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AND ENGINEERING JOURNAL

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CANADIAN
ELECTRICAL NEWS
AND
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VOL. IX. DECEMBER, 1899 No. 12.

AN ELECTRIC HEATING AND COOKING PLANT.

IN their new hospice building at Niagara Falls, Canada, the order of the Carmelite Fathers have installed a modern electrical plant for lighting, heating and cooking purposes. This plant has taken the place of all other kinds of fuel for cooking and heating in the building, no less than 100 horse power being used for the various purposes.

The building in which this plant is installed is 200x250 feet, the distance from the ground to the top of the tower being 85 feet. The following particulars of the electrical equipment are found in the Electrical World :

The current used by the Carmelite Fathers is obtained from the Canadian Niagara Power Company. It is generated in the station of the Niagara Falls Park and River Railway, where the Canadian Niagara Power Company has installed a temporary plant pending more elaborate development under its franchise privileges, in order that the Canadian side of the river at the Falls may have all the electrical power called for in factories and other places. The power station is located about two miles from the hospice, and the current is carried over No. 3 bare copper wire strung on a pole line. The transformer house of the hospice plant is a small wooden building located about 150 feet from the main building. It contains two 30-k.w. Westinghouse and one 25 k.w. General Electric transformers, primary 2,200 volts and three-phase secondary 110 volts, current being transmitted through underground cable to the switchboard in the main building. The switchboards are located in the basement. A switchboard with double-throw switches controls two phase of the current, and the third phase is controlled by a switchboard adjoining the first one, and is used for cooking, lighting, etc. The two switchboards are so arranged that either transformer can be used independent of the other for either purpose.

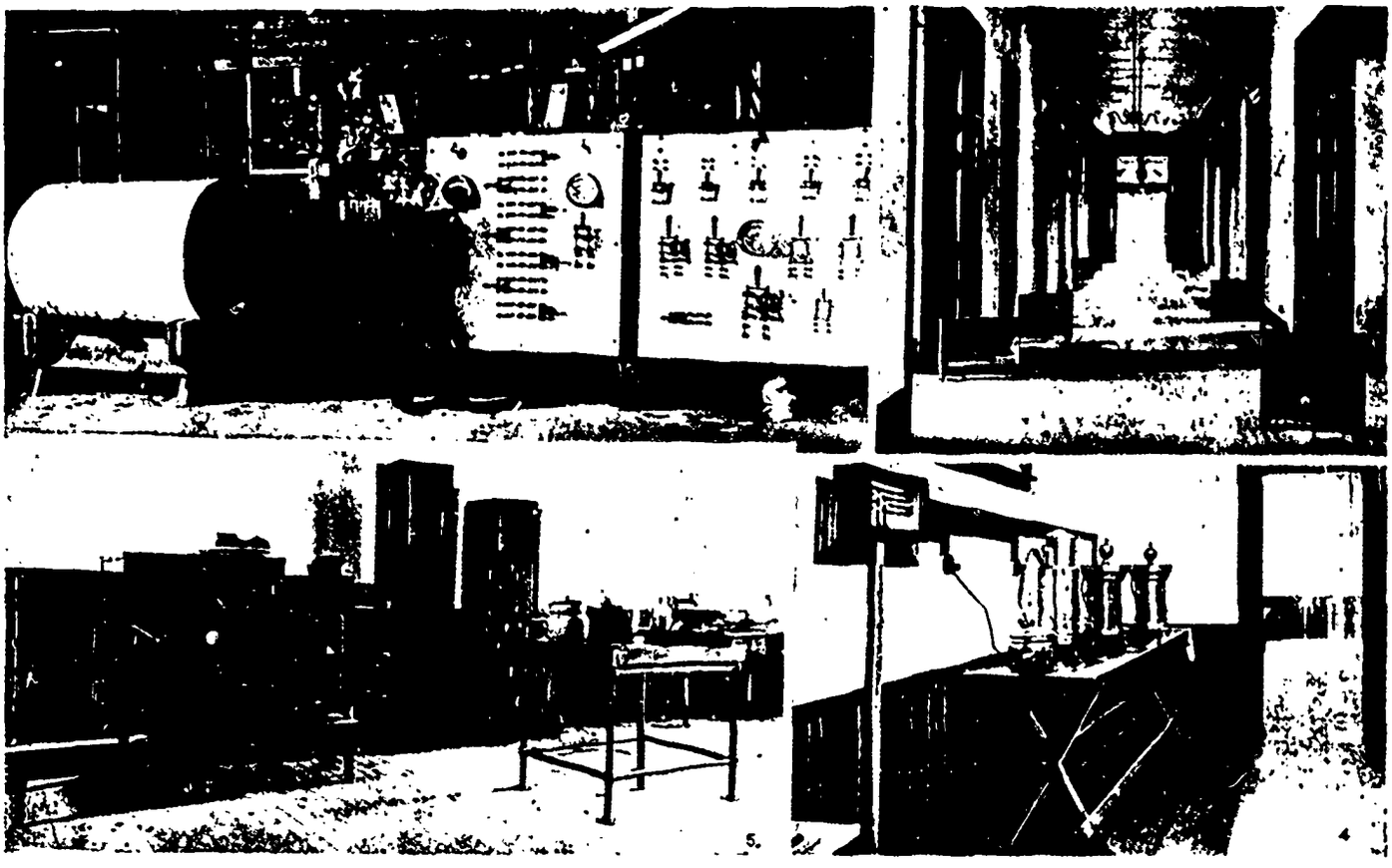


Fig. 2.—Electrically Heated Boiler. Fig. 3.—Corridors. Fig. 4.—Butler's Pantry. Fig. 5.—Electric Kitchen.

ELECTRIC HEATING AND COOKING EQUIPMENT IN CARMELITE HOSPICE, NIAGARA FALLS, ONT.

In the hospice building there are 200 16-c.p. incandescent lights, the current supply of which is taken from 25 horse power used for this purpose, for cooking and for heating water. The total amount of power taken by contract is 100-h.p., and the other 75-h.p. is applied to heating the lower floor of the hospice building, which comprises 11 bed rooms, a dining room, reception room

and office, and the corridor. This corridor is 120 feet long, 10 feet wide and 15 feet high. In it are installed nine 4-h.p. heaters. Each of the bed rooms is 10 by 12 by 15 feet and in each one there is one 4-h.p. heater with a changeable heat switch of two heats.

The kitchen of the hospice is equipped with