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CANADIAN
ELECTRICAL NEWS
AND ENGINEERING JOURNAL

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NEW SERIES, VOL. X.—No.

MARCH, 1900

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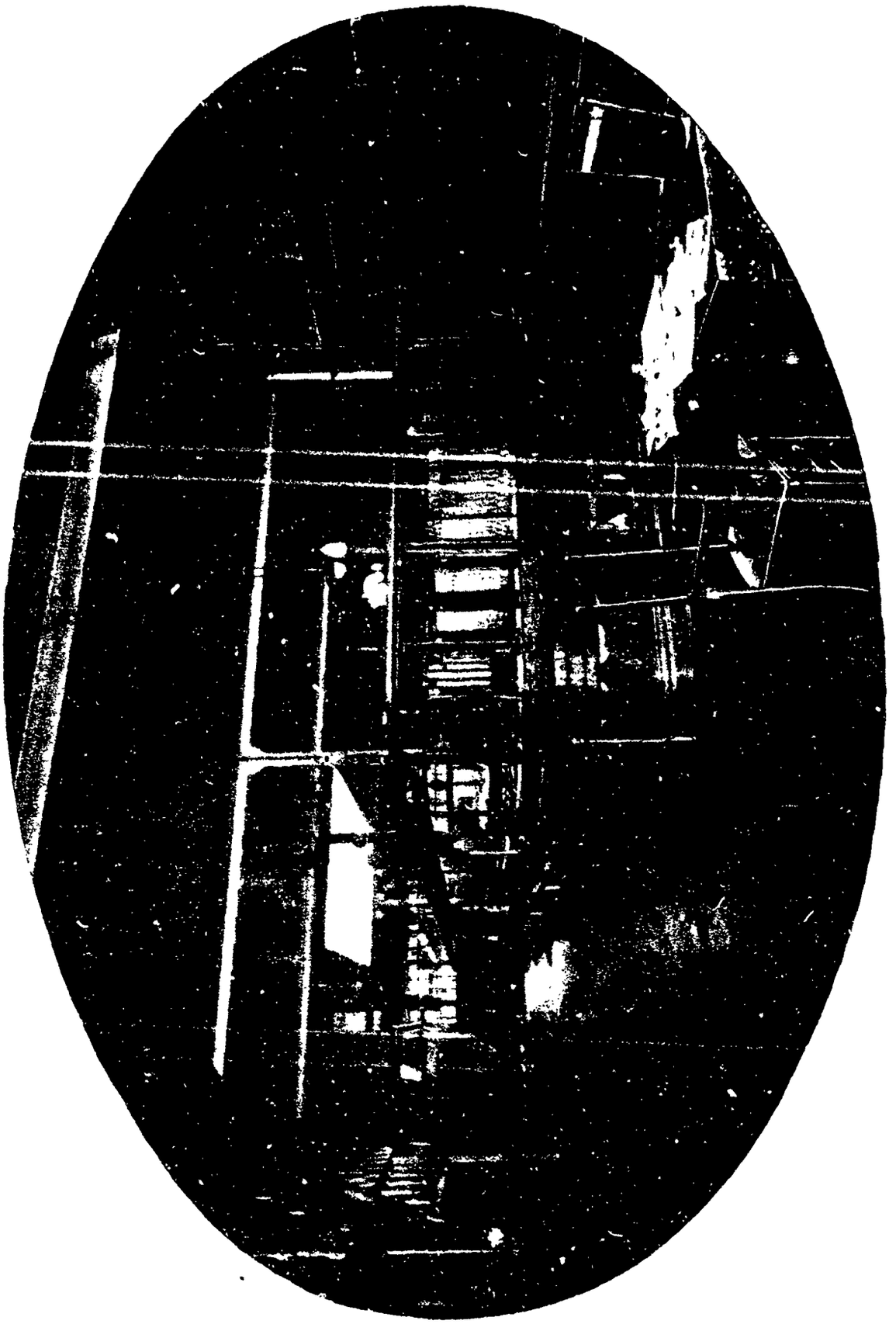


CANADIAN GENERAL ELECTRIC CO. LIMITED TORONTO

RIOR VIEW OF GENERAL OFFICES

NEW OFFICES OF THE CANADIAN GENERAL ELECTRIC COMPANY.

Owing to the rapidly increasing growth of their business, the Canadian General Electric Company last year found that the accommodation at their head office, 65 to 71 Front street west, Toronto, had become inadequate for their needs. They consequently leased the entire building, Nos. 14 and 16 King street east, and had it remodelled to suit their present requirements and also with a view to providing future accommodation. The alterations were completed about the first of September last, at which date removal to the new premises was commenced.

The new offices are conveniently situated in the centre of the business district of the city. The building is a four story one, with a total floor space of over 25,000 square feet. It is equipped throughout with modern facilities and a completeness of detail particularly suitable for enabling the company to meet the growing demand and better serve the wants of their customers throughout the Dominion.

On the ground floor are situated the general manager's office, board room, offices of the executive officials, and the general offices. A handsome suite of private offices has also been provided for the convenience of out-of-town customers, to whom the company extend an invitation to make use of them for business appointments, etc.

On the first floor is a nicely arranged show-room and a display of samples, representing a wide range of electric light, power and railway material, and general supplies, including switchboards, station and portable measuring instruments, motors, transformers, enclosed arc lamps, fan motors, electric cooking and heating appliances, and numerous other devices, many of which are shown in operation. Those who are directly or indirectly connected with the electrical industry will find a visit to this show room of much interest.

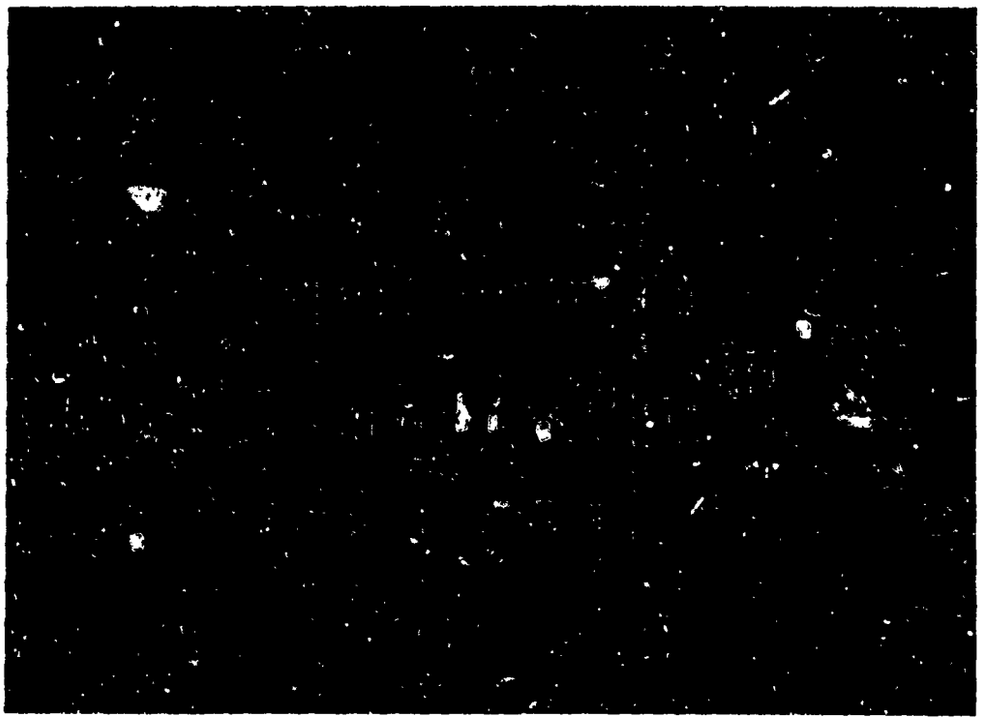
The warehouse is also located upon the first floor and includes the second floor and basement, with a total floor area of about 17,000 square feet. A large and well assorted stock of staple supplies and material is carried. Each floor of this department is connected by a private warehouse telephone system.

CANADIAN GENERAL ELECTRIC COMPANY, TORONTO.—GENERAL MANAGER'S OFFICE.

The entire third floor is occupied by the engineering department, and is laid out in general office, designing, drafting and testing departments.

All of the different departments and floors are rendered easy of access by means of an electric passenger elevator. Among other salient features of the establishment may be mentioned a local telephone system with a central office in the building, thus enabling every department to have direct communication with each other as well as to outside points. A long distance telephone and telegraph office (the Company having its private wire to the works at Peterboro') are also conveniently located in the general offices.

We might go on indefinitely dealing with the innumerable details which go to make up the many valuable appurtenances and conveniences of these offices.



CANADIAN GENERAL ELECTRIC COMPANY, TORONTO.—VIEW OF WAREHOUSE.

Mention might be made, however, of the fact that most of the building is lighted by C. G. E. 5-ampere direct current enclosed arc lamps. This system, which is generally conceded to be one of the best means of artificial lighting, is most satisfactory.

For the accompanying views, showing the general manager's office, general offices and warehouse, we are indebted to the Canadian General Electric Company.

CENTRAL ONTARIO POWER COMPANY.

A CHARTER has been granted by the Ontario legislature to the Central Ontario Power Company, Limited, with a capital of $750,000. The objects of this company are to develop the Burleigh Falls water power, to carry on the business of an electric light, heat and power company in Peterboro', Lindsay, and vicinity; and, subject to provisions of the Street Railway Act, to construct an electric railway in the town of Peterboro', village of Ashburnham and townships of Smith and North Monaghan. The incorporators are: J. A. Culverwell, managing owner of the Burleigh Falls water power, Honourable Richard Harcourt; Eugene Coste, engineer, F. W. Barrett, Dr. Edward Adams, all of Toronto; Robert James McLaughlin, of Lindsay; James Kendry, Peterboro', H. J. Taylor and H. L. Larkin, St. Catharines, and Honourable Peter McLaren, Perth.

The twenty-third annual convention of the National Electric Light Association of the United States will open in Chicago on the 22nd of May next.

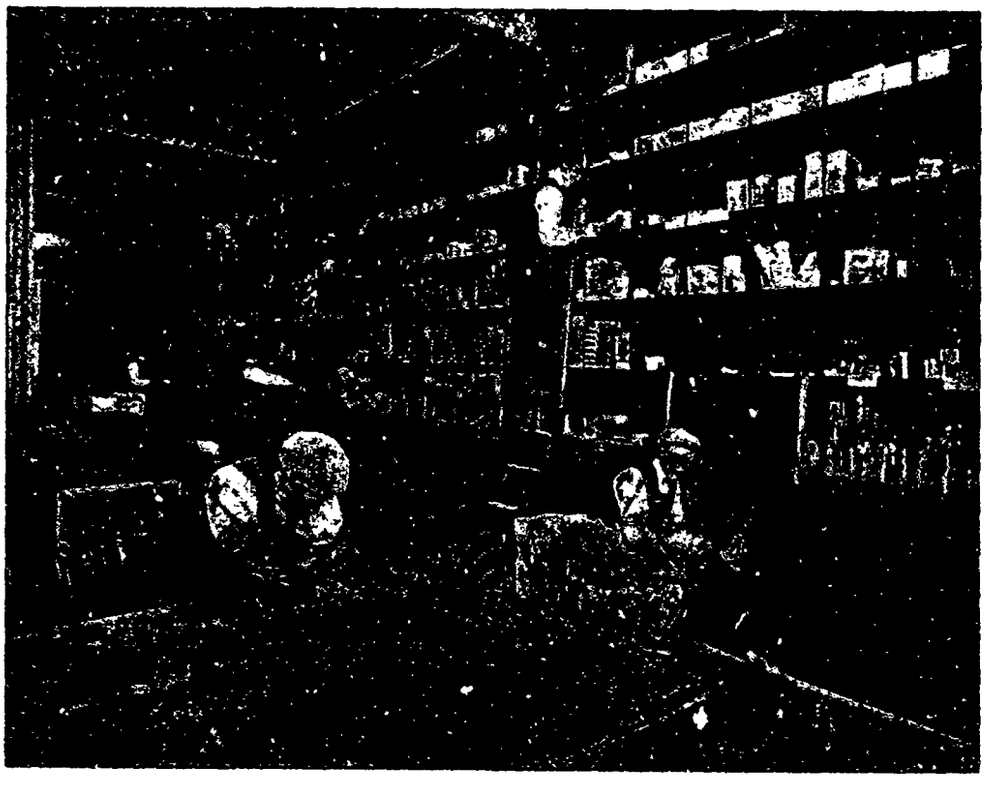
Mr. W. J. Clark, of Toronto, has made application to the Ontario Legislature to construct an electric railway from Mine Centre to Dryden, Ont., and to acquire water powers along the proposed route.

The new electric light plant installed by the city of Winnipeg was put in operation a fortnight ago, and is said to work satisfactorily. There are 212 arc lights, and the total cost of installing the system was in the neighborhood of $60,000.

Mr. James Ferguson, of New York, was recently in Vancouver forwarding a scheme to transmit electric power to that city from Slave river, 20 miles distant. It is said that a company has been formed and that $200,000 will be expended in installing a plant.

Power's Directory of the electric lighting central stations in the United States, Canada and Mexico continues to reach us every three months. The subscription price of this work is $4 per year, the publishers being E. L. Powers Company, 150 Nassau street, New York.

The Power Publishing Company, World building, New York, have sent us a copy of a recently issued monograph on "Condensers." It consists of a series of lectures and articles upon the subject reprinted from the columns of Power and contains, a vast amount of information. The price is 50 cents.



CANADIAN GENERAL ELECTRIC COMPANY, TORONTO—VIEW OF WAREHOUSE.

