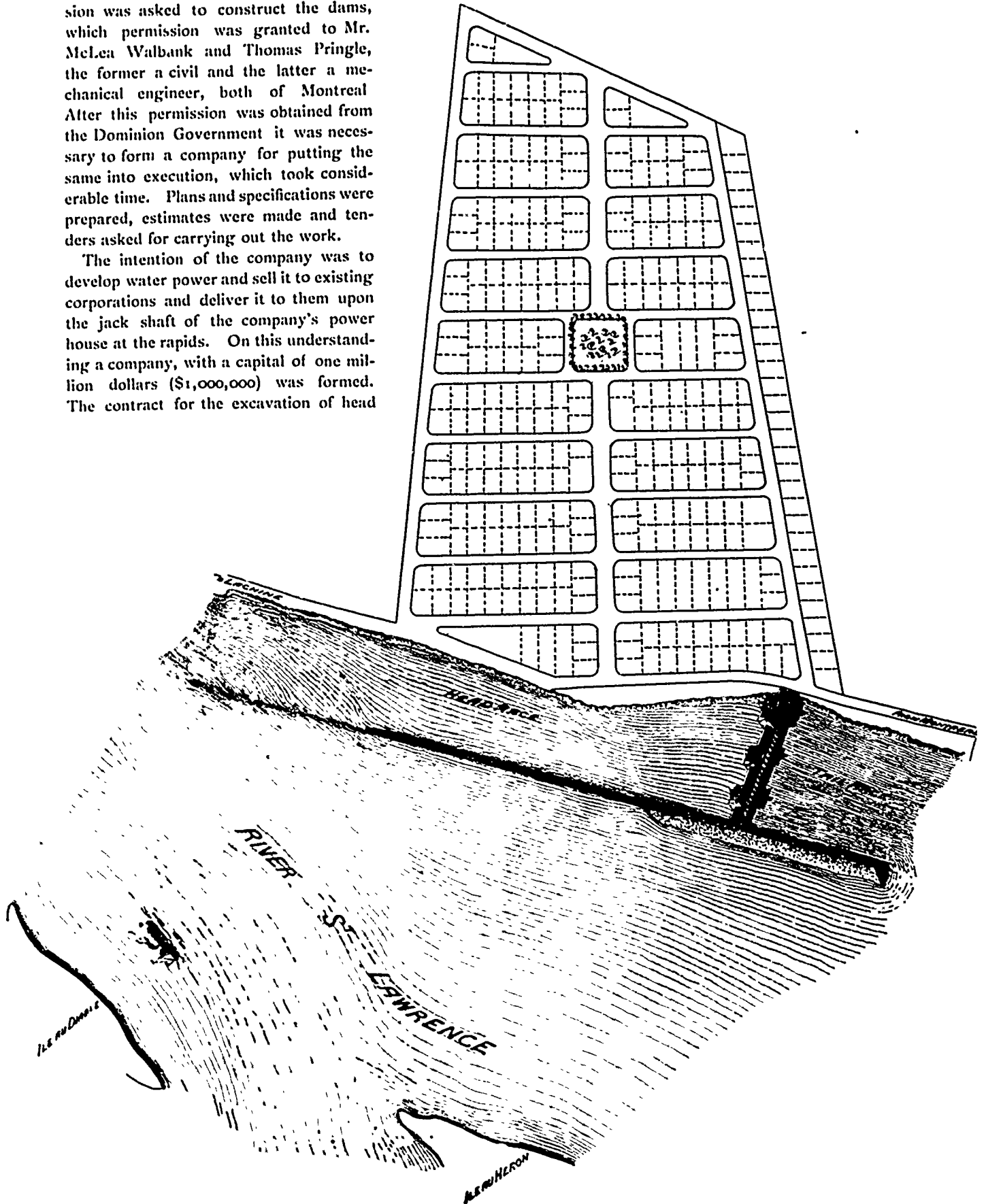
Without a visit to the works in question it is impossible for anyone to conceive an idea of the magnitude of the undertaking and the amount of work already accomplished.

It was only at the end of August, 1895, that permission was asked to construct the dams, which permission was granted to Mr. McLea Walbank and Thomas Pringle, the former a civil and the latter a mechanical engineer, both of Montreal. After this permission was obtained from the Dominion Government it was necessary to form a company for putting the same into execution, which took considerable time. Plans and specifications were prepared, estimates were made and tenders asked for carrying out the work.

The intention of the company was to develop water power and sell it to existing corporations and deliver it to them upon the jack shaft of the company's power house at the rapids. On this understanding a company, with a capital of one million dollars (\$1,000,000) was formed. The contract for the excavation of head

and tail races and the construction of stone and crib dams was awarded to Messrs. Wm. Davis & Sons, of Ottawa, and the work actually got under way late last fall.

The directors immediately set about trying to dispose of their power, and having offered it at what they considered a reasonable figure to several large corporations, who declined to negotiate until the completion of the works in question, perhaps thinking that when completed so large a power would only be in the market for the very wealthy corporations, they made no



offer, doubtless figuring that "Possession is nine points of the law," and that a company without rights or franchises would have small chance of disposing of their power, and they waited for a bargain.

The directors of the Lachine Rapids Hydraulic & Land Company knew the value of their power, they had



MR. G. B. BURLAND, President.

faith in their undertaking, at least the promoters had, and at a meeting of the shareholders, held some time later, it was decided, that if the opinions of the company's engineers could be corroborated by outside experts, the necessary money would be forthcoming to convert the power into electricity, and sell it wholesale and retail directly to the customers themselves. Messrs. Walter Shanley and T. C. Keefer, two of our best known engineers, were consulted, and after hearing the explanations of the company's engineers on the question of frazil or anchor ice, back water, examining the plans and specifications of the works, their report more than



MR. T. PRINGLE, Vice-President and Engineer.

endorsed the statement already given, and it was therefore decided to increase the capital of the company to two million dollars, and to award contracts for electrical machinery.

The next question considered was the ingress into the city, and here the company met with considerable opposition, but having quietly secured the controlling interest in the stock of the Citizens' Light & Power Company, Ltd., whose works are situated at Cote St. Paul, a company having a notarial agreement with the city of Montreal for the erection of poles in all its streets, having contracts for street lighting for long terms of years with the towns of St. Henry, St. Cune-

gonde, Westmount and St. Louis de Mile End, and the lighting of the Montreal Harbor, also various contracts for private lighting, they seized the opportunity of obtaining an extraordinary entrance into the city of Montreal. Existing corporations did not like this step on the part of the Lachine Rapids Hydraulic & Land Company, and as soon as they commenced to avail themselves of their rights to erect poles, no less than two companies entered suit to prevent them doing so. This resulted in the company acquiring the charter of the Standard Light & Power Company, which was granted by the Legislature of the Province of Quebec, and which gives, without the city's consent, the



MR. W. McLARA WALBANK, Managing Director.

authority to lay underground conduits in the streets of the city of Montreal. It was however reserved in the charter for the city to prescribe the manner in which the streets might be opened. But the city treated the requests of the company with contempt; and on the company commencing operations, their men were forcibly restrained and arrested at the request of the Montreal City Council. The result was, that Mr. Walbank, the vice-president and managing director of the Standard Light & Power Company, applied to the superior court for an injunction to restrain the city police from interfering with the men in the carrying out



MR. A. PRINGLE, Secretary and Engineer.

of their work. The injunction was granted and the case argued and won by the company. The city went to appeal, and judgment in appeal was rendered quite recently, unanimously maintaining the company's charter, and declaring the injunction absolute and allowing the work to go on. Therefore the Lachine

Rapids Hydraulic & Land Company with its associated companies have now pole rights and underground rights throughout the whole city.

DESCRIPTION OF THE WORKS.

The plan of the works on a very small scale is shown, which gives the head race and wing dam, guard pier, tail race and main dam with power houses on it, and the land acquired for the future model high class suburb that the company propose to erect.

The proposed head race is one thousand feet wide at the main dam and is about four thousand feet long, and will have an average depth of water of thirteen feet. The bottom of the tail race will be some nine or ten feet lower than the bottom of the head race, and will be some twelve or fifteen hundred feet wide, allowing ample capacity for the carrying away of the water discharged from the wheels. The main dam is constructed of cut stone, about four feet wide and about fifty feet long, set to quarter inch joints and grouted in cement filled in with concrete between the stones. These stone piers rest upon concrete foundations which start at the wheel pit level and finish at the top of the flume bottom. There are two vertical sliding gates in each flume and system of stop logs at the lower end



MR. ALEX. FRASER, Director.

with a steel frame and iron rods secured to the bottom of the flumes, so that the weight of the water will have a tendency to assist in holding the stop logs in position. In front of these is an iron rack especially made to keep off all debris from the wheels. The wheels themselves are "Victor" make and have been tested at Holyoke and given over eighty per cent efficiency. The wheels are vertical and governed by an improved governor which will control the speed within 2% from no load to full load. The wheels will be coupled by bevel core gears to a horizontal shaft, six in series, and at the extremity of the shaft will be a 750 K.W. generator which is being made in Schenectady for the Canadian General Electric Company. The speed of these machines will be 175 revolutions, generating a current of 4400 volts. They will be the most modern three-phase machines and built to be easily moved for repairs.

The increase of temperature after a continuous run of twenty-four hours at rated speed must not exceed forty degrees centigrade above the temperature of the air at five feet distance from the shaft. The inherent regulation of the dynamo shaft shall be set with the drop of potential between 10% at rated load, and the non-inductive load shall not exceed 6%. The dynamos

are to operate regularly and parallel, having common bus bars. And in so operating, each dynamo must carry its portion of the total load. The insulation is to withstand successfully a potential ten times as great as that for which it is designed, and the armature to be tested for twenty thousand volts.

As already stated, the wheels shall be connected six to each machine, there being twelve machines, there



MR. PETER LYALL, Director.

will be in all seventy-two wheels. The power house will consist of a building about one thousand feet long with three centre portions divided off so as to form the dynamo house starting from the shore.

There will be on each line of shaft six wheels and a generator; then a generator and six wheels; then again six wheels and a generator and a generator and six wheels; then six wheels and a generator; then a generator and six wheels. This doubled will complete the electrical lay-out. The building is of steel construction, the dynamo portions being Laprairie pressed brick. The foundations and flooring of the dynamo houses are of concrete and steel beams, and the turbine sheds of steel work with three inch plank covered with corrugated iron.

A traveller, capable of carrying twenty-five tons with



MR. E. K. GREENE, Director.

thirty-nine feet span, will travel the full length of the dynamo house and turbine sheds moving any machinery that may be required and at the same time placed so as to lower or raise the head gates. The switch-boards will be of the latest type. The pole line starting from the power house is constructed of lattice steel poles and calculated to stand a wind pressure of six thousand pounds. It is fitted up with 6 x 6 cross-arms, made of

British Columbia fir with double petticoated porcelain insulators, and carrying No. 0 wires as far as the Lachine Canal, near the Curran bridge, when it will pass underground until it enters the sub-station located at the intersection of Seminary and McCord streets. The current will from this point be distributed throughout the city in underground conduits, which are being constructed by the Standard Light & Power Company.



Mr. W. P. DAVIS, Senior Member of the Firm of Wm. Davis & Sons, Contractors.

The names of the officers of the company and of the engineers and contractors of the works, are as follows:—

G. B. Burland, Montreal, President.

Thomas Pringle, Montreal, Vice-President.

W. McLea Walbank, B.A. Sc., Montreal, Managing Director.

Alexander Pringle, Secretary Pro-tem, Montreal,

Alexander Fraser, Ottawa, Director.

E. Kirk Greene, Montreal, Director.

Hugh Graham, Montreal, Director.

Peter Lyall, Montreal, Director.

ENGINEERS.

T. Pringle & Son and W. McLea Walbank, Montreal.



Mr. W. H. DAVIS, of Wm. Davis & Sons.

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For wood work, the James Shearer Company, Ltd.

For water wheels and hydraulic machinery, Stilwell-Bierce & Smith-Vaile Company.

For electrical machinery, the Canadian General Electric Co.

For wire work, the Dominion Wire Works.

Underground conduits, National Underground Conduit Co., New York.

We are pleased to be able to present to our readers, accompanying this article, portraits of some of the above named gentlemen.

EXPANSION OF BOILERS BY HEAT.

