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CANADIAN
ELECTRICAL NEWS
AND
STEAM ENGINEERING JOURNAL

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CANADIAN

ELECTRICAL NEWS

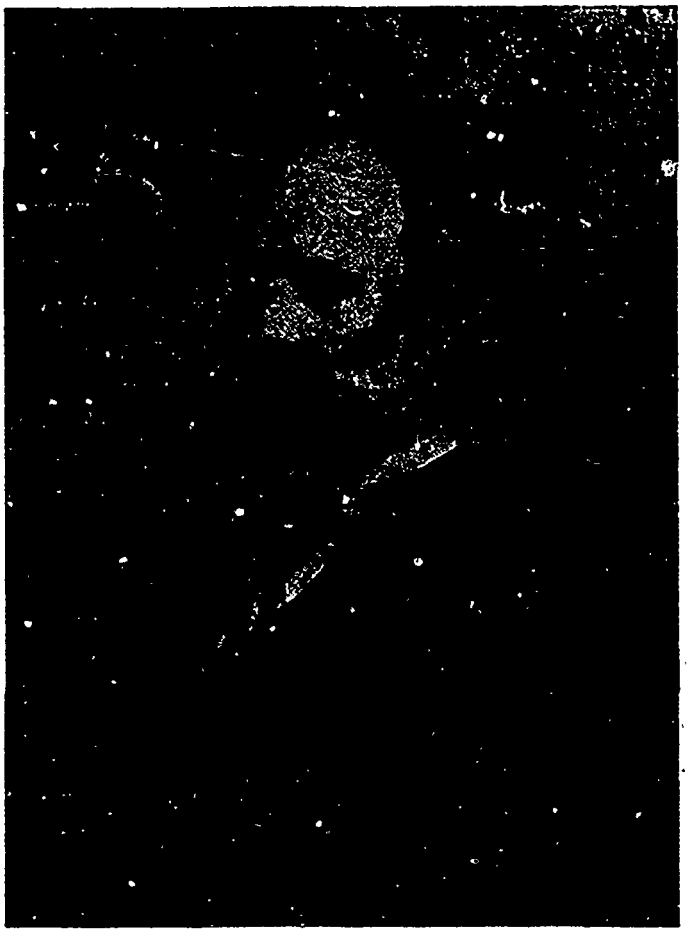
AND

STEAM ENGINEERING JOURNAL.

VOL. VII. MARCH, 1897 No. 3.

MR. W. H. BROWNE.

A PERUSAL of the somewhat lengthy address, printed elsewhere in this number, delivered on the occasion of a visit of inspection to the works of the Royal Electric Company, Montreal, will serve in a measure as an introduction to the manager, Mr. W. H. Browne, a capital portrait of whom appears on this page. Scarcely more than two years has elapsed since his acceptance of the position of head of one of the largest electrical manufacturing concerns in Canada, yet through his energy and ability the company have been compelled to greatly enlarge their plant, and to-day they possess a modern factory in every respect, with a plant valued at $2,500,000, and employing 500 workmen.



MR. W. H. BROWNE, Manager Royal Electric Company.

Mr. Browne was born under the American flag in the year 1849, his birth-place being Troy, N. Y. When only seventeen years of age he was attracted to the city of New York, where he engaged in the foundry and general hardware manufacturing business. The mechanical as well as business experience thus obtained formed the foundation of his future success, as, in addition to being afforded the opportunity of perceiving the possibilities of the electrical field, he was brought in contact with some of the leaders of commercial and industrial enterprise in the American metropolis.

Besides investing in other electrical enterprises, Mr. Browne became interested in and was one of the organizers of the Richmond, Va., electric railway, which was the first electric railway in the United States, and was commenced in the year 1888. He continued as manager of this road and its lighting plant until 1891, but in addition received the appointment in 1888 of manager of the United Electric Light and Power Company, perhaps the largest concern of the kind existing at that time, which afterwards absorbed the United States Illuminating Company and the Brush Illuminating Company. Mr. Browne has occupied his present position since January, 1895, and during the past two years the company have met with marked success.

THE BELL TELEPHONE COMPANY.

THE seventeenth annual meeting of the shareholders of the Bell Telephone Company was held in Montreal last week. The annual report presented showed that 653 subscribers had been added during the year, the total number of sets of instruments *earning rental being* 29,362. The company now owns and operates 341 exchanges and 275 agencies.

There were 176 miles of poles and 1,013 miles of wire added to the long distance system in 1896; of these 11 pole miles and 236 wire miles are in the Ontario department, and 165 pole miles and 777 wire miles in the eastern department.

The long distance lines now owned and operated by the company comprise 15,864 miles of wire on 6,060 miles of poles. The new building in Montreal is nearly completed, and will be ready for occupancy in May. The new building in Winnipeg was completed last November.

Mr. John Crawford expressed a doubt as to the advisability of extending the long distance service. He did not consider it as profitable as the short distance.

The annual report was adopted and the old board of directors unanimously re-elected, which terminated the proceedings.

E. S. Jenison, of Port Arthur, Ont., proposes to utilize the water power of the Ecarte Rapids and Kakabeka Falls, on the Kaministiqua river, for light and power purposes, and is seeking authority therefor from the Ontario government. Moss, Barwick & Franks are acting as solicitors.

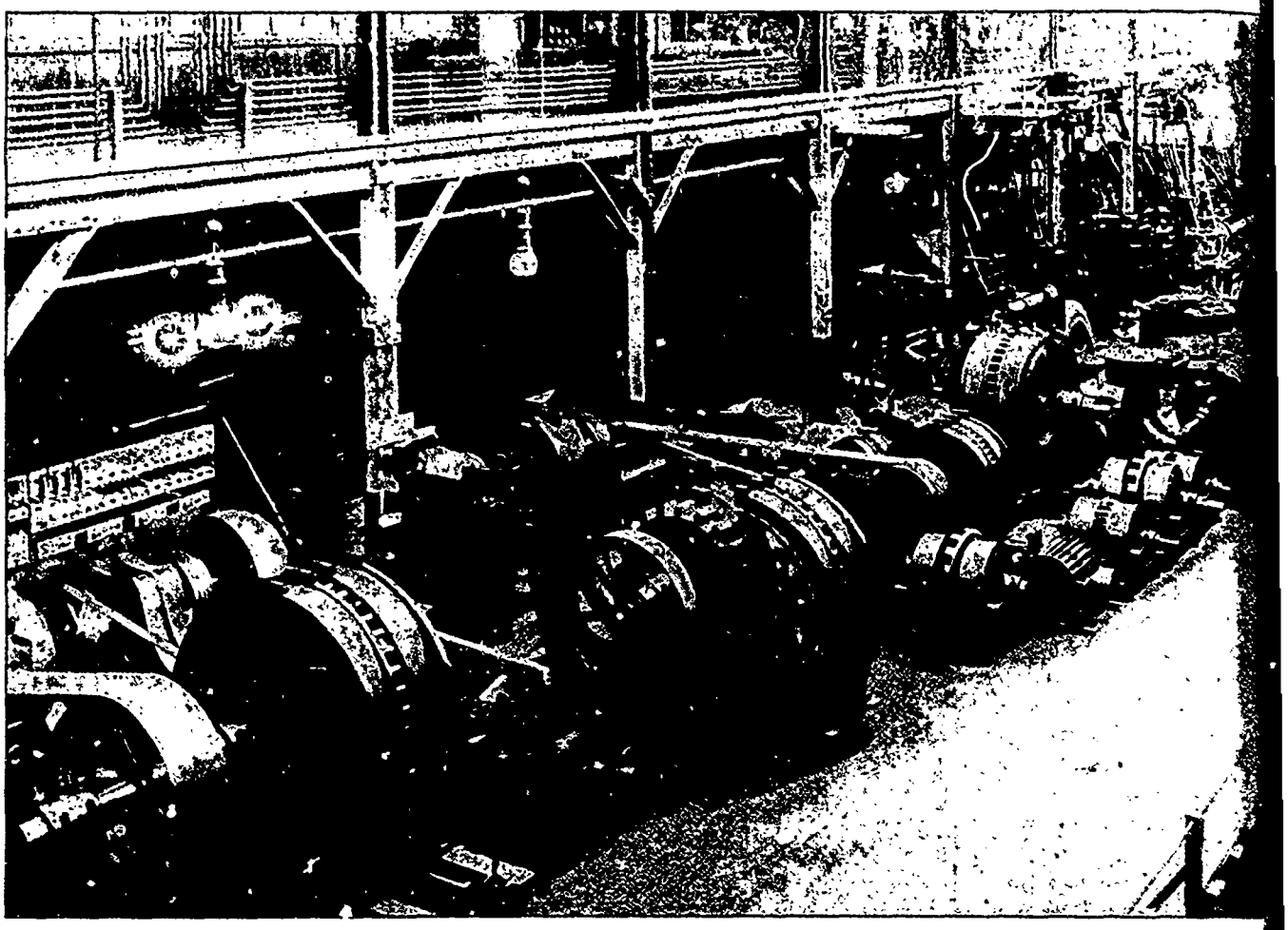
THE ROYAL ELECTRIC COMPANY.

In response to the invitation of the above company, a large number of persons, comprising shareholders and men prominent in the various walks of life, gathered in Montreal on the 10th of February for the purpose of making an inspection of the company's generating station and manufactory. In point of arrangement and equipment this station and factory are claimed to be representative of the most modern practice, and therefore offer a valuable object lesson to the visitor.

The following persons connected with the electrical interests were present, in addition to a large number representing the various branches of commerce as well as the professions:

Mr F H. Badger, Manager Montmorency Electric Power Co., Quebec; Jules Bourbonniere, Manager Imperial Electric Co., Montreal; W. J. Camp; A. A. Dion, Superintendent Ottawa Electric Co., Ottawa; Ormond Higman, Chief of the Electric Light Inspection Department, Ottawa; W. Munderloh, of Messrs. Munderloh & Co., Montreal; L. B. McFarlane, Supt. Bell Telephone Co, Montreal; R. E. T. Pringle, Montreal; Fred. Thomson, of Messrs. F. Thomson & Co., Montreal; J I Wright, Manager Toronto Electric Light Co., Prof. Carus Wilson, Electrical Department, McGill University, Montreal; Edward Carter, St. Johns Elec- Co., St. Johns, Que.; H. O. Fisk, Supt. Peterboro' Light and Power Co., Peterboro', Ont.; J. M. Fortier, Pres. Imperial Electric Light Co., Montreal; Jas. H. Howry, Packard Electric Co., St. Catharines, Ont.; J. A. Kammerer, General Sales Agent, Royal Electric Co., Toronto; E. A. Lacroix, North Shore Power Co., Three Rivers, Que.; W. S. Shaw, Shaw Electric Co., Montreal.

The works were gaily decorated with flags, and on the second floor of the generating station was spread a tempting luncheon. Here the visitors received a hearty welcome from the President of the company, the Hon. Senator Thibeaudeau, who in his concluding remarks introduced Mr. W. H. Browne, the general manager of the company. Mr. Browne spoke at some length, outlining in a very able and interesting manner the development of the company's enterprises from their earliest beginnings. Mr. Browne's remarks, printed in full below, will repay careful perusal, as showing the wonderful strides in the direction of development and improvement which electricity is making in the Dominion. Canada has not been content merely to keep abreast of the times, but is actually proving herself to be a pioneer in electrical progress, both in relation to lighting and power. Mr. Browne spoke as follows:



View of Royal Electric Company's Factory, Montreal, Showing Apparatus Recently Completed.

Gentlemen,—To the citizens of Montreal the Royal Electric Company is well and chiefly known by the brilliant illumination which provides the security of daylight to the streets and parks of the city.

It is also known by the cheerful radiance of the numerous incandescent glow lamps, which makes pleasant and decorate so many residences and places of business.

As a manufacturer of electrical machinery and apparatus, it is, however, better known throughout the Dominion of Canada than in the city of Montreal.

It has been manifest on several occasions that many, even of those who are intimately acquainted with the company, have very little actual knowledge of the extent and character of the source of the illumination they enjoy and have a very inadequate conception of the enterprise represented by, or the establishment constituting the Royal Electric Company.

To those throughout the Dominion, who are users of electrical appliances, the company is well known as manufacturers of the best and most advanced type of such appliances, and in a general way as conducting the largest electric light and power plant in Canada, but the full extent of this feature of the business is not thoroughly comprehended even by those who purchase and use its manufactures.

The completion of recent improvements made in the generating station, and of the equipment of the new factory in full working

order, and at work in the manufacture of large apparatus, has, therefore, been deemed an appropriate occasion to bring to the personal knowledge of the citizens of Montreal and to those throughout Canada, who are interested in electrical enterprises, the fact that in the Royal Electric Company the city of Montreal and the Dominion of Canada possess an industrial institution of the highest rank.

We have believed that it would be an especial pleasure to you to become acquainted by actual inspection with the details of an electrical manufacturing establishment within your city and country, which in character of machinery and equipment employed in adaptability to its purpose, and in quality and finish of product, is the equal of any on the continent second to none.

We have also believed that it would be to you an equal pleasure to see in operation a generating station unique in many particulars, far in advance of stations even in the largest cities, and containing features which are models and standards to which others will conform.

This is the object and purpose which actuated the president and directors of the Royal Electric Company to extend the invitation, which your presence indicates was agreeably acceptable.

The factory and station you have seen to-day represent the utmost development attained to the present moment in the electrical art as applied to light and power purposes and also represent the development and growth of the Royal Electric Company, which has kept pace with the progress of electrical science.

From a beginning in 1884, with a dynamo of 12 light capacity, a work room containing a few ordinary machines, shop tools, a dozen employees, and a capital of less than $50,000, it has steadily and continuously progressed, so that to-day its generating plants provide electric current for street lights, house lights and motive power to the equivalent of 100,000 16 candle power incandescent lamps, with capacity for 50,000 more; its factory is equipped with the latest and most modern machinery capable of building the largest electrical machinery used in the world, and is now actually at work manufacturing generators of each nearly 3000 horse power capacity; has nearly 500 employees and possesses plant representing $2,500,000.

It introduced in 1884 a new business in Canada beginning with the manufacture and use of what was then the best and most improved electrical apparatus and continued to be the leader in its line.

To-day it is manufacturing and using generators and other electrical apparatus which are so far superior to those hitherto or elsewhere made in Canada as to be considered, even in the electrical world, a new departure, the improvement is so radical and far reaching.

The company began business in 1884, having both its factory and generating station in a small building in Down street.

In September, 1885, the building on the corner of Queen and Wellington streets was leased and became the factory, lighting station, stores and offices of the company.

In July, 1886, the streets of Montreal were first illuminated, 113 lights being placed; to-day nearly 1500 lights in the streets render your city one of the best lighted on the continent.

In 1888 the first incandescent lights were supplied, and a dynamo having the capacity to provide 500 lights was installed. The station which you have just inspected has connected with it and serves at present about 65,000 incandescent lights, besides electric motors and arc lights and is capable of supplying 50,000 more.

In 1889 the generating station, known as the East End station, on Water and Commissioners streets was established solely for arc lighting.