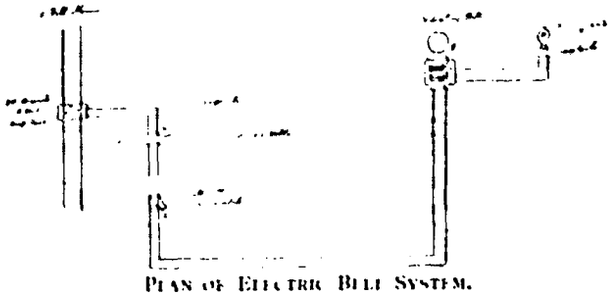
PLAN OF ELECTRIC BELL SYSTEM.

MONTREAL, February 1st, 1900.

Editor Electrical News

DEAR SIR, Thinking that some of your subscribers may have occasion to use ordinary electric bells on an electric light circuit, I enclose sketch and herewith offer explanation of a plan found to work very satisfactorily.

By ordinary electric bells, I refer to those which are generally connected with 2 or 3 cells of open circuit battery. There are bells wound to operate, I believe, on 110 volts D.C., but same are not "common stock," and it means delay to procure them. Assuming, there-



PLAN OF ELECTRIC BELL SYSTEM.

fore, that we have a bell having coils whose resistance are from 4 to 7 ohms, and that the factory manager, having had trouble with batteries running down, and with small boys among the help "monkeying" with same, we will install as per sketch from the electric light circuit, D.C.

Explanation: We use 52 volt lamps simply so that if there is a bad ground one of the lamps will receive the full voltage and burn out, thus opening the line. The shunt lamp must be the standard voltage of the circuit, in this case 110. The only thing requiring any experiment is this shunt lamp; possibly an 8 or 10 c.p. may be found to act better than 16 c.p. The shunt lamp is connected to the pivot supporting the armature and to the pillar supporting contact screw back of armature, the object of this shunt lamp being to act as a condenser and absorb the spark which would otherwise ruin the platinum contacts in time.

The switch (or button) being double-poled, the main part of the circuit is open unless just at such time as the bell is in operation. If more than one bell is desired to be rung, cut the wire at points shown x x and continue the circuit, using bells connected for single stroke. These S S bells will, of course, vibrate also in unision with the stroke of the vibrating bell which controls them.

No new principle is involved here, but I am not aware that it has been used thus, although I have seen bells rung by being put in series with one 16 c.p. lamp (on one wire), said lamp being of the standard voltage of the circuit. It is apparent in this style that the sparking of contacts has not been provided for, neither has any provision been made against a 'ground,' as is done in method here shown.

Trusting the above may be of use to some reader, and if acceptable I may give you later an arrangement of alternating current used with success.

Yours truly,

SUBSCRIBER.

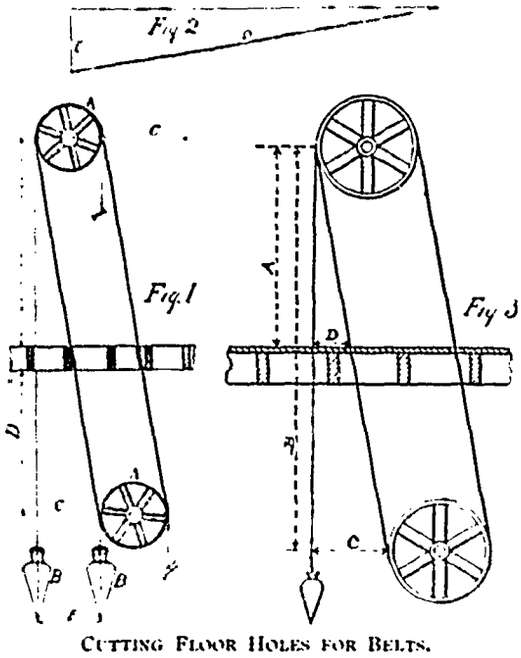
N. B.—Use porcelain insulators and No. 14 electric light wire for installing.

The corporation of Ottawa, Ont., desires tenders by March 13th for fire alarm supplies and coils.

HOW TO CUT A BELT HOLE.

Correspondents to the American Miller have been telling how to find out just where to cut a belt hole in a floor. Fig. 1 shows one method, the advocate which says for it: A A represent the two pulleys. We will draw the line, with plumb-bob B attached, over the top pulley, allowing it to dot the floor, where we will bore a hole for the string to go through. We then allow the plumb-bob to swing clear of this hole and below the lower pulley. Then for accuracy we place a line over the face of the lower pulley, with a plumb-bob attached to it also. Now, to find the degree the two pulleys represent, we measure the distance between the points of the two plumb-bobs, on the line marked E. We then measure between lines C C representing the center of each shaft. By reducing these two measurements to quarters of an inch we find the degree of the bevel D, which is shown in Fig. 2. Set the bevel to this degree, place it on the floor where the hole is to be cut, and rest it on a level; place a straightedge on the face of the pulley, allowing one end of it to rest on the floor; bring it to the same pitch as your bevel and you have the center of the hole.

The one contributing the plan shown in Fig. 3 says: All we want is a man with a small auger, a plumb-bob and line, a saw, pencil and measuring tape. Let him plumb down from the face of the upper pulley, dot the floor, bore a hole and pass the plumb line through so it will swing clear from the upper pulley. Measure the distance from center of top pulley to floor, which is shown in the sketch as line A. Then measure from center of top pulley to line C, running through center of bottom pulley. Finally, measure the distance from plumb line to face of lower pulley, which measurement forms the C. Multiply A by C and divide the product by B, which will give the length of D. For example, distance A is 8 feet, distance B 12 feet, and distance C 20 inches. Then 8 times 20 equals 160, divided by 12 equals 13⅓ inches, which is the distance from plumb line to edge of belt hole. Allowance must be made for belt and lacing. If the two pulleys are of the same size the second belt hole will go through the floor at a distance from the first belt hole equal to the diameter of the pulley. If the pulleys are of different sizes, the distance will be about equal to the sum of the diameters divided by 2. Bore small holes and stretch



CUTTING FLOOR HOLES FOR BELTS.

the plumb line over pulley faces to see if measurements are correct, and then saw in whichever direction the holes must go to give the belt plenty of room.

The Canada Atlantic Railway Co. have inaugurated a system of electrical clocks at terminal points on their line. The clocks are run by storage batteries, and do not require winding. Time is taken from them all along the line at 11 o'clock a. m. each day.

The experts appointed to examine the applicants for the position of engineer of the new municipal building in Toronto have reported that in their opinion none of them reached the necessary standard, and it has been recommended that the council again advertise for applicants for the position. The salary is to be $1,250 per year.

ELECTRIC LIGHTING AND POWER PLANT, VICTORIA HOSPITAL, LONDON, ONT.

One of the most modern and efficient equipments installed during last year was that of the Victoria Jubilee Hospital at London, Ontario. A rigid specification was prepared by the Gilbert Wilkes Engineering Company, of Detroit, under whose supervision the work was installed and tested.

The plant, consisting of two direct connected engines and generators of 43 h.p and 32 k.w. capacity respectively, were to be of noiseless operation, to have a regulation within a two per cent. limit, and a capability of being over-loaded twenty-five per cent. for several hours without injury. The contract was secured by the Electrical Construction Company, of London, Limited, who have installed the entire plant without an objection being raised, and it has been in use now about five months, giving the very best of satisfaction.

Being a duplicate plant, it has been customary for the engineer in charge to run each unit for twenty-four hours, as light and power are required continuously throughout the building. However, beginning with Saturday, 17th February, one of the generating sets was started on a seven day continuous (night and day) run, at the end of which temperatures were taken, showing the following remarkably low temperature rise of the different parts above the surrounding atmosphere :

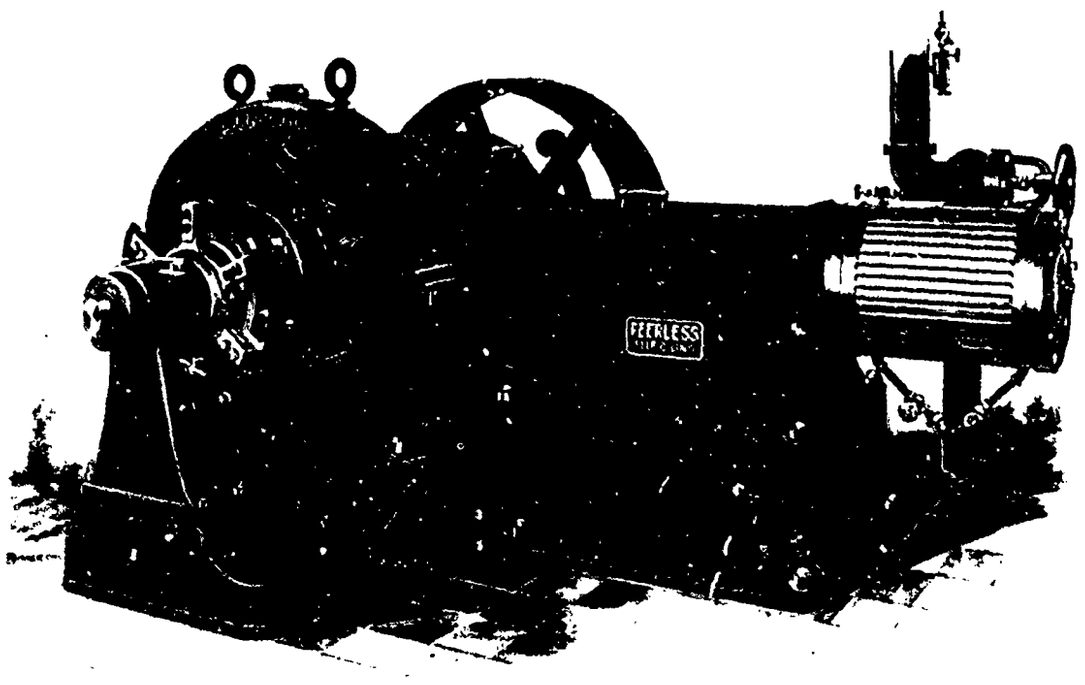
Commutator, 11° centigrade.
Armature core, 17° centigrade.
Crank pin journal, 17° centigrade.
Left bearing of engine, 13° centigrade.
Right bearing of engine, 11° centigrade.
Oil of engine, 16° centigrade.
Field coils of dynamo, 9° centigrade.

Considering that a limit is allowed in general engineering practice of 40° and sometimes 50° centigrade, the above figures are exceptionally satisfactory. During the week the load had varied between 10 per cent. over-load and one-fifth of full load, no adjustment of the brushes being necessary, nor was any special attention whatever required.

The engines, supplied by E. Leonard & Sons, also of London, are of their Peerless self-oiling type, and are lubricated automatically in all parts without attention. Renown engine oil is used for all bearings, and Capitol Renown for the cylinder.

The equipment is electrically controlled by means of a beautiful pink Tennesee marble switchboard, provided with Weston instruments, ten light circuit switches, five motor circuit switches, main switches, pilot lights, ground detectors and rheostats, making a very compact and well arranged board.

The plant also furnishes power for two direct connected elevator equipments, installed by Messrs. Malloch & Co., of London, the electric motors and controllers of which were furnished by the Electrical Construction Company, of London, Ltd., who also installed two motors direct belted to fans, which are used to exhaust air from the entire building. In all, the Victoria hospital is deservedly proud of its plant, which is entirely of London manufacture.



Electric Lighting and Power Plant, Victoria Hospital, London, Ont.

THE GENERAL DEMAND FOR EDUCATION.

America has become the workshop of the world. Immense resources and economic methods of manufacture enable her to compete successfully with all other manufacturing countries in their own markets, and during the next few years the expansion of her trade will become the talk of the world.

The great impetus recently given to all technical trades and professions by the announcement of a new era of commercial prosperity, has forcibly brought to the attention of the public the great value of technical education, acquired simultaneously with practical experience. The graduate of the ordinary technical university is obliged to accept a minor position in his profession, and trust to his education for rapid advancement. But the ambitious mechanic can make immediate application of his technical knowledge and secure, in the shortest possible time, a lucrative position.

The various engineering colleges are open to but few. Night schools are only found in the larger cities. The International system of instruction by correspondence fully meets the requirements of ninety-five per cent. of the people, by supplying the education for which employers are willing to pay, and pay well.

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

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The Canadian Electrical Association.

A MEETING of the Executive Committee was held at Ottawa recently when all preliminary arrangements were made for the Annual Convention. The dates selected are the 27th, 28th and 29th of June. The headquarters during the Convention will be at the Russell House, where the meetings of the Executive and of the Association will take place. A number of suggestions were received from members relative to subjects for papers, and a committee was appointed to make a selection of subjects and authors. A strong committee was appointed to make the necessary local arrangements, and it is certain, in view of the success which attended the Convention previously held in Ottawa, that the approaching meeting will be one of the best in the history of the Association.

The Discovery of Commercial Incandescent Lighting.