A. C. KIRK, in a recent discussion on "Hard Firing in Boilers," gives it as his opinion that the expansion of the material of boilers, and the strains that frequently cause them to leak are largely due to irregular heating, and this irregular heating must be greatest in the largest boilers whose various surfaces are exposed to very different temperatures, says the Scientific Machinist. Thus, the temperature of the flues of a Lancashire boiler being much higher than that of the shell, its movement must necessarily be greater. This would be an argument in favor of boilers of compact form like those used in ships. It has often been observed that new boilers, that is to say, boilers having clean inner and outer surfaces give much better results in steaming than those that have been in service for months, and this is used as a reason for decrying the tests of new



Mr. JAS. D. DAVIS, Junior Member of Wm. Davis & Sons.

boilers as a standard of duty. Nevertheless the duty of a new boiler could be kept up till it was worn out if it were fed with pure water and fired with gas or other smokeless fuel. So the results of test should rather be taken as standards of efficiency to be worked up to. This is all the more feasible since various methods of forced combustion render it possible to burn slack, steam coal, gas coal, patent fuel and anthracite in the same furnace, and equally without smoke.

The problem of raising steam in a boiler begins with the burning of the fuel, which must be consumed at the required rate and burned completely so as to keep the heating surfaces as clean as possible. The heat has to be communicated to the water with the smallest loss on the way, and the steam has to be used in the least possible time after production, in order to work with economy.

Notice of application for the incorporation of the Willson Carbide Works of St. Catharines, Limited, has been given. The object is the manufacture of calcium carbide and any other metallurgical substances, the capital to be \$200,000. The incorporators are: Thomas Leopold Willson, St. Catharines; E. A. Neresheimer, New York; A. M. Scott, Woodstock; John Garry, St. Catharines, and R. G. Cox, St. Catharines. Messrs. Willson, Neresheimer, Scott and Garry will be the provisional directors.



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EDITOR'S ANNOUNCEMENTS.

Correspondence is invited upon all topics legitimately coming within the scope of this Journal.

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

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Boiler explosions are principally due to two causes, viz., defective steam apparatus and ignorant or careless engineers and firemen. The extent to which these causes exist is shown by a tabulated statement of boiler explosions for the past sixteen years, which was submitted at the annual convention of the National Association of Stationary Engineers held recently in Buffalo. The explosions during this period aggregate 3,586, involving the loss of 4,508 lives, 6,348 cases of serious injury, and damage to property in 13½ per cent. of the explosions amounting to \$8,288,370. These figures speak volumes in favor of the better education of the engineer and the periodical inspection of steam producing apparatus.

Sunday Cars. In connection with the revival of the Sunday car agitation, the City Council of Toronto have obtained from prominent legal gentlemen, including Sir Oliver Mowat, Minister of Justice, the opinion that as a condition of submitting the question of Sunday cars to a vote of the citizens, the Council have the power to impose such special conditions upon the company as they may deem advisable. One would suppose that the most important consideration, especially from the standpoint of those who hold that a Sunday service is objectionable, would be to secure a properly regulated and limited service. It is surprising to observe, however, that the special condition insisted upon by the anti-Sunday car element in the Council, is that the company shall be compelled to grant a three-cent fare on Sunday. It cannot be doubted that cheap fares are an inducement to the citizens to use the cars. That being the case, is it not highly inconsistent on the part of those who declare that Sunday street car traffic is demoralizing, to compel

the street railway company to offer the citizens the greatest possible inducement to patronize the cars on Sunday.

The Canadian Westinghouse Company. A DISTINCT addition is to be made to the electrical manufacturing industries of Canada, by the establishment at Hamilton of a branch manufactory of the Westinghouse Electrical Manufacturing Company, of Pittsburgh, Pa. All the arrangements to this end, including the purchase of the McKechnie factory building, and the granting of special privileges by the city, have been concluded, and the works are expected to be in operation early in the new year. The Canadian company will be known as the Westinghouse Manufacturing Co., Limited, of Hamilton. The names of the incorporators are:— Messrs. George Westinghouse, Henry Herman Westinghouse and John Caldwell, all of Pittsburgh, manufacturers, and the Hon. James M. Gibson and Mr. Archibald E. Malloch, of Hamilton. Messrs. H. H. Westinghouse, the Hon. James M. Gibson and Archibald E. Malloch are to be the provisional directors of the company.

A Fair Method of Appointment. IT has been usual in the past for a great deal of wire-pulling to be done to secure the position of engineer in large public buildings. In consequence it frequently happened that the man who was best equipped by knowledge and experience failed to get the position. In other words the man with the greatest amount of "pull" got the appointment over the heads of men who were better qualified, but were no good as wire-pullers. We are pleased to observe that these conditions are not to be allowed to prevail in connection with the new city buildings now approaching completion in Toronto. At a recent meeting of the City Council a resolution was adopted that the stationary engineer to be placed in charge of the boilers and heating of the buildings be appointed after a competitive examination. It begins to appear as if those engineers who aim to secure the good positions in the future must rely less upon their ability to pull wires and more upon their knowledge of engineering.

The Power of Niagara. THE company which is utilizing the power of Niagara Falls on the American side has paid the Ontario government the sum of \$25,000 per year for several years past for an option to the exclusive privilege of utilizing the water power on the Canadian side also. The term of this option will expire in two years, and the government are being urged not to renew the arrangement, as Canadian capitalists are prepared to utilize the power of the Canadian Fall if the opportunity of doing so is given them. It is improbable that the American company will let so valuable a privilege slip through their fingers unless they should find ample scope for their capital and ambition in connection with their huge enterprise on the American side. But if they do forfeit it, the Ontario government should consider very carefully the terms on which such privileges should be granted in the future. The success which has attended the methods employed for the utilization of the power of the American cataract permits of a more accurate estimate of the possibilities in this direction and consequently of the value which should be placed upon exclusive rights to the use of the power. There is no

doubt whatever that before many years shall have passed the means will be found of transmitting power from Niagara to the towns and cities in and adjacent to the Niagara peninsula. If it is deemed wise to grant exclusive rights to one company, the period for which such rights are to be granted should be one of reasonable limit, and the revenue received by the province should be carefully proportioned to the prospective value of the privilege. As a method of disposing of the privilege to the best advantage the government might publicly invite bids for the franchise.

A Long-Distance Power Transmission Scheme.

THE scheme for the transmission of electric power by the Keewatin Power Co., from Keewatin to Winnipeg, which was the subject of comment last year, is not dead as might be supposed, seeing that nothing has recently been heard about it. On the contrary we learn that the Power Company have employed a competent electrical engineer to go thoroughly into the possibilities of the enterprise and to formulate plans and prepare specifications upon which tenders for the required plant may be based. Not only has this been done, but we understand that tenders have actually been submitted by the Royal, Westinghouse and General Electric Companies, and their merits are now being considered. It is rumored that the line potential proposed is between 25,000 and 30,000 volts. The distance between the terminals of the line would be 120 miles. This is one of the most ambitious power transmission schemes which has yet assumed tangible form; its further development is therefore a subject of wide interest.

Qualification of Wiremen.

AT the present moment, the only qualification that a man must have, in order to apply for a wiring job, is the possession of a screw driver and hammer, and the cheapest man gets it. Whenever a town is being lighted, a host of perfectly irresponsible men settle there and go about canvassing for installations, which they put in without any reference to the general wiring plan of the town, and in many cases, in the most unworkmanlike manner. The consequence is, as has been already pointed out in these columns with reference to a particular case, that no coherent scheme is possible, and that in two adjacent houses lamps will be subjected to pressures differing at any moment, by so much as three volts. In one large hotel in a small provincial town, a test shewed that lamps in two adjacent rooms that formed the termini of two branches, had six volts difference in their pressures. This is, it is to be hoped, an unique case, but it illustrates the evils of allowing anyone to do wiring. An examining board might be formed, including representatives from the Fire Underwriters, the Canadian Electrical Association, the larger manufacturing companies, and from some of the larger operating companies, who would examine candidates as to their knowledge of wiring rules and methods, their knowledge of practical electricity, and their acquaintance with central station economies. Certificates would follow of two or three classes, shewing that the examinee had been found competent by reading or experience to (a) entirely manage a central station plant, both alternating and direct current, steam or water power, both the plant and the business; (b) merely look after the electrical machinery, as dynamo tender and electrician, to effect repairs and make extensions; (c) do the wiring in houses or

streets. B would include C. It is not to be expected that this proposal would immediately find acceptance. Old timers, who "know it all" already, would treat it with contempt, but there are many companies who would gladly avail themselves of the assurance afforded by such a certificate of the competence of their employees, and who would even hold out higher pay inducements to their staff, in order that they might qualify themselves for it. At first, of course, it would be no proof of incompetence if a man did not hold such a document, but it would always be strong argument in his favor if he did. A board of examiners could be selected, the personnel of which had such unquestioned standing in the electrical profession that their endorsement would carry weight and disarm criticism. We shall be glad to have expressions of opinion on this matter from central station men.

We are convinced that the general level of electrical knowledge would be raised by the inauguration of such an innovation. There would, in course of time be an emulation among the younger and more ambitious members of the profession, which would lead to more careful and thorough study, and a rapid dissemination of knowledge that could not be other than beneficial both to those who operate power houses and those who draw dividends from them. The opinion that now seems to obtain, that competent knowledge of electricity is to be acquired by "induction" so to speak—that a man who works around dynamos and lamps for a couple of years is a thoroughly well posted "electrician," would become less strong in proportion as study became more general; for of no science is the saying more true than "the more a man studies the less he knows."

THE specifications for the plumbing work for the new municipal buildings in Toronto, have given rise to very unfavorable criticism at the hands of some prominent manufacturers of heating and sanitary apparatus, and we should like to suggest that the electrical manufacturing industry has an equal cause for complaint, and on similar grounds. The plumbers' complaint is that the specifications, instead of calling for apparatus of "any" make, but imposing a certain particular make as a standard of excellence, seem to impose as a condition that none but one particular make shall be supplied, thus imposing limitations that practically withdraw the matter from open competition. In the electrical work also—which, by the way, in the interests of the public, we should like to know was being planned by an electrical specialist, certain particular conduits have been named in the specifications to the exclusion of others, equally excellent. Why should this be so? Specifications should, no doubt, be so drawn up as that none but suitable machinery and apparatus could be tendered for thereon, but it seems to be hardly in the public interests to expressly favor one class of manufacture at the expense of others, when the bona fides of all manufacturers can be insured by specifying appropriate tests. And one other matter we would draw attention to—why include electrical wiring with the plumbing and heating work? What obvious connection is there between a plumber and an incandescent wireman? Would it not have been as well to make a separate contract for this work?

Status of the Electrical Engineer in Canada.

GOOD engineering is the great want of the day in electrical matters, and if works that are distinctly electrical enterprises are carried on by members of other engineering specialties, it is not because there are no electrical engineers in Canada. McGill College turns out electrical specialists who are sought for to fill the most responsible positions in the United States; the School of Practical Science in Toronto gives a most admirable technical training; and there are electrical courses in Kingston R. M. C., the Toronto Technical School, and other institutions; and yet it is doubtful whether the electrical profession has even a status in Canada. The engineering of electric lighting plants, power transmissions, and railways, is placed in the hands of architects, sanitary engineers, provincial land surveyors—anybody but electrical engineers, and the results are just what might be expected. Architects and civil engineers require all their time to keep themselves posted in their own business; and it is not to be expected that they can keep themselves up to the times in electrical matters where improvement is so rapid along many differing lines, and where the text book knowledge of ten years ago is left behind in the dark ages. Special training is necessary in order to qualify anyone to follow along the march of electrical progress, without falling far to the rear; and it is inevitable that specialists in other branches, even highly educated civil engineers, will merely voice the ideas of some particular electrical manufacturing company, to which they have referred for technical assistance.

PERSONAL.

The employees of the Great North-Western Telegraph Co. presented Mr. W. D. Toye with a marble clock on the occasion of his recent marriage.

Mr. Wm. A. Sweet has resigned his position with the Hamilton, Grimsby & Beamsville Electric Railway to accept the position of chief engineer of the Hamilton Radial Electric Railway.

Mr. Robt. A. Ross, who was for some years chief electrical engineer with the Royal Electric Co., and previously occupied a similar position with the Canadian General Electric Co. has commenced business in Montreal as a consulting mechanical and electrical engineer.

Mr. G. F. Cummings, an eminent electrician, was recently in Toronto in the interests of the Conduit Electrical Company, of Detroit, who are considering the question of opening a branch in this city. Mr. Cummings is well known in Toronto, being at one time in charge of the engineering department of the Edison Electric Light Works.