In 1891 the building in which you are at present was built and equipped as a generating station to meet the rapidly increasing demand for incandescent lights.

In 1892 the first electric motor circuit was established.

In 1893 the evident extensive field available in Montreal for the application of electric current directed the attention of the company to the utilization of water power. After an exhaustive examination of all water powers contiguous to Montreal, and after a most thorough comparison of the merits and demerits of each as applicable for electric light and power purposes all were rejected except that of the Richelieu rapids at Chambly, the rights to which were secured by the company.

VISITORS VIEWING THE FACTORY OF THE ROYAL ELECTRIC COMPANY, MONTREAL.

In 1894 the building at the corner of Wellington and Queen streets, which in 1885 was more than sufficient for all the purposes of the company, was found to be inadequate for the manufacturing purposes alone, and plans were prepared for the erection of a new factory building, so that the factory equipment could be placed therein by the expiration of the lease of the former building on May 1st, 1895.

In 1894 also the desirability of a greatly improved line of electrical apparatus and the opening of new fields for such apparatus resulted in a contract agreement with the Stanley Electric Manufacturing Company of Pittsfield, Mass., for the sole right of manufacture and sale in the Dominion of Canada of the apparatus which they had a short time previously introduced in the United States and which almost immediately assumed first rank as electrical machinery and was recognized by all, who were competent by experience to judge, as being vastly superior to any which had been hitherto produced, and possessing features entirely unknown to the old style of apparatus, features and character of construction which placed it as far beyond all that had previously been made as the marine engines of the ocean liners of to-day are in advance of the ordinary stationary engines of 50 years ago.

This apparatus, known and designed by the initials of the names of its joint inventors and designers, Messrs. Stanley, Kelly and Chesney, being capable of supplying from the same machine and

from the same wires, incandescent lights, arc lights and motors, occupied a new field and made profitably possible the extension of electrical business in directions not hitherto commercially available.

It also occupied a new field, for instead of being the cheap temporary method of construction characteristic of earlier electrical machinery, it is built in the very best manner, equal in every particular in finish and character of manufacture to the best machinery in every other line of commercial practice.

The S. K. C. generators completely revolutionized the method of construction and operation theretofore employed. The particular feature, which in all other generators is the source of constant annoyance, expensive and frequent repairs and loss of service, namely, the revolving wire wound mass known as the armature, with its complicated commutator and constantly wearing and fire emitting brushes, requiring the closest attention of employees and numerous devices for operating and regulating was entirely abandoned and instead is employed simply a solid steel wheel, having contact with no other part and having no wearing or contact surfaces except the journal bearings. To the electrical operator this feature alone was a long coveted boon and is a source of constant delight. To the owners it is a source of great economy and increased net revenue. The record and date of these generators is that the maintenance and repair account has been reduced to nothing.

The S. K. C. system employs the simplest method of what is known as the polyphase system, the development of which has made possible the transmission of power commercially to great distances, thereby opening avenues to the manufacturer of electrical apparatus before impracticable, and enabling the development of otherwise unprofitable water power.

In Canada this field promises to be of prodigious proportions. This class of business usually calls for apparatus of large capacity, and the equipment of the new factory has been planned and carried out to meet this new demand. To the former extensive equipment was added larger tools, among them being two boring mills, one adapted to finish parts of apparatus having a diameter of seven feet, the other capable of finishing parts having a diameter of twenty feet (the latter tool, by the way, being built in the factory itself), a planer, probably the largest of its kind in Canada, also an electric crane capable of hoisting and moving to any part of the building masses of 30 tons in weight, together with several drilling machines, bolt and screw making machines, punches and other accessory tools. Thus equipped the factory is capable of, and is actually at work now in the manufacture of dynamos (namely, those for the Chambly water power), each of which will aggregate in weight upwards of 100 tons and each capable of developing 3000 horse power, being the largest dynamos, except those at Niagara Falls, that have ever been made. Besides these there are being manufactured at the present moment for the Montmorency Company, of Quebec, two dynamos, each of 1000 h. p. capacity, and two each of 350 h. p. capacity, and there have been just completed for a water power, 16 mile transmission plant from Narcisse to the city of Three Rivers, two each of 400 h. p. capacity, and the dynamos aggregating 2500 h. p. capacity, which you have just seen in operation in the station in which you are now, a total for the four places of upwards of 25,000 horse power.

The S. K. C. system is the only one in which dynamos are made to deliver current at very high voltages directly from the generators. Those now in operation at, as well as those being constructed for the Montmorency Company of Quebec, are being operated and will operate at a voltage of nearly 6,000 volts. The Chambly generators will deliver directly from the machines to the lines 12,000 volts. In all other systems the high voltage necessary to convey electric current long distances must be obtained by other devices, known as transformers or converters, the generators usually only delivering a pressure of 1000 volts and the transformers increasing such pressure to the voltage desired. The transformation involves a loss of energy and is a source of interruption and expense, besides its increased cost, which is unnecessary with the S. K. C. system.

The S. K. C. system is alone in this feature, and this characteristic opens the way for the Royal Electric Company to be the advanced leader in the electrical field for light and power purposes, and particularly where the transmission of power to considerable distances, and in large quantities is required. These conditions practically constitute the Royal Electric Company as the engineers for such systems.

Since the introduction in the early part of 1894 of the S. K. C. system in the United States, which was practically first introduced in the early part of 1894, to the present time, there has been put in use or are in process of construction under order in the United States and Canada, generators of this system of a total aggregate capacity of about 900,000 horse power.

Another appliance of the S. K. C. system, namely, the transformer, also revolutionized that necessary adjunct of every alternating current lighting plant, which, as made before the introduction of the Stanley transformer, was a source of the greatest expense to such stations.

Since the introduction by the Royal Electric Company of these transformers into Canada, their value in the prevention of waste has been frequently demonstrated and is now so firmly established that every electric lighting station, in the endeavor to improve its earning capacity, is displacing the old types of transformers, which have been in use and substituting therefor S. K. C. transformers.

Although first offered to the electrical public but a few years ago, there are in use to-day S. K. C. transformers having an aggregate capacity of upwards of 1,000,000 lights, and the demand for them is constantly increasing.

The peculiar success of the S. K. C. system is due to the new features and principles it embodies, but is also equally due to the extremely high character of the methods and materials employed in manufacture. These methods require the utmost accuracy, the greatest care, the best materials and the finest finish.

The manufacture by the Royal Electric Company of the S.K.C. apparatus is carried on in direct accordance with the plans, specifications, drawings and methods in use by the Stanley Electric Mfg. Co. in their own works, and in every detail and particular are exact duplicates of those made by them. All the advantages of contact with the widely extended field covered by the Stanley Company in the United States are available to and at the disposal of the Royal Electric Company, and are utilized for the benefit and are at the service of its customers.

The factory is planned, equipped and manned for the manufacture of high class apparatus only, and is devoted solely and entirely to work of that character. When the introduction of this class of electrical apparatus was begun by us we were told by some of our good friends that there was no market in Canada for this class of goods. Our experience during the last two years fully and completely refutes that suggestion, for we have found that when we made known in actual practice the fact that electrical apparatus of this character was available, the best and only the best was wanted, and the result is the condition of our factory to-day—engaged to its utmost capacity in the fulfilment of orders, being in many cases repetitions of previous orders.

The S. K. C. system, however, does not constitute the entire business of the factory, the manufacture of direct current dynamos and motors, arc lamps and machines, and railway generators and motors adding materially to the demands on the capacity of the works; a recently completed order being the entire new equipment of generators and motors for the Montreal Park and Island Railway Company.

The manufacture of insulated wire and of many kinds of instruments and other appliances is extensively carried on, and since the beginning of the business of the company it has installed in Canada 70 arc light plants, using an aggregate of upwards of 8,000 arc lamps, and 145 incandescent plants, with a total capacity of more than 250,000 lights, distributed from Victoria in the west to Prince Edward Island in the east.

Judging, therefore, by the past of the Royal Electric Company, and by its present conditions and demand for its manufactures, with the large new opportunities opened by its S.K.C. system, the future bids fair to tax the capacity of this complete factory to its utmost working power night and day. At the present day, the business already in hand will keep it constantly occupied at least during the present year, working day and night.

With such improved apparatus available, it became incumbent upon the Royal Electric Company to utilize in its own illuminating business the advantages obainable from the S. K. C. system. To that end about a year ago the board of directors authorized the improvements which have been recently completed in its lighting system—these improvements being the placing of Stanley transformers upon its lines of the S. K. C. generators, which you have just seen, in this station, and the erection of the new distributing switchboard.

One of the advantages resulting from these improvements, which will appeal directly to our shareholders, is that with more than 10,000 lights connected to the station at the present time than there were a year ago, and although the improvements have practically been only just completed, an economy has been accomplished in the item of fuel to the extent of 6,000 tons; that is, there was consumed during the year 1896, with the increased business, 6,000 tons of coal less than during the year 1895.

When the improvements within the station were begun a year ago, the four engines, two of 500 h.p. capacity and two of 1,000 h.p. capacity each, were connected to some thirty separate dynamos by means of lines of shafting on two floors of the station. As you have just seen, three of these engines are connected directly by belting directly to what are practically three dynamos, the fourth engine being at present not required.

Any of you who saw this station a year ago will remember that the entire space of the first and second floors was completely filled with shafting, pulleys, belting and dynamos, and both floors presented an exceedingly crowded condition. As you have perceived to-day, the first floor alone fulfils all the purposes of the station, and its condition is open, roomy, bright, cleanly and cheerful.

The switchboard, which bears the same relation to our lighting and power systems as the pilot house does to a steamship, and controls the distribution of the electric current from the generators to the premises of our customers, has been especially designed and constructed with two important considerations in view; the first to secure an entirely incombustible condition, the second to obtain a flexibility and facility of operation which will enable the transfer of any circuit to or from any generator so quickly as to be practically imperceptible when all the lights are burning.

The first condition of incombustibility is a necessity to insure permanent service to our patrons, and has been completely accomplished. The second condition secures uniformity of service to our customers, a condition which we have abundant reason every day to realize has also been accomplished.

The switchboard is so arranged that any circuit, with every light thereon burning, may be instantaneously transferred from one generator to another without perceptible change in the light, and this is done so frequently without being noticed that it is the best possible evidence of the complete adaptability of the switchboard to its purpose.

A fact in connection with these improvements and the change from the old system to the new is, that all of these changes were made without the interruption for a single instant of the service to

the upwards of 60,000 lights served from this station, which is in operation continuously during every hour of every day in the year.

To those familiar with the handling of electric currents, this will seem a feat almost without parallel; and even to those who are not familiar a consideration of the labor, risk, care and rapidity of action involved in transferring nearly 100 wires, all of them charged with electrical current, from nearly 30 dynamos and the old switchboard to 3 dynamos and the new switchboard without the least interruption, will represent a work of great magnitude.

This entire change from the old system to the new, from the old to the new switchboard, was made within the period of ten hours, our customers obtaining their service undisturbed.

The dynamo room and the switchboard are models in arrangement, with abundance of room, ready opportunity for attention, and complete capability of control and manipulation.

As the generators are of the two-phase system, we are able to furnish from the same machines and on the same wires incandescent lights, arc lights and motive power, and we are now prepared to furnish current for motive power purposes in any part of the city, and can furnish such power measured by meter, the same as incandescent light is used.

All of this work and all of this apparatus within the station has been placed not only for the purpose of improving our present system of electric lighting and increasing the opportunity for the use of electric currents for motive power, but it has also been done especially with a view to being utilized in connection with the electric current to be transmitted from the water power generator plant at Chambly.

The switchboard has been constructed so as to be capable of handling and distributing current for upwards of 200,000 incandescent lights and equivalent capacity in electro-motive power.

The generators at present operated by the steam engines are designed to be operated by the electric current from the Chambly water power as motors, wherewith will be operated the necessary complement of arc light dynamos to serve current for all the arc lights in the city streets and public places, as well as to operate the direct current generators now supplying current for motive power. The circuits for such direct current motive power will be maintained, so that customers having motors available for use on such current can be supplied with such power.

Within this station will be placed transformers to reduce the high voltage on the lines from Chambly to that used for distribution throughout the city. This current will be conveyed to the present switchboard and thence to the lines already extending throughout the city, and also to the generators, which will then become motors. The entire system of lighting and power now carried on in this station and at the east end station will be served entirely from here, as will also any additional current required for increased business, the entire distributing system being concentrated in this station, with practically no alterations in the present equipment.

The east end station will be maintained in its present condition as a steam generating arc lighting station, to be used as a relay or emergency station only. The steam engines in this west end station will also be retained in their present position, and in the extremely remote contingency of an interruption from any cause in the delivery of the current from Chambly, the motors will immediately again become generators and perform the functions they are now fulfilling. With this arrangemet there will exist a water power plant and a steam plant entirely independent of each other, insuring absolute continuity of service.

The maintenance of the east end station in its present condition and the arrangement of this west end station, so as to be promptly transformed again into a steam generating station, is a precaution taken against what is assuredly a very remote contingency, but it has been so arranged in order to remove all opportunity for interruption of service to our customers.

That there is extremely little chance of interruption in the delivery of current from the Chambly water power into this city may be determined by a consideration of the conditions entering into its development, and at this juncture it is appropriate to speak of the Chambly water power generating and distribution of electric current therefrom.

The dam being built is to be one homogeneous mass of concrete, forming practically a monolith or a structure made of but one stone. This dam has been designed and is being built under contract by the foremost hydraulic engineering company on this continent according to the plans and under the direct supervision of its chief engineer, who is recognized as the most competent authority in this character of construction.

The wheels are also to be provided by and are under contract with the same engineering company.

The entire hydraulic work has been contracted with the above mentioned company under guaranteed results, among which are the maintenance, at all times, of a working head of 28 feet and the delivery to the shafts of the electrical generators of not less than 20,000 horse power. There will be eight units or sets of wheels, each of a capacity of 2,650 horse power. Each of these units or sets of wheels will be connected directly without the intervention of any gearing or appliance to cause loss of energy to the shaft of one electrical generator,—in fact, the shaft of each set of water wheels and of each generator will be practically one continuous shaft, thereby reducing to a minimum the loss of energy and the occasion for the expense of repair.

Besides these eight sets of wheels and generators, (the generators we have already described as being under construction in our factory, and each of which will weigh 100 tons) there will be two sets of water wheels, each operating an exciting generator of capacity sufficient to supply the excitation current required by all of the generators.

The dam, as stated before, will produce a head of water 28 feet in heigth and will utilize the entire water of the Richelieu river, the outlet of Lake Champlain. The reservoir or head race thereby created will extend up the river from the dam to a point where the level of the water in the head race will merge with the natural level of the river, such point being a mile and a half or more above the dam, thereby securing a very long deep mill pond, which, with the high working head of 28 feet, will effectually remove all possibility of that bug-bear of water powers in cold climates,—frazil.

The location of the dam has been selected at a point where the highest known rise of the water in the Chambly basin below the dam will not affect the level of the tail race. Therefore all possibility of interruption due either to frazil or back water is completely removed.