THE article in our last issue referring to the invention of incandescent lighting has awakened considerable interest. The statement was omitted from this article that Mr. Edison's first incandescent lamp patent, No. 214636, was issued April 22nd, 1879, and that the basic patent on high resistance filament was issued May 4th, 1880. Mr. Edison filed his first application for a patent on a paper carbon filament December 11, 1879. The patent of April in that year was really a thermostatic regulator for each lamp. The Ottawa Journal, in referring to the article, quotes the remark of a cynical scientist, that "Mr. Edison has never invented anything, but that a skilful adaption of the electrical adaptions—for the term 'invention' when electricity is the master is rather an uncertain term—and a free use of newspaper advertising has given him his notoriety." The Journal questions our statewent that the principle of electric lighting was discovered in Toronto prior to Edison's invention, and dips deep down into the history of electrical science to prove that the principle was known prior to the date of the Toronto discovery. Our statement referred to commercial incandescent lighting, although it was not stated. It is a well known fact that the use of carbon enclosed in a vacuum or gas for the production of continuous electric light was not discovered until the period mentioned. It was well understood, previous to that time, that light could be obtained by heating carbon by means of an electric current, but the carbon, when thus heated in the atmosphere was speedily destroyed, and the light could only be maintained for a very brief period. In connection with this subject the reader is referred to the chapter reproduced in another column from a Brochure entitled "Wireless Telegraphy," by Richard Kerr, F. G. S., describing experiments made in Scotland by James Bowman Lindsay, who is said to have succeeded in lighting his room by electricity, and to have publicly exhibited an electric lamp in Dundee in the year 1835.

The Nernst Lamp.

Referring to the Nernst method of electric lighting as invented by professor Walter Nernst, of Gottingen, Germany, we pointed out in a previous issue that a great drawback to the commercial development of the lamp is the necessity of heating the rod before it will light. Experience has proved that this has been an almost insurmountable difficulty. Numerous patents have been taken out in Germany for a quick-acting, reliable automatic heater, and while a measure of success has been

attained, the practical difficulties do not yet seem to have been overcome. We have read a brief account of the first commercial application of this lamp, and it is due to the inventor to state that the claims of high efficiency have been borne out. When Prince Albert of Prussia visited the University of Gottingen, his apartments were lighted with Nernst lamps, and now the lamp is being advertised in that city for house and store lighting. The lamps are to be used on the regular 110 volt circuits. A 25 c. p. lamp operates on 33 watts, or 1.3 watts per candle power. This is about double the economy which has been attained by the incandescent lamp. The Nernst lamps thus far used have the heater placed in close proximity to the staff, and consequently can only be used for low candle power. Another type of Nernst lamp has been invented, however, which is designed for higher candle powers, and which, it is thought, may overcome the objections above referred to. It cannot be said that the experiments have produced results which give promise of bringing it into general use. and for the immediate future at least the present form of vacuum lamp will continue in use. In this connection we may refer to some statistics of the incandescent lamp submitted by Mr. Barstow to the Brooklyn Institute of Arts and Sciences. Mr. Barstow pointed out that the incandescent lamp is now in its twentieth year and that the total production in the United States is about 20,000,000 per year. The different varieties and forms in which the lamp appears number over 147,000. The price of the lamp has been reduced from one dollar to eighteen cents each; and while the cost today is but one-fifth that of twenty years ago, the efficiency has been increased but three times.

Is Electricity Dutiable?

THE United States Treasury Department has been asked to give its decision as to the legality of collecting a duty on electricity. The Ontario Power Company purpose generating electric power on the Canadian side of Niagara Falls and transmitting it across the border, where it will be utilized for light and power. Those who desire that a duty should be placed on the electric current argue that it is a vendable and valuable product of manufacture, which can be easily and accurately measured. On the other hand, it is declared that the electric current cannot be regarded as an "article" within the meaning of the law, that it has no power to do work but only serves as a means of transmitting power, and that it is utterly impossible to import electricity because it instantly returns to its source. This question has alway been a debatable one. Some years ago the Treasury Department of the United States handed out a decision to the effect that no duty could be collected. The Dominion Government in 1893 took an opposite view, the Controller of Customs deciding that electricity brought into Canada from the United States should be subject to a duty of twenty per cent., on the ground, if we remember rightly, that it was an "unenumerated manufactured article." The *Electrical Review*, in support of its contention that no duty can be collected, makes the following original comparison: "Suppose two pulleys, one on each side of the Niagara river, with a rope or belt connecting them. This arrangement would transmit power if one of the pulleys is turned. Similarly, while it was running there would be a more or less rapid importation f the belt, and an exactly similar exportation. And it could not be said with truth that such an arrangement constitutes an importation of power, for the power, in its applicable form, does not exist in transit, but only at the driven pulley. Now this arrangement is an exact analogue of an electrical power transmission."

The Proposed Dodge Telephone Company.

IN another column will be found a letter from the promoter of the proposed Dodge Telephone Company in reply to the article printed in our February number referring to this company. This letter when read in connection with our previous article, must be regarded as being a clever piece of special pleading rather than a clean cut defense of our criticisms of the company's business methods. For example, the promoter states that the company has not decided whether to apply for a Provincial or Dominion charter, and that the decision with regard to this matter will largely depend upon the number of applications which may be received for preferred stock. In another part of his letter, however, he states that the purpose of the company is to operate at first in the provinces of Ontario and Quebec, and afterwards through the Dominion. Seeing that the company could not operate in the two provinces mentioned without a Dominion charter, the reason given for deciding upon the character of the charter and for the delay in obtaining a charter falls to the ground. We deny the contention that it is a usual practice for the promoters of a company to solicit stock before a charter has been obtained and a board of directors appointed. On the contrary, the usual course is to first secure a charter, and second to appoint a strong board of directors in whom the public will have confidence and who will therefore induce investments in stock. If as the promoter states a large number of applications for stock have already been received, there should be no difficulty in appointing a board of directors and in publishing their names. The investing public have also a right to know the character of Mr. Dodge's patents for which he is to be paid the magnificent sum of $1,500,000. As the fundamental patents on telephone apparatus are public property, it would appear that Mr. Dodge's patents must be on subsidiary devices or combinations which cannot be considered essential to the conduct of the telephone business, and the intrinsic value of which is likely to be far below the sum which the company propose to pay to Mr. Dodge. Special stress is put upon the necessity of organizing the company in such a way as that competitive companies shall not be able to secure control of the stock, but the public have a right to enquire who is to guarantee that Mr. Dodge will not sell out his stock, and thus place the control of the company in other hands. Our readers will observe that the promoter offers to waive the clause in the company's prospectus to which special objection was made in the previous article, which gives the company the right to apply to expense account the deposits of applicants for stock, even in cases where their applications may not have been granted. This clause has evidently been dropped because it was found too hot to hold, and we predict that other changes will also have to be made for the satisfaction and security of the public before the proposed company can successfully establish itself.

The Columbia Telephone Co., of Grand Forks, B. C., now operate over 500 miles of line. They propose to extend their system this year into the Similkameen country.

TELEGRAPH and TELEPHONE

DISCOVERY OF WIRELESS TELEGRAPHY.

THE following chapter, reviewing the life of James Bowman Lindsay, who in his day made wonderful experiments with electricity, is taken from a brochure on "Wireless Telegraphy," by Richard Kerr, F.R.S :

JAMES BOWMAN LINDSAY.

Born 1799 Died 1862.

In giving an account of any discovery or invention, it is but right to give honor to whom honor is due. Therefore we cannot refrain from paying a tribute to the memory of the man who, in these islands at least, was the first to suggest a method of signalling across space without intervening wires. Not only did Lindsay suggest, he also carried out successful experiments in proof of his theories.

It would not be easy to name a greater genius than James Bowman Lindsay, nor a more noble character. Certainly few, if any, have accomplished so much in a life-time of penury. All his life long he must have pinched himself to the utmost limits in order to purchase materials for his numerous experiments. He worked, and worked alone, on the borders of starvation. He had no house ; only one room could he afford, but that one room had in it more than any palace in the kingdom. It was lit up by an electric light of his own installation in the year 1835. It is difficult to realize that sixty-three years ago a room could have been so illuminated. That same room was famous for other reasons. It was here he wrote several of his works, and that portion of his dictionary in fifty different languages, which, in his own handwriting, is in a glass case in the Dundee Museum.

When I saw that manuscript, and the vision of his life struggle passed in a moment through my mind, I removed my hat in reverence for the memory of that poor but rich linguist of Dundee. A short account of what he accomplished under enormous difficulties will be acceptable now that telegraphy without wires is occupying so much attention.

James Bowman Lindsay was born in 1799 at Carmylie, and was taught weaving, and from earliest youth he endeavored to educate himself. In 1821 he entered St. Andrews as a student, working at his trade during the college recess. In 1829 he was appointed lecturer and teacher at the Watt Institution, Dundee. After finishing his arts course, he became a divinity student, but never took license. In 1841 he was appointed teacher in Dundee prison at a salary of fifty pounds. He was a diligent student of science, made many discoveries, and published many works. It was possible that he was the first to use electric light. Not only did he succeed in lighting his one room in 1835, but he publicly exhibited an electric lamp that same year in Dundee. In 1845 he suggested the possibility of extending the electric telegraph to America. In 1853 he maintained that it was possible to establish electrical communication through water without connecting wires. In 1854 he patented this invention. That same year he conducted experiments in London and at Portsmouth, where he successfully telegraphed without wires across water 500 yards wide. In 1859 he telegraphed in this manner across the river Tay at Glencarse, where it is about half a mile wide, and read a paper on this subject before the British association assembled at Aberdeen.

In presence of the members he conducted experiments at Aberdeen docks, which successfully proved the correctness of his theories. During the last two or three years of his life he had a pension of one hundred pounds granted by the Queen on the recommendation of Lord Derby. In his experiments Lindsay was very successful but it is a matter of doubt whether his suggestion as to signalling to America would have met with success, even if facilities had been granted for the trial. At the same time, it is hardly fair to condemn the suggestion in the absence of the man. The genius of the mind that could invent wireless telegraphy, and the indomitable energy that could encounter the labour of writing a dictionary in fifty languages, cannot easily be set aside or even deemed in error ; we do not know all the resources that were behind the suggestion. That his was a prescient mind also will be seen in the remarkable words inserted in the advertisement announcing the opening of his science classes, which appe in the Dundee Advertiser of April 11, 1834: "Houses and towns will in a short time be lighted by electricity instead of gas, and heated by it instead of coals, and machinery will be wrought by it instead of steam, all at a trifling expense." Fancy all this foretold sixty-four years ago. Some of Lindsay's experiments were made in the presence of a turnkey of the gaol and a young friend who is now a venerable old gentleman, highly respected in Dundee. This friend, Mr. Louden, sr., tells me that Lindsay would station them on one side of the Tay, requesting them to watch carefully the needle he had placed in position, and to note how it moved. He would then insert his plates in the water on their side of the river, and crossing over to the opposite side, would complete his arrangements. His battery, containing twenty-four Bunsen cells, would be set in action. Later on Lindsay would return, and question them eagerly as to the behaviour of the needle. The different movements to the right and left would be noted, and, on comparing them with the messages he had sent from the other side, he was perfectly satisfied he had accomplished telegraphy without continuous wires. He would then return to his little room as happy as possible. It is comforting to know that the studious Lindsay, with all his poverty, got some satisfaction and joy in this life. Nowadays we can purchase batteries and wires and all electrical appliances at a moderate cost, and every detail ready for immediate service. It was not so in Lindsay's day. He had to make up his cells, and possibly to coat and otherwise insulate his wires. Mr. Louden knows that Lindsay had to make his own intensity coils, and he tells me that one particular coil used in his earlier experiments was 4½ feet long and contained five miles of wire. Think of it. Think of the cost, and where the money was to come from. Think of the patience of the man with primitive and limited appliances. The modern experimenter in electricity has no difficulties compared with those combated by Lindsay. Besides, in Lindsay's case, more wire, more acids, more metals, ment less food, less new clothes, less comforts of all kinds. Before looking into this remarkable room of his—which if now existing would be a sacred spot to the scientific mind of to-day—let us refer once more to his practical experiments. One of the first demonstrations of his theories took place at Earl Gray dock, Dundee, in presence of many men of science. He immersed seperarate plates in each side of the dock, and transmitted messages with ease and accuracy. Going to a wider expanse of water, he repeated his experiments across the Tay at Dundee and Woodhaven, where the river is nearly two miles wide. These wonderful experiments were the chief topic of conversation at that time in Dundee, but nothing was done to give them a practical bearing. This was not Lindsay's fault. The business of the philosopher is to find out the mysterious forces in Nature, and simply to indicate their application. It remains for others, who have the necessary capital and practical ability, to adopt the ideas and suggestions and to shape them to a useful result. The philosopher's part was done and well done. If the term "philosopher" does not apply to Lindsay, it never applied to any man. How is it that there is no memoir to this man's life and doings? Where is the statue to his memory in Dundee? I have seen statues in large cities to the memory of men not worth remembering—men who rose to fame on other men's shoulders ; men who, in point of morality and genuine worth, were not fit to enter his little room, or to polish poor old Lindsay's boots. But if Lindsay's wishes could be ascertained, he would ask for no statue. It is more than probable he would suggest a large lecture hall, to which the public could have free access to hear unfolded the grand mysteries of Nature, to the study of which his own life was devoted. Doubtless the time will come when the people of Dundee will do their duty, and honor themselves by honoring the memory of Lindsay. Few men who ever saw light on these islands of ours so completely ignored self on behalf of science, or with so much earnestness of purpose have struggled against poverty and accomplished so much ; for it must be borne in mind that "Lindsay's work as a linguist was as remarkable as his scientific discoveries, and would have made a reputation for him rivalling that of Mezzofanti."

But we have not yet peeped into those famous rooms of his. Sir W. C. Leng writes : "James Lindsay the learned Carmylie weaver, died while I was in Dundee, 1862. His rooms (two rooms now that he had a pension) on a flat near the harbor, were walled round with books, and had stacks of books on the floor. His great work in manuscript—a dictionary of twenty-six* languages, lay arrested by death on the table.