Mr. D. H. Keeley, Superintendent of Government Telegraphs, has returned from an inspection trip in the east, after an absence of two months. Taking the government cable steamer Newfield, he repaired the cables between the Magdalen Islands and Cape North, and between St. Paul's Island and Cape North, also the Bay of Fundy cable to Whitehead Island.

We learn that the statement we published in our last issue that Mr. C. F. Medbury had accepted a position with the Western Electric Co., of Chicago, is incorrect. Mr. Medbury is at present acting as consulting engineer to Mr. Horace Beemer, promoter of the Quebec Electric Railway Co., and to the promoters of electrical enterprises in other parts of Canada. The wish of his numerous friends is that he may find sufficient employment for his talents to warrant him in again taking up his residence in Canada.

By a special car of the Winnipeg electric street railway, twenty-four Indian children from the Brandon Industrial Institute were recently conveyed to the power house, where Mr. Glenwright, superintendent of the railway, explained to them the operation of the machinery. The children are said to have evinced great interest in their visit.

BY THE WAY.

As an illustration of the power-consuming qualities of a modern pulp mill, it may be mentioned that the mill at Grande Mere, Quebec, requires for its operation 6,000 horse power, or an amount equal to that at present consumed by all the industries of Hamilton. What a big coal pile would be required to keep the machinery of this mill in operation, if it were not located in a country of magnificent water powers.

x x x x

I NOTICED in passing the Toronto Industrial Exhibition Grounds the other day, that the rails used for the operation of the pioneer electric railway on the Van Depoele system, by means of which ten years ago visitors were carried from Strachan Avenue to the Fair grounds, are still in position. Are they being kept on exhibition as one of the curiosities of the Fair? If not, the wonder is that the management has not before this converted them into cash at the price of old iron.

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I AM told that the British Columbia mining boom has already proved to be a good thing for the Canadian telegraph companies, whose western business has expanded considerably since the gold fever set in. It is to be regretted that owing to the lack of railway communication, our eastern manufacturers and supply houses, do not secure for their goods the British Columbia market, which of right should be theirs, and which if open to them would greatly stimulate business in eastern Canada.

x x x x

PETROLIA, the headquarters of the Canadian petroleum industry, is now lighted by electricity. Naturally enough the shareholders in the oil companies opposed the introduction of the modern illuminant, no doubt on the ground that to do otherwise would be tacitly to admit that coal oil lighting is an out-of-date method. The battle between these interested champions of old-time methods and the progressive element of the community was waged for many months, before victory for progress was achieved. Following close on the adoption of modern lighting the town has set about the construction of an extensive and costly water works system, and seems to be determined to be in every respect a thoroughly up-to-date community.

x x x x

AN acquaintance of mine, a competent electrician, who has been endeavoring to secure a situation as superintendent of a lighting station, writes me in the following vigorous fashion: "I am entirely disgusted with the electrical business. Central station owners want a first-class man to work for nothing. They expect all the best requirements for about 35 to 40 dollars per month. In fact they want a "fireman and electrician." Anything that can use the coal shovel is good enough to run a central station, and as to wiring, so long as a man can get up a pole that is all that is required. The ability to shovel coal, climb a pole, put a pair of carbons in an arc lamp and sling oil around the power house are the essential requisites." I fear that there is more truth than poetry in the above complaint. Men buy expensive machinery and put it in charge of ignorant, careless attendants, because their services can be had for less money than would be required to pay competent men. The apparent saving in salary, is the point on which their attention is fixed; with such men frequent break-downs, unnecessary wear and tear of machinery, inefficiency of production, waste of supplies, and the

hundred and one leaks, pass unnoticed. A little careful enquiry in these directions would show that the losses arising throughout the year from these causes would suffice to pay many times over the additional sum necessary to secure the services of a thoroughly competent superintendent. My friend's letter reveals I believe one of the principal reasons why many electric lighting plants do not pay, and the sooner the owners of such plants come to recognize that profits are contingent upon good management, the sooner will the electric lighting business take a step upward, and rank with other enterprises from which satisfactory profits are derived.

x x x x

I AM reminded by a conversation I had with a citizen of Dundas the other day, that it is an unwise policy on the part of holders of public franchises not to cultivate in every possible way the good will of the citizens of the municipalities upon which they must largely depend for support. This man, who claimed to voice the sentiments of the community, complained very strongly of the attitude of the management of the Hamilton and Dundas Railway Company towards the town of Dundas. He claimed that the Company had no intention of transforming the road into an electric road, but were trying to put the town in the position of being compelled to contribute by way of bonus to the funds of the Company a sum of about \$2500 per year for all time. He complained of the action of the Company in making a charge of 10 cents for small parcels which passengers could carry on their knees, and for which formerly no charge was made, and said that the lack of consideration in such particulars had given rise to a feeling of antagonism on the part of the citizens towards the railway Company, as a result of which an effort would probably be made to induce the Hamilton Street Railway Company to extend their lines to Dundas by way of the main street of the town, over which and one or two other streets the Hamilton and Dundas Company does not control the right of way. There is no doubt that if a trolley line were in operation between Hamilton and Dundas, it would at once capture the traffic and render the present steam road a valueless piece of property. As to whether the complaints preferred against the present Company are well founded, I have no means of knowing, but it is at least unfortunate for the Company that citizens of the town should feel themselves called upon to give public expression to opinions which must tend to deprive it of the good wishes and cordial support of the community. In this connection I may mention that the Company are at present putting down new rails, and it is said to be their intention to put on some new cars

A new design in steam engines has been patented in Canada, United States and Europe, by Cleveland and Peterson, of Brandon, Man. One engine on this pattern has been built at Ritchie's machine works, Hamilton.

The Town of Chatham, Ont., is considering the question of installing an electric light plant, to be controlled by the town, and has secured the following statistics relative to the cost of operating similar plants in other towns. Chatham, 65 lamps, all night, 23½ cents each per lamp; Brantford, 35 lights, all night, 23 cents; Cobourg, 23 lights till midnight, 21 cents; Port Hope, 33 lamps till midnight, 15 cents; Peterboro, 25 cents per light all night; Ingersoll, 36 lights till midnight, 20 cents; Woodstock, 70 lights till midnight, 19 cents; Belleville, 61 lights, all night, 24 cents; Galt, 50 lamps, 22 cents till midnight; Hamilton, 369 lights, all night, 25 cents; Guelph, 90 lights, all night, 24½ cents; Owen Sound, 30 lamps, all night, 30 cents; London, 300 lamps, all night, 25 cents.

COSTS OF MANUFACTURE.

By H. W. NELSON.

SOMEbody has said that the mountain travailed and groaned and brought forth a mouse. This might be said of the superfluous energy expended in finding the costs of manufacture. Reams of paper and myriads of figures are collected, collated, and the result is one little most unreliable observation of the actual cost. The nearest actual knowledge of the amount spent in manufacture is gained from the balance sheet, but this cannot be called the absolute truth on account of the use of unreliable data in the valuation of the inventory of goods in stock, and in a state of partial completion. The uncertainty of the inventory valuation will nevertheless figure as a small percentage of error on the balance sheet, provided the finished stock from year to year is kept at an uniform amount and valued at an arbitrary figure, providing the same figure is used for each inventory, and that the quantity of the partially finished product is kept small. If such provisos are practicable, the result obtained in any case is a very unsatisfactory one, it simply shows the total profit or loss, i.e.:—the cost on the whole manufacture. Very few companies, however, limit themselves to one uniform article of manufacture—thus their balance sheet, although perhaps showing a profit, does not show whether the profit over the cost of one article is being absorbed by the loss on another. To overcome this, a Cost Department is instituted and a multiplicity of shop orders is issued. The shop orders are supposed to furnish the correct observations, and the Cost Department to collect and collate them. The department without doubt works hard and conscientiously and probably considers that it obtains the actual figures of cost. To see the fallacy of this one has only to follow the shop orders closely on their passage to see what a snow-hall like amount of error they are accumulating. To explain by an example:—Supposing that a 50 kilowatt dynamo, direct current, is to be built; Shop Order No. 100 is issued on the factory for the machine and all material and labour expended on it is to be charged to order No. 100, and all returns to be credited of course.

The dynamo consists essentially of a bed-plate, two pillow-blocks, armature with shaft, commutator and brush-carriage, pole-pieces and field-coils. The bed-plate and pillow-blocks are received in the rough from the foundry, and are charged correctly against the shop order, from the foundry bill price; the labour handling them to the mechanics however goes against factory expense, etc; the labor planing, boring, drilling, is charged correctly; then bolts being necessary, are ordered from the store-

ordered for the bearings; only part is used, the rest remains in the melting-pot, and is used on another order.

Take the armature and its accessories:—The laborer's work for handling is charged to the general dumping order, viz: Factory Expense, or worse still, the laborers make out time tickets on which they guess the apportionment of the time they have spent on different shop orders, to them meaning-

PLATE I. 30 kilowatt 125 Volt Dynamo. Material

Description of part	No. of pieces	Total weight in the rough lbs.	Price per unit	Costage and freight per unit	Cost to mechanic	Weight finished	Cost of shop material
Bed Plate							
Sub-base Bolt	1	1210					
Bolt	4	300					
Pillow Blocks							
Copp	2	600					
Cap bolt	2	75					
Oil rings	2	5					
Babbitt metal	1	20					
Bolt	8						
ARMATURE							
Front plate for body	1	10					
Back - - -	1	10					
Radial bolt	16						
Discs for body	360	500					
Insulation	-	10					
Rope	-	500					
Clot	-	29					
Yarnish	-	10					
Mica	-	500					
Wire	-	5					
Commutator	-	50					
Front ring	-	75					
Back - - -	-	100					
Cylinder	32						
Bolt nuts	16						
Screws	50	65					
Bar	-	15					
Mica	-						
Shaft							
High speed							
Washers							
Washers							
Washers							
Pully							
Bar							
Key							

less numbers. The armature winder commences work with a full or possibly a superfluous equipment of material, which is charged up correctly; his foreman is perhaps obliged to take him off this job temporarily (a frequent necessity in shops) to rush through another armature, the man is on piece-work and needs material in a hurry, uses some of that supplied on the first order and fails to report the matter. The first order thereby becomes charged at completion with a superfluity of material and the second one not charged sufficiently. To enumerate more errors of observation would make this article too long and tedious; practical men will recall dozens and dozens of instances to illustrate the point. The argument does not hold good that these and similar faults show up bad foremen. To follow up all the details of all the shop orders in work, closely and accurately, would require a force of clerks in the factory, and it cannot be expected that foremen and workmen alone, who are not trained to clerical work, can follow or grasp the importance of the matter.

The suggestion occurs, why not take one individual piece of work of each kind and have a clerk familiar with shop work follow it through from start to finish? Very good; but this is only one observation and is liable to variation, and what is wanted is an average taken over a large number of pieces of one particular kind or size. This brings the matter back to the old shop orders which have been shown to be uncertain and unreliable, and which also demand a large amount of clerical labor continually.

A method of approximations is in force in one of the large American shops, which has all the appearance of being a good one both mathematically and practically, as will now be shown.

PLATE II.