The character of the construction of dam, power house, wheels, dynamos, switchboard, is all of the highest order. There are no gears to wear or break, there are no wire-wound armatures liable to destruction, there are no commutators, brushes or wearing parts in the dynamos, the only wearing parts in the water wheels and electrical machinery being the shaft and its bearings, consequently every source of danger has been apprehended and guarded against.

The current will be conveyed from the power house at Chambly to the city of Montreal by two separate lines of poles and wires. Should an accident happen to any part of either line of poles or wires necessitating repairs, the current required will be transmitted by the other line during the time such repairs are being made. This will permit such repairs to be made without interruption to service or danger to employees, because there will be no current passing over the line being repaired as the other line will carry all that is required.

Arrangements have been consummated with the Grand Trunk railway, whereby the wires for the crossing of the St. Lawrence river will be carried on the Victoria bridge, and there also the wires will be so placed that a duplicate system corresponding to the duplicate pole line will be provided. The same duplicate system will be employed within the city from the bridge terminus to the distributing station. No danger of interruption from injuries to pole lines can therefore be apprehended.

All the work and material for the Chambly water power electrical transmission plant is under contract to be completed by September 1st, 1897. The progress already made in all the various parts of the work assures completion in accordance with the contracts, so that in September of this year, this west-end station, which is now a generating station of large size, will become merely a distributing or sub-station of the one at Chambly, the second largest electrical generating station in the world.

The advent of the electric current from Chambly will create new conditions in the city of Montreal.

The low price at which electric current can then be supplied will permit its use in many directions not now considered.

Its use for illumination will naturally become greatly increased, but the greatest advantages from it will accrue to commercial interests. Motive power will be available at rates which will not only render it profitable for present users of steam power to abandon it, but numerous new industries will be attracted to and established in the commercial metropolis of Canada where, in addition to the many other advantages it possesses, power will be as inexpensive to the manufacturers as if they were located directly upon some water fall with the usual disadvantages and expense of inaccessibility and inconvenience. It must have a direct, immediate, and permanent beneficial influence upon the value of real estate in the city and vicinity because of the largely increased demand for land required for additional manufactories. The appearance of the city, as well as its hygienic condition, and, therefore, also its value, will also be greatly improved, for, as it will be unprofitable to operate steam plants, they will be discontinued and soon will disappear with their necessary accompaniment of that black smoke which produces the dark, murky cloud that now so often hangs like a dismal pall over the city, shutting out its beauty, begriming its buildings, soiling the furnishings and decorations of its residences as well as the clothing and persons of the inhabitants, and impregnating the atmosphere with matter detrimental to health.

Besides accomplishing these material benefits in the commercial interests of the city, the electric current from Chambly will become the handmaid of domestic service, will lighten the labors of the household, affording the means of cooking and heating without the labor of handling coal and ashes, or the disagreeable adjuncts of scorching flame or of offensive odors; making easy and agreeable the service of the kitchen, laundry and the sewing room, and, most important of all, with these results will come vastly increased safety from fire; your insurance statistics will indicate most graphically the numerous sources of dangers in this respect which will be removed by the extended use of the electric current above outlined.

The diminished cost of electric current for illumination will very extensively increase the use of light; exteriors as well as interiors of buildings and windows will be illuminated for decorative effect; public or street lighting will not alone be extended into every street, by-way and lane, but will be increased in number in every street, which will be possible within reasonable expenditure, and the city will become bright, cheerful, healthful and clean, and its streets at night will be as safe as under the glare of the noon-day sun. This is no idle anticipation nor a fanciful picture, but a very probably near-by reality.

The successful progress of the Royal Electric Company is a component of the increased prosperity of the city of Montreal, and through the use of its manufactures, the Dominion will obtain similar advantages.

We can, therefore, anticipate with pleasure as the result of your visit here to-day a more intimate knowledge of the Royal Electric Company, and in consequence not only your good wishes but your valuable friendly aid and assistance in promoting its enterprises to broader dimensions and still greater successes.

After making a thorough inspection of the lighting station and factory, under the direction of the officers of the company, the health of the President was proposed by Ald. Stevenson, and replied to in suitable terms by Senator Thibeaudeau. In proposing the health of the general manager, Mr. Browne, Alderman Sadler remarked that Montreal was the best lighted city in America. A toast to the heads of the departments, proposed by Lieut.-Col. Strathy, was responded to by Mr. P. G. Gossler, chief electrician. After congratulatory speeches by Messrs. Frank Badger, Jr., John Morrison and D. Parigeau, M. L. A., the company sang the National Anthem and Auld Lang Syne, and separated.

MR. WILLIAM THOMPSON.

We have the pleasure of presenting to our readers the accompanying portrait and sketch of Mr. Wm. Thompson, the author of the series of articles on "Chemistry in the Boiler Room," and other contribu-

Mr. William Thompson.

tions which have recently appeared in the pages of this Journal, and which, we doubt not, have been read with interest and profit.

Mr. Thompson was born and educated in the home of the iron trade, Middlesbro, Eng. In 1883 he came to Canada, and found employment in Toronto and Brampton until 1891. Since 1891 he has been employed by Armstrong & Cook, as superintendent and chief engineer, operating their waterworks and electric light plant at Montreal West, Que. Both the electric and waterworks systems were installed under his supervision.

To thoroughly equip himself and master all the details of his profession, Mr. Thompson has taken a special course in analytical chemistry under the tuition of the well-known chemist, Prof. J. T. Donald, of Bishop's University, Montreal.

It may be safely predicted that Mr. Thompson's ambition, coupled with ability and push will yet place him in the front rank of engineers.

WORTH TWICE THE PRICE.

Mr. G. Coop, Regina, N. W. T., in remitting his subscription to the Electrical News, writes: "Your paper is worth twice the money."

QUESTIONS AND ANSWERS.

In reply to Jas. McPherson's enquiry in your last issue, I beg to say that an injector should work under conditions stated, provided, of course, his injector is in good order, and feed pipe of ample area so as to reduce friction to lowest margin. I understand him to say his Blake pump has to force water a distance of 80 feet horizontally, and then go vertically, and receives its supply of water under pressure of from 20 to 40 pounds pressure. Cause of knocking is most likely poor adjustment of suction valves, which are probably adjusted to work at atmospheric pressure. Run your cold water into a barrel for a while and pump from this, and see if knocking disappears. If it does, set the spring on your suction valves to work at cold water pressure, or pump from a tank using ball-cock to regulate supply of water; the latter course is recommended.

Wm. Thompson.

A. M. S., Manitoba, writes: "Can you tell me anything about this acetylene gas of T. L. Willson's of Hamilton? A man is getting it up here, and if his accounts be true there will be no electric light in the world in a few years."

Answer.—Acetylene gas has been known for many years, but it is only within the past few years that a method of producing it by electricity has been discovered. The value of an invention of this kind may be estimated from the length of time it takes to become universally used. If acetylene was able to displace electricity as an illuminant, it would probably have made more progress during the several years since its discovery. The fact is that there are many drawbacks to its use. Some people go so far as to say that some of these are so nearly insuperable as to make it certain that acetylene will do no great amount of displacing for many years to come. There are usually two sides to every question, and while much may be said in favor of acetylene, it has been found that the care and attention required in its use, together with its liability to explosion, are likely to prevent it from becoming very popular. This is without taking into account its expense.

"Operator," Millbrook, Ont., writes: "I would like to know what is the nominal candle power of an alternating arc lamp, taking 10 amperes and 28 volts. The lamp is of the Kester make."

Answer.—There is no recognized standard of nominal candle power of arc lamps, but 9.6 amperes and 45 to 50 volts is usually considered 2000 candle power.

"R. B." writes: "The area of the base of a cone is 450 sq. inches, what must be its height that its volume may be 1 cubic foot?"

Answer.—

$\frac{1}{3}$ altitude × area of base = volume of cone.

$\frac{1}{3}$ altitude × 450 = 1 cubic foot = 1728 cubic inches.

$\therefore$ altitude $= \frac{1728}{150} = 11.52"$.

From this can be quite readily found the length of the slant side.

$$\text{length} = \sqrt{\left(\frac{\text{diameter of base}}{2}\right)^2 + \text{altitude}^2}$$

$$\text{and as the diameter} = \sqrt{\frac{540}{\frac{3}{4}}} = 23.9"$$

$$\therefore \text{length} = \sqrt{11.95^2 + 11.52^2} = 16.6"$$

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.

HAMILTON NO. 2.

At the last meeting of the above association, Mr. Stobbs gave an illustration of the working of the planimeter, and Mr. Norris showed the difference between the working of a slide valve with and without lead.

LONDON NO. 5.

The regular meeting of London No. 5 was held on Thursday, the 18th inst. It was reported that during the past two months the membership had been doubled. Mr. St. John, boiler inspector, of Toronto, was present, and answered many questions pertaining to engineering asked by the members. He impressed upon the engineers that valuable life and property were entrusted to their care, and that their responsibilities were great. Constant care and skill were necessary, and at times great presence of mind would prevent the breaking down of an engine, and even the explosion of a boiler. Mr. St. John lectured at some length on the steam boiler, and a hearty vote of thanks was tendered him by the association for his kindness.

KINGSTON NO. 10.

The members of Kingston association held an open meeting on the 18th ultimo, which proved to be one of the most interesting and instructive yet held. The president, Mr. Fred. Simmonds, opened the meeting with a few brief remarks, and called upon Ald. Elliott, who read a carefully prepared paper on "The Main House Trap and its Application from a Sanitary Standpoint." Mr. Harry Breck followed with an illustrated paper on "The Manufacture of the Incandescent Lamp," and a contribution on "The Steam Indicator," was given by Mr. McEwen, which will appear in the April number of the NEWS. A paper on "Gas and Its Manufacture," written by Col. Kerr, superintendent of the Kingston Gas Company, was read by John Orr, and Bro. S. Donnelly gave a short talk on "Valve Motion," after which a hearty vote of thanks was tendered to the authors.

Bro. Geo. Hazlett, past-president of the Winnipeg association, who is a former resident of Kingston, was present, and gave an outline of the order in the west. He spoke of boiler inspection certificates, and thought that Ontario was rather behind some of the other provinces in this respect. Open meetings of the association will be held every three months.

POINTS ON SHAFTING.

THE author of a paper on "Shafting in Factories," presented before the American Society of Mechanical Engineers, summarizes his conclusions on the subject as follows:

It seems to the writer that in ordinary machinery establishments an observance of the following rules might effect a saving that would be noticeable in the annual balance.

1. Use pulleys of large diameter on counters and narrow fast-running belts.

2. Use nothing but the best oil and plenty of it, catching all drip, and either purifying it or using it for some other purpose.

3. Have all the shafting and counters oiled regularly and do not depend too much on automatic oiling.

4. Inspect line shafts from time to time, and see that they are in line and can be turned easily.

Many line shaft boxes bind at the sides when screwed down, sometimes increasing the turning moment 100 per cent.

THE NATIONAL TUBE WORKS.

AMONG the largest producers of pipes and tubing in the United States is the National Tube Works Company, of McKeesport, Pa. Being located practically at the mines of the greatest bituminous coal deposit of the world, with an abundant supply of lime, coal and iron ore, they operate under most favorable circumstances. The works were first established in Boston in 1865, and in 1872 the company built a small mill at McKeesport. To-day the works extend for a mile along the bank of the river and from nine to ten thousand men are employed. The annual capacity of tubular goods is over 250,000 tons, and the company are said to be the largest manufacturers of charcoal iron boiler tubes in the world. Owing to the rapid growth of steel making, in the year 1892 a complete steel plant was built near their blast furnaces, which enabled the company to control every stage in the process of manufacture from the raw iron ore to the finished pipes and tubes. The pipe mills are large enough to take nearly the entire product of the steel works, by which they are enabled to make for their pipe mills the highest quality of mild steel, of a special grade.

The blast furnace consists of two modern stacks, 80 feet high and 20 feet internal diameter. The power is furnished by a 3,500 horse power battery of boilers, and the average output is 18,000 tons of Bessemer pig iron per month. The steel plant comprises two eight ton converters and a 35 inch blooming mill with the necessary appliances. One of the features of the plant is the immense horizontal compound condensing blowing engine, the largest one turned out up to the time of its installation.

The boiler plant is also noticeable. It consists of about 2,500 horse power of the water tube type; all boilers fitted with automatic stokers. Slack coal is the only fuel used. The output of both the blast furnaces and the steel plant is especially limited by the fact that such great care is taken throughout to be sure that the highest possible grade of steel is produced. Six complete puddle mills are also kept for running when occasion requires for making iron piping. The rolling mill department consists of 14 different mills adapted to the various sizes of skelp required.

The tube works proper is most interesting. The pipe mill where the small gas and water pipe is made contains seven welding furnaces and other necessary machines. The lap-weld mills, where the boiler tubes and larger sizes of pipe are made, contain ten double bending furnaces and twelve welding furnaces. Pipe up to and including 24 inches is regularly made, and plans are under way for making pipe 30 inches in diameter. A new furnace recently completed is of a novel construction, and furnished with new electrical appliances. The pipe mill department also contain two large machine shops, a forge for making couplings for the pipe, a foundry, and numerous minor departments. The fuel used throughout the works is artificial gas, known as "producer gas," furnished by about 75 producers. After the pipe is welded, it is inspected throughout, tested to the stipulated number of pounds to the square inch of internal hydrostatic pressure varying from 300 to 5,000 pounds, and after a final inspection the goods are ready for the consumer.

As offering some faint idea of the varied and intricate details connected with this establishment, it needs but to be suggested that, from the one-eigth inch gas pipe to the huge 24 inch water, oil or gas main, there are above 1,000 several and different sizes of tubes turned out by this establishment, and on its blanks as carried regularly in stock.

In the process of manufacture an elaborate system of tests is employed from the beginning until the end, and every precaution is taken to ensure the most perfect result possible in modern skill and science.

The National Tube Works Company is capitalized at $11,500,000, and has offices at Boston, New York, Pittsburg, Chicago, St. Louis and London, England.

The Valley Telephone Company held their annual meeting at Middleton, N. S., last month. Judge Savery was re-elected president, and extensions to the line were decided upon.

CANADIAN ELECTRICAL NEWS
STEAM ENGINEERING JOURNAL

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TORONTO BRANCH NO. 1.—Meets 1st and 3rd Wednesday each month in Engineers' Hall, 61 Victoria street. John Fox, President, Chas. Moseley, Vice-President; T. Eversfield, Recording Secretary, University Crescent.

MONTREAL BRANCH NO. 1.—Meets 1st and 3rd Thursday each month, in Engineers' Hall, Craig street. President, John Murphy; 1st Vice-President, J. E. Huntington, 2nd Vice-President, Wm. Smyth; Secretary, H. Archibald York; Treasurer, Peter McNaughton.

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BRANDON, MAN., BRANCH NO —Meets 1st and 3rd Friday each month in City Hall A. E. Crawford, President; Arthur Fleming, Secretary.

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LONDON BRANCH NO. 5.—Meets on the first and third Thursday in each month in Sherwood Hall. G. B. Rider, President; D. Campbell, Vice-President; Wm. Meaden, Secretary-Treasurer, 533 Richmond street.