"He had got a volume of ponderous bulk, and had ruled it in narrow lines across and across, so as to allow of the equivalent of each word being written in many languages, in a small hand, on the same line as the original. Very pathetic was the testimony borne by that book to the old man's ambition to leave something monumental behind him, and the manner in which his hand had been stopped in the midst of his labors."

*It was a dictionary of fifty languages.—R. K.

THE DODGE TELEPHONE COMPANY OF CANADA.

To the Editor of the ELECTRICAL NEWS:

SIR,—We observe, not without some degree of satisfaction, that the prospectus of the proposed Dodge Telephone Company of Canada, Limited, has received attention at the hands of your editorial department in the February number of your journal; and in reply to your criticisms, which we will endeavor to take up, point by point, as closely as may be possible under the circumstances, beg to submit the following statements:

We believe it is not at all unusual for companies of a broadly public character to solicit subscriptions for their stock, prior to the work of organization being entirely completed. And there exists some excellent reasons in their particular instance for deferring for a time this important step. In the first place, the proposed company can procure incorporation under two different joint-stock company acts—the Dominion and the Provincial. The chances are certainly at present all in favor of Dominion incorporation; but a good deal will depend upon the total amount of the 8 per cent. preferred stock, which will be taken up and accepted during the next three or four months. We desire to proceed surely and at the same time very cautiously; and if a sufficient quantity of this stock is placed within a few months hence in hands perfectly satisfactory to the management, a Dominion charter will certainly be obtained. Moreover, we are advised that it may be advisable to apply either to the Dominion, or to the Local Legislature—which will depend, of course, upon the particular Act that will be chosen for our purposes—for certain special legislation, that may be desirable, if not absolutely necessary, in our interests.

With regard to the issue of the prospectus before the Provisional Board of Directors was filled up, we may simply say that we are extremely anxious to select a Provisional Board having the very widest and most representative character possible, and this work has as yet not been finished; still we hope, within a very short period of time, to be able to place before the public a Board whose composition will be equally satisfactory both to ourselves and to the investing public.

With regard to the holding back of a very large block of, and a controlling interest in, the Stock, we can give several reasons, which we consider ample justification for the adoption of this policy.

In the first place, it is no secret at all among those conversant with the manipulation that frequently occurs in connection with the launching of such enterprises, that such an active competition as is intended in this case—which competition is further certainly in the very best interests of the general public—could be prevented in the easiest possible manner by the simple expedient of securing subscriptions for a controlling interest in the stock of the company. This plan was successfully adopted a few years ago in Montreal, and the principal promoter in the present company was still more recently foiled in his plans in New England by a somewhat similar subterfuge. And he thought that in this very instance he had the greater reason to complain, in view of the fact that he was sold out by intimate friends, whom he had benefitted, and who would have been benefited in still greater degree by the continuation of the system which he had been chiefly instrumental in calling into active existence.

Now it may be well to state at this point, and in the most emphatic manner, that the promoters of this company have but one object in view in bringing the claims of this projected telephone company before the public—the establishment upon a permanent basis of a strong independent telephone company to operate, first, in and between the large cities of the Provinces of Ontario and Quebec, and afterwards throughout the remaining suitable parts of the Dominion. We find an impression prevailing in some quarters that it is in the plans of the promoters to sell out eventually to the existing company, but there is absolutely no ground whatever for such a report, which may well have been put in circulation by interested parties. However, enough has happened elsewhere in the United States to give color to such rumors, although the results prove with equal force that the existing company eagerly takes advantage of every available opportunity for effectually extinguishing opposition by a purchase. The controlling interest simply in the Detroit and New State Independent Telephone Companies, for instance, recently cost that organization $1,245,000. The capitalization in question amounted to $2,500,000, of which some $1,400,000 was paid up.

The common stock in the proposed Dodge Telephone Company represents in addition compensation to Mr. Dodge for his patented improvements in telephone instruments and practice, which will be found to be possessed of unusually great value, while a portion, as is not all uncustomary in the case of company flotation, may be used in the shape of promotion stock. The subscribers to the 8 per cent. preferred stock will however be in no way prejudiced in regard to these matters, as they will have an undoubted first lien to the extent of eight per cent. per annum upon the profits earned. And as you are doubtless aware, telephone propositions have been found to be very profitable enterprises.

Finally we may say that there is no intention, and never has been any intention, on the part of the promoters of this company to retain any part whatever of any subscription for stocks, which subscription has not been accepted by the Directorate. However, as many people appear to read the clause in question in a similar light, and as there is now no question whatever of the successful flotation of the company upon the scale desired by the projectors, we have not the slightest objection to drop altogether this particular clause, which would, of course, in that event be wholly inoperative under any circumstances whatever. We have no wish to bring into life utterly useless bugbears, on which hostile influences will naturally seize, in the hope of doing some mischief, even though they do not succeed in their main design the complete extinction of opposition in the great Canadian field.

And you will be rejoiced to learn, in answer to the concluding portion of your editorial criticism, that many applications for stock have been already received, and that the future prospects of the company are all in all of the most satisfactory possible character. I am,

Yours very truly,

J. A. MACMURTRY.

THE BELL TELEPHONE COMPANY.

The annual meeting of the Bell Telephone Company was held in Montreal on February 22nd. A very satisfactory report of the year's business was presented. The total revenue from exchanges, long distance lines, private lines, etc., amounted to $1,456,682, and the expenditure $1,103,375, leaving a net revenue for the year of $353,307. The statement showed the plant and patents on December 31st, 1899, to be valued at $5,244,436.33. The annual statement was in part as follows: 2841 subscribers have been added during the year, the total number of sets of instruments now earning rental being 34,923. The company now owns and operates 343 exchanges and 450 agencies; 1686 miles of wire have been added to the long distance system in 1899; of these 318 miles are in the Ontario department and 1368 are in the eastern department. The long distance lines now owned and operated by the company comprise 18,920 miles of wires on 6,229 miles of poles. Since the last report, the building in London has been completed, a building has been erected in Parkdale, and a building for the stores department has been erected on Mountain street, Montreal, all of which have been paid for.

The report was unanimously adopted and directors elected as follows: C. F. Sise, Robert Mackay, John E. Hudson, Robert Archer, Wm. R. Driver, Hugh Paton, Charles Cassils, and Thos. Sherwin.

SHORT CIRCUITS.

The New Brunswick Telephone Co. have decided to build a line next summer between St. John and St. Stephen, N. B. The company will in the spring commence the proposed line between Fredericton and Chatham.

The Union Telephone Co., of Musquodoboit, N. S., at their annual meeting last month, elected officers as follows. President, Edgar Archibald; vice-president, James Annand, secretary-treasurer, H. C. Taylor.

The Nova Scotia Telephone Co. are considering the advisability of extending their long distance service from Halifax to Sydney, C. B. It is understood that the expenditure would be about $50,000, a large proportion of which would be spent in making cable connection across the straits of Canso. Mr. C. Harris of Halifax, is manager of the company.

The annual meeting of the Montreal Telephone Co. was held in Montreal January 11th last. The annual report showed the total assets of the company to be $2,267,811, divided as follows: Telegraph cables, $33,487; offices and equipment, $212,500; real estate, $279,946; and cash, other real estate, amounts receivable, etc., $115,988. The excess of assets over shareholders' capital was stated to be $151,823, and the contingent fund $7,548. There were declared during the year four quarterly dividends of two per cent. each, a very satisfactory showing. The old board of directors was unanimously reelected, and at a meeting of directors Mr. Andrew Allan was again elected to the presidency.

MONTREAL

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

MONTREAL, Jan. 3rd, 1900.

THE LACHINE RAPIDS COMPANY.

THE annual meeting of the Lachine Rapids Hydraulic and Land Co. was held about two weeks ago. The report of the directors stated, according to the local press, that notwithstanding the fact that since the last annual meeting further discounts had been allowed to customers, the company was firmly established on a paying basis. During the year the expenditure authorized on capital account was $413,709, this representing improvements at the rapids and machinery ordered but not yet delivered. The two 1,000,000 gallon fire pumps had been completed, and steam pipes, with hose, etc., provided and installed. Two of the four generators ordered in 1898 were delivered and put in service. There were at present on the company's circuits 493 transformers, with a total capacity of 66,740 sixteen candle-power lamps. The net increase in incandescent lamps connected to the circuits during the year amounted to 16,114, showing a total of 56,249 lamps connected. The total amount of current sold as power amounted to 1,954 horse-power, being an increase of 1,030 horse-power during the year.

The report stated that several extensions to the underground system of the company had been made, and in this connection the directors referred to the advantages of the underground system. Since its installation there had not been a single accident or interruption. The financial statement showed the gross revenue for the year to have been $164,834 78, and the operating expenses $72,-798.10. After paying interests on bonds, a net profit of $69,128.-04 was shown.

The directors were re-elected, and at a subsequent meeting they elected officers as follows: G. B. Burland, president; Alexander Fraser, vice-president; W. McLea Walbank, managing director; Robert White, secretary-treasurer.

The case of Wm. Dwyer against Frothingham & Workman for having had his arm paralysed by an electric wire used for an incandescent lamp in the factory of the defendants, and from which the globe had been removed, has been amicably settled by the defendants consenting to pay $600 damages and costs. The man had to be taken to the hospital, where an operation was performed on his arm.

A Mrs. Price appeared a few days ago before the Society for the Protection of Women and Children and made application for funds to enable her to sue for compensation on account of her husband being killed by electricity. She was informed by Mr. Marshall, the secretary, that this did not come within the scope of the Society. The above no doubt refers to a case which happened in this city lately, where an operator at the incinerator was employed on top of a heap of rubbish outdoors in cleaning out some sort of melting pot or crucible with the aid of a long iron rod. The sediment, whatever it was, being evidently stubborn, he raised his rod to take a more forcible blow, with the result that the upper end of the rod crashed into an arc light which was suspended above and which was on a constant current direct current circuit. The man dropped at once and was shortly pronounced dead.

The premises being built by the Estate McIntyre on the site of the old Greenshields warehouse, corner of Victoria Square, and which were destroyed by fire about a year ago, are being wired for enclosed type arc lamps, also for several incandescent drop lights by the Montreal Electric Co. This construction firm are using for the first time in Montreal the Greenfield flexible metallic conduit as manufactured by the Sprague Electric Co., of New York, they deeming it most suitable for use in the peculiar floor construction (fire-proof) being placed in this building.

Messrs. Fred. Thomson & Co. had a small fire on their premises recently, damage being done to the extent of $1,500, covered by insurance. As an offset to the daily papers I would state positively that the fire was due to the deadly "stove," which got overheated.

The Bathurst Power Co., of Bathurst, N. B., is seeking incorporation, to build dams and operate electric and steam plants on the Nepisguit and Tetegouche rivers, in New Brunswick.

CORRESPONDENCE.

THE RECENT ACCIDENT IN MONTREAL.

OTTAWA, ONT., March 3rd, 1900.

Editor CANADIAN ELECTRICAL NEWS:

DEAR SIR,—In the February number of your journal appeared an editorial commenting upon an accident in Montreal, resulting in the death of Mr. Alphonse Girouard. This matter was brought up for discussion at the last meeting of Court Elektron I. O. F., which is a Court of the Independent Order of Foresters in Ottawa composed of persons engaged in the electrical business. The undersigned was instructed to write you concerning part of the aforementioned editorial, which is to the effect that "in order to permit of the accident the inside wiring must have been grounded." It was the unanimous opinion of those present at the above meeting that had the inside wiring been subject to a good "ground," the accident could not have happened, as the current would take the much easier path at the grounding of the wires rather than through the body of deceased.

As such accidents may materially effect a large portion of the electrical business, it is thought that this matter should not be let drop until thoroughly discussed and fully investigated, and to this end a further argument on the subject would not be amiss.

Yours truly,

EDMUND J. O'REILLEY.

[An expression of opinion from the electrical fraternity on the above subject is solicited.—THE EDITOR.]

PERSONAL.

Mr. A. T. Smith, superintendent of the Bell Telephone Company, has transferred his headquarters from Kingston to Toronto.

Mr. Stanley Shepard, superintendent of the Valleyfield Electric Company's power house at Valleyfield, Que., has accepted a more lucrative position in Rio de Janerio, South America.

Mr. J. S. Grant, chief engineer of the civic electric light plant of New Westminster, B.C., has tendered his resignation. A successor has been appointed in the person of Mr. J. J. Healey.

Mr. Frank Jackson, a student in the engineering department at Queen's University, Kingston, has received an appointment in the office of the Canadian General Electric Company at Peterboro.

Mrs. Black, mother of Mr. Geo. Black, manager at Hamilton of the Great North-Western Telegraph Company, died in that city a fortnight ago. The deceased was born in Auchterarder, Scotland, and was ninety-one years of age.

Mr. P. Bowler, city electrician of New Westminster, B.C., has resigned his position, and has been succeeded by Mr. Thos. Proctor, of Fort William, Ont. Mr. Proctor was for a number of years electrician on the steamer Empress of India, and also acted in that capacity for the North British Railway.

HOW HE WON SUCCESS.