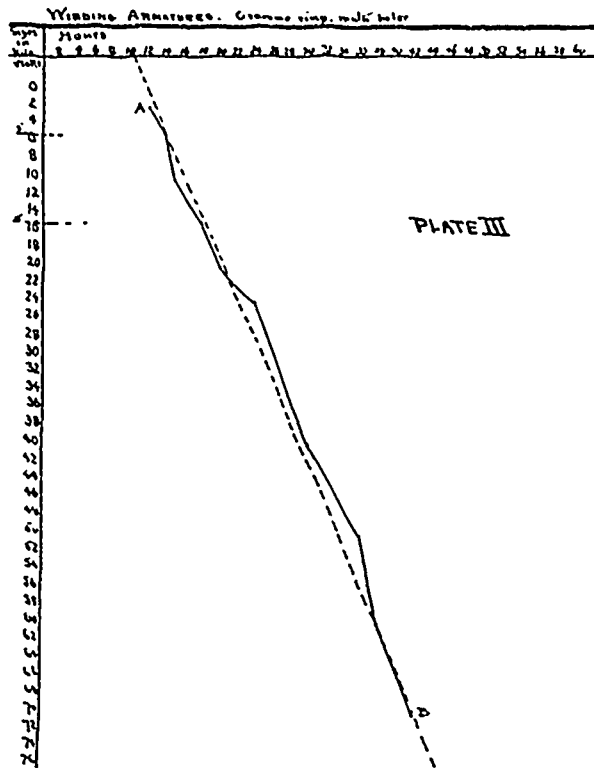
Steel iron castings Weight of rough pieces as shown on foundry bill—

Name of casting	1Kw	2Kw	5Kw	7 1/2 Kw	10Kw	11Kw	15Kw	20Kw	30Kw	40Kw	50Kw	60Kw	80Kw	100Kw	Date
Bed Plate											1205				Nov 1
											1190				- 10
											1260				- 11
											1199				- 14
											1201				- 16
											1204				- 18
Average weight											1205				
											1204				
Pillow Blocks															
Average weight															

that different bolts are better, which are thereupon substituted, and the discarded ones are forgotten (a common error among the best of foremen) and remain with the oddments on the mechanics bench. Shop Order No. 100 is thereby over-charged. Later on possibly the discarded bolts apply on another job and shop order, and are not charged. Then again 25 lbs. of Babbitt's metal is room on the shop order; the superintending engineer decides

It may be mentioned at once that the working out of such a scheme must be left entirely in the hands of the Works Manager, and must not be left in the hands of clerks, as they generally lack the judgment necessary in this regard, or even to accountants, however capable they may be as accountants. The latter from the nature of their training are wedded to exact balances, and would shudder at an approximation.

To start with, and to stick to the example shown above: the factory is engaged in building direct current dynamos and motors, and the cost of manufacturing is required. Lists of the constituent parts of the different sizes of machine, classified under



the headings of their essential parts must first be prepared (see Plate I and Plate II). The weights in the rough on Plate I must be taken from the best average that can be obtained from Plate II. It should be the duty of the receiving clerk to keep Plate II (which is a first-class birds-eye view for the manager, over the foundry weights) posted up to date.

The drawings and engineers' data will give the theoretical quantities of other material, and a few careful observations of the amounts actually used must be made under the personal supervision of the Works Manager. Space will not permit a more elaborate illustration of these details.

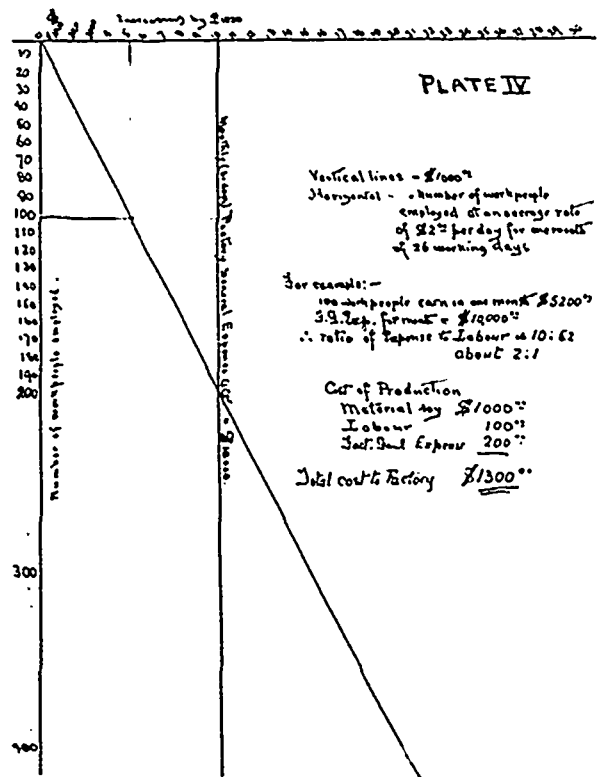
The labor is the next thing to consider; there is the labor which is strictly productive, and there is that which is so often dumped into a general expense account. In the first, if the whole shop is on piece work, finding the cost is more or less of a simple matter; if otherwise, reliable figures must be obtained from an average over many observations. Taking the latter case, it is advisable to commence with, to get one good observation on several different sizes of the same type, and plot them on cross-section paper as shown in Plate III. This gives a good basis on which to approximate the time taken on intermediate sizes, viz: by simply following the horizontal lines to the curve A.B., and reading on the perpendicular lines the number of hours as shown. Experience has proven that an approximation such as this is not merely guess-work, but differs very slightly (a fraction of a percentage) from the afterwards ascertained actual facts. Theoretically the curved line A.B. should be the dotted straight line A.B., but there are practical considerations which prevent it. This curve is only a preliminary one, and fresh observations must be made from time to time to check it, and to demonstrate the fact of its deviation from the dotted line A.B., being due to good practical reasons.

Next comes the labor which is so often confounded with expense. For instance, handling, painting, extra chippings on castings, helpers to operatives, etc. There seems to be no legitimate reason for not classing this in with the productive labor: it is a labor cost on the machine, and can be accounted for directly. This labor can be approximated in the same manner as the purely productive labor as shown by Plate III. It is, however, a some-

what more variable quantity, and requires the average of several very close observations on the extreme, and two or three intermediate sizes before plotting the curve. Works Managers will at once see the strength of this caution, recognizing as they do, that this class of labor is one of the "little foxes" which play such sad havoc with the cost of production.

Finally the general expense of the factory is to be accounted for. In the Factory General Expense account care must be taken to EXCLUDE all expenses of the selling offices, advertising, and freight on finished product, in short all expenses outside the factory gates. Clearly understanding this, the method of apportioning to material and labor as above, the true proportion of factory general expense is very simple. It is understood, of course, that under the heading of material is included freight, cartage, duty and other dues; under labor is included all operatives, and their helpers' pay, laborers handling the raw material or product in any form; in brief, the pay of all persons handling the material inside the factory gates, otherwise than storekeepers. Factory General Expense includes managers, foremen, clerical help, storekeepers, expenses of light, heat and power, rent, insurance and other charges incidental with running the factory. It is readily seen by this that the factory general expense bill is practically a fixed quantity, whereas the Labor bill is a quantity varying with the busy and slack seasons. Expense bears to Labor a definite relation, and on the contrary has no relation to Material. To explain this more fully:—Factory General Expense is the salary of the personnel and the incidental running expenses as shown above, and can be lowered to a very slight extent, if to any, during slack seasons, while on the other hand, the number of productive employees has to be increased or decreased according to the work on hand. Thus in a busy season the factory general expense may bear the relation of five dollars expense to five dollars of operatives' wages, in a slack one the five dollars expense remains fixed, whereas the operatives' wages bill is only one dollar.

All that is necessary now is to get an exact statement from the Accounting Department of the charges to Factory General Expense



over a definite period, the longer the better, and make a diagram as in Plate IV.

Plate IV not only demonstrates the fact without figuring that the Factory General Expense piles up the actual cost of production considerably higher in slack than in busy seasons, but it gives the manager a simple and ready-reckoner in figuring against a close call from competing firms and saves the nerve-racking uncertainty of adding arbitrary percentages for the safety margins.

The above, although badly cramped from its necessary conciseness, should be a fairly lucid demonstration of a simple and cheap method of "cost making," which eliminates almost entirely the personal equation, viz: the arbitrary percentage margins, and

unsystematic guess-work allowances so very much in vogue in many of the most up-to-date companies.

The figures herein shown are strictly systematic and scientific, and it cannot be contended that such approximations are in any way guesses.

THE STEAM ENGINE.

By JOHN C. GOUGH.

Those of us who have made for ourselves a toy engine (and I am inclined to believe that the number will be found not inconsiderable), and have watched it doing its whirling revolutions of some 2,000 or 3,000 per minute, might naturally be led to the conclusion that there was no limit to the velocity with which steam can travel, or to the speed with which it can enter and pass out of the cylinder, and its motion be changed or reversed. Such a notion would be, however, erroneous in the extreme, as the speed at which steam travels on its way to or from the cylinder of a steam engine is an important factor in determining the best size of the steam passages, ports, etc. It has been found by experiment that so long as the steam in a pipe is not required to travel at a higher rate of speed than 100 ft. per second, or 6,000 ft. per minute, the loss from friction, etc., in the pipes and passages is not a serious one, and the pressure at which it can be obtained on the piston is not much reduced from the boiler pressure. Beyond this speed, however, serious loss of pressure takes place, and hence the importance of having the steam ports so large that the velocity referred to may not be exceeded.

Those engineers who have had much experience in the overhauling of steam engines, are aware that in a large number of old engines the ports and passages in the cylinders are very much too small. In a case which recently came under the notice of the writer, the area of the steam port was not more than one-thirtieth of the cylinder area, and the loss from wire-drawing, poor vacuum, etc., was in consequence very considerable, although the piston speed was not a high one.

When the steam ports and passages of an engine are too crippled, there is, in addition to the loss from wire-drawing, etc., a further loss of power from the increased resistance to the exit of the steam from the cylinder, causing what is known as "back-pressure."

In condensing engines, even though there may be a plentiful supply of cold water and good "vacuum" in the cylinder, when the exhaust passages are tortuous, and contracted, an exceedingly poor effect of the vacuum will be obtained in the cylinder.

Perhaps, as good an illustration of this as could be obtained is shown in the diagrams (Figs. 1 and 2) taken from a condensing

still seen at the commencement of the exhaust, a very much greater effect is obtained from the vacuum throughout the stroke than under the conditions shown in Fig. 1. Hence we see, that besides the loss of pressure in admission when the ports and passages are too small, an even greater loss is experienced from the back-pressure, resulting from the resistance to the egress of the steam.

Many rules have been given for determining the size of steam ports, etc., but none can be considered as other than empirical which does not take into account the fact above mentioned, viz., that the velocity of the steam in following a piston should not in the passages exceed 100 ft. per second, or 6,000 ft. per minute. Bearing this in mind, we shall see that the area of the steam ports should have the same ratio to the area of the cylinder that the piston speed in feet per minute has to reach 6,000, from which we easily deduce a rule, thus:

$$\text{Area of port} = \frac{\text{Area of Cylinder} \times \text{Piston speed in feet per minute}}{6,000}$$

A rule in very general use amongst engineers and to be found in most engineering pocket-books, is to make the area of steam port equal to 1/16th the area of the cylinders. Let us see how this corresponds with the rule we have just found. Take for example, say, an engine having 5 feet stroke running 50 revolutions per minute: that is to say, with a piston speed of 500 feet per minute. By our rule we have,

$$\text{Area of port} = \frac{\text{Area of Cylinder} \times 500}{6,000} = \frac{\text{Area of Cylinder}}{12}$$

so that we see for 500 ft. piston speed, the common rule for making the steam ports equal to 1/16th the cylinder area would give too small a passage, the port requiring to be not less than 1/12th the cylinder area, in order not to lose pressure and power from the entering steam having too high a velocity. If the piston speed were only 400 ft. the port might be made only 1/15th area of cylinder, because

$$\frac{\text{Area of Cylinder} \times 400 \text{ ft. per minute}}{6,000} = \frac{\text{Area of Cylinder}}{15}$$

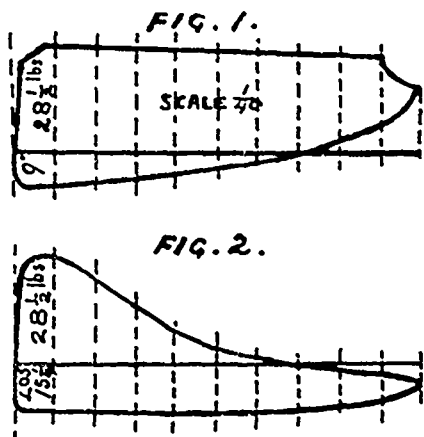
and so on if the piston speed were still further reduced; the common rule would give a larger steam port than is necessary. In order to avoid the great loss experienced by restriction of the exhaust, as shown in the above diagrams, it is customary to make the exhaust ports about half as large again as the steam ports, so that the egress may be as free as possible, and the back-pressure on the piston reduced to a minimum.

There being then so much advantage in having large passages to and from our cylinders, the consideration naturally arises as to what conditions determine the limits in the opposite direction, or can we really make the steam passages and steam ports too large? It is well known that too much "clearance" space at the ends of the cylinder means loss of steam at each stroke of the piston, and in the same way an excessive capacity of steam port or passage would mean waste, through more steam having to be thrown away in exhausting than is really necessary. A further consideration respecting the disadvantage of having too great width of area of ports is found in the cooling influence of the exhaust steam, the temperature of which, at or below the atmospheric pressure, is very much lower than that of the fresh steam at its entrance to the cylinder. The passage of the exhaust steam through the ports as the high-pressure steam has to pass through, abstracts a considerable amount of heat from every part of the metal with which it comes in contact, and this heat has to be supplied again by the entering steam at each stroke. The question, therefore, of having the steam ports of an engine a proper size, neither too small, so as to cause loss by wire-drawing, back-pressure, etc., nor too large, so as to give rise to loss from cooling, etc., it will be seen is one which has a material influence on economical working. The rule here given is a practical one of long personal experience and one which the writer can recommend.