GUELPH BRANCH NO. 6.—Meets 1st and 3rd Wednesday each month at 7:30 p. m. H. Geary, President; Thos. Anderson, Vice-President; H. Flewelling, Rec.-Secretary; P. Ryan, Fin.-Secretary; Treasurer, C. F. Jordan.

OTTAWA BRANCH NO. 7.—Meet every second and fourth Saturday in each month, in Borbridge's hall, Rideau street; Frank Robert, President; T. G. Johnson, Secretary.

DRESDEN BRANCH NO. 8.—Meets 1st and Thursday in each month. Thos. Steeper, Secretary.

BERLIN BRANCH NO. 9.—Meets 2nd and 4th Saturday each month at 8 p.m. J. R. Utley, President; G. Steinmetz, Vice-President; Secretary and Treasurer, W. J. Rhodes, Berlin, Ont.

KINGSTON BRANCH NO. 10.—Meets 1st and 3rd Thursday in each month in Fraser Hall, King street, at 8 p. m. President, F. Simmons; Vice-President, J. W. Tandvin; Secretary, A. Macdonald.

WINNIPEG BRANCH NO. 11.—President, G. M. Harlett; Rec.-Secretary, J. Sutherland; Financial Secretary, A. B. Jones.

KINCARDINE BRANCH NO 12.—Meets every Tuesday at 8 o'clock, in McKibbon's block. President, Daniel Bennett; Vice-President, Joseph Lighthall; Secretary, Percy C. Walker, Waterworks.

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Information regarding examinations will be furnished on application to any member of the Board.

Central Stations vs. Isolated Plants.

MR. R. S. Hale discusses, in the Engineering Magazine for February, the relative economy of electric current supplied by a large central station as compared with an isolated plant. He concludes that the economy is largely on the side of the large station, for the following reasons: The isolated plant is more expensive in first cost, excepting only the items of boilers and street conductors; if all the expenses are included, the cost of operation of an isolated plant is far greater than that of a central station. He therefore contends that it is cheaper for the real estate man, the hotel-keeper, or the drygoods merchant to devote his brains to making money in his own field, where he is an expert, than to waste his time on a small electric plant.

Improvements in Water Wheels.

THE utilization of water power for the economical generation of electricity for light and power, besides creating a market for water wheels, is directing attention to the subject of water wheel design. The decrease in milling operations in Ontario in recent years, coupled with the total or partial failure of quite a number of water powers, led to the increased use of steam, with the result, we believe, that improvements in water wheel design and manufacture have scarcely kept pace with those in appliances for the generation of steam. As already stated, however, the increasing use of electricity is calculated to change this condition, and lead to the most careful attention being given to the design of water wheels, so as to secure the utmost generating power combined with the most economical use of water. At the recent exhibition at Geneva there was an interesting display of wheels, in which the Girard and Pelton types predominated. The horizontal type seemed to

have the preference, however, for low heads. A noticeable feature in all was the highly efficient regulators for use in the generation of electricity.

Improvements in Arc Lamps.

Specially noticeable during the last six months has been the wonderful improvement made in arc lamps for use on constant potential circuits--both direct and alternating current. That this is a very important matter will be evident to any station manager who is frequently asked for an arc light for a store, and whose street circuit is already full. In fact there are many cases where street lighting on the constant potential arc system would be actually preferable to the usual series system, and in the larger towns where a considerable part of the expense is the wages of lamp trimmers and carbons, the saving effected by using the long burning arcs, on the highly efficient D. C. machines would amount up to a very appreciable figure. There are many cases where an arc might be placed in front of a store window, or in the office of a hotel, and as it would have to be lighted at ordinary commercial hours, it would not be possible to put it on the street circuit. The difficulty, however, is solved, and business secured by this lamp, which is placed as an ordinary incandescent.

Canadian Electrical Association.

At a largely attended meeting of the Executive Committee of this Association held on the 25th inst., preliminary arrangements were made for the annual convention to be held at Niagara Falls, Ont. Wednesday, Thursday and Friday, the 2nd, 3rd and 4th of June, were selected as the dates for the convention. Committees were appointed to make the necessary arrangements and to secure papers. A number of valuable papers have already been promised, and the outlook for the meeting is a most promising one. Niagara Falls is at the present time the most interesting and instructive spot in the world for persons interested in the development of electricity. The enormous works of the Cataract Construction Co., the construction of which was in progress on the occasion of the previous visit of the Association to the Falls, are now in successful operation. Here are to be seen the largest generators in the world, and all the accompanying apparatus for the supply of electrical energy on an enormous scale. The line for the transmission of power to Buffalo, a distance of upwards of 20 miles, is also now in operation. These works will be open for the inspection of the members of the Association, and, combined with many other attractions, will tend to make the occasion a memorable one.

Fuel Economy.

We would draw the attention of managers of steam operated electric stations, to the advantages to be derived from the use of fuel economizing apparatus—more especially so when, as is very frequently the case, the class of operative responsible for the generation of steam is by no means really competent to get as much good out of the fuel as possible. Owing to either poor design of boiler settings, or injudicious chimney and flue proportions, and largely to poor firing, the temperature at which the heated gases escape from the furnace into the chimney is greatly in excess of what would be necessary to produce a good draught, and any means whereby such excess of temperature can be made use of is an evident saving. Probably the best way of utilizing this excess heat is to raise by it the temperature of the feed water, by causing the pipes conveying this feed water to pass through a special chamber in the chimney base and so come in contact with the escaping gases on their way from the boiler. Of course such an arrangement costs money, but the savings effected thereby are sufficiently appreciable to make it really worth while considering the question. To give a simple illustration of the *gain in heating feed water*, suppose a 1000-light plant, operating from dusk until daylight every night throughout the year, condensing, with coal at $3.50. The water in the hot well will probably be at about 100° F., and has thus to be raised 112° before steam is generated. Such a plant will have an average throughout the year of about 500 horse power hours nightly, and 182,500 horse power hours for the year. The water required to be evaporated into steam will be somewhere about 75,000 gallons, and this has to be raised in temperature from 100 to 212°. To do this will be required not less than 50 tons of ordinary coal, which at our price is $175. An efficient waste heat economizer would not cost $1,000; the interest on the investment would be say $60, and the other $115 a clear gain. With a good economizer, as a matter of fact, the feed water can be raised to much above boiling point. We commend this to the careful consideration of our readers.

Central Station Management.

The days of hap-hazard methods in the management of central stations for the supply of electric light and power are rapidly passing away. There are men to be found in this, as in other lines of business, who fail to heed the signs of the times, and who make little or no effort to keep abreast of the progress which is constantly taking place. The fate of such men is not difficult to predicate sooner or later they will find themselves forced out of the business by their more progressive competitors. It is not going too far to say that every owner and manager of a central station who neglects to inform himself with regard to the latest improvements in machinery and operative methods is assisting to bring into use other forms of illumination, and is likewise placing arguments in the mouth of the advocates of municipal control. In view of the efforts which are being made to supplant the electric light, and to transfer the electric lighting business from private companies to the hands of municipal corporations, it behooves the owners and managers of central stations to bestir themselves to acquire exact knowledge of the latest improved apparatus and methods and the ability to apply this knowledge to the conduct of their business, so as to be able to furnish light and power in the most efficient manner, and at the lowest possible cost to producer and consumer.

A combine is announced to have been organized in the United States to regulate the prices of incandescent lamps.

It is reported that the Kootenay Water Supply Company and the Kootenay Hydraulic Mining Co., of British Columbia, who have extensive water powers at Waneta and on the Pend d' Oreille, propose to amalgamate, with the object of utilizing in Rossland and other mining camps the 10,000 horse power they control. A large electric plant will be required, the distance being fifteen miles.

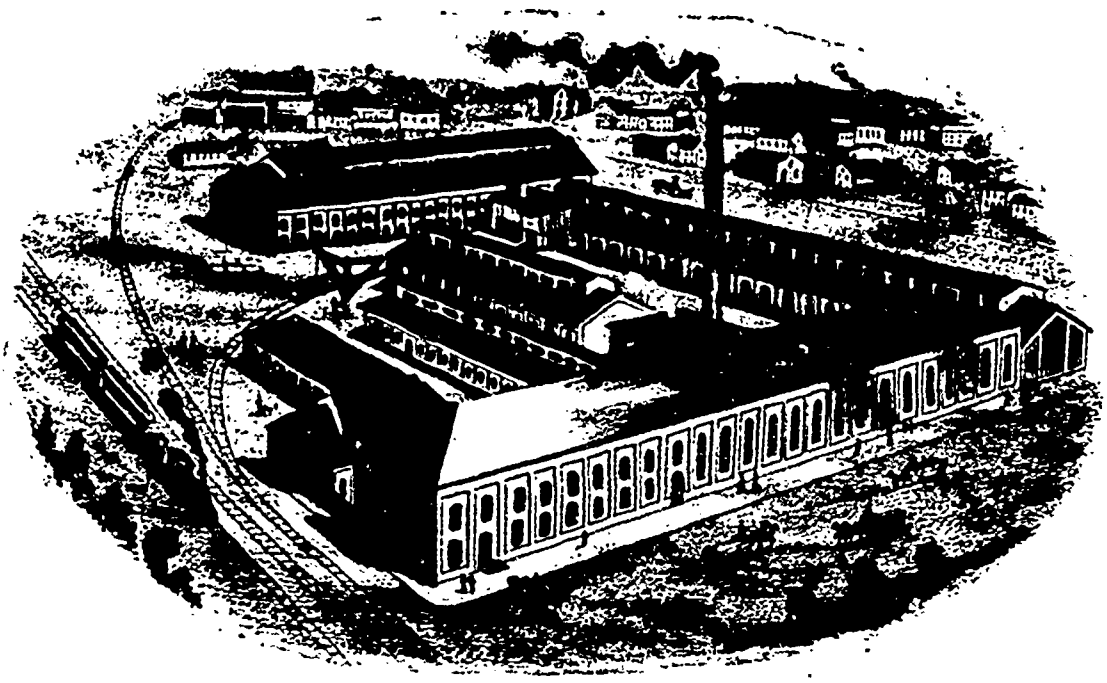
A NEW APPLICATION OF ELECTRICITY.

THE introduction of electric power in the operation of the refrigerating plant of the Quebec Storage Company, in Quebec city, is another new field for central stations, with which to increase their day load. The plant being installed to drive the refrigerating machinery consists of two 50 and two 15 h.p. two-phase "S.K.C." induction motors; the larger of these motors are to be for the operation of the compressers and are now being set up, replacing two engines. These motors are belted direct to two lines of shafting, which are so arranged that they can be made one continuous line by a friction clutch, the intention being that, if necessary, either motor can operate both compressors, or either one of them as circumstances may require, the compressors being driven by belting from the shafting described. From this same shafting will also be operated two pumps, which are used to bring about a circulation of the brine in the pipes.

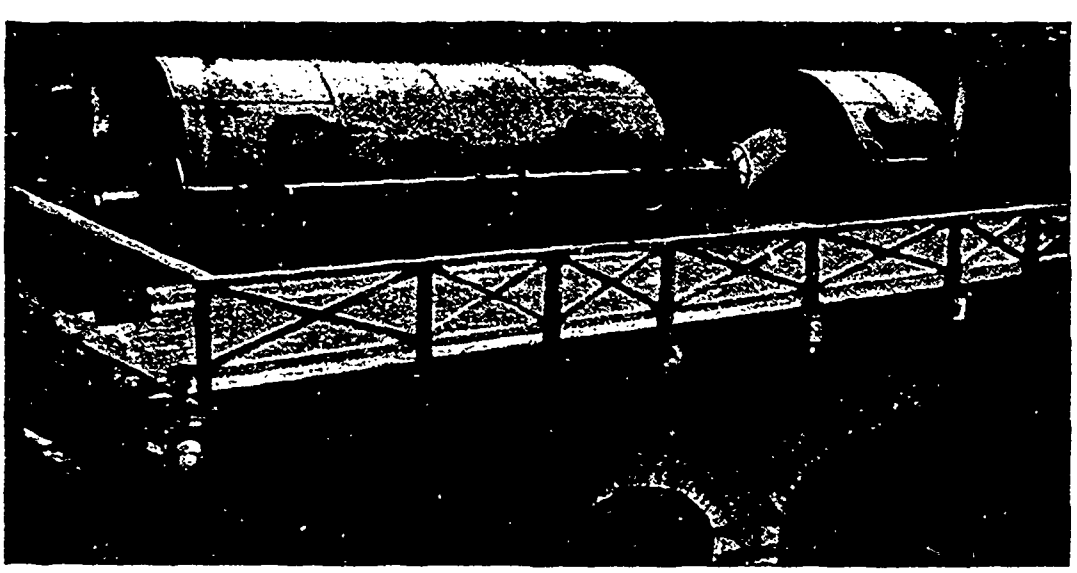
The two 15 h. p. two-phase "S.K.C." induction motors will, in a like manner, be connected to two shafts arranged so that by friction clutch they can be made one. Each of these motors is arranged to operate on a fan for driving air over the pipes to be cooled, and also for operating a pump for the circulation of the brine. In this case also by the use of the friction clutch, either motor can operate one or both shafts and pumps. Each of these two 15 h.p. motors is also used to operate a freight hoist and can be used interchangeably.

The current for driving this plant will be supplied by the Montmorency Electric Power Company from their two-phase "S.K.C." generating plant at Montmorency Falls, fully ten miles distant from the Quebec Storage Company's warehouse and refrigerating plant and thus, as above noted, superseding a steam plant, which has been in operation for the last few years, and it was found that the operation of the plant would be much more satisfactory and more economical by electric than by steam power.

The entire electrical plant is to be in operation by the first day of May next. The "S.K.C." two-phase motors, as well as the auxiliary apparatus necessary thereto, are being supplied by the Royal Electric Company, of Montreal.



WORKS OF THE S. MORGAN SMITH CO., YORK, PA.



The engraving represents a line of horizontal McCormick Turbines, consisting of one pair and one single 51 inch in iron cases. These turbines are developing 2,700 horse-power, which is taken off at one end of the shaft and is used in the cotton mill of the John P. King Manufacturing Company, Augusta, Ga. The McCormick wheel is the invention of John B. McCormick, who also invented the Hercules wheel. The McCormick is his latest invention and embodies points of merit in its construction which are not found in other turbine named. It is very heavy, strong, well built and nicely finished.

CHEMISTRY IN THE BOILER ROOM.

By Wm. Thomrson, Montreal West.

PART III

As already stated, carbon and oxygen enter into combination in two different proportions, and form two new chemical compounds, one of these being the result of perfect and the other the result of imperfect combustion.