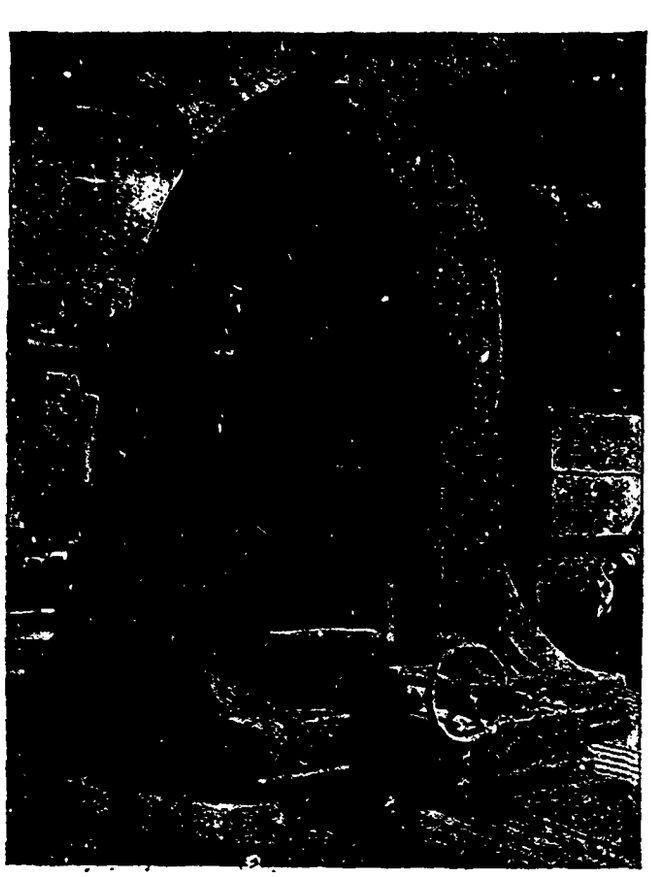
A prominent technical journal in a recent issue contained a pithy paragraph answering an eastern daily which referred disparagingly to correspondence instruction. A reader wrote a letter thanking the editors for their stand and stating that he owed his success largely to a course in a correspondence institution. This is the case of hundreds of men to-day. Never in the history of the world has the poor but ambitionus man had such opportunities as are presented to him to-day. It is the lack of technical training that keeps bright young men down. Few can attend college; they are compelled to work every day. But now anyone can have a private instructor. The correspondence institution goes to him at his convenience.

There is no boy so poor but he could manage to pay the moderate charge of the American School of Correspondence, situated at the famous seat of learning, Boston. A careful inspection of the school's attractive instruction papers convince one of the painstaking thoroughness and accuracy which distinguishes the work of this New England institution. The school is chartered by the Commonwealth of Massachusetts, and enjoys the respect and confidence of thousands of earnest students throughout the United States. The instructors are all graduates of leading scientific schools and have had valuable experience along engineering lines. The benefit to the student of this expert supervision cannot be overestimated.

ELECTRIC RAILWAY DEPARTMENT.

DOUBLE CURRENT GENERATERS AND ROTARY CONVERTORS.

In the operation of street railway systems, double current generators and rotary converters promise to form an important part of the station equipment in the future. The Westinghouse Electric & Manufacturing Co., of Pittsburg, Pa., have recently supplied several machines of the above types for street railway work. The double current generators installed by the Metropolitan Railway Co., of Toronto, were described in a recent issue of the ELECTRICAL NEWS. On this page we give illustrations of a 600 k.w. double-current generator installed for the Quebec Montmorency & Charlevoix Railway by Messrs. Ahearn & Soper, of Ottawa, Canadian agents for the Westinghouse Co. This machine is direct connected to a water-wheel, receiving power from the Montmorency Falls, and operates at a speed of 286 revolutions per minute. It has 28 poles, and delivers direct current at 550 volts and two-phase alternating currents at 8,000 alternations and about 400 volts. It will carry its full rate of load on either end, or it will divide the load of direct and alternating current in any proportion that may be required. The direct current is fed into the railway line adjacent to the station and the alternating current is transmitted at a high voltage to a sub-station some distance away.



VIEWS OF 600 K.W. DOUBLE CURRENT GENERATOR—QUEBEC, MONTMORENCY AND CHARLEVOIX RAILWAY.

The Westinghouse Company have supplied for the Third Avenue Railroad at New York, six of the largest rotary converters yet constructed, having ten poles and operating at 300 revolutions per minute. Four of these are now being used as double current generators. They have large over-load capacities, so that when working under full load continuously there is very slight rise in temperature. These machines are rope driven from horizontal steam engines, direct current being taken from the commutators at 550 volts for feeding the railway circuits, and from the collector rings are taken alternating currents at approximately 350 volts. From this pressure these latter currents are raised by means of step-up transformers and transmitted to the 129th street station to operate a similar machine now used as a 1,000 k.w. Westinghouse converter. These double current generators can be changed to rotary convertors whenever desired. This is done by cutting off the shaft and by the addition of a starting motor. The rotating part of the starting motor is pressed upon the armature shaft of the rotary.

It is claimed that to gain the best results with double current generators it is necessary that they be operated at a high speed to avoid a multiplicity of poles. For this reason they are especially well adapted for direct connection to water wheels. The greater flexibility afforded to a station by the use of double current generators is almost certain to bring them into general use for both railway and lighting circuits. Since they are able to deliver their regular output as either direct or alternating current, or a part of each at a low voltage, the direct current is at once available for use on the three wire systems without passing through any auxiliary machinery, and the alternating current, although not suitable for service at a distance on account of its low voltage, can be raised by transformers.

It is pointed out also that storage batteries may be very advantageously used in connection with double current generators, either to increase direct current capacity at time of maximum load, or to supply the entire output of both direct and alternating currents at time of minimum load, and to regulate the station pressures for both the direct and alternating current at any load.

At a meeting of the city council of Moncton, N. B., it was decided to take steps to compel the Moncton Street Railway Co. to operate its road within six months or take up the rails.

It is understood that an agreement has been reached by which an electric railway will be constructed in the town of Woodstock, Ont. Mr. J. C. Wallace, representing the promoters, states that cars will be running in six months.

The Lulu Island Railway Co., of New Westminster, B.C., have decidtd to build an electric tramway from Granville street, Vancouver, to a point on the north arm of the Fraser river. It is also contemplated to build a branch from New Westminster to the North Arm False Creek line, making about 13 miles new road.

ENGINEERING and MECHANICS

THE GASOLINE ENGINE.

By H. S. Pitt

My intention this evening is to bring before you, in as practical and familiar a way as possible, the main features of the gasoline engine, and I trust that none of my audience will be disappointed if the intricacies of the subject are omitted. In the first place, it would be well to consider the characteristics of the fuel used, viz., 74 degree gasoline. Gasoline, as you all know, is derived from crude petroleum during the process of refining, and being one of the lighter constituents of the parent oil, it possesses not only the quality of inflammability, but is extremely volatile, vaporizing in the open air at ordinary temperatures. I have here a small phial of gasoline, and its volatile quality is readily observed by taking a small portion upon the palm of the hand; it will be seen to evaporate almost immediately, and it is this quality which makes it specially valuable for power purposes, as gasoline is virtually liquid gas and can be readily mixed with a proper proportion of air and burned under such conditions as to produce motion.

As regards its inflammability, there is a popular impression that gasoline is explosive and extremely dangerous to handle, but this impression springs more from a lack of knowledge than from the facts of the case. As I will now proceed to show you, gasoline burned in liquid form produces a strong, quick flame, but does not give an explosive effect by any means, and when it is considered that such a liquid as gasoline must first become a gas, and further must be mixed with a certain proportion of air before in can be exploded, it will be readily seen that only very simple measures are necessary to ensure perfect safety, viz., handling it by daylight only, and keeping it in air-tight receptacles.

I will now draw your attention to the drawing of a gasoline engine which I have on the platform, and you will at once observe in it a striking similarity to the ordinary steam engine. Both have cylinders, valves, pistons, connecting rods, cranks and fly wheels. As a matter of fact, both are heat engines, the steam engine employing what might be termed external combustion and the gas and gasoline engine internal combustion. There is, of course, an entirely different cycle of operations in the two machines. The steam engine utilizes the energy of some combustible which is transferred to water and carried to the engine in the form of steam. The gas or gasoline engine utilizes the energy of hydro-carbon or other gas, by burning it directly in the cylinder, thus causing expansion of the air drawn into the cylinder on the suction stroke, thus imparting motion to the piston. Chemically stated, the oxygen of the air and the hydrogen and carbon of the gas are the elements which, by combustion, expand the nitrogen of the air and the watery vapor produced by the union of oxygen and hydrogen, and also carbon dioxide and carbonic acid gas formed by the union of carbon and oxygen.

Most commercial engines operate on what is known as the "Otto cycle," which is carried out during two revolutions, or four piston strokes of the engine. We will consider this cycle as applied in the ordinary single acting engine, and commencing with the suction stroke, we will turn the fly wheel and cause the piston to move a full stroke outward. The result is naturally to create a vacuum in the space between the piston and cylinder head, and to open the automatic inlet valve A, allowing air to rush in and fill the cylinder space. This air is drawn through a somewhat restricted opening, and therefore passes through the cylinder ports and enters the cylinder with considerable velocity.

You will notice a little metal cup at the back of the cylinder. This is the gasoline receptacle, and is kept constantly replenished by a small pump operated by the engine and drawing its supply from the main gasoline tank. A small tube projects from the cup into the air part and the swiftly moving air current picks up and instantly vaporizes a few drops of gasoline on each suction stroke from this tube. The cylinder is therefore filled with a mixture of atmospheric and gasoline gas at the end of the suction stroke, and the whirling action of the air current effectively mixes the two elements. The openings for air and gas are so arranged that the proportions are about 8 parts of air to 1 part of gas, which forms a mixture affording the most complete combustion when lighted. The next stroke of the cycle is the compression stroke. Compression of the gaseous mixture gives a more complete infusion, quicker firing and far greater pressure. This compression is effected by the momentum of the fly wheel acting on the piston through the crank and connecting rod, and as both the inlet valve and the exhaust valve open inward, they automatically close on the reversal of the piston. At the end of the compression stroke the contents of the cylinder are at a pressure of about 60 lbs. per square inch in the majority of commercial engines, though both higher and lower compression is used in special cases. The piston is now at its extreme inner stroke, and ready for the third or power stroke. In order to utilize heat energy of the gas it is of course necessary to ignite it, and this is effected in modern engines in two ways, viz., by the electric spark and the hot tube.

By the former method, either a small dynamo, a storage battery or a primary battery is used to produce the necessary electric current. Where the dynamo is used the wires are carried direct to the make and break appliance in the cylinder, but where a battery is employed it is necessary to interpose a spark coil into the circuit. The igniter consists essentially of two conductors, preferably tipped with platinum, which are caused by suitable mechanism to break the circuit at the proper moment for ignition, and thus produce a spark. (The primary cell apparatus I have on the platform produces such a spark by suddenly breaking the circuit as described.) In practice the igniting points are brought into the interior of the cylinder and the spark is produced at the best point to secure efficient ignition of the compressed gases. The hot tube is much simpler than the electric apparatus. It consists merely of a small short tube of iron, nickel, platinum, or composition, open at one end and sealed at the other. The open end is screwed into the engine cylinder, and the tube having been heated to a dull red by a Bunsen burner, fed by gasoline from a small elevated tank, all is ready for work. The tube is, of course, kept canstantly heated by the Bunsen burner during the operation of the engine. When the gases are compressed into the hot tube they ignite at a moment which is controlled by the length of the tube, the shorter the tube the earlier the ignition and vice versa The moment of ignition can be precisely determined when electric ignition is used, by adjusting the sparkling mechanism, but with the hot tube the time of ignition is more or less experimental, and as ignition at the exactly proper moment is necessary for a complete combustion and good economy, it is evident that the electric spark has a point of advantage in this particular, but when the upkeep of batteries, and sparking points, and the annoying stoppages incidental to the use of electricity are considered, most operators of gasoline engines in my experience prefer the hot tube. The ignition of the gases causes a sudden and vigorous expansion of the air brought into the cylinder during the first or suction stroke, the pressure rising to 200 lbs. or more, according to the amount of original compression and the perfection of the mixture. This causes the piston to take a powerful stroke, and immediately on the completion of this stroke the exhaust valve is opened by a rod and cam and the burned products of the power stroke are swept out of the cylinder, and all is again ready for a new suction stroke, thus completing the cycle of four strokes, which I again name in order, first, outward suction stroke; second, inward compression stroke; third, outward power stroke; and fourth, inward exhaust stroke.

I will now proceed to a brief discussion of the component parts of the gasoline engine, using the part drawing of the Northey gasoline engine on the board for my purpose. In the first place, the bed presents no unusual features apart from its being extra massive and somewhat higher than a steam engine bed would be, owing to the larger fly wheels employed. The shaft runs in heavy bronze half-boxes planed to fit the sockets in frame, and held in place by cast iron caps. This part of the bed is specially stayed to resist the shock of the power stroke. The fly wheels are specially massive, two are used on each engine. The crank shaft is a steel forging. The crank is forged solid, and drilled and slotted out, as the best practice demands, and the whole is very carefully made to withstand the severe duty it has to perform. The connecting rod is a steel forging slotted out at the piston end, and provided with bronze boxes and wedge and screw take-up. It is provided with marine type brasses at the

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crank end, with turned steel studs, double lock-nuts and split pins. The piston is very deep, as it forms its own guide. It is provided with four or five rings of the spring type. The cylinder is water-jacketed all round, as shewn, this being necessary to keep the temperature of the inner wall of cylinder down to a point at which the special cylinder lubricating oil can do its work. A mineral oil with special qualities must be used, as heavy vegetable oil would thicken and even char in a gas engine cylinder, thus doing more harm than good. As the gasoline engine is a heat engine, this necessary cooling of the cylinder for lubricating purposes is very wasteful, 40% of the heat generated going into the cooling water. The cylinder head is also jacketed, as the inlet valve face in it must be protected from the fierce heat. The inlet valve is a mushroom shaped poppet valve, with a long stem carrying a spring which ensures its prompt closing. It is an automatic valve, which is opened when necessary by the vacuum produced in the cylinder. At the back is the little receptacle for gasoline mentioned earlier in this paper, and entering the bottom of the cylinder will be seen the air pipe with the gasoline injector protruding into it. On the horizontal part of this air pipe is a valve to control the proportion of air used, while the gasoline is varied in quantity by a needle-valve at the base of the gasoline receptacle. The hot tube and bunsen burner apparatus are seen at the top of the cylinder close to the back cover, and the lubrication of the cylinder is effected by a sight feed drop lubricator placed at the forward end of same.