The steam ports in Corliss engines are, in usual practice, 1/12th, and exhaust ports 1/5th of the piston area. The piston speeds, of course, govern the application of those rules in nearly every instance.

MONTREAL, Q. E., 12th Oct., 1896.

The Spokane and British Columbia Telephone and Telegraph Co. propose constructing an international telephone line between Washington and British Columbia. Arrangements have been made for connection at Spokane with the Inland Telephone Company, and on the British Columbia side with the Vernon and Nelson Telephone Company's system.



engine a few months ago. The engine was furnished with a cut-off valve, by means of which the steam could be cut off at any desired portion of the stroke. In Fig. 1, it will be observed, the steam is admitted during about nine-tenths of the piston's stroke, and when released, escapes with such difficulty through the contracted exhaust passages, that the back-pressure exceeds that of the atmosphere during three-tenths of the return stroke, and, at the termination of the stroke, when the full effect of the vacuum is usually obtained in the cylinder, there is an absolute back-pressure of something like 6 lbs. that is to say, to use the common expression, the "vacuum" is only 9 lbs.

Fig. 2 was taken from the same engine and immediately after Fig. 1, when driving a much lighter load, and the steam cut off about 1/3th the stroke. The quantity of steam to be condensed is here so much less that a "vacuum" of 13 1/2 lbs. is now shown in the cylinder, and although the effect of the restricted exhaust is

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

NOTE.—Secretaries of Associations are requested to forward matter for publication in this Department not later than the 25th of each month

TORONTO NO. 1.

TORONTO No. 1 held their regular fortnightly meeting in Engineer's Hall, 61 Victoria street, on Wednesday evening, 21st ultimo, at which one candidate was initiated. After the regular routine of business, Bro. Cross gave an interesting "chalk talk" on figures, and was presented with a hearty vote of thanks.

The Library Committee reported that the first of a series of book cases was on view in the library room, and that upwards of 100 volumes were already on the shelves. They wish to thank those who have been kind enough to donate to this work, and to state that they would be pleased to hear from the manufacturers or others who feel inclined to assist this branch of the Association's good work.

The Banquet Committee reported that they had made arrangements for the tenth annual banquet, to be held at the Palmer House on November 25th (Thanksgiving Eve). This hotel is centrally located, at the corner of King and York streets, and the dining hall has facilities for accommodating 300 guests. The secretary of the committee hereby extends a hearty invitation to all members of the C. A. S. E., and hopes that in case written invitations are not received all officers and members will consider the above invitation sufficient.

G. C. MOORING, Sec. of Com.
15 Charlotte street.

QUESTIONS AND ANSWERS.

A. B. C., Ontario, writes: "Please give the horse power or friction load of a 100 horse power high speed engine belted direct to a slow speed alternator of 1000 lamps capacity; also the horse power required to charge two miles of primary line (without any lamp on) and transformers of 1000 lamps capacity."

ANSWER.—It is impossible to give quantitative answers to your questions. The friction load of an engine belted to a generator, depends on many very variable quantities, such as condition of bearings, state of belt, make of engine and generator, etc. About ten horse power, however, should not be exceeded, on running everything empty in your size of plant. Your second question is even more impossible than the first. By the expression "charge" when you ask the horse power required to "charge" 2 miles of line and transformers, we think you mean, that if a primary line two miles long has transformer primaries connected up to a capacity of 1000 lights, and the secondaries are left open; then how much current will the ammeter indicate? In other terms, you want to know the magnetizing current of transformers to a capacity of 1000 lamps. There is no rule for this; the magnetizing current depends, in amount, on the design of the transformer, the materials of which it is constructed, its capacity; a large transformer will generally require a smaller magnetizing current, in proportion, than will a smaller one of the same make; and you will find that transformers of to-day, which embody the principles of design and construction which have been arrived at by careful scientific investigation, will prove considerably more economical on this point than are those which were

made a few years ago, before transformers had received the study which has been devoted to them during the past two or three years. You will also find that the general idea that a transformer is the easiest thing in the world to make, is erroneous. We are sorry that our answers are necessarily so very indefinite, but the questions themselves do not admit of anything more so. The manufacturers of your transformers have probably made observations of the magnetizing current, and might give you information.

ELECTRICAL DEVELOPMENT IN EUROPE.

L'INDUSTRIE Electrique publishes the following figures in regard to electrical development in Europe: There are 560 miles of electric roads in Europe, which is an increase of 125 miles in one year. The number of electric cars has increased from 1236 to 1747 in the same time. Germany has 250 miles of electric roads and 857 motor cars. France has 82 miles and 225 motor cars. Great Britain has 65 miles, with 108 cars, and Austria-Hungary has 45 miles, with 157 cars. Next comes Switzerland, Italy, Spain and Belgium, in the order given, while Russia has but one electric railroad, with 6 miles of track and 32 motor cars, and Portugal ends the list with 1 $\frac{7}{8}$ miles. Of the 111 European lines 91 are overhead trolleys, of which there were 35 in Germany, 12 in Switzerland, 10 in France, and 7 each in England and Italy, and 6 in Austria-Hungary, etc. Of electric railroads with underground current there were but three at the beginning of this year, one each in England, Germany and Hungary. Nine lines are provided with an insulated central track, through which the current is conducted, eight of these railroads being in Great Britain and one in France. The remaining eight lines are provided with accumulators. Of these, four are in France and two in Austria, and one each in England and the Netherlands.

SPARKS.

At the annual meeting of the Nanaimo, B. C., Telephone Company, held early in October, the following directors were elected: Messrs. J. C. Armstrong, O. Plunkett, M. Bray, E. Pimbury and G. Norris. Subsequently G. Norris was chosen president; J. C. Armstrong, vice-president; W. K. Leighton, secretary and collector, and G. E. T. Pittendrigh, manager.

The Royal Electric Company are installing for the Sussex Water and Electric Company, Sussex, N. S., one of their 40 k. w. "S.K.C." two phase generators, with 360 16 c.p. lights capacity in transformers, and are wiring up the town. The Sussex Company are supplying both arc and incandescent lighting, as well as motors from the same dynamo and circuits. With the continued improvement in alternating arc lamps, it is now quite feasible to do this. A number of plants are now in operation furnishing arc and incandescent light, as well as motors from the same dynamo and circuits; excellent results are reported. The use of motors makes it possible to run the plant the full 24 hours with increased capacity.

The shareholders of the Merchants' Telephone Company, Montreal, held their annual meeting on the 7th of October, Mr. F. X. Moisan, the president, in the chair. The annual report stated that two hundred and thirty-one new telephones had been placed during the past year, making a total of over 900 now in operation. The treasurer's report showed a surplus of \$19,000. It was decided to negotiate a further loan of \$45,000 to extend operations. The following gentlemen were elected directors: F. X. Moisan, L. E. Beauchamp, J. E. Beaudoin, A. S. Delisle, G. N. Ducharme, L. H. Henault, M. T. Lefebvre and F. Dagenais. At a subsequent meeting of the directors, Mr. F. X. Moisan was re-elected president, Mr. A. S. Hamelin, vice-president and L. E. Beauchamp, treasurer.

GAS CYLINDER EXPLOSIONS.

A GOVERNMENT committee in England has made official inquiry, and found that, of nineteen cases of gas cylinder explosions in different parts of the world, four were due to carelessness, one from mixed gas or vapor due to improper compressing arrangements, four to bad cylinders, three either to bad cylinders or to an excessive pressure due to overcharging, one due to ignition from oil, and one for which no cause could be assigned. The committee recommends that in the case of cylinders of compressed gas that is, oxygen, hydrogen or coal gas and of lap-welded wrought iron, a greatest working pressure of 120 atmospheres, or 1,000 pounds to the square inch, and the stress due to working pressure not to exceed six and one-half tons to the square inch; proof pressure in hydraulic test, after annealing, 224 atmospheres, or 3,360 pounds to the square inch; permanent stretch in hydraulic test not to be more than 10 per cent. of the elastic stretch; and one cylinder in fifty to be subjected to a statical bending test, and to stand crushing nearly to flatness between two rounded knife edges without cracking. In the case of lap-welded or seamless steam cylinders, the greatest working pressure is fixed by this committee at 120 atmospheres, or 1,800 pounds to the square inch, carbon in steel not to exceed 0.25 per cent., or iron to be less than 99 per cent.; tenacity of steel not to be less than 20, nor more than 33 tons to the square inch.

BOILER SCALE AND STEAM EFFICIENCY.

DISCUSSING the subject of boilers and feed water recently, Professor F. B. Crocker made some terse remarks on the subject. The water used in steam boilers is obtained either from the regular city water supply or from some source such as a pond, river, or well. Which of these is best to employ depends upon the circumstances in each particular case, but in almost every instance the question of the purity of the water is an important matter. Almost any water available for use in boilers contains from 10 to 100 grams of solid material per gallon, and since a 100 horse-power boiler evaporates about 30,000 pounds of water per day of ten hours, or about 400 tons per month, the accumulation of this material becomes very considerable, assuming only half of it to be deposited. Impurities of water are of two distinct kinds: First, small particles of solid material mechanically held in suspension, the presence of which is perfectly evident to the eye, forming what is called, in plain language, muddy or dirty water. The other class of impurities are mineral substances dissolved in water, producing little or no change in its appearance or transparency. Impurities of the first kind can be removed by filtering, or by simply allowing the suspended particles to settle; but impurities actually dissolved in the water can only be eliminated by some process of chemical or physical precipitation. The so-called "hard water" is simply water containing compounds of lime, magnesia, etc., in solution, which are particularly objectionable in water for boilers, since they are deposited as a scale or incrustation upon the interior, and seriously interfere with the transmission of heat through the metal, thereby reducing the efficiency of the boiler and also introducing a danger that it will become excessively heated and weakened. These deposits in boilers sometimes reach a thickness of half an inch or more, and are extremely troublesome and difficult to prevent or to remove after they have formed.

It is estimated that scale one-sixteenth of an inch thick necessitates the use of about 10 per cent. more fuel, one-fourth inch almost 40 per cent more, and half to three-quarter inch scale actually doubles the amount of fuel required to generate a given quantity of steam. These facts, and the greatly increased repairs and danger arising from scale in boilers, show the great importance of eliminating it.

THE EFFECT UPON THE DIAGRAMS OF LONG PIPE-CONNECTIONS FOR STEAM ENGINE INDICATORS.

If an indicator is to be relied upon to give a true record of the varying pressures and volumes within an engine cylinder, its connection therewith must be direct and very short.

Any pipe connection between an indicator and an engine cylinder is likely to effect the action of the indicator; under ordinary conditions of speed and pressure, a very short length of pipe may produce a measurable effect in the diagram, and a length of three feet or more may be sufficient to render the cards valueless except for rough or approximate work.

In general, the effect of the pipe is to retard the pencil action of the indicator attached to it.

Other conditions being equal, the effects produced by a pipe between an indicator and an engine cylinder become more pronounced as the speed of the engine is increased.

Modifications in the form of the diagram resulting from the presence of a pipe are proportionately greater for short cut-off cards than for those of longer cut-off, other things being equal.

Events of the stroke (cut-off, release, beginning of compression) are recorded, by an indicator attached to a pipe, later than the actual occurrence of the events in the cylinder.

As recorded by an indicator attached to a pipe, pressures during the greater part of expansion are higher, and during compression are lower, than the actual pressures existing in the cylinder.

The area of diagrams made by an indicator attached to a pipe may be greater or less than the area of the true card, depending upon the length of the pipe; for lengths such as are ordinarily used, the area of the pipe-cards will be greater than that of the true cards.

Within limits, the indicated power of the engine is increased by increasing the length of the indicator pipe.

Conclusions concerning the character of the expansion of compression curves, or concerning changes in the quality of the mixture in the cylinder during expansion or compression, are unreliable when based upon cards obtained from indicators attached to the cylinder through the medium of a pipe, even though the pipe is short.