The first of these is known as carbon dioxide or carbonic acid gas, and written symbolically $C O_2$, meaning that two atoms of oxygen have combined with one atom of carbon to form the new chemical compound carbon dioxide, and as a result of this combination a given quantity of light and heat was given off at the exact time that combination between the two elements took place. It should be carefully noted that neither light nor heat is given out from the coal nor yet from atmospheric air themselves, until the two elements under consideration are brought into combination with each other under certain defined conditions, and that there is neither loss nor gain in weight as a result of heat having been given off. Nature provides that each element shall have a fixed atomic weight, and this has been fixed by chemists for carbon at 12 and for oxygen at 16; therefore, if carbon and oxygen have entered into chemical combination to form carbon dioxide the product will have a given weight; and if you take, for example, one pound of carbon and admit just sufficient oxygen to form carbon dioxide, you will require to admit 2⅔ pounds of oxygen, and as a result will produce a certain quantity of light, a given quantity of heat, and exactly 3⅔ pounds of carbon dioxide; although a direct and distinct change has taken place in these two elements; the carbon has disappeared as carbon in the solid state and oxygen has also disappeared as oxygen in the gaseous state, and a new gaseous compound has been formed having volume according to temperature and a weight corresponding exactly with the weight of the two elements combined before chemical combination took place. As a matter of fact both light and heat have been given off, still we have no loss in weight, proving conclusively that heat is not a substance stored away in the coal nor yet in the air, but is simply a result of the two elements, carbon and oxygen, having entered into chemical combination, and must be given off at the exact moment combination between the two elements takes place.

The new chemical compound $C O_2$ has its own peculiar properties, and is neither combustible nor yet a supporter of combustion. It will not burn for the same reason that water will not; it has combined with all the oxygen it is capable of, and has practically the same effect on our fires, and must be got rid of just as soon as formed. Under equal conditions of temperature it is heavier than atmospheric air, a fact that will readily impress mechanical minds.

There is, however, another important chemical compound formed during the combustion of fuel, and already referred to as carbon monoxide, written symbolically C O. In this case only one atom of oxygen combines with one atom of carbon the two elements combining in equal proportions to form C O this as I have stated being the result of imperfect combustion. To an unlearned fireman there is apparently no difference between the two products C O and $C O_2$—they are both compounds of carbon and oxygen, and in each case the carbon disappears and combines with oxygen to form a new gaseous compound, and during the act of combination in each case both heat and light are given off, but in vastly different proportions.

Roughly stated, C O may be said to have formed under following conditions: Let us suppose we have a covering of strongly heated carbon on our grate, which we cover with a layer of green coal. This fresh coal is at once heated, and since each atom of carbon has an equal affinity for oxygen the carbon acts as a reducing agent to the $C O_2$ passing from heated carbon on grates, and reduces it to C O. If a supply of air is now given, the oxygen from the air will combine with C O and cause combustion to take place, the new compound passing off as $C O_2$. It will be observed that C O differs from $C O_2$ inasmuch as C O is combustible while $C O_2$ is incombustible, and I may say another important difference is, that C O is very much lighter in specific gravity than air, and consequently easily escapes unconsumed to chimney.

Our great object as engineers is to get the greatest possible amount of heat out of the least possible quantity of coal. Every pound of coal we use, be it good, bad or indifferent, has a certain fixed calorific value as a heat-producing agent, past which we cannot go.

In boiler room practice and evaporation tests, all kinds of methods are adopted to arrive at the amount of what is termed "pure coal" burnt per lb. of water evaporated,—nearly all of which are wide of any reliable results. Even in the highest practice it is a common thing to divide determination of elements in coal under four general headings, such as "moisture" "volatile substances" "carbon" and "ash." As a consequence of this very common error we often see the statement in print that the rate of evaporation per pound of pure carbon is so close to, or actually in excess of theoretical calorific value of this substance, that results are misleading and very often denied by well-informed engineers.

"Volatile substances" includes some very important elements for our purpose, and until we know what our "volatile substances" are composed of, and in what proportion, it is quite impossible for us to arrive at any reliable conclusion as to the calorific value of our fuel. As an instance, I might cite the highly important element hydrogen, which is contained in this class, and which has by far the highest calorific value of any of the constituent parts of our coal. The calorific value of hydrogen has been fixed at 62,000 heat units, or what is commonly termed British Thermal Units. A B. T. U. being, as, no doubt, your readers are aware, the amount of heat required to raise the temperature of one pound of water one degree Fahrenheit. Consequently one pound of hydrogen entering into combination with oxygen, as set forth in earlier articles on this subject, will form 9 lbs. of water and give off during the act of combination sufficient heat to raise the temperature of 62,000 pounds of water 1° F., or, what is the same thing, evaporate 64 pounds of water from and at 212° F. under atmospheric pressure.

The calorific value of one pound of pure carbon has been fixed at 14,500 heat units, but this is subject to important chemical truths and conditions. This is the maximum calorific value of pure carbon, and to enable the engineer to secure this amount of heat he must have perfect combustion and completely form the chemical compound $C O_2$.

The importance of our closely following natural laws during combustion of our fuel and the actual need of at least a rudimentary knowledge of chemistry can not be better illustrated than here, let us briefly review our general statements. 1st. Hydrogen is separated when coal is decomposed by heat. 2nd. It is a very light substance, and under proper conditions as to temperature, combines readily with oxygen. 3rd. Carbon combines readily at a given temperature with oxygen in one of two proportions. 4th. Both the elements, hydrogen and carbon, have a distinct calorific value as a fuel.

That hydrogen on combination with oxygen during act of combination gives off 62,000 heat units or evaporates 64 pounds of water from and at 212° F., under atmospheric pressure.

Carbon combined with oxygen in proportion to form $C O_2$ gives off during act of combination 14,500 heat units, or will evaporate 15 pounds of water from and at 212° F.

Carbon combined with oxygen in proportion to form C O gives off during act of combination 4,350 heat units, or will evaporate but 4.5 pounds of water from and at 212° F.

C O combined with oxygen to form $C O_2$ gives off 4,750 heat units or will evaporate but 4.9 pounds of water from and at 212° F.

Every engineer can readily see the importance of having as nearly perfect combustion as possible, of carefully preserving the element hydrogen from escaping unconsumed, and the important fact that combination must take place within the furnace since heat is only given off at the actual time and moment of combination between the elements. It is also just as important that the air current be properly regulated since an excess of oxygen will simply pass into the chimney unchanged, and with the nitrogen absorb a certain quantity of the heat given off, and consequently reduce the evaporative efficiency of the fuel.

Other than the understanding of the chemical reactions constantly taking place within the furnace, a knowledge of chemistry is invaluable to us, since it enables us by means of analysis to readily determine the component parts of our fuel and its value as a fuel. In the sample in question, leaving out the unimportant elements, we are enabled to arrive at its calorific value. Since it consists of 85% carbon, and as each pound of carbon has a value of 14,500 B. T. U., we get 12,320 B. T. U. from this source, and from the hydrogen 3,100 B. T. U., or a total of 15,420 heat units equal to the evaporation of 15.9 pounds of water from and at 212° F. under atmospheric pressure per pound of fuel used. Knowing the actual value of our fuel, it then becomes an easy and simple matter for us to test and ascertain our actual evaporation and compare with the theoretical value of our fuel and see exactly what we are doing, and thus determine the cause of any loss or lack of fair economy.

I noticed the statement recently that a nation's greatness

depends upon the chemical knowledge of its people, and I think every engineer, who has closely studied his profession, will bear me out in saying that the greater our scientific knowledge the more valuable we become as engineers.

In conclusion, let me illustrate what an immense field for improvement lies ahead of us as engineers in this very question of securing the greatest possible efficiency per pound of coal burnt. I have said that each pound of coal has a defined calorific value and that each unit of heat has a definite value and duty. Heat is energy, and energy cannot be destroyed, and, as a consequence, every unit of heat has a certain defined mechanical value. It has been fixed that the mechanical equivalent or duty of an heat unit is the raising of 772 pounds 1 foot high, or what is the same thing, the raising of 1 pound 772 feet high.

Let us take, for an example, a 100-horse power plant using 180 pounds of coal per hour. This quantity of coal is equivalent to 2,775,600 772 2,142,763,200 foot pounds, being the mechanical value of heat generated from this quantity of coal per hour. This is equivalent to 1,078 h. p., and still in our most modern plants we are only able to obtain 100 h. p., or about 1/10 the actual value of the fuel. This is our best practice, and I venture to say that the average plant does not utilize more than 3% of actual value of fuel. I confess this is rather a startling statement to make, but a fact nevertheless.

CORRESPONDENCE

THE DUTY ON ELECTRICAL MACHINERY.

HAMILTON, ONT., Feb. 11, 1897.

To the Editor of the CANADIAN ELECTRICAL NEWS

SIR, In an article appearing in your February number entitled "The Duty on Electrical Machinery" written over the signature "Justice" several sweeping statements are made tending to decry the electrical industry in Canada.

Being directly interested in the design and manufacture of electrical apparatus, I would take exception to several of these statements as being wholly misleading.

The writer of the article starts out by saying that the electrical industry in Canada has no "raison d'etre" and yet a little further down states that we have "several very excellent colleges giving electrical courses and degrees." Now I cannot see why the industry has no "right to be"; manufacture in this line to-day is based more on a matter of design and engineering and not on invention and research as in the early days of the art, and graduates of our colleges are supposed to be capable of designing a great part of the machinery as used in our lighting and power plants, and it is my candid belief that we have men in this country, many of whom working at nominal salaries in our various manufactories, who are in every way qualified to do a great deal in this line if they but had the confidence and support of our manufacturers and would further proclaim their capabilities without "fear and trembling."

While I will admit that it would be useless, with our meagre experience and knowledge in this particular branch, to attempt to introduce heavy power transmission apparatus in competition with the highly developed apparatus of American design, yet there remains a great field for perfected constant potential and arc lighting devices, and for the classes of specialties which are always in demand, and because a few large alternators are imported there is no reason why the industry as a whole should be made to suffer in face of a tariff which would result in the flooding of the country with endless cheap apparatus.

There is of course no doubt that some of our Canadian made apparatus is not what it should be; as an instance we can cite the fact that there are not three firms in this country who make a modern and efficient constant potential motor or dynamo, but yet we have not the slightest ground for an excuse for this state of affairs, as we have engineers capable of constructing modern apparatus if sufficient confidence were placed in their abilities instead of undervaluing same.

Being interested in the Thompson Electric Company I may state that the arc lighting apparatus of that firm is wholly of Canadian design in all its details, and designs are now being gotten out for open and enclosed arc lamps for either direct or alternating current circuits, which will enter the market in open competition with any imported or domestic article, both as regards efficiency and price.

The few articles entering into the construction of electrical machinery, which are of necessity now imported from the United States, would soon be furnished if the demand arose for sufficient quantities, and would it not be better to foster such industries, as well as retain the present ones, by guaranteeing sufficient protection, instead of doing the opposite by removing same?

Yours truly,

WM. A. TURBAYNE.

CLOSE REGULATION.

ST. MARYS, ONT., Feb. 22nd, 1897.

To the Editor of the CANADIAN ELECTRICAL NEWS.

SIR, Will you allow me space in your valuable paper for the following, which may interest some of the electrical fraternity? I am in charge of an arc plant, and have 28 lamps direct current. The power is supplied by an 80 h. p. Corliss engine, non-condensing; average steam pressure 70 lbs. I have also a small incandescent dynamo, 30 lights, and a flax mill, with variable load. During a test the other night I let the steam vary 25 pounds on steam gauge, with the result that the voltmeter only varied one volt during the whole change of pressure. This I think remarkably close regulation in speed. I would like to hear through your paper the experience of other electricians on same line, and how close is the average variation in such a case.

Yours, JOS. H. WARD.

MOONLIGHT SCHEDULE FOR MARCH.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1	P. M. 6.10	A. M. 5.40	11.30
2	" 6.10	" 5.40	11.30
3	" 6.20	" 5.40	11.20
4	" 6.40	" 5.40	11.00
5	" 7.10	" 5.35	10.25
6	" 8.20	" 5.35	9.15
7	" 9.20	" 5.35	8.15
8	" 10.30	" 5.35	7.05
9	" 11.40	" 5.35	5.55
10		5.35	4.55
11	A.M. 12.40		
12	" 1.30	A. M. 5.30	4.00
13	" 2.20	" 5.30	3.10
14	" 3.00	" 4.30	2.30
15	No light.	No light.	
16	No light.	No light.	....
17	No light.	No light.	....
18	No light.	No light.	....
19	P. M. 6.40	P. M. 9.20	2.40
20	" 6.40	" 9.20	2.40
21	" 6.40	" 10.50	4.10
22	" 6.40	" 12.00	5.20
23	" 6.50	A. M. 1.10	6.20
24	6.50	2.10	7.20
25	" 6.50	" 3.00	8.10
26	" 6.50	" 3.40	8.50
27	6.50	" 4.10	9.20
28	" 6.50	" 4.40	9.50
29	" 6.50	" 5.10	10.20
30	" 6.50	" 5.30	10.40
31	" 6.50	" 5.30	10.40
		Total,	197.10

NEW ARC LIGHTING SYSTEM.

Many of the arc lighting plants throughout Canada comprise in their electrical equipment dynamos which were designed some fifteen years ago, and which have not undergone since that period any radical changes of note, and arc lamps having birth about the same date, and which, although in some few cases they may have witnessed changes tending to cheapen the cost of manufacture, yet closely resemble the identical lamps of that period.

It is claimed that makers of arc apparatus have not made any pronounced digression from their original designs; they were too busy designing incandescent machines and perfecting the street railway, power, and the various alternating current systems of generating and translating devices, and as this work taxed to the utmost their staff of designers, and as the arc systems of the day seemed to make light of some kind, and references to arc improvements were "pigeon-holed," and thereafter a long time remained.

Recently, however, a sort of arc lighting reaction has set in, and a demand has arisen for more efficient and serviceable apparatus, the older devices having been literally falling to pieces.

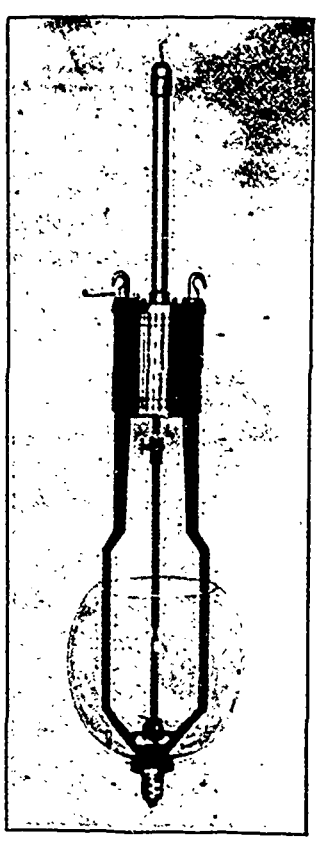
The Thompson Electric Company, formerly of Waterford, Ont., but now manufacturing in Hamilton, in order to meet this demand, prepared designs and constructed in detail a complete new system of arc lighting, including an automatic generator, lamps, and all station and outside accessories. They now offer a dynamo for which they claim some of the good features heretofore commonly associated only with constant potential machines, notably the suppression of sparking, a really genuine regulation, and a commercial efficiency largely over 50%, features which one cannot attribute generally to the arc dynamos in use throughout the country to-day.

Arc lamps, and neat looking lamps at that, are now made by the same company, which are said to maintain a steady light through long periods of burning, and which are satisfied with a terminal voltage of 48 or 50 at the end of an all night run, and not 60 or 65 as heretofore. The gain is obvious; the dynamo is not compelled to furnish a constantly increasing E. M. F. in order to maintain arcs which lengthen as the shunt coils heat and carbons waste away, and the lamps burn at their most efficient wattage. This favorably affects the fuel pile.