On the side is the exhaust casing, valve and gear. The casing is water jacketed to protect the valve and seat, and the valve is the same as the inlet valve, viz., a mushroom shaped poppet valve. The value of a poppet valve in gas and gasoline engines lies in the fact that they lift squarely off their seats, and owing to the rush of air or gas through them, the seats are always kept clear of grit or dirt, which soon destroys any valve of the sliding variety.

Poppet valves expand evenly and keep tight under the trying circumstances met with in gas engine practice, and they are easily ground to place when worn or leaky. The proper opening of the exhaust valve is secured by the action of a cam operating a side rod. The exhaust cam is mounted on a secondary shaft which is set in motion from the main shaft by a pair of gear wheels, of unequal size. The gear on the main shaft has one-half the number of teeth of that on the cam shaft. This is necessary from the fact that the exhaust valve is opened once during two revolutions of the main shaft. Where electric ignition is used, the secondary shaft also operates a switch or cut-out, allowing the current to pass only at the beginning of the power stroke, and thus saving the battery. Both inlet and exhaust valves are held to their seats by spiral springs. We have now briefly mentioned the essential parts of the gas or gasoline engine, for a gasoline engine can be easily arranged to use gas. In fact either gas or gasoline can be used at will in the Northey engine. Where gas is used a combined air and gas valve is employed, which automatically adjusts the supply of air and gas in proper proportions.

We will now consider the governing apparatus, taking the Northey engine governor as our example. It will be realized that the governor is a very important part of the mechanism, as its duty is to proportion the number of impulses that the engine will run at practically the same speed from no load to full load. The governor works on the well known principle of centrifugal force operating through a pair of weights so attached to the main shaft as to move a sliding collar along it. This collar has a lip at its outer edge which engages a pivotted finger, the steel tip of which is formed into a knife or chisel edge. This tip moves inward or outward in sympathy with the motion of the governor balls, and is so arranged that it will catch upon a similar chisel edge formed upon the exhaust valve rod. The purpose of this mechanism is that when the engine speeds up a couple of turns more than the normal speed, the pivotted finger is pressed in far enough to catch the detent on the exhaust valve rod and hold the exhaust valve open. The motion of the exhaust valve rod also brings a thin bar of steel behind a collar on the inlet valve stem and holds the valve tight closed. When the parts are in this position the engine cannot draw in a charge of gas or gasoline, and cannot compress because the exhaust valve is wide open. All that can happen, therefore, is that air is alternately drawn in and forced out of the cylinder, incidentally clearing out the spent gases. After a few revolutions the speed of the engine comes down to normal, and as the governor balls come together the governor finger is withdrawn and the exhaust valve closes, while the inlet valve is allowed to open by the withdrawal of the bar. A charge of gas and air is at once drawn in, compressed, fired and exhausted, and the operation is repeated until the governor again comes into action. So perfect is the action of the hit and miss governor, as this type is named, that though the power is applied only every fourth stroke, we are enabled to run a dynamo and operate electric lights with remarkable steadiness and without the intervention of storage batteries.

The method of starting a gas or gasoline engine in the smaller sizes is (after heating up the tube where used, which takes a few minutes) to give the fly wheels a couple of turns by hand. This draws in a charge, compresses and fires it, after which the engine automatically performs its functions. In the larger sizes a so-called self-starter is used, consisting of a small hand air compressor fixed to the side of the engine bed, and a percussion arrangement by which a match or cap gives the spark. The air compressor draws its supply through a small gasoline holder filled with cotton wick and forces a mixture of air and gasoline into the cylinder clearance, the piston being held in place with the crank just above the centre. After a pressure of 20 or 30 lbs. has been reached the match or cap is ignited by the sudden action of a small plunger and the gaseous mixture fired. The air expansion thus brought about causes the engine to take a few rapid revolutions, which suffice to start it. In some cases the engine pumps air under pressure into a tank when working, and this compressed air is used to start the engine when necessary.

The cooling of the cylinder and adjacent parts is effected, as before stated, by circulating water through the jackets provided for the purpose. The water supply is in most cases a sheet metal or wooden tank, with connections at top and bottom. The water in this tank is kept just above the level of the upper connection, and as the cylinder of the engine heats up, a circulation is established through the connecting pipes and tanks. The amount of water required is very trifling. It has been found that the best economy is obtained when the cooling water is kept near the boiling point and tanks are proportioned with that end in view. Where convenient, water under pressure is used for cooling, dispensing with tanks, and sometimes a pump on the engine draws cooling water from a well or convenient stream. The noise made by the exhaust has proved a difficult problem to tackle, as a contrivance which effectually quiets the noise of the exhaust also sets up back pressure and consequent loss of efficiency. The various experiments in this direction have finally sifted down to the plain muffler pot, a plain cast iron covered pot with two openings in the top threaded to receive the exhaust pipes. The purpose of this contrivance is to allow the exhaust to expand where it will make the least noise, and the muffler pot fairly effects its purpose.

Measurement of power in a gas or gasoline engine is practically identical with that in a steam engine, as in both the indicator affords a diagram which exhibits the necessary data. In a gas or gasoline engine, however, as the power is applied only every fourth stroke, and the engine is single acting, only one-fourth of the total piston speed can be considered in the computation.

It will be noted that the power of a gasoline engine is affected by two factors only, namely, cylinder area and piston speed, unlike the steam engine in which the factors are cylinder area, piston speed and the varying pressure of the steam. In the gasoline engine the mean effective pressure is practically constant, as it is produced by the combustion of gases whose volume and constituents are practically identical in each charge. It follows, therefore, that a gasoline engine should be rated for the market at its brake or actual horse power, and this is done in the case of most engines. The customer who buys a 12 h.p. gasoline engine gets an engine which will develop that power and a percentage over when running at a proper speed, and the facts are guaranteed by the maker. The only way in which the power of the engine can be increased is by speeding it up, so the engine should always be of ample power for the total load. On the other hand, too large an engine should not be chosen, as engines run under power show a marked decrease in efficiency. Experiments with a 12 h.p. gas engine show a consumption of 15 cubic feet of gas per horse power per hour at full load, 15½ at 10 h.p., 16½ at 87 h.p., 18 at 6 h.p., 21 at 4 h.p., and 30 at 2 h.p.

The different applications of the gasoline engine are numerous and interesting. The marine engine, for instance, has so many advantages over the steam engine, particularly for small boats, that as it is perfected it must eventually take first place in this direction. It has no boiler throws off, no heat, needs no firing, and needs a mimimum of attention, besides being compact and clean

in a marked degree. The marine gasoline engine is not reversible, but a reversible propeller, or a reverse gear mechanism is used. This latter is the well known "Jack in the Box" arrangement and works perfectly. The exhaust is carried overboard under water and is absolutely noiseless; a small pump supplies the cooling water, and the gasoline tank is placed generally in the bow. The Otto or 4 cycle type is growing into popular favor very rapidly, as it is more economical than the two cycle engine, and is perfectly safe because it uses the gasoline in liquid form, while the two cycle engine uses a carburetter or gas-making appliance and thus offers opportunity for explosions. The two stroke cycle engine is so called because it completes its cycle in one revolution. The upward stroke of the piston draws a charge of carburetted air into the base of engine through a check valve, which, on the downward stroke, is partially compressed and forced into the cylinder, where it is fired. The upward stroke, which draws the charge into the base, also completes the compression of the charge in the cylinder. The exhaust takes place through a port uncovered by the piston at the end of its down stroke. Electric ignition is generally used in marine work. The automobile seemed at one time to offer a large field for the hydro-carbon motor, but in my opinion the steam engine and boiler in a refined form offers the best solution of the problem. The gasoline engine is troublesome to start and must be kept constantly in motion. The speed of a gasoline engine cannot be varied to the extent necessary in carriage work, without great complication, and cannot be reversed without introducing the same objectionable feature; while the steam engine has an infinite variety of speeds, its reversal is easily arranged and it will start at the touch of a lever. The engines used for the purpose are beautiful refinements of the ordinary steam engine with tubular frames, steel cylinders and working parts—they are usually twin cylinder engines. The boilers are copper pipe boilers fired by gasoline, and entirely automatic as to firing, steam and water regulations.

The gasoline engine finds a broad field, however, for mining, agriculture and other purposes, and new uses are being found for it continually.

PRODUCTS OF COAL.

The monthly open meeting of the Hamilton branch of Stationary Engineers was held on Tuesday, February 20th. The principal event of the evening was an address by Mr. J. M. Williams, of J. Winer & Co., on the subject of products that could be obtained from coal. The address was illustrated throughout by means of blackboard drawings, and specimens of the various substances named were on exhibition for the inspection of the members present.

It was demonstrated that after the first product, which was heat, the next two of greatest importance were gas and coke. From the coke we obtain electric light carbons and carbide of calcium used in the production of acetylene gas. Coal tar was the next production, and as the substances obtained from the distillation of this tar are practically innumerable, the principal products only were touched on.

We first obtain from coal tar a substance called benzol, which, combined with nitric acid, forms nitro-benzol, which is used extensively in the art of perfuming soap. Next we produce carbolic acid, then creosote, a substance used for preserving railway ties, wharves, etc. Then follows napthaline, used in the manufacture of camphor balls; in exceptionally cold temperature this substance sometimes blocks up the gas pipes. We then obtain solid paraffins, principally in the form of waxes. The last product obtained through the distilling process of coal tar is pitch.

It was then shown how the articles and productions mentioned were applied to the manufacture of modern commodities of everyday use. The explosives used in modern warefare are composed largely of materials obtained from coal, such as carbolic acid, etc.; napthaline goes into some of them and is used in some of the cartridges of the present day. The speaker exhibited samples of cordite and other explosives, and explained how smokeless powder differed from ordinary gun-powder. It was shown how natural articles of commerce were being imitated by productions from coal tar, such as oil of wintergreen, obtained from carbolic acid; musk; saccharine, which is 500 times sweeter than common sugar; and also artificial perfume resembling flower of lilac. In cases of sickness saccharine can sometimes be used where sugar could not. Gum-benzoic, naturally obtained from the juice of a tree grown in eastern countries, a substance which has been used from earliest times in making insense, and in all probability utilized in the preservation of mummies, is now artificially made in the form of benzoic acid. Mr. Williams had on exhibition a piece of gum-benzoic which was over two hundred years old. A substance is also obtained from coal tar which is practically the same as quinine.

At the conclusion of the address a hearty vote of thanks was tendered Mr. Williams for his trouble in preparing such an interesting and exhaustive address on the subject. Mr. L. B. Mann, of Boston, one of the prominent stationery engineers on the other side, addressed the meeting before it closed, and announced that he would be present at some meeting in the near future and address the members at some length. Mr. H. J. Wickens, of Toronto, made a few remarks, and a paper from him on "Electricity" is looked for in the near future.

QUANTITY OF CONDENSING WATER REQUIRED PER MINUTE IN CUBIC FEET

For Every Hundred Feet of Piston Speed per Minute. Steam Pressure in Pounds.