W. F. M. Goss, in *Scientific Machinist*.

The attention of those of our readers who are desirous of becoming acquainted with the principles and applications of Roentgen rays and phenomena of the anode and cathode, is directed to a book on this subject by Edward P. Thompson, M. E., E. E., New York, and recently published by Messrs. D. VanNostrand & Co., of the same city. This book, consisting of 200 pages, reviews the history of investigations and experiments in connection with the electric discharge from the time of Faraday, Davy, Page and others, and treats of the variety of purposes to which our present knowledge of the subject may be applied. It is suggested that the study of the subject might well have a place in the curriculum of scientific schools. The book, which is illustrated with numerous engravings, sells at \$1.50 per copy.

SPARKS.

The Metropolitan street railway is being extended to Richmond Hill.

The London Street Railway Company are putting in a new 536 horse power engine in their power house on Bathurst street.

An electric light plant has been installed at Trail, B. C., consisting of an alternating dynamo of 1000 16 c.p. lights and an arc machine of 25 lights.

The dispute between the city of Winnipeg and the Street Railway Company has been finally settled, and arrangements are now being made to extend the line.

The Asbestos and Danville Railway Company, of Danville, Que., will apply to parliament for authority to build an electric railway from Danville to Asbestos.

George Hunt, proprietor of the St. Lawrence Machinery Supply Company of Montreal, is reported to be offering his creditors ten per cent. on claims amounting to \$3,100.

The Montreal Park and Island Railway Company expect to have their line completed to Lachine this fall. The power houses at St. Laurent and Lachine are also nearing completion.

Judgment for \$700 and costs was recovered by Mr. Nelles, ex-manager of the Hamilton, Grimsby and Beamsville Railway, in his suit against the company for alleged wrongful dismissal.

A company of Brantford capitalists are promoting a scheme for the construction of an electric railway from Brantford to Paris and Ayr, and probably to Galt. A charter for the road is held by the promoters.

The St. Hyacinthe and Granby Railway Co., of St. Hyacinthe Que., is seeking incorporation with a capital stock of \$100,000, to build a steam or electric railway, between Bingham, Brome County and St. Hyacinthe.

There is now in course of construction for the Ottawa Street Railway Company an electric locomotive for hauling lumber from the yards of Messrs. W. C. Edwards & Co. to the Canada Atlantic Railway after the hours of the regular passenger service.

The Chateau & Northern Electric Railway Co. will shortly complete their electric road from the city of Montreal to Bout d'Isle, a distance of twelve miles. An initial trip over the section between Maisonneuve and Point Aux Trembles, where the power house is located, was made a few days ago. Four cars have arrived from the Canadian General Electric Co., Peterboro', and two more are shortly expected.

The announcement has been made within the past few days that an international syndicate of capitalists has secured control of the largest tramway in London, England. Mr. Wm. McKenzie, president of the Toronto Street Railway Co., who some weeks ago was given a franchise for an electric railway in Birmingham, is at the head of the syndicate, and with him are associated Mr. James Ross, of Montreal, and several street railway capitalists of New York, St. Louis and Philadelphia.

The quarterly meeting of the shareholders of the Hamilton, Grimsby and Beamsville Electric Railway Company was held on the 2nd inst., when the statements of the secretary-treasurer, Mr. Adam Rutherford, for the six months ending September 30 were accepted. Mr. Rutherford was voted stock in the railway to the value of \$2,000 for his services up to March, 1894. The Beamsville extension of the road has been completed, and was placed in operation a few days ago. The annual meeting of the company will be held on the fourth Monday in January.

Arrangements have been completed by the Westinghouse Air Brake Manufacturing Company, of Pittsburg, for the establishment of a branch factory in Hamilton, Ont., and a new Canadian company will be organized, to be known as the Westinghouse Manufacturing Co., Ltd., of Hamilton. The capital stock will be \$500,000. The names of the applicants are: George Westinghouse, Henry Herman Westinghouse and John Caldwell of Pittsburg, and Hon. J. M. Gibson and A. E. Malloch, of Hamilton. It is proposed to manufacture electrical appliances and air brakes for railways, switches, etc.

Tenders for a telephone franchise for the city of Toronto, were opened a fortnight ago. Tender No. 1 was by George Mussol, who offered to establish the system described as automatic, giving absolute secret connection and a continuous service at nights. No. 2 tender proposed that the Citizens Telephone Company of Toronto (to be incorporated) would furnish the Wilhelm Telephone Company System of Buffalo. No. 3 was by Clark, Gowes & Co.,

on behalf of a client. Tender No. 4 was from Messrs. Beauchemin, Montreal, offering to furnish a service on the basis of the Merchants' Telephone Company of Montreal, at \$25 each.

The paragraph which appeared in our October number relative to the proposed electric railway at Quebec, was slightly inaccurate. We are advised that Mr. Beemer, the original promoter and owner of the franchise of the railway, has concluded an arrangement with a company for the construction of the road, which when completed and put in operation, will be taken over by Mr. Beemer.

The following figures show the prices paid for electric lighting by a number of Ontario towns:

Town	Power	Price per light
Belleville	2,000 candle power	\$127.75
Brampton	2,000 "	64.00
Chatham	2,000 "	85.27
Clinton	2,000 "	66.00
Cobourg	2,000 "	62.50
Dunnville	2,000 "	60.82
Galt	2,000 "	80.30
Guelph	2,000 "	89.42
Ingersoll	2,000 "	73.00
London	2,000 "	108.58
Meaford	2,000 "	55.00
Niagara Falls	2,000 "	85.00
Owen Sound	2,000 "	90.00
Simcoe	2,000 "	73.00
Toronto	2,000 "	108.58
Wallaceburg	2,000 "	75.00
Welland	2,000 "	57.26

A company has been organized in Peterboro to install and operate a plant for the supply of electric power. The members of the company, Messrs. W. H. Meldrum, John Carnegie and James Kendry are well known and enterprising citizens, and in their hands the undertaking should have results at once beneficial to the town in enabling it to offer to manufacturers the advantage of cheap electric power, and at the same time the returns in a financial way should be satisfactory. The power site is located at Auburn, giving a maximum transmission distance of four miles to the farthest point at which power is to be supplied. The initial installation consists of a 250 K.W. slow speed 3 phase generator of the Canadian General Electric Co's. latest type. This machine will run at the very slow speed of 200 revolutions, and will be direct coupled to the line shaft, thus saving the loss in a belt transmission. Current will be distributed at the transmission voltage, 2080 volts, directly to all the motors of more than 50 horse-power capacity. For smaller motors step down transformers will be used to reduce the pressure to 115 volts. Contracts have already been secured by the Company for some 250 or 300 horse power and it is considered likely that the installation of a second generator will be necessary in the near future. The plant is to be in operation on the 1st of January next.

The North Shore Power Company of Three Rivers, Quebec, have secured a franchise from the City of Three Rivers to supply incandescent and arc lamps as well as to pump the city water. The corporation of the City of Three Rivers installed a municipal lighting plant, but have turned it over to the North Shore Power Co., who are going to operate it with power generated on the Batiscan River at Batiscan Chute, and convey the same to Three Rivers, a distance of 16 miles. This Company have purchased from the Royal Electric Co., two of their S.K.C. 2 phase generators with a capacity of 240 K.W. each. It is the intention to generate the current at their water power, using step-up transformers, bringing the pressure up to 11,000 volts, and at Three Rivers step-down transformers will be used to reduce the pressure to a working pressure of about 1000 volts, where it will be connected to the present lighting circuits that were turned over to the North Shore Power Company by the corporation of Three Rivers. The flexibility of the system being put in by the North Shore Company is being well demonstrated by the fact that the step-down transformers are located in the old lighting station at Three Rivers, and that the present circuits for incandescent lighting will be directly connected to the step-down transformers, and that the expense in making the change in the Three Rivers station is practically nil. The transformers in use for about 3000 lights already installed are of the Royal type of 16000 alternations, and as this is also the periodicity of the 2 phase generators being installed, no change on their lines or transformers is necessary. The corporation of Three Rivers had in operation one arc dynamo of 50 lights, and one with 30 lights capacity. It is intended to drive these two arc machines with one of their single phase alternators which have been in use a number of years there, and which will be coupled in one side of the 2 phase circuit and driven as a synchronous motor.

SPARKS.

Mr. John Davidson, of Smith's Falls, Ont., has invented an electric heater.

Improvements have recently been made to the electric light station at Sherbrooke, Que.

An electric plant for lighting the town of Hull is being installed. It will be located at Deschenes Mills.

The incorporation is announced of the Amherstburg Electric Light Company, with a capital of \$20,000.

An eastern syndicate is endeavoring to secure control of the New Westminster, B. C., electric light plant.

It is rumored that a rival telephone company will shortly commence business at Halifax, but the report lacks confirmation.

Prospects are said to be favorable for the conversion at an early date of the Hamilton and Dundas Railway into an electric road.

Mrs. E. Bradley, of Lynchburg, has begun an action against the Hamilton Radial Electric Railway Co. for \$5,000 damages for the death of her son.

The Northern Electric Railway Company is applying to the Quebec legislature for incorporation, to build an electric railway from Montreal to St. Jerome.

The Ottawa Car Co. is now constructing a combined passenger, baggage and express car for the Ottawa Electric Street Railway Co. It will be 40 feet in length 13 feet longer than the ordinary passenger cars, and will have accommodation for 36 passengers and run on eight wheels.

The new exchange of the Bell Telephone Company at Winnipeg was recently opened. It is said to be one of the most complete systems in the Dominion, and was designed by Mr. J. A. Baylis, the company's expert. Prior to leaving for Montreal, Mr. Baylis and his assistants were tendered a complimentary dinner.

The Peterboro' Town Council has accepted the offer of the Peterboro Light and Power Co. to supply the town with eighty-five 2,000 candle power arc lamps for the sum of \$65 per arc lamp per year, they to pay the sum of \$400 per year as rental for the use of the streets. The new contract is to be for the term of seven years from January 1st, 1897. Additional lamps over eighty-five are to be charged at the rate of \$60 per year.

Daniel McAuley, a young mechanical engineer of Port Morieu, C. B., has patented an invention to prevent boiler explosions. It is a steam boiler pressure indicating alarm, which is set to go off when the pressure on the boiler has reached a point over which it ought not to go, much the same as the engineer sets his alarm clock for five in the morning. If the steam valve is out of order, as often happens, no explosion can occur, because this patent will give the alarm.

Arrangements have been made for the development of the water power of the Pend d'Oreille river, in British Columbia. A power station will be located at the mouth of the river, about twelve miles from Rossland. The plan contemplates the construction of a dam, from which the water will be conducted in steel flumes and delivered to the water wheels. It is claimed that 10,000 h.p. can be developed, but it is proposed to install 2,000 h. p. to begin with. The total investment in connection with the enterprise will be in the vicinity of \$250,000.

In pursuance of a certain indenture made between the Yorkshire Guarantee and Securities Company and the Consolidated Railway Company, of Vancouver, B. C., the assets of the latter company will be offered for sale on the 17th inst. The property consists of an electric street railway extending throughout the cities of Vancouver, Victoria and New Westminster, and also between Vancouver and New Westminster, and between Victoria and the town of Esquimalt and Oak Bay, including power plants, rolling stock, etc., also lighting plants, power houses, machinery, etc., in Vancouver and Victoria.

At the annual meeting of the Acetylene Light, Heat and Power Company, held in New York during the past month, President Adams, in his address, stated that the new illuminant had been favorably reported on by both the Philadelphia Fire Underwriters' Association and the New York Board. He also presented the names of thirty fire insurance companies which had approved the use of the automatic generators. This last statement was based principally on the fact that permission had been granted a certain large risk to use acetylene, but under a number of conditions, among which was one prohibiting the storing of the carbide on

the premises. It was also required that the tank be placed outside the building.

"During his present visit to Peterboro," says the Review, "the electric light inspector of this division, Mr. Wm. Johnston, has found two electric light meters of the other kind which were being used in private houses where ten lights are generally burned but which had not registered any of the electricity passed through them for several months. The cause of this lamentable state of affairs—as viewed by the company—was apparent last night, when the inspector broke those very official looking seals which he places on every correct meter and disclosed "da niggah in da fence." Doubtless in that terrific thunderstorm in June last, when poles were struck on Macdonnel and other streets and the company's loss was counted by hundreds of dollars, some of the electricity which everybody gets gratis entered these meters and destroyed their usefulness to the company. Another case settled by Mr. Johnston was that of a local company whose manager complained that the meter they had was running too fast. The test of this meter was made in the presence of the manager and a representative of the Light and Power Co., and was found to be one per cent slow, or in favor of the consumer."

TRADE NOTES.

The Royal Electric Company are installing a lighting and power plant for the Brookfield Mining Associates at North Brookfield, N. S.

The Corporation of Huntsville purchased a 1000 light alternator of their standard single phase type from the Canadian General Electric Co.

The Royal Electric Co. have just completed the installation of an incandescent lighting plant in the large woollen mills of A. W. Brodie, Hespeler, Ont.

E. H. Thomas & Co., Norwich, Ont., are lighting their factories by electric light. The Royal Electric Co. are furnishing and installing the apparatus.

Mr. G. A. Adams, Adamsville, P. Q., has recently installed lighting plant for illuminating his mill and residence. The apparatus was supplied by the Royal Electric Company.

Wenger Bros., of Ayton, Ont., are lighting up their mills and a portion of the town by electricity; they expect to install about 200 lamps. The dynamo, etc., is being furnished by the Royal Electric Company.

Mr. J. W. Easton has severed connection with the John Abell Co., of Toronto, and connected himself with the Stevens Manufacturing Co., of London, who will in future build his latest improved electrical apparatus.

Mr. C. W. Henderson, contractor and manufacturer, has recently installed in the Canada Life new building, Montreal, electric calls in the elevators, which system is something new and very novel, being designed and manufactured expressly for that company.

The T. H. Taylor Co., Ltd., of Chatham, Ont., are lighting their large mills by electricity, and have placed their order for a 200 light dynamo with the Royal Electric Co. They are also having installed by the same firm 150 lamps throughout their mills and store house.

The Welland Vale Manufacturing Company, St. Catharines, Ont., have completed a large addition to their factory; it is being lighted throughout with electricity. There will be about 500 lamps. The plant is being furnished and installed by the Royal Electric Company.

Mr. C. W. Henderson, contractor and manufacturer of electrical supplies, Montreal, has recently fitted up some of the largest buildings in that city, notably the Montreal Street Railway Co., Montreal Diocesan Theological College, Standard Shirt Co., Thompson Shoe Co., Montreal Steam Laundry.

Mr. J. W. Skinner, of Mitchell, Ont., Canadian representative of the National Electric Mfg. Co., of Eau Claire, Wis., reports having recently made the following sales: 1000 light dynamo to the town of Goderich; 350 light plant to J. L. Eidt, to light the village of Auburn; 1000 light plant to the Kensington Furniture Co., of Goderich.

Letters patent have been issued incorporating the Paxton-Tate Company, of Port Perry, Ont., to manufacture saw mill machinery, water-wheels, etc. The capital stock is \$99,000, and the promoters are George W. Dryden, James Carnegie and William McGill, of Port Perry, Leonard Burnett, of Greenbank, Hon. John Dyrden, of Toronto, and F. W. Hodson, of Guelph.

ELECTRIC RAILWAY DEPARTMENT.

AMERICAN STREET RAILWAY ASSOCIATION.

THE recent convention of the above association at St. Louis is described as having been one of the most successful in its history. The name of Mr. C. E. A. Carr, manager of the London Street Railway Co., appears in the register of attendants as the sole representative of Canada. The association declined to entertain a proposal for amalgamation with the National Electric Light Association. Captain McCulloch, vice-president and manager of one of the St. Louis street railway corporations, was elected president for the ensuing year. Niagara Falls was selected as the place of next meeting.

MONTREAL STREET RAILWAY.

THE annual meeting of the Montreal Street Railway Company was held on the 4th inst. The chair was occupied by Mr. L. J. Forget, the president of the company, and there was a good attendance of both directors and stockholders. The annual statement showed that the net earnings for the year ending September 30 last were \$1,253,183.14, as against \$1,096,911.31 for the previous year. The gross earnings were \$555,033.69. The net profits were \$462,106.79, as against \$351,349.13 in 1895. Of this amount two dividends of 4 per cent. each and a bonus of 1 per cent. were declared, amounting in all to \$360,000, the balance of \$102,106.79 being added to the surplus.

The cost of operating during the entire year was 56.48 per cent. of the entire receipts, as compared with 59.20 per cent. for the previous year.

The good results obtained from the conversion of the system to electricity are very apparent in the statistical statement. The net earnings for the year 1896 are nearly as large as the gross earnings for 1892, being \$555,033.69, as compared with \$564,406.57, and the operating expenses per cent. of earnings has fallen from 82.68 to 56.48.

The rapid growth of traffic during last winter necessitated additional power, rolling stock, etc., and an additional boiler house at the William street power station to supply steam to a new 2,500 horse power direct-connected engine and generator, was erected. Fifty open motor cars were constructed in the spring, and twenty-four closed cars are now nearing completion at the company's shops.

A resolution of condolence was passed at the death of Mr. Edward Lusher, for many years connected with the company.

The number of passengers carried in 1896 was 4,018,713 in excess of 1895. The figures for the last five years were 29,896,471 in 1896, 25,877,758 in 1895, 20,569,013 in 1894, 17,177,952 in 1893, and 11,631,386 in 1892. The transfers given last year were 8,541,530, or 28½ per each hundred passengers.

The Board of Directors was re-elected as follows: Mr. L. J. Forget, Mr. James Ross, Mr. K. W. Blackwell, Mr. G. C. Cunningham, Col. F. C. Henshaw.

It is stated to be the intention of the company to issue an additional million dollars of stock, the funds being required for extensions, improvements, etc.

ELECTRIC RAILWAY FOR QUEBEC.

AFTER negotiations extending over a long period, the construction of an electric railway for the city of Quebec seems now to be an assured fact. A meeting of the shareholders was held on the 10th ultimo for the purpose of organizing the company. A report was read by Andrew Thomson, president of the Union Bank of Canada, showing the steps which had been taken towards organizing the company, the nature of the proposed contract, and the agreement with the Montmorency Power Company for the furnishing of power. The subscribed capital was limited to \$320,000, and this amount had all been taken up. The following directors were elected: Messrs. Wm. Shaw, Andrew Thomson, John Breakey, E. E. Webb, Judge Chauveux, H. Kennedy, E. W. Methol. On motion of the Hon. L. P. Pelletier, seconded by Mr. A. Thomson, a resolution was adopted empowering the Board of Directors to enter into a contract with the Montmorency & Charlevoix Railway Company and the Montmorency Electric Power Company for the construction of the road under the former's contract with the city, and for the supply of power by the latter. Mr. Beemer transferred his franchise to the company, but reserves the right to redeem the road up to the 1st of July, 1898, by paying interest on the capital at 6 per cent., and a commission of 10 per cent. on the amount expended by the company.

Since the meeting the four parties to the agreement for the construction of the road have signed the contract. These are, the city of Quebec, the Montmorency and Charlevoix Railway Company, the Quebec and Levis Electric Power Company, and the Quebec District Railway Company, the latter being the name under which the company will operate the road.

Large quantities of materials have already arrived for the work, and over two hundred men are employed in construction. Within a very short time the citizens of Quebec will enjoy all the advantages of a thoroughly-equipped electric railway.

CORNWALL ELECTRIC STREET RAILWAY.

THE authorities of the town of Cornwall, fully alive to the importance of rapid transit, determined to have an electric street railway, and the enterprising firm of Hooper & Starr were given the franchise. These two gentlemen are well known throughout Canada and have had a wide experience in electrical and railway work.

Ground was broken on the 21st of April of this year, and by the 24th of May 3½ miles of track were laid. There are now 5 miles of single track in operation. The handling of freight was expected to be the main source of revenue, but the passenger traffic has been greater than was anticipated, and the park, which was opened for the benefit of the patrons of the road, has proven a great attraction for the summer months.

THE ROAD BED.

The construction of the road bed was placed in charge of Mr. Bruce, C.E., who was for some time with the C. P. R. Where there was solid bottom, 9 inches of heavy boulders were laid, and on top of this were placed 4 inches of broken stone. The ties (standard) were then

laid on with earth between. A coat of macadam was afterwards placed on top, covering the rails. A heavy steam roller was then run over this, giving it a smooth, level surface. The rails are 56 lbs., with strap fish plates bonded with 0000 wire, with a malleable tapering thimble which is set in the rail. The wire is run through this and the thimble is hammered in tight. This is claimed to be a decided improvement over the soldering method.

On the portion of streets where there were sandy or boggy bottoms, cedars were laid to a width of eight or nine feet, on top of which four to five inches of macadam were laid, with ties, etc., on top. There is over a mile of this construction. Some cedars were 40 feet in length, the minimum being 16 feet. One place on their private property near the G. T. R. depot a boggy place was made solid by laying boards diagonally, with the boulders, crushed stone, etc., on top. Curves are laid very flat, and heavy freight cars are hauled easily round them.

Little can be said of the overhead construction, as there is no feed wire, the station being in the centre of the circuits. The trolley wire is 00 hard drawn.

ROLLING STOCK.

The cars comprise four motors, three trailers, and a locomotive, but the three trailers are being converted into motors. Two open car bodies and one closed car body, and the body of the locomotive were built by the Rathbun Company, and the balance by the Canadian General Electric Company. The locomotive is equipped with four C. G. E. 800 motors on double trucks, two motors on each truck, and weighs 15 tons. The motors are arranged on the double series system, which permits of regulating the speed according to the load. All the cars and the locomotive are mounted on steam car wheels, preventing that rocking motion incident to cars using light wheels. The trucks are made by the Canada Switch and Spring Co.

THE POWER HOUSE.

The power house is a handsome brick structure, faced with pressed brick, and designed by Mr. H. Ross Hooper, who was the architect of the car barns. It is 125 x 35 ft., divided into a dynamo and a boiler room, the dimensions of which are 75 x 35 ft. and 48 x 35 ft. respectively. The roof is supported by iron trusses.

The dynamo room is well lighted and ventilated, and the ceiling is sheeted with corrugated iron. The floor is matched hardwood, and the foundations of the machines and engines are of stone capped with brick. A 250 h.p. Robb-Armstrong cross compound engine drives a 200 k. w. C. G. E. generator. The water of the St. Lawrence is used for condensing, and a Northey condenser is in operation, with a National (Robb-Armstrong) heater. A slate switchboard is mounted with full C. G. E. equipment for the generator. The chief engineer's office and a work bench and tools occupy part of one side, and there is sufficient room for a duplicate engine and generator.

The boiler room contains two "Monarch" boilers of 150 h.p. each. The furnaces are fed with fuel of hard pea coal, mixed with the soft run of the mine. Fire-proof doors separate the dynamo and boiler rooms.

THE CAR BARN.

The car barn is a frame structure, sheeted on roof and sides with metallic shingles and siding. It is 95 x 60 ft., part of which - 16 x 95 ft. is used for a freight shed.

The roof is supported by three independent trusses from a 60 foot span. The capacity of the barn is nine cars. A 30 foot repair pit is used for all repairs on trucks, motors, etc., besides a repair shop, which is in one corner. On the freight shed side are double tracks and a platform 6 ft. wide running the full length of the building. The freight is unloaded from the cars to the platform, and then into the shed.

THE ROUTES.

The system centres at the post-office on Main street, and cars meet all trains and boats. There are two lines and a spur line. One line is on the east side to the park, and the other extends from the station on west side and connects with the east side line. The spur line runs to the mills. The cars run from 5.30 a. m. to 12.30 p. m. No registers are used, the conductors being supplied with what are called shot boxes. In each box is a little shot receptacle, which will not upset as long as the conductor does not turn the fare box upside down to rifle its contents.

The park owned by the company comprises 15 acres, and is prettily situated and laid out for the enjoyment of the patrons of the road. A merry-go-round is operated by a C. G. E. 800 motor.

The directorate of the road is as follows: - President, H. Ross Hooper; vice-president and managing director, D. A. Starr; secretary-treasurer, F. M. Siddall; A. J. Hooper and W. R. Hitchcock.

LEGAL.

In the action brought by one Burns against the London Street Railway Company, to recover damages for the killing of plaintiff's dog, which ran across the track within ten or fifteen feet of an approaching car, the first Division Court of Middlesex held that the case came within *Hay v. G. W. R. W. Co.*, 37 Q. B. 465, and the action of the dog was the cause of its death, and therefore the plaintiff could not recover.

The appeal of the Toronto Railway Company from the decision of the Court of Revision confirming an assessment of \$537,137 upon their street equipment, was argued a week ago before the County Judges of York, Peel and Ontario. Messrs. B. B. Osler and Wm. Laidlaw argued the case for the Company, and the City Counsel for the city. Mr. Osler contended that the company's franchise being a limited one they stood in the relation of tenants of the city, and as such were exempt by law from taxation—the taxes being payable, except under special agreement, by the landlord. Mr. Osler advanced the further argument that the railway was a highway, the rails being part of the soil, and as such should be exempt. Counsel for the city interpreted the assessment act as placing the rails, poles and wires of the Company within the meaning of real estate, and as such liable to assessment. He quoted the words "purchaser" and "vendor" in the agreement between the Company and the city to show that the company does not stand in the relation of a tenant of the city. Judgment in the case has not yet been rendered.

The Winnipeg Street Railway Company employ for the conveyance of pic-nic and excursion parties, a motor car, attached to which are four trailers consisting of old horse cars fitted with new platforms and sills, a railing all round, and seats arranged across both sides and ends, with space for a passageway from the steps at either end. These trailers are lighted by lamps strung on wires supported on poles at either end of the car.

The Montreal Street Railway Company have recently had a system of interlocking safety devices placed at the Wellington Bridge crossing the Lachine canal. An electric motor is employed to turn the bridge. Before the bridge is opened, a derail, consisting of a tongue switch, is so set as to turn the car off the track at a distance of 80 feet from the bridge on either side, thus preventing the possibility of a plunge into the canal while the bridge is open.

SPARKS.

An electrician named A. Lepitre was instantly killed by coming in contact with an electric current in the Montreal Light & Power Company's station.

It is rumored that as soon as the Chambly water power is developed, steps will be taken to construct an electric railway between Montreal and St. John.

It is announced that the Cataract Power Co., of Hamilton, which was recently organized, have closed contracts in Hamilton for power to the value of \$50,000 a year.

The Sussex Water and Electric Light Co. have entered into an agreement with the town of Sussex, N. B., to install an electric light plant. Mr. F. E. Norton, of St. John, has charge of the construction work. A 500 light power plant will be installed.

At a convention of street lighting officials held recently at New Haven, a poor showing was made on behalf of municipal control of electric lighting plants. It was stated that Wabash, Ind., purchased a plant for \$18,000 and sold it for \$30; Xenia, O., paid \$35,000 for a plant and ten years later sold it for \$10,000; Moline, Ill., bought a plant at \$15,000 and four years later sold it for \$8,000; Michigan City bought a \$10,000 plant and sold it for \$2,500.

The two rival electric light companies at Renfrew, Ont., are about to amalgamate, under the name of the Electric Light and Power Company. A charter of incorporation is now being asked for, the applicants being W. A. Mackay, T. W. Guest, A. C. Mackay, A. A. Wright and Howard Wright. The erection of a new power house will be one of the first improvements, a site for which has been secured. It will be a large structure, and will contain two steam engines, one being 225 horse power.

The Owen Sound Electric Manufacturing and Illuminating Co. have decided to furnish incandescent light and power, as well as arc lighting to the Town of Owen Sound. Their water-power is situated three miles from the business centre of the city; this they have very lately improved, and now have a steady power of 200 horse or more the whole year round. The Royal Electric Company have secured the contract to furnish them with "S.K.C." two phase dynamos and apparatus, in order that they may be able to supply power as well as incandescent light, thus enabling them to use their water-power the entire 24 hours of the day—during the daytime furnishing power to the different manufacturers, and at night furnishing the arc and incandescent lights. This was one of the first companies in the electric lighting business in Canada. They have always been very conservative, and have been successful from the start.

ROBIN, SADLER & HAWORTH

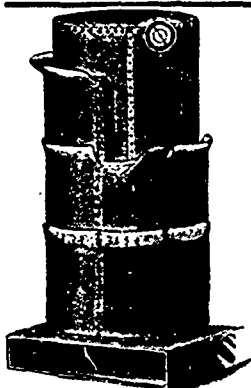
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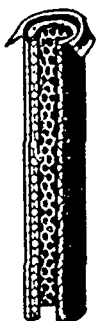
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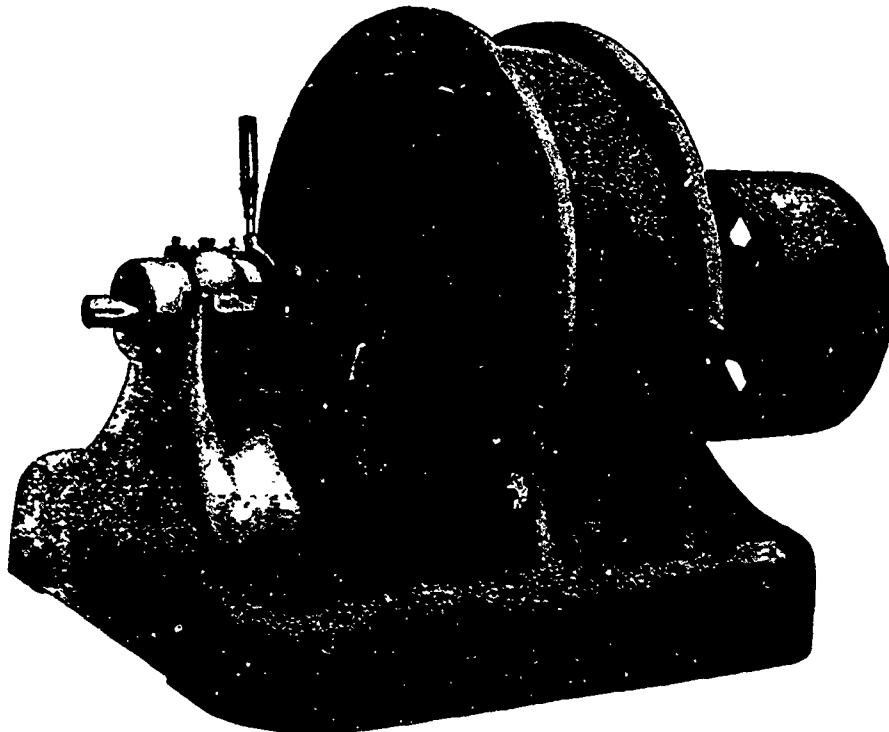
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The Monocyclic System

has been established by the experience of the past year to be the only satisfactory system for the distribution of

Light and Power

from the same generator and circuit. We invite attention to its superior mechanical design and construction; its absolute simplicity in distribution as compared with the complications of the polyphase systems; its perfect regulation secured by compounding to compensate for line loss; its freedom from unbalancing, the lighting circuit being single-phase; the perfect operation of our induction motors, which require no condensers.

MORE FACTS ABOUT S.K.G. APPARATUS

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OCT 21 1896

ANSWERED

Oct. 21/96

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Royal Electric Co.
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OCT 22 1896
SECY. & TREAS.

Gentlemen

We have now been running our "S.K.C." Plant installed by you for us for nearly a year and must say that we are entirely satisfied with the working of the Dynamo as well as the working of the Transformers. The Dynamo takes less power than we expected it to do for the number of lights burning on it. You know our dynamo is driven by a waterwheel and that we regulate it by hand we have been able to do this very easily and have had no trouble with the regulation and must say that the whole plant comes well within the guarantee given by you. Besides the machine gives no trouble only to wipe the dust off once & while I have not oiled it since April and the bearings never heat. It is really the best machine on the market— we think it is in due justice that we should write this letter.

Yours truly
Glen Williams Mgr. Light Co.
Asst. Mgr. Hitchinson

The Best Proof of the Superiority of the S. K. C. Apparatus is the Satisfaction expressed by all our Customers. Its Simplicity, Reliability, Efficiency and Close Regulation give a sense of Security impossible with Wire-Wound Armatures.

The Royal Electric Co.

MONTREAL, QUE.

Western Office: TORONTO, ONT.

SPARKS.

Granby, Que., is agitating for the electric light.

The council of Dundas, Ont., have decided to have the town lighted by electricity.

The new building for the Brantford Electric Light Company will shortly be completed.

The Ontario Electric and Engineering Company, Toronto, is being incorporated with a capital stock of \$10,000.

T. E. Bulwer has been registered proprietor of the firm of H. E. P. Bulwer, electrical supplies, Montreal.

Mr. James Noxon, Inspector of Ontario Asylums and Prisons, is experimenting with an appliance for burning tan bark for fuel for boilers, which, if successful, will be

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Having first-class certificate, to take charge of engines, dynamo, etc., in a new commercial building in Montreal. Must also be able to supervise the building itself. No one need apply unless fully qualified and recommended. Address Box 100, CANADIAN ELECTRICAL NEWS

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One 30 h.p. Compound-Wound

RELIANCE DYNAMO

250 volts; one extra armature for same.

One 40 h.p. Compound-Wound

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250 volts. Both machines in first-class order, having been just replaced by larger ones. Can be delivered at once.

TEMPLE ELECTRIC CO.,
Montreal, Que.

FOR SALE

One 50-Light 4 Ampere (Ball) Arc Dynamo, with Station Apparatus and 46 Lamps; also one 25-Light 8 Ampere (Reliance) Dynamo, all in good order.

The above will be sold at a bargain. For particulars apply to

H. S. CANE,
Newmarket, Ont.

ROBERT A. ROSS, E. E., (M. E. Grad. S. P. S., E. E. Degree Toronto University. Member A. I. E. E.) Late Chief Electrical Engineer Royal Electric Co., Montreal, Works Engineer Canadian General Electric Co., and previously with Engine Companies.

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Specifications, Plans, Supervision, Valuation and Advice on Steam and Electric Plants. Special Machinery Designed. Room 15, Hamilton Chambers, 17 St. John St. Montreal.

introduced in the prisons and asylums of Ontario.

By the bursting of a drive pulley at the electric light works, St. Thomas, Ont., the shafting and dynamo were badly damaged.

The town of Kaslo, B. C., has rejected the proposal of Alexander & Retalack to put in an electric light plant, the by-law being defeated.

Some time ago the Western Electric Co., of Chicago, were negotiating to establish a plant in Vancouver, B. C., and deposited two bonds of \$5,000 with the city.

The scheme has since been abandoned, and the city has returned the bonds.

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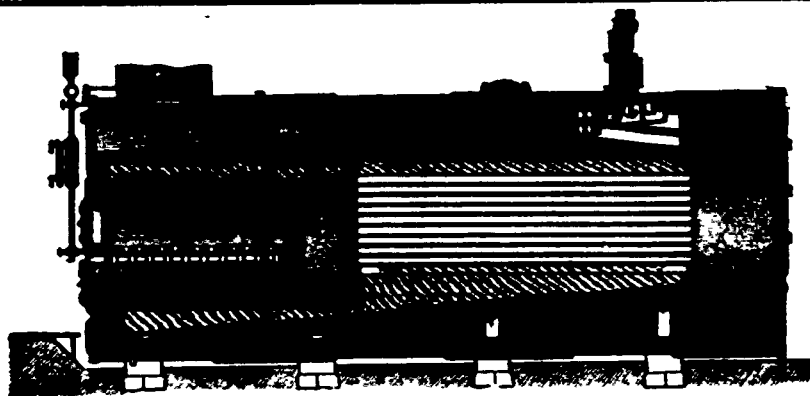
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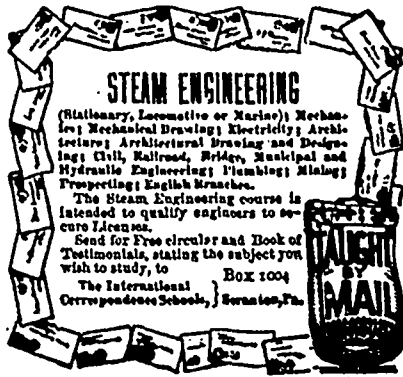
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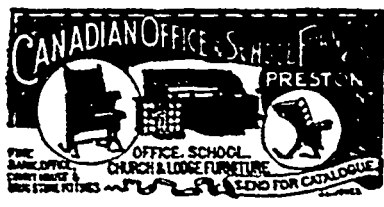
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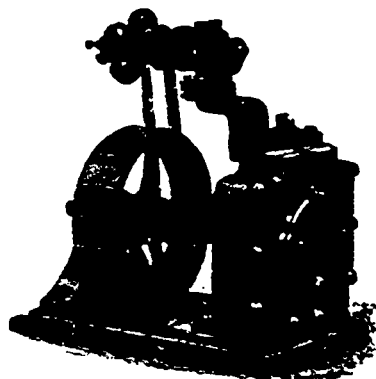
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