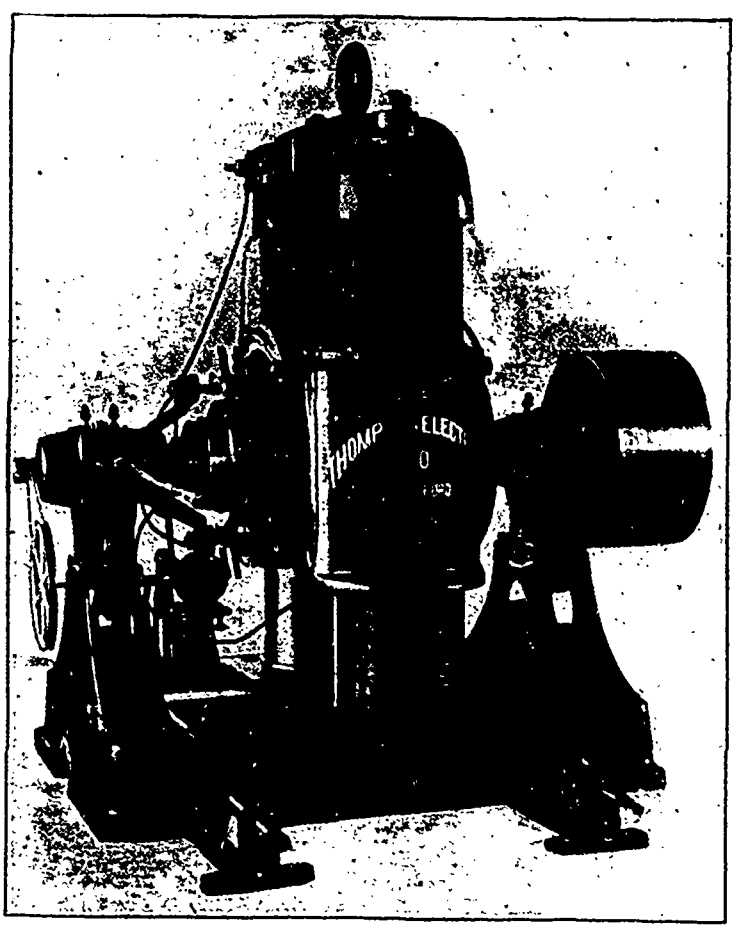
The dynamo, the general outline of which may be noted by reference to the accompanying reproduction, possesses a number of valuable features. In the relative saturation of the field magnet and armature cores a wide departure from former practice has taken place, and the disposition and shaping of the pole-pieces have been so combined that as a result commutation is effected sparklessly throughout the entire range of the brushes, from full load to zero potential, and with but a single set of brushes having a constant width of lap. This calls for but one rocker-arm and greatly simplifies the regulating gearing.

The useful properties of a large armature reaction are employed in assisting regulation, and with the brushes in a fixed position several lamps may be switched on or off without greatly increasing or decreasing the current strength, although in practice the regulator immediately adjusts the brushes to a position of constant current value and of sparkless operation.

The manufacturers claim that the mechanical features of the machine, a substantial base, sliding rails for belt adjustment, self-centering pedestals with self-oiling and



Arc Lamp—Thompson Electric Co.



Arc Dynamo—Thompson Electric Co.

aligning gun metal bearings, oil-gauges, and bored pole-pieces with a uniform width of air-gap, place it well beyond the criticisms of the operator.

The arc lamps, also illustrated, have been in use with eminently satisfactory results in a number of plants throughout the Dominion. They are substantially constructed mechanically and are correct electrically, and, in view of the greater number of lamps which are now placed on a single circuit, ample insulation is provided.

All parts of the mechanism perform their proper functions, both as regards feeding, cutting-out and relighting, on any current from 3 to 12 amperes, and the voltage across the arc remains practically constant throughout this range and during the entire period of burning, the feeding point remaining practically constant and the movements being imperceptible, resulting in a stable and unwavering arc.

In designing this lamp the greatest possible simplification, compatible with the most serviceable operation, has been the main object, and no complicated and frail devices are allowed to enter into its construction. The idea has been to abolish repairs and reduce operating expenses.

Current indicators, non inductive lightning arresters, and a complete line of improved station and outside accessories are embodied in this modern system of arc lighting. This system of apparatus is manufactured by the Thompson Electric Company, of Hamilton, under the designs of their electrical engineer, William A. Turbayne, and they will be glad at all times to furnish any information to any who may be interested in the matter.

THE AUBURN POWER COMPANY.

The following particulars regarding the plant of the Auburn Power Company, at Peterboro', Ont., which has just been put in operation, have been kindly furnished by Mr. W. H. Meldrum, managing director of the company.

The plant is of the three-phase type, for power purposes only, furnished by the Caeadian General Electric Company, and is A. P. 36-250-200 type, having 36 poles, and operates at 200 revolutions per minute, having a periodicity of 60 cycles per second, with a potential at full load of 2,000 volts. The machine and exciter are driven by two 66 in. "Boss" wheels, made by The Wm. Hamilton Manufacturing Co., of Peterboro'. The shafting, crown wheels and pinions, with eye beams, breach trees etc., were furnished by Messrs. Wm. & J. G. Greey, of Toronto, and the operating of the same reflects credit upon the manufacturers, there being some 18 tons of iron outside of the water wheels. The gear runs as smooth as a clock. The whole driving arrangement is carried on four steel girders, 6 x 14 in., bolted to six solid concrete piers. The water wheels operate under a 15 ft. head of water on the Auburn dam, and are tabled to 450 h. p., and being coupled together, the same shaft extending to the generator, which is 12 ft. in diameter and rests on a solid concrete bed. A large coupling bolts the armature of this large generator to the shaft, making a thoroughly rigid direct-coupled plant. The power plant is all in shape, and the big generator weighs some eighteen tons. It is the intention to supply power to all classes of manufacturers in Peterboro'. The company have a large surplus of water.

SPEED BY ELECTRICITY.

Mr. W. J. Camp, of Montreal, writing in the Telegraph Age, says:

On page 467 of the last issue of the Telegraph Age appears an item from Electricity, London, suggesting the "use as a new unit of length for very great distances . . . . . over which an electrical impulse could be sent in one second; it is assumed that in one second a current impulse would travel seven times around the earth" (about 175,000 miles.) It may surprise many of your readers to be told that the speed of the electric impulse is very much less than is generally supposed. By actual experiment in Canada, between distant points, over No. 6 B.W.G. iron wire, without repeaters interposed, it was found that the speed was about 3-100 of a second per 1,000 miles, or 33,000 miles per second.

I might mention an experiment I tried last August. I made up a telegraph circuit from Montreal to Montreal (duplexed), with repeaters, as follows:

	Miles.
Montreal	0
Sudbury	443
Fort William	998
Winnipeg	1,425
Swift Current	1,937
Donald	2,450
Vancouver	2,909
Portland	3,277
San Francisco	3,995
Albuquerque	5,195
Kansas City	6,011
Chicago	6,673
Toronto	7,315
Montreal	7,655

At McGill College, Montreal, a chronograph was connected and signals sent round the circuit, these signals being recorded when starting and also when completing the circuit. The average time occupied was .52 of a second for the 7,655 miles. I then connected the receiving side of one end to the sending side of the same end, so that a signal would be repeated back on the opposite side of the duplex, making a total circuit of 15,310 miles. The average time to complete the double circuit was 1.06 seconds.

Allowing 2-100 of a second for each of the twenty-six repeaters, this would make the speed only about 28,600 per second in the second case and about 29,400 in the first. The repeaters, of course, had to be estimated according to other tests, and the probability is that some of them occupied more time than others. Some of the repeaters were not well adjusted, as it was difficult to get the signals around the doubled circuit, a dash being reduced to a dot.

On a previous occasion the same circuit was arranged so that one end repeated into the other, and a signal started in one direction traversed the circuit eight times before it stopped. On another occasion a duplex circuit between Montreal and Vancouver, 2,909 miles, was connected at both ends, so that a signal went backward and forwards for over 200 times, and then only stopped on account of someone interrupting the circuit.

It is announced that acid in lubricating oil may be detected by putting the samples to be tested in a clear glass bottle, with a copper wire running down through the cork, air tight. Stand the bottle in a sunny place and let it remain for some days. If on removal verdigris or green rust is on the copper there is an acid in the oil. Such oil should not be used on machinery.

THE THREE-PHASE TRANSMISSION PLANT AT THE VALLEYFIELD MILLS.

Among the most important of the great textile manufacturing establishments of the Dominion both in respect to the amount of capital invested and the value of the annual output are the mills of the Montreal Cotton Company at Valleyfield, P. Q.

At this point a dam erected by the Dominion Government to increase the depth of water in Lake St. Francis connects the Grande Isle de Beauharnois with the south shore of the St. Lawrence river creating incidentally an excellent water power. Upon this island, 23 years ago, the first mill of the company was built, containing 600 looms, the necessary carding and spinning equipment and a bleachery. About 16 years ago the mill was extended to contain 1,300 looms, and a dye house and finishing department were added to the bleachery. Three years ago the bleachery and dye-house departments were re-arranged and greatly enlarged and the mills have been enlarged each year since, until now they contain 80,000 spindles and 2,330 looms, and a bleachery and dye-house large enough to handle 120 tons of cloth per week.

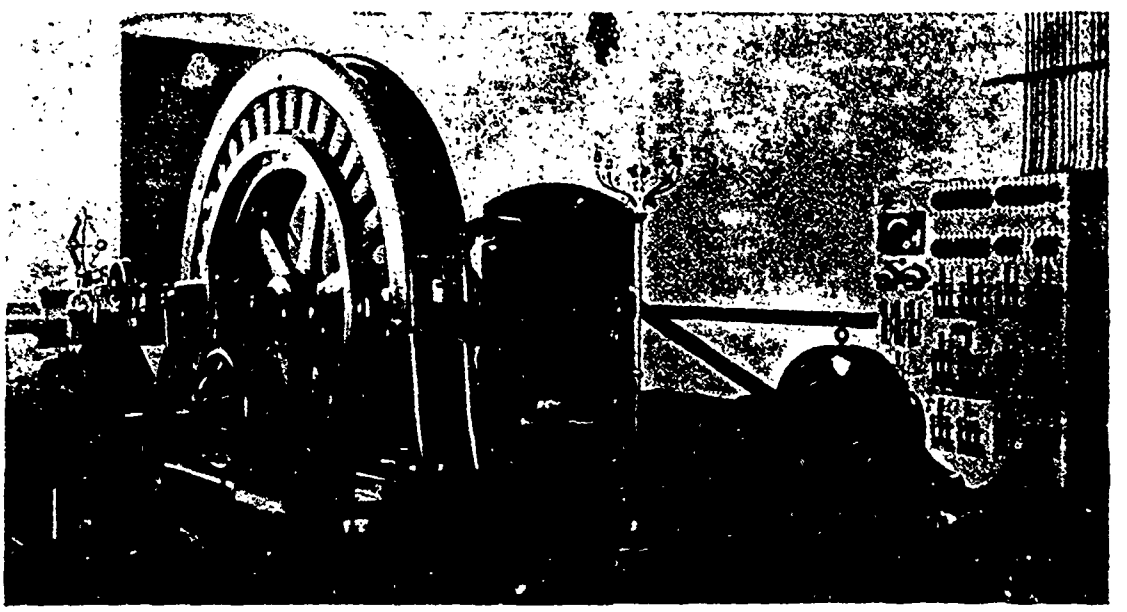
The large increase in the size of the plant during the past three or four years, combined with the lowness of water in the St. Lawrence, has rendered necessary an increase in the power plant of the company. This, up to last year, consisted of seven 60" and four 54" Hercules turbines and two 84" Risdon turbines.

The selection of electricity as the transmitting and distributing medium for the additional power plant was arrived at after a careful consideration of the first cost and losses involved in the various alternatives offered, of which the most feasible considering the comparatively short distance to which the power had to be carried, to the farthest point not more than 1,000 feet, was a rope transmission. The choice of electricity and of the three-phase system with induction motors was made after an investigation by the general manager of the company, Mr. Louis Simpson, of the principal plants operating under similar conditions in America, including the three-phase plants installed by the General Electric Company at the Pelzer and Columbia mills.

For the hydraulic portion of the new plant a new flume was excavated, which was arranged to contain eight 60" McCormick turbines, each calculated to develop about 300 h. p., making a total of 2,400 h. p. The turbines are erected in pairs, each pair driving a 400 kilowatt generator. The lower part of the power house is all built in solid concrete, the power house proper above water, being built of stone, lined with terra cotta lumber. The roof is composed of 5" solid timber laid upon girders and covered with resin cement, and on the inside it is sheathed in steel, which is stamped out in panels and painted. Altogether the power house in solidity of construction and excellence of detail and finish is not excelled, if indeed it is equalled in America.

The wheels are governed by Replogle's new relay governors, the turbines being supplied by Mr. S. Morgan Smith, of York, Pa. The saddles and shafting were furnished by Wm. Kennedy & Sons, of Owen Sound, and by Mr. John McDougall, of Montreal. The gearing wheels were supplied by Mr. S. Morgan Smith.

For the electrical plant, as has been stated, the three-phase system of the Canadian General Electric Company was adopted and a contract given to that company for two 400 kilowatt generators, the first of which has been installed and in satisfactory operation for about two months. The second machine will be in operation in the course of a few weeks. These generators, which are designated as A. P. 36-400-200 have 36 poles circumposed within a steel yoke about the periphery of the revolving iron-clad armature and represent the latest development in design and construction for machines of this type. A point to be noted is the very slow armature speed, 200 revolutions per minute, which admits of direct coupling to the jack-shaft and of a consequent saving in power and floor space and a generally increased simplicity in the entire installation. The armature, which is of what is known as the A. P. type, is of the multi-tooth style of construction with distributed winding, and has, in consequence, a very low armature reaction with a correspondingly close inherent regulation. The generator voltage, on account of the short distance over which the power is to be transmitted, has been fixed at 550 volts, thus admitting of the current's being used directly on the motors at that pressure without the use of step-down transformers. The motors are of the C. G. E. Co.'s stand-

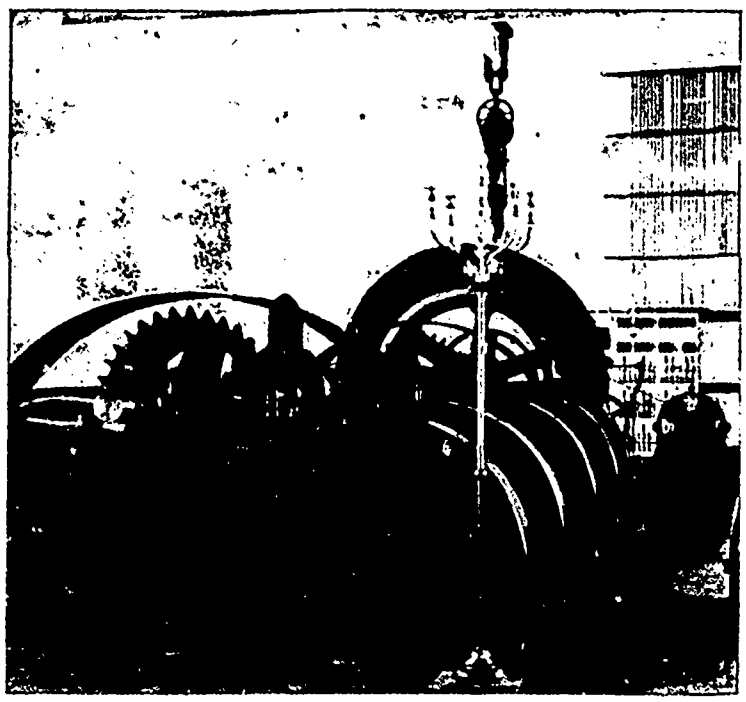


Electric Transmission Plant at Valleyfield, Que.

ard induction type varying in size from 50 to 100 h.p. and are, where a saving in floor-space is desirable, of the inverted type, bolted to the ceiling. They are, of course, self-starting under full load, and as they are without collector rings or brushes, are especially suited for operation under the conditions favorable to combustion which exist in a cotton mill.