Barometer Reading Inches of Mercury	Vacuum Pounds per Square Inch	Temperature of Condensing Water	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	110	120	130	140	150	Diameter of Piston in Inches
2.03	1	68	6.9	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.6	7.7	7.8	7.9	8.0	8.0	8.0	8.2	8.3	8.5	8.6	8.8	6
2.40	2	62	7.2	7.3	7.4	7.5	7.6	7.8	7.9	8.0	8.1	8.2	8.3	8.4	8.6	8.7	8.8	9.0	9.2	9.4	9.6	9.8	7
2.83	3	55	7.5	7.7	7.9	8.0	8.1	8.3	8.5	8.6	8.8	8.9	9.1	9.2	9.4	9.5	9.6	9.9	10.2	10.5	10.7	11.0	8
3.23	4	49	7.8	8.1	8.3	8.5	8.7	8.9	9.1	9.3	9.5	9.7	9.9	10.1	10.3	10.5	10.7	11.0	11.3	11.6	11.9	12.2	9
3.66	5	42	8.1	8.4	8.6	8.9	9.1	9.3	9.5	9.7	9.9	10.1	10.3	10.5	10.7	10.9	11.1	11.4	11.7	12.0	12.3	12.6	10
4.08	6	36	8.4	8.7	9.0	9.2	9.5	9.7	9.9	10.1	10.3	10.5	10.7	10.9	11.1	11.3	11.5	11.8	12.1	12.4	12.7	13.0	11
4.51	7	29	8.7	9.0	9.3	9.5	9.8	10.0	10.2	10.4	10.6	10.8	11.0	11.2	11.4	11.6	11.8	12.1	12.4	12.7	13.0	13.3	12
4.95	8	23	9.0	9.3	9.6	9.8	10.1	10.3	10.5	10.7	10.9	11.1	11.3	11.5	11.7	11.9	12.1	12.4	12.7	13.0	13.3	13.6	13
5.68	9	14	9.3	9.6	9.9	10.1	10.4	10.6	10.8	11.0	11.2	11.4	11.6	11.8	12.0	12.2	12.4	12.7	13.0	13.3	13.6	13.9	14
6.46	10	5.4	9.6	9.9	10.2	10.4	10.7	10.9	11.1	11.3	11.5	11.7	11.9	12.1	12.3	12.5	12.7	13.0	13.3	13.6	13.9	14.2	15
7.31	11	6.6	9.8	10.1	10.4	10.7	10.9	11.2	11.4	11.6	11.8	12.0	12.2	12.4	12.6	12.8	13.0	13.3	13.6	13.9	14.2	14.5	16
8.18	12	7.6	10.1	10.4	10.7	11.0	11.3	11.5	11.7	11.9	12.1	12.3	12.5	12.7	12.9	13.1	13.3	13.6	13.9	14.2	14.5	14.8	17
9.05	13	7.8	10.4	10.7	11.0	11.3	11.6	11.8	12.0	12.2	12.4	12.6	12.8	13.0	13.2	13.4	13.6	13.9	14.2	14.5	14.8	15.1	18
10.32	14	8.6	9.5	10.3	11.2	11.9	12.6	13.2	13.7	14.2	14.7	15.2	15.7	16.2	16.7	17.2	18.1	19.1	20.1	21.1	22.0	23.0	19
11.42	15	9.7	11.7	12.7	13.7	14.7	15.6	16.6	17.6	18.5	19.4	20.3	21.2	22.1	23.0	23.8	25.5	27.2	28.8	30.5	32.2	33.8	20
11.82	16	11.7	12.9	14.2	15.4	16.6	17.7	18.9	20.1	21.2	22.4	23.5	24.6	25.7	26.8	27.9	30.0	32.1	34.1	36.2	38.2	40.3	22
12.45	17	13.9	15.4	16.8	18.3	19.7	21.1	22.5	23.9	25.3	26.6	28.0	29.3	30.6	31.9	33.2	35.7	38.2	40.6	43.0	45.4	47.9	24
13.30	18	16.4	18.1	19.8	21.5	23.2	24.8	26.4	28.0	29.6	31.2	32.8	34.4	35.9	37.4	39.0	41.9	44.8	47.7	50.5	53.3	56.2	26
13.39	19	17.1	18.9	20.8	22.6	24.4	26.1	27.8	29.5	31.2	32.8	34.5	36.2	37.8	39.4	41.0	44.1	47.2	50.2	53.3	56.3	59.4	28
15.70	20	21.8	24.1	26.4	28.6	30.8	33.0	35.2	37.3	39.5	41.6	43.7	45.8	47.8	49.9	51.9	55.8	59.7	63.5	67.3	71.0	74.8	30
17.24	22	24.8	27.4	30.0	32.6	35.2	37.6	40.1	42.5	44.9	47.3	49.7	52.1	54.4	56.7	59.1	63.5	67.9	72.3	76.5	80.8	85.0	32
18.01	24	28.0	31.0	33.9	36.8	39.6	42.5	45.2	47.9	50.7	53.5	56.1	58.8	61.4	64.1	66.7	71.7	76.7	81.6	86.4	91.2	96.0	34
19.08	26	31.4	34.7	38.0	41.2	44.4	47.6	50.7	53.8	56.9	59.9	62.9	65.9	68.9	71.8	74.8	80.4	86.0	91.5	96.9	102.3	107.7	36
20.14	28	35.0	38.7	42.3	45.9	49.5	53.0	56.5	59.9	63.4	66.8	70.1	73.5	76.7	80.0	83.3	89.6	95.8	102.0	108.0	114.0	119.9	38
21.20	30	38.8	42.9	46.9	50.9	54.8	58.8	62.6	66.4	70.2	74.0	77.7	81.4	85.0	88.7	92.3	99.3	106.2	113.0	119.6	126.2	132.8	40
22.26	32	42.8	47.3	51.7	56.2	60.5	64.8	69.0	73.2	77.4	81.6	85.7	89.8	93.8	97.8	101.8	109.5	117.1	124.6	131.9	139.1	146.3	42
23.29	34	47.0	51.9	56.8	61.6	66.4	71.1	75.8	80.4	85.0	89.6	94.1	98.5	102.9	107.3	111.7	120.2	128.5	136.7	144.7	152.7	160.6	44
24.35	36	51.3	56.7	62.1	67.3	72.5	77.7	82.8	87.9	92.9	97.9	102.8	107.7	112.5	117.3	122.1	131.3	140.4	149.4	158.2	166.9	175.6	46
25.40	38	55.9	61.8	67.6	73.3	79.0	84.6	90.2	95.7	101.2	106.6	112.0	117.3	122.5	127.7	133.0	143.0	153.0	162.7	172.3	181.8	191.2	48
26.40	40	60.7	67.0	73.3	79.5	85.7	91.8	97.9	103.8	109.8	115.7	121.5	127.2	132.9	138.6	144.3	155.0	165.9	176.6	186.9	197.2	207.4	50

CONDENSER CAPACITIES.

MR. A. Aller, writing in Power, gives the accompanying table showing in cubic feet the quantity of condensing water required per minute, concerning which he says: This table enables any engineer to easily determine the condensing water required for a steam engine or steam pump. For instance, if the condenser is required for an engine, say diameter of piston 20 inches, length of stroke 48 inches, speed of piston 600 feet, cut-off ¼, initial steam pressure 80 pounds, by referring to table, 20 inches diameter of piston at 80 pounds steam pressure, for 100 feet of piston speed per minute at full stroke requiries 19.4 cubic feet of water per minute, and at 600 feet piston speed would be 116.4 cubic feet, and when divided by ¼ stroke would equal 29.1 cubic feet of water, or 218 gallons of condensing water per minute, and when condenser is required for pump it is necessary to know how many gallons of water is discharged regularly by pump at a given pressure. For instance: If pump is discharging 500 gallons per minute against 100 pounds pressure or 230 feet head. As one horse power is required for every 2,500 gallons of water elevated one foot high per minute, 500 gallons of water elevated 230 feet high would require 46 horse power. Thus by this simple table the quantity of condensing water required is easily ascertained, as this table is applicable for any style of condenser used for steam engines or steam pumps. You will notice on table in left hand column the horse power gained for every 100 feet of piston speed per minute.

The officers and members of the Montreal Association of Stationary Engineers recently presented Mr. J. J. York, mechanical superintendent of the Canada Sugar Refining Co., with a handsome silver tea set and tray, appropriately engraved. The presentation was made by Mr. Thos. Ryan, and was intended as a small token of recognition for the efficient services rendered by him as president of the association. The members were afterwards invited to a sumptuous repast at Mr. York's residence.

INTERIOR CONDUITS.

When interior conduit was first placed upon the market, its reception was by no means an enthusiastic one. There seemed to be a strong prejudice against that mode of wiring, and it was thought unnecessary and objectionable by many electrical engineers. The Interior Conduit and Insulation Company, which has since been absorbed by The Sprague Electric Co., was, however, convinced of the necessity for better methods of wiring than had existed up to that time, and perseveringly demonstrated beyond all doubt the desirability and necessity of such a system. From its first step in offering to the public unarmored asphaltic paper conduit, this company claim to have met all the varying conditions imposed by the rapid improvement in the art of modern building construction. The introduction of unarmored conduit was followed by that of brass armored, and later by iron armored. Its latest product is the flexible metallic conduit, now made in all sizes and possessing many features of excellence. A few of the many advantages claimed for this conduit are: By reason of its great flexibility as well as its perfectly smooth and almost frictionless interior, it is entirely feasible to string it over beams and around comparatively sharp constructions, equivalent to many more elbows than might be used in the rigid pipe system in the same situation, and yet retain the wire freedom so essential to drawing in or withdrawing.

The design of the conduit is such that while affording the greatest ease in bending to a curve formation, it absolutely prevents the possibility of flattening. The interior is thus invariably of uniform diameter and symmetrical proportions.

The surface presented to the insulation of a conductor in "drawing in" is less than 20 per cent. of its entire length, while that portion of the insulation in actual contact with the conduit after it has settled to its position can never exceed 25 per cent. of the whole, leaving the balance practically suspended in free air.

Another important feature of the construction of this conduit that will appeal especially to architects and builders is that the outer surface is such that plaster or other surfacing material will rigidly adhere to it, thereby entirely eliminating the unsightly "plaster cracks" so frequently in evidence where rigid conduit has been covered by a comparatively thin layer or "skim coat."

It is generally admitted that the best wire insulations require either to be kept dry or to be completely and continuously immersed in water. Since to effect the latter is impracticable, the problem is to achieve the former as nearly as is consistent with practical methods. It is well known that condensation or "sweating" takes place with great freedom in unlined metal pipes, and also that the water so condensed will be retained within a pipe system indefinitely, resulting in keeping the wires moist without completely submerging them, thus absolutely guaranteeing the ultimate destruction of their insulation. Now, were the same pipe thoroughly ventilated throughout every unit of its length and its diameter, it is apparent that the products of condensation would not be retained. In fact, there would not be any condensation.

Flexible metallic conduit is just such a ventilated pipe; by reason of its spiral formation there is no unit of its length or of its diameter without its vent. Wires placed in such a conduit are of necessity maintained in a condition as free from moisture as is physically possible short of hermetically sealing them, which, as is now known from long experience, is practically impossible.

The destructive action of a short circuit in unlined rigid tube is too well understood by electrical engineers and others to require extended discussion here; it has been demonstrated, however, by actual experiment, that such destruction cannot occur in the flexible metallic conduit on account of its perfect ventilation, which allows the energy of a "short circuit" to be dissipated throughout every unit of the conduit section in which it develops, leaving the interior of the conduit as perfect as before the occurence of the "short circuit."

Experiments with nails, hammers, saws and other tools have clearly demonstrated that flexible metallic conduit has mechanical strength superior to commercial gas pipe of the same wall thickness and of approximately the same interior diameter, therefore as a satisfactory protecting envelope for insulated conductors it is more desirable than any form of conduit at present manufactured; the formation of the outer metal ribbon presenting an almost impenetrable surface to nails, etc.

The tools required for installing Greenfield flexible conduit are few and simple. An adjustable vise is provided for holding the tube while it is cut with an ordinary hack saw. A reaming tool, similar to that used with iron pipes, removes the slight burr caused by the saw.

An additional protection against any possible injury to insulation while the wire is being drawn in, is provided by a small, soft metal bushing which is inserted in the end of the tube and secured permanently by an expanding tool. When the bushing is inserted in the end and the expanding tool applied by a strong pressure of the hand it forces the metal into the spiral formation of the tube, making a smooth and frictionless finish to the end.

The National Underwriters Association has decided that conductors used in this conduit should have insulation equal to that required for conductors installed in uninsulated metal conduit, as shown in their Rule No. 40, Class D, and that the conduit will be approved under the same conditions imposed by them on any other uninsulated pipe.

As it is manufactured in lengths of 100 feet, and as the circuit divisions in interior wiring rarely exceed that distance, it follows that no necessity exists for a break in the continuity of a division from junction box to outlet. But the great gain is in the saving of time, labor and cost of construction, as it is obvious that there are no elbows with their diminished cross section, no threads to cut, and consequently no burden of tools to constitute a workman's equipment. Again, while many contractors have thought on account of its many advantages that it was more expensive than the plain rigid iron pipe, this is quite a misconception, as in addition to the saving it effects in elbows, and couplings, and labor in installation, the conduit itself is somewhat cheaper. The use of this conduit therefore solves the problem of rendering an uninsulated "plain" metal conduit thoroughly reliable, safe, and in all respects a satisfactory protecting envelope for the insulated wire it encloses.

The Sprague Company still maintains its position as the pioneer in this department of electrical fields. All its manufactures are approved by the National Board of Fire Underwriters, and may therefore without hesitation be recommended for every kind of interior wiring.

Persons interested may obtain further particulars or catalogues from the Canadian sales agents, Messrs. Jack & Robertson, 7 St. Helen St., Montreal.

MOONLIGHT SCHEDULE FOR MARCH.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1....	P.M. 6.20	A.M. 5.40	11.20
2....	" 6.20	" 5.40	11.20
3....	" 6.20	" 5.40	11.20
4....	" 9.00	" 5.30	8.30
5....	" 10.20	" 5.30	7.10
6....	" 11.30	" 5.30	6.00
8....	A.M. 12.20	" 5.30	5.10
9....	" 1.10	" 5.20	4.10
10....	" 2.00	" 5.20	3.20
11....	" 2.30	" 5.20	2.50
12....	" 3.00	" 5.20	2.20
13....	" 3.20	" 5.20	2.00
14....	No Light.	No Light.	.....
15....	No Light.	No Light.	.....
16....	No Light.	No Light.	.....
17 ...	P.M. 6.40	P.M. 9.00	2.20
18....	" 6.40	" 9.45	3.05
19....	" 6.40	" 10.45	4.05
20....	" 6.40	" 11.45	5.05
21....	" 6.40	A.M. 12.40	6.00
22....	" 6.40	" 1.40	7.00
23....	" 6.40	" 2.30	7.50
24....	" 6.40	" 3.20	8.35
25....	" 6.50	" 4.00	9.10
26....	" 6.50	" 4.40	9.40
27....	" 6.50	" 5.00	10.40
28....	" 6.50	" 5.00	10.10
29....	" 6.50	" 5.00	10.10
30....	" 6.50	" 5.00	10.10
31....	" 6.50	" 4.50	10.00
		Total.....	189.00

The owners of the Velvet Mine in British Columbia purpose constructing a railway from Rossland to the mine. It is probable that electricity will be the motive power. Upon this point a director of the British Electric Co. will shortly make a report to the owners.

SPARKS.

The Louisburg Electric Water and Power Co., of Louisburg, C. B., is seeking incorporation.

The Lay Whip Co., of Rock Island, Que., intend erecting a new factory, to be operated by steam power.

The Montreal Street Railway Co. have fitted up club rooms for their men at the corner of Cote and Vitre streets.

The two companies applying for charters to build an electric railway from Ottawa through the Winchester district to a point on the St. Lawrence river have amalgamated.

Mr. W. T. Stewart, electrical engineer, of Toronto, has been engaged to prepare an estimate of the cost of a system of street and commercial lighting for Toronto Junction, Ont.

Negotiations are said to be in progress for the location at Brantford, Ont., of a well known firm of manufacturers of electrical apparatus, whose headquarters are in the United States.

The electric light plant at Huttonville, Ont., was completely destroyed by fire on February 15th. The plant was used for lighting the town of Brampton, four miles distant, and was insured for $3,000.

A gentleman has made a proposition to the town council of Collingwood, Ont., to establish smelting works and rolling mills there. He agrees to expend $1,300,000 on the plant. It is his intention to utilize the blast furnace gases for the production of power to operate the blowing engine and electric plant that will be installed for driving the machinery.

Mr. Clyde K. Green has entered upon his duties as traffic manager of the electric railway system of the Cataract Power Co., of Hamilton, and Mr. J. B. Griffith, late manager of the Hamilton street railway, has been installed as purchasing agent of the syndicate. Mr. H. R. Leydon has successed Mr. Gordon J. Henderson as manager of the Hamilton Electric Light & Power Co., and Mr. Henderson will be appointed to another position in connection with the company's plant.

The annual meeting of the Halifal Electric Tramway Co., Limited, was held at Halifax on February 12th. The statement of the directors showed a net profit of $61,798, as compared with $54,748.54 for the previous year. The percentage of operating expenses was reported to be lower than in any previous year, showing a decrease of 3.91 per cent. as compared with 1898. The car mileage increased during the year by 20,334 car miles, and 2,616,231 passengers were carried, an increase of 196,963 over the previous year. The total instalment of incandescent lamps throughout the city was given as 17,267. The power station equipment was increased by a constant current alterating arc lamp transformer of 100 lamps capacity, a line transformer of 50,000 capacity, and 110 meters. Mechanical stokers were placed under one boiler.

Messrs. Wright & McKinley, of Seaforth, Ont., are still negotiating with Dr. Norton for the purchase of the electric light plant at Shelburne. If an agreement is reached they agree to supply lights at the following rates on a five year contract: For lighting streets from dusk until midnight, and eleven o'clock on Sundays, with 20 arc lamps, run on moonlight schedule, $500; for lighting town hall and public library with 20 incandescent lights of 16 candle power, $25. Rates to private takers would be: 1 to 3 lights, 16 c.p., 40c. a month; 4 to 10 lights, 16 c.p., 35c a month; 11 to 15 lights, 16 c.p., 33c a month; over 15 lights, 16 c. p., 30c. a month. Bed room lamps, 8 c. p., $2 per year; 10 c.p., $2.25 per year; 16 c. p., $2.77 per year. Halls and churches, $1.50 per 16 c. p. per year. Cleat wiring, $1 per lamp. Concealed wiring, $1.25 per lamp.

SPARKS.

The Victoria Telephone Co., of Woodville, Ont., at a recent meeting, decided to extend their line to Lindsay.

The British Columbia Electric Railway Co. intend to do considerable double-tracking in the city of Victoria.

It is said that the Montreal Street Railway Co. have decided to provide special cars for the convenience of smokers.

A new building will be erected in Montreal for the Canadian Pacific Telegraphs, the plans for which are now being prepared by Maxwell & Shuttuck, architects.

The town council of Richmond, Que., have given a five year contract for street lighting to the electric lighting company of that place, at the price of $1,000 per year.

The corporation of the village of Beaurivage, Que., is seeking power from the Quebec Legislature to construct an electric railway within the municipality and connecting with the city of Montreal.

Messrs. Peter Ryan and John Shields, of Toronto, have submitted to the council of Kamloops, B.C., a proposition to establish electric light and waterworks systems costing $100,000, provided they are given a franchise for thirty years.

The transport "Milwaukee," which was chartered to carry the Canadian cavalry to South Africa, was fitted with electric lights. The installation includes a 10 k.w. multipolar dynamo and switchboard, which is being supplied by the Royal Electric Co. This is the second transport for which this company have supplied the electrical apparatus.

SPARKS.

The village council of East Toronto is looking into the question of installing an electric light plant.

Various sites have been visited by the city council of Halifax, N.S., which has decided to establish a municipal electric light plant.

The United Electric Co., of Toronto, purpose erecting new factory buildings, increased business having made larger works necessary.

A by-law will likely be submitted to the ratepayers of Yarmouth, N. S., to provide the sum of $13,000 for a steam pumping plant for the waterworks system.

Messrs. W. A. McLean, D. Robertson and others have been incorporated as the Walkerton Electric Light & Power Company, of Walkerton, Ont., with a capital of $30,000.

It is stated that the Dominion government has decided to install a storage battery plant at Hamilton beach, and to light the piers and approaches to the canal by electricity.

A very attractive booklet descriptive of the Lundell motor has been received from Messrs. Jack & Robertson, of Montreal, Canadian agents for the Sprague Electric Company.

The Canadian General Electric Company are in need of additional factory accommodation, and it is probable that they will erect a large addition to their works at Peterboro, Ont.

The E. B. Eddy Co., of Hull, Que., have awarded the contract for electric motors for operating their factory in Hull to Ahearn & Soper, Canadian agents for the Westinghouse Company.

The mayor of Winnepeg has announced that he will introduce a by-law to provide $300,000 for the installation of a municipal gas plant, also that he will take steps to secure the franchise for private electric lighting.

The Crow's Nest Pass Electric Light and Power Co. has been incorporated by the Government of British Columbia. It is proposed to develop water powers and supply electric light and power to the town of Fernie and vicinity.

Some idea may be gained of the output of the Goldie & McCulloch Co., Limited, of Galt, Ont., when it is known that they sold 34 engines the first 47 days of the present year. They are busy is all their other departments as well.

Messrs. W. B. Snowball, R. A. Snowball, Geo. E. Fisher, R.A. Lawlor and D. G. Smith are seeking incorporation as the Chatham Electric Light Co., capital $50,000, to carry on an electric lighting business in the vicinity of Chatham, N. B.

Mr. M. Kyle, of Rat Portage, Ont., when in Toronto recently, stated that as soon as the mines of the Gold Panner Mining Company were established on a firm basis, a water power would be utilized and the entire plant operated by electricity.

One for the New Midland Elevator Co., one for the Beaver Portland Cement Company, Marlbank, and three for the Linde British Refrigerator Co., of Montreal, are among recent sales of Wheelock engines made by the Goldie & McCulloch Co., Limited, Galt, Ont.

The C.P.R. Telegraph Company have decided to purchase the building now occupied at the corner of Hospital and St. Francois-Xavier streets, Montreal, and in the spring to erect on the site thereof a new building so planned as to meet the requirements of their rapidly growing business.

A committee of the council of St. Mary's, Ont., visited the towns of Goderich and Seaforth to secure information regarding the operation of waterworks and electric light plants. This committee has recommended that the town assume control of all private electric lighting and that additions be made to the plant.

Among recent sales this year of Ideal high speed engines made by the Goldie & McCulloch Co., Limited, of Galt, is one for St. Francois-Xavier College, Antigonish, N. S., two for Canadian General Electric Company, and one for Wm. Cowan & Co., Prince Albert, N. W. T. These engines are in demand all over the Dominion, as the above orders show.

The T. Eaton Company have decided to remove their entire engineering department from its present location in the main building to a new building recently erected on the north side of Albert st., Toronto. As this is one of the largest isolated electric and steam plants in the Dominion, this change will involve a vast amount of labor. The chief engineer of this plant is Mr. E. J. Philips.

SPARKS.

The Canadian General Electric Company have subscribed $1,000 to the National Patriotic Fund.

Mr. R. A. L. Gray, electrical engineer and contractor, Toronto, has removed to new and more convenient offices in the Rossin House block, 83½ York street.

It is understood that a company will apply for a charter to operate a street railway in the municipalities of Fairville and Carleton, adjoining the city of St. John, N.B.

It is reported that the Cataract Power Company, of Hamilton, will extend their radial railway system to Oakville at an early date. It is also stated that the Toronto Street Railway Company will build a road west to the same point, thus completing an electric railway system between Toronto and Hamilton.

The city of Montreal and the Montreal Street Railway Co. have agreed to ask the courts to decide the proportion of cost to be borne by each for the removal of snow from the streets during the winter. The street railway company has, in the past, paid two-thirds of the costs, but the old contract having expired, the company wish a new agreement entered into on the half cost basis.

Messrs. Wallace & Little will make application at the coming session of the Ontario Legislature for the incorporation of the Woodstock, Thames Valley & Ingersoll Electric Railway Co., to construct an electric railway through to the town of Woodstock, and of West Oxford to Ingersoll, with branches to other [illegible]

Scientific American, Oct. 14, 1899.

THE AUTOMOBILE MAGAZINE has at last come to hand and is the most thoroughly satisfactory periodical which we have seen in any language on the subject. It is of regular magazine size and has 111 pages. The quality of the articles is very high and the illustrations are of the best. Everyone who is at all interested in the automobile will find something in the new magazine which will interest him. Even the social side is far from being neglected, as there is an article on the recent floral parade at Newport and on the Automobile Club of France. The Automobile Index, which occupies some nine pages, is exactly what has been needed. On the whole the magazine is a most satisfactory one.

N. Y. Evening Post, Oct. 9. 1899.

The new illustrated AUTOMOBILE MAGAZINE (New York: U. S. Industrial Publishing Co.) has a very attractive appearance, and is so varied in contents, without undue padding, that one wonders how the editor can fill his pages hereafter. Still, the list on page 101 shows that there is a considerable "foreign automobile press;" and what foreigners can do in the way of furnishing "copy" to the printer, Americans can. The society feature of the new vehicle is brought to the front with news from the Newport festival—the driver, by the way, not always sitting on the left. There are competent-seeming book reviews, and some concessions are made to the general reader in comicalities of pencil and verse. The magazine seems free from bias.

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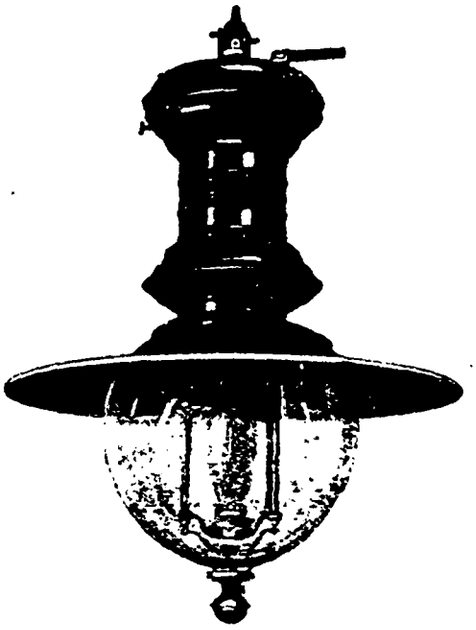

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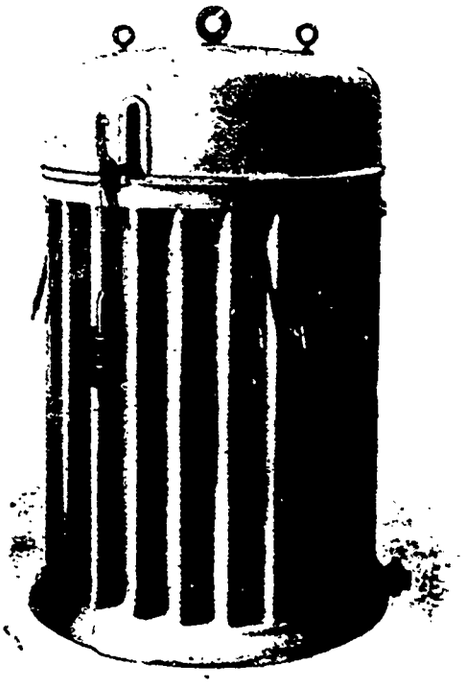

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SPARKS.

Tenders have just been taken for lighting the streets of the town of Napanee, Ont., for a period of ten years.

The Royal Electric Company, at a meeting of the directors held a fortnight ago, declared a quarterly dividend of two per cent.

The corporation of Hull, Que., will shortly let the contract for lamps, wires and fixtures for the new arc lighting system. There will be 75 arc lamps.

Mr. L. E. Gauthier, of Montreal, is preparing plans for a boot and shoe factory to be erected at Hull, Que., in which there will be installed several electric motors.

The Montreal Street Railway Company proposes to place its wires underground. The manager, Mr. F. L. Wanklyn, states that it has been decided to expend $200,000 on a conduit system which has become necessary owing to the large number of cars on the streets. The work will last about nine months.

The Chambly Water & Power Company have commenced the construction of a new tail race at Chamby in order to develop the entire water power. The contract has been given to P. Lyall & Sons.

Mr. Geo. C. Robb, of the Boiler Inspection & Insurance Co., has recommended that two new horizontal tubular boilers of 125 h.p. be installed in the Machinery Hall of the Toronto Industrial Exhibition.

The Underfeed Stoker Company of America, was incorporated last month in New Jersey, with a capital of $1,000,000, to manufacture an automatic stoker. The incorporators include Messrs. Geo. Gooderham, W. R. Brock, T. Rowan, J. L. Ross, Elias Rogers, Lloyd Harris, and J. B. Dill, of Toronto.