Altogether, the plant is a model one in every respect, and as the successful outcome of the first attempt on a large scale in Canada to secure increased economy by the use of electric power in the operation of a large industrial establishment reflects the highest credit on Mr. Louis Simpson, the able and energetic general manager of the Cotton Company, and his foreman mechanic, Mr. Jas. Sparrow.

It might be added that the Montreal Cotton Company have now, as a result of the extension of their plant, a surplus of about 1,500 horse-power which they would be prepared to dispose of for manufacturing purposes, on a most liberal basis. The excellent situation and shipping facilities of Valleyfield should, under these circumstances, make it a particularly desirable manufacturing site.



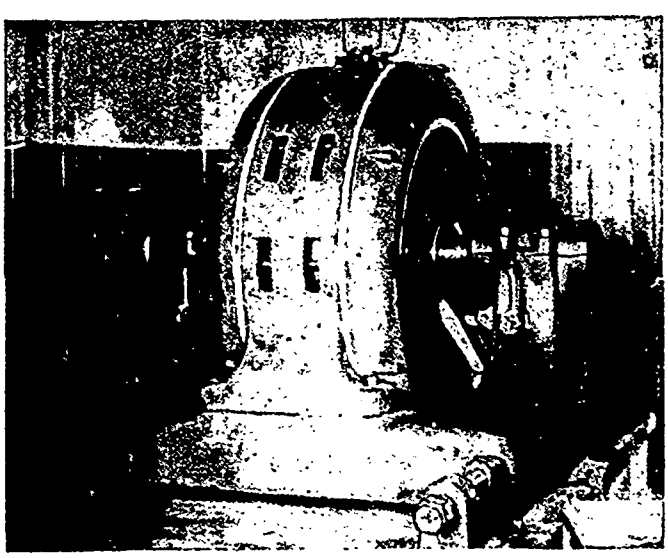
ELECTRIC TRANSMISSION PLANT AT VALLEYFIELD, QUE.

PERSONAL.

Mr. F. L. Walmsby, an electrician in the employ of the Toronto Street Railway Company, died last month. He was born in Davisville 36 years ago.

Mr. W. H. Breithaupt has been elected president of the Berlin and Waterloo Street Railway Company, to succeed the late E. Carl Breithaupt. Mr. Harry Aldrich has been appointed electrician for the electric plant.

At the recent meeting of the Executive Committee of the Canadian Electrical Association the secretary was instructed to convey



ELECTRIC TRANSMISSION PLANT AT VALLEYFIELD, QUE.

an expression of the sympathy of the members of the Association to the relatives of the late Mr. E. Carl Breithaupt.

Mr. A. A. Knudson, electrical engineer, who is well known in the maritime provinces as the moving spirit of the electrical exhibition held some years ago in St. John, N. B., has recently entered into partnership with F. E. Knudson at 66 Broadway, New York. The firm will act as consulting and supervising electrical engineers.

The Welland Power and Supply Canal Company will apply to Parliament for authority to extend the time for commencing their proposed works.

TRADE NOTES.

The contract for the electrical equipment of the Montreal Park and Island Railway Company's suburban lines has been awarded to Ahearn & Soper, of Ottawa. Westinghouse No. 38 B. and No. 12 A. motors will be used throughout.

It is the intention of Mr. T. H. Breck, of Kingston, to commence business in that city on the 1st of April in the line of electrical supplies and novelties. Mr. Breck has been in the employ of the Kingston Light, Heat and Power Co. for four years, and during the last two years has had charge of the arc lamp department of the company.

SPARKS.

Graham & Peckles, electricians, have commenced business at Halifax, N. S.

The annual statement of the Bear River, N. S., Electric Light Company showed the earnings for the year to be $1,244.80, and the net expense $661.30. Over seventy lights were added during the year.

The town of St. Mary's is extending its new electric light plant to 31 lamps. It is said to be giving thorough satisfaction at a cost of about 400 dollars less than the old system, and they now have 3 times the candle power.

The Hamilton Electric Light Company recently held their annual meeting, president Robert Thomson being in the chair. The statements presented by the secretary-treasurer were satisfactory, and the following directors and officers were re-elected. Robert Thomson, president, John Knox, vice-president; J. V. Teetzel, Q.C., secretary-treasurer; Robert Evans, Alex. Turner, J. J. Wright, S. F. McKinnon, H. M. Pellatt, Toronto. Gordon G. Henderson was reappointed manager, and C. S. Scott auditor. The president tendered a dinner to the directors and friends in the evening.

The annual meeting of the Toronto Electric Light Company was held on the 2nd of February. The report of the directors stated that the business done had shown a steady increase, and the earning capacity had been maintained, notwithstanding the decrease in revenue caused by a reduction in the price of light. The income for the past year for lighting, power, rent, etc., was $265,897.46, while the expenses were $172,234.69, leaving a balance of profit of $93,762.77, out of which four quarterly dividends were paid at the rate of 7 per cent. per annum, amounting to $75,119.94, leaving a balance of $18,642.83 to carry forward. The old Board of Directors was elected as follows:—H. M. Pellatt, President; W. D. Matthews, Vice-President; A. H. Campbell, S. F. McKinnon, Hugh Blain, W. F. Murray, Hon. George A. Cox, Robert Jaffray, W. R. Brock, Samuel Trees, Thomas Walmsley, H. P. Dwight, Frederic Nicholls and Hugh Ryan.

MANUFACTURE OF THE INCANDESCENT LAMP.*

By Harry Breck.

The incandescent lamp, as we see it, is made in two distinct parts. First I will describe the globe. The globe, as it is delivered from the glass works, comes in the form of a florence flash, as shown in Fig. 1. ; this is heated and a cone drawn out at the part x (Fig. 1.) To this portion is placed a piece of glass tube shaped as in Fig. 2. The reason for the narrow portions (marked a a Fig. 2,) I will explain later.

The next operation is to make the base for the filament. A glass tube is taken and a portion of it near the end is thickened, as in Fig. 3. This afterwards fits into and is fused into the neck of the globe (marked a Fig. 1). Two platinum wires are then put in this tube and the end (marked x Fig. 4) is heated and the two wires are thus imbedded in the glass. Care is taken that these two platinum wires do not come in contact with one another. These wires are bent, as shown in Fig. 4, in the shape of an L. To these terminals are afterwards fused the ends of the filament.

After the filament (the manufacture of which I will speak of next) is fastened on by an electro deposit of copper to these platinum wires, the base (Fig. 4) is

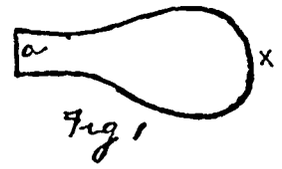


Fig 1

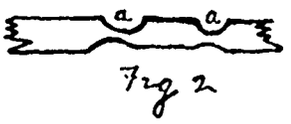


Fig 2

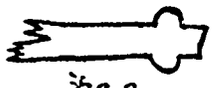


Fig 3

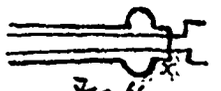


Fig 4

Fig 5

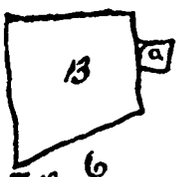


Fig 6

Fig 7

fused into the neck of the bulb (Fig. 1 marked at a) ; it then appears as in Fig. 5. The end of the tube, marked x, is then connected to an air pump, and the vacuum procured. The end "a" is then fused, afterwards B, and the lamp is complete ready to be connected to the brass vase. The reason for the two sealings is to avoid all possibility of air escaping into the globe, a second sealing renders this impossible; and the reason that platinum wire is used is that it expands and contracts with heat almost the same as glass.

Now for the construction of the filament. This filament is NOT wire, as a great many suppose ; it is practically the same substance we burn in our arc lamps, namely, carbon. This filament is made of carbonized bamboo. The carbon is taken and split several times, lengthwise, all the hard silicious outer covering removed, and the remaining straight fibrous portion is shaved down until it is of uniform thickness, and then cut to the required length. These are taken and pressed between two metal blocks which are accurately surfaced to each other. The projecting pieces of bamboo are cut away, except a small portion at each extremity. This leaves a fine strip of bamboo, with an enlarged portion at each end. These strips are then placed in moulds (the chief form being the horse-shoe shape of filament) of the shape required for the filament. These moulds are of nickel, and in them are cut grooves of horse-shoe shape. A flat nickel plate is placed over them, and the whole is placed in an oven and heated to an immense heat, so the bamboo becomes completely carbonized. The filaments are then fastened to the platinum points in the manner already described.

You ask, "what about the gas in the fibres of the carbon filament ; how do you get rid of it?" This is the method : When the lamp is being exhausted a current of electricity is sent through the lamp (this is set on when the lamp is very nearly exhausted) and any air or gas contained in the filament is expelled and passed out while the air is being exhausted. In a 16 c.p. lamp the current used would raise the lamp to a 32 c.p., and so you see only the fittest survive. It can be known when the gas is all driven out by the disappearance of the violet blue color surrounding the filament.

All that now remains to be done is to fasten the lamp to the base. The method of doing this is shown in Figs. 6 and 7. Two pieces of brass "a" and "b" (Fig. 6) are kept separated by a porcelain disc (see end view Fig. 7), the shaded portion showing the porcelain.

The shell b (Fig. 6) is made of thin sheet brass, and the part a (Fig. 6) is a brass rod about 1½" long and about ⅛" in diameter. These make the connections in the socket. One wire of the lamp is soldered into this brass rod (a Fig. 6), the other into the brass shell (b Fig. 6). The lamp is fastened into this with plaster of Paris. This completes the process of manufacture of the incandescent lamp.

*Paper read before the Kingston Association of Stationary Engineers.

IN MEMORIAM.

Since the date of our last issue we have received from members of the Canadian Electrical Association and others many sympathetic references to the death of the late Mr. E. Carl Breithaupt. Among these are the following lines from Mr. D. H. Keeley, of Ottawa :

TO THE MEMORY OF E. CARL BREITHAUPT, VICE-PRESIDENT OF THE CANADIAN ELECTRICAL ASSOCIATION.

A light gone out! Alas, a light gone out
Whose full bright radiance, while it lasted,
Oft times gave courage when lethargic doubt
Sat 'pon th' hoped emprise of one exhausted.

Brilliant the mind 'twas his to bring to bear
On all occasions affecting what we did;
He bore in all our aims a gen'rous share,
E er helped investigate what's to us hid!

Miss him we will—alas, the light that's g ne'
In all our growth of practice; in our convention halls'
Where'er obtains the need for brain and brawn—
Th' qual'ties outpushing our inhemming walls.

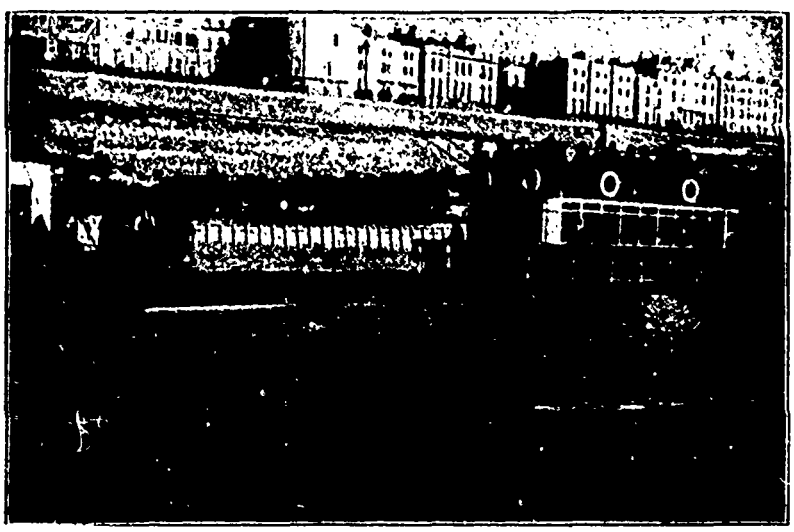
O he who sh ne so brightly in our sphere—
Who strove to make our onward way the fleeter—
Has left behind with us a memory dear,
Of pure devotion, of himself, a sweeter'

—A Fellow Member.

ELECTRIC RAILWAY DEPARTMENT.

A SEA-SHORE ELECTRIC RAILWAY.

An electric railway which has lately been put in successful operation between Brighton and Rottingdean, England, is one of the most novel systems which has yet come under our notice. The promoter operated a small sea shore tramway at Brighton, which he desired to extend to Rottingdean, a distance of four miles. The steep cliffs along the route made it necessary to follow the foreshore, which was covered almost constantly with water, and at a point slightly above low water mark, but some fourteen feet below the sea at high water, the track was constructed.

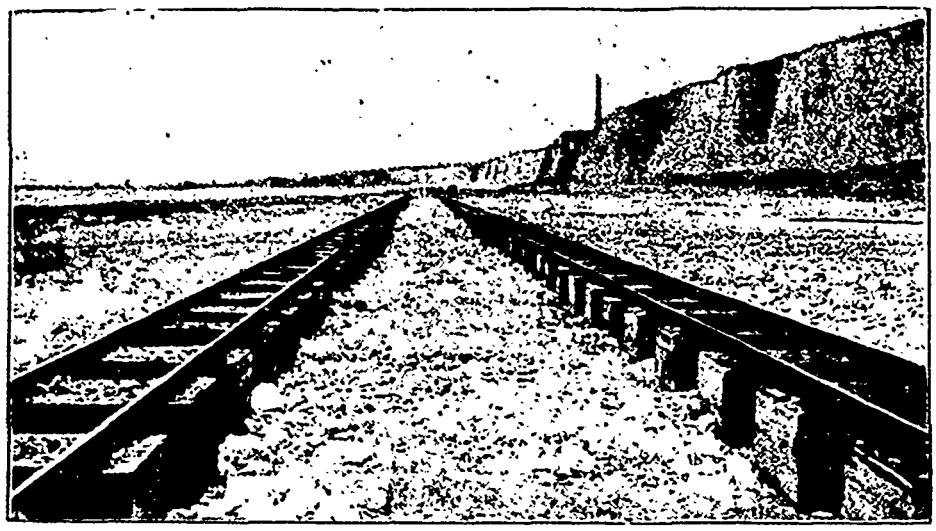


Car Leaving Pier.

It was proposed to run the cars at all times irrespective of the tide, which necessitated the building of a car of special design. It was made of a half boat and half car, mounted on four long legs, at the end of which are the wheels which run on the track. The car has 16 wheels, each leg of the car being mounted on a four-wheel bogie, and the wheels of the bogie run on the narrow gauge line. The bogie trucks are shaped like a double-ended boat to facilitate passage through the water as well as to remove obstructions from the lines. The four bogies are held together by steel tubular struts, and the wheel base is about 28 feet. The top of the main legs carry lattice girder work, on which the main deck is erected, the whole structure being braced together by means of cross ties. The main deck is 50 feet in length and 22 feet in width, surrounded by iron railings, provided with wire netting. There is also a saloon in the centre, with a second deck on top, and altogether the car will carry two hundred passengers.

The track consists of four rails, 54 pounds to the yard, the distance between the two outer rails being 18 feet, which will give an idea of the width of the car. Much difficulty was encountered in laying the track, as work could only be carried on when the tide was low. The rails are fastened to concrete blocks, placed every few yards by means of steel clips and bolts, the latter passing through oak blocks placed between the rails and the concrete. Tie rods are used every ten feet on the straight and every five feet on the curves, heavy angle fish plates being used for the rail joints. The accompanying illustrations will enable our readers to a better understanding of the system.

The cars are propelled by means of overhead trolley wires of a special type, and on the cars are two 30 h.p. motors of the C. G. E. 800 type, placed vertically over two of the main legs, the armature being connected through bevel gearing to a vertical shaft geared to the axles of the wheels. The controlling devices are located at each end of the deck, and the brakes are operated by rods passing down the two unoccupied legs. The generating plant consisting of a four-pole railway generator direct-connected to a high-speed double-acting engine, is located at the Rottingdean end of the line. The machinery, however, is not of a sufficiently novel design to warrant a description. The total cost of the road is estimated at $150,000, this sum including the construction offices at each end.



View of Track at Low Water.

MR. H. J. SOMERSET.

Mr. H. J. Somerset has been appointed to the position of Superintendent of the Winnipeg Electric Street Railway, to fill the vacancy caused by the retirement of Mr. G. H. Campbell, as manager.

For the last three years Mr. Somerset has held the position of electrician for the company, so that his appointment comes by way of promotion.

He received his professional training at the Worcester (Mass.) Polytechnic Institute, from which he gradu-

ated in 1891, with the degree of B. Sc. in Mechanical Engineering. Previous to his attendance at the Polytechnic Institute he spent two years in practical work in steam engineering and machine shop practice with the Canadian Pacific Railway.

After graduation he devoted himself for a like period to electrical work as applied to street railway operation at the Canadian General Electric Company's works at Peterboro', and on the Toronto Railway.

Mr. Somerset brings into his new sphere of duty a thorough knowledge of every department of street railway work, and an ambition to make a record for himself which augurs well for his success.

SPARKS.

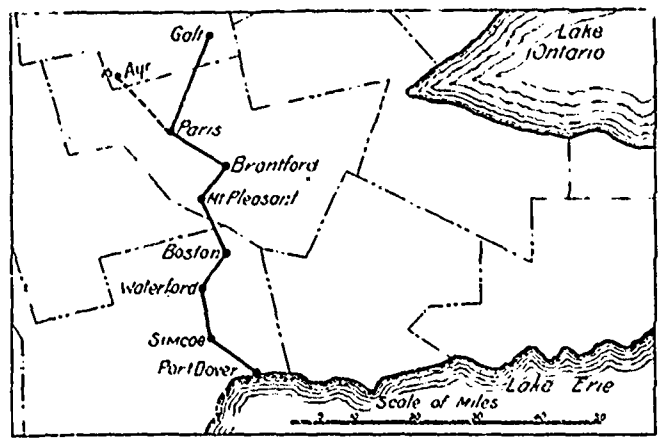
The Central Counties Railway Company propose extending their line and adopting electricity as the motive power.

Several changes have taken place in the staff of the London street railway. Mr. L. DeHart, superintendent, has retired, and is replaced by Mr. S. Potter. Mr. L. Robinson, assistant superintendent, has been promoted to the superintendency of the Montreal Park and Island Railway, and is succeeded by Mr. John Break.

A conference was held between some prominent citizens of St. Catharines and the managers of the Hamilton, Grimsby and Beamsville railway, for the purpose of considering the extension of the railway from Beamsville to St. Catharines. Owing to engineering difficulties and the expense of construction, it is not probable that the work will be carried out by the company. The statement has been made, nevertheless, that Hamilton capitalists are prepared to build the proposed line, provided power can be obtained from DeCew Falls.

BRANTFORD, PORT DOVER AND GALT ELECTRIC RAILWAY.

A COMPANY has been organized at Brantford, Ont., Mayor Elliott being one of the promoters, to construct an electric railway south from Brantford to Port Dover,



on Lake Erie, via Mount Pleasant, Boston, Waterford and Simcoe, a distance of about 50 miles. A northern branch will extend to either Galt or Ayr, about 30 miles distant, making a line 70 miles in length. The road will carry passengers and light freight, and will extend through a rich agricultural country and connect a number of small towns. The accompanying map showing the line is reproduced from the Street Railway Review.

The street railway company at Port Arthur, Ont., are considering the question of putting in a plant for lighting purposes.

SPARKS.

The London Street Railway Company have commenced work on double-tracking the remaining portion of the line to Springbank.

The Ottawa River Navigation Company, which controls the Carillon and Grenville railway, a line 13 miles in length, propose to convert the road into an electric system at an early date.

The South Essex Electric Railway Company are applying to the Ontario Legislature for power to build an electric railway from Windsor to Sandwich, thence to Amherstburg, Kingsville and Leamington.

The Desbarats & Northern Railway Company is seeking incorporation to build a steam or electric railway from St. Joseph's Island, Algoma, to a point near Desbarats Station, thence to Moose Factory, on James Bay.

Several gentlemen interested in the Ottawa street railway visited Montreal and paid a visit to Sohmer Park. It is proposed to run a similar park at the West End Park, Ottawa, where a large pavilion will be erected.

Messrs. J. J. Franklin, of Toronto, and George C. Rankin, of Detroit, are said to be at the head of the syndicate which proposes to build the Chatham City and Suburban Electric Railway. The council will be asked to extend the franchise to include electric lighting.

At the annual meeting of the shareholders of the Quebec Street Railway Company, held on the 2nd ultimo, directors were elected for the ensuing year as follows. Messrs. G. R. Renfrew, G. LeMoine, F. Tessier, D. C. Thomson, J. C. Thomson, S. J. Shaw, E. H. Taylor. At a subsequent meeting of the directors Gaspard LeMoine was elected president and G. R. Renfrew vice-president.

Incorporation is asked for the Ingersoll Radial Electric Railway Company, for the purpose of constructing an electric railway from Ingersoll to St. Marys, through the villages of Thames ford and Kintore, with branch lines to Tilsonburg and Brownsville. The capital stock is placed at $500,000, and bonding powers to the extent of $10,000 a mile are asked. Operations are to be commenced within two years.

It is reported that among the other attractive novelties which the Hull Electric Railway Company intend introducing next summer will be an electric water route between their proposed new hotel at Aylmer and their park at Point aux Pins. Piers will be sunk a short distance from shore to hold the poles for the support of the overhead wire, and a flat-bottomed boat with trolley will convey passengers to and from the park along the margin of the lake.

A bill to incorporate a new tramway and electric company has been introduced a few days ago. The new company propose to run cars to Bedford, through Rockingham, a distance of 8 miles, also to have the privilege of supplying electric light and power for manufacturing purposes; capital stock $300,000. Among the promoters are Messrs. E. Crowe, H. J. Crowe and A. E. Sulis, and the work is to be completed in three years.

The Fort Erie Electric Railway will apply to Parliament to increase the capital stock to an amount not exceeding $250,000; also to authorize the company to extend its railway from its terminus in the village of Fort Erie to Chippewa, through the villages of Fort Erie and Bridgeburg, for the purpose of constructing and operating a street railway within the limits of said villages. It is also proposed to construct a branch line from the main line of said railway north to the village of Ridgeway.

There has been for a considerable time disagreement between the Toronto City Council and the Street Railway Company as to the mode of determining the length of track on which the mileage should be paid. The city holds that curves, crossings and the like should be measured. The company, on the other hand, refuses to pay for the curves and crossings. As a result of this disagreement, the City Solicitor has entered an action against the Toronto Railway for $23,870 arrears of mileage, for a construction of paragraph fifteen of the franchise under which the mileage is paid and for a declaration that the city is entitled to $17,055 per quarter instead of $15,000, the amount now paid. The total amount involved during the term of the franchise is almost a quarter of a million. The suit will be brought to trial as soon as possible.

A dispatch from Niagara Falls, Ont., states that a deal has been consummated by which Alderman George Hanan and Mr. Edward Davis secure control of the Niagara Falls, Clifton and Drummondville street railway, a line three miles in length, extending from Niagara Falls, Ont., to Drummondville, now Niagara Falls South. The road is now operated by horses, and was controlled by New York parties, who held a nine years' franchise. It is understood that a Toronto syndicate were the purchasers, and that an additional extension of their franchise for ten years will be asked from the Councils of Niagara Falls and Niagara Falls South. It is probable that during the present year the motive power of the road will be changed to electricity, while among other improvements in view is the extension of the line to Fort Erie, opposite Buffalo, to connect possibly with some of the electric lines running out of Hamilton. Mr. George Hanan has superseded Mr. Black as manager.

CANADIAN GENERAL ELECTRIC CO.
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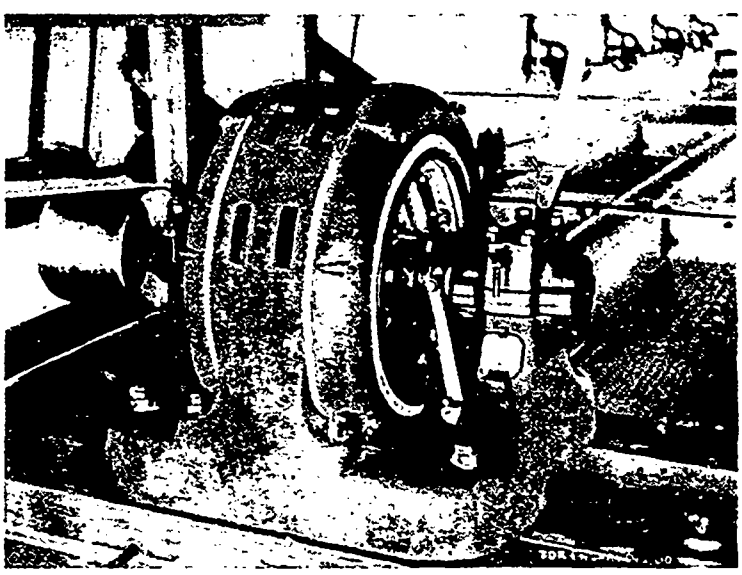
138 Hollis Street -	HALIFAX.	Granville Street - -	VANCOUVER.



INVERTED TYPE INDUCTION MOTOR, OPERATED FROM MONOCYCLIC OR THREE-PHASE CURRENTS.

The.... MONOCYCLIC System

Single Phase for Lighting —— Polyphase for Power

We have pleasure in referring intending purchasers of Alternating Apparatus for supplying **Light and Power from the same generator and circuit,** to the following companies which have purchased our Monocyclic Machines during the past eighteen months:

HALIFAX ELECTRIC TRAMWAY CO. -	300	Kilowatts	Capacity.
THE HULL ELECTRIC CO. - -	300	"	"
BROCKVILLE ELECTRIC LIGHT & POWER CO.	100	"	"
PORT HOPE ELECTRIC LIGHT CO. -	75	"	"
MATTAWA ELECTRIC LIGHT & POWER CO.	75	"	"
PARRY SOUND ELECTRIC LIGHT & POWER CO.	75	"	"
DUNNVILLE ELECTRIC LIGHT CO. -	75	"	"
JOHN SHEARER, BLAIR - -	75	"	"
D. KNECHTEL, HANOVER - -	75	"	"
KILMER, McINTYRE & CRAWFORD, DURHAM	75	"	"
NEW GLASGOW ELECTRIC CO. -	75	"	"
CONSOLIDATED RAILWAY CO., VANCOUVER	150	"	"

SPARKS.

A proposal to light Huntingdon, Que., by electricity is being considered.

Shubenacadie, N. S., proposes to have its streets lighted with electric lights.

The Moncton Manufacturing Co., of Woodstock, N. B., is seeking incorporation, to manufacture engines, etc.

A syndicate is said to be making arrangements for operating a cable car system at Rossland, B. C.

The British Columbia Electrical Construction Co., of Vancouver, B. C., has been dissolved. W. Brown continues.

The Reid Bros. Manufacturing Company, Toronto, manufacturers of bent iron pulleys, have gone into voluntary liquidation.

The City of Quebec have renewed the contract for street lighting for five years with the Montmorency Electric Power Company.

The foundation for the new electric light and power plant at Trail, B. C., is completed, and the dynamos and other machinery are being placed in position.

The annual meeting of the shareholders of the Canadian General Electric Company was held in Toronto on February 8th. The report for the year 1896 showed assets amounting to $1,213,963.41. The directors were re-elected as follows: President, W. R. Brock; Vice-President, H. P. Dwight; Second Vice-President and Managing Director, Fred. Nicholls; Board of Directors, Hon. Geo. A. Cox, Robt. Jaffray, J. K. Kerr, W. D. Matthews and Hugh Ryan.

The seventeenth annual report of Mr. E. O. Champagne, boiler inspector of Montreal, shows that during the year he made 1,720 visits and conducted 706 examinations of boilers, submitted 430 to hydraulic pressure and 44 to hydrostatic proof. Ten were entirely condemned and 129 declared defective. Fifty new boilers were installed and inspected. The inspector issued 317 notices and 474 certificates of inspection, and issued 516 certificates to mechanics.

The annual report of Mr. P. Bowler, city electrician, New Westminster, B. C., states that the number of incandescent lamps in use in 1896 was 4,481, an increase of 1,555 during the year. The report recommends the extension of the system, at an estimated cost of $3,500. The present staff of the electric power house is one electrician, two engineers, two firemen, two trimmers, one lineman and one dynamo tender. The cost of street lighting is placed at the same figure as the year before, viz., 35 cents per light per night.

Mr. Joseph Cozens, the original promoter of the proposed Sault Ste. Marie and Hudson Bay Railway, who took the first steps towards obtaining a charter for the road in 1889, advocates the adoption of electricity as the motive power. In a recent paper read before the Ontario Land Surveyors, he says: "Concerning the railway itself, I trust it will be the first electric through line on the continent. The water powers on the route will furnish more than sufficient power, and that electricity will be used for railways of the future is beyond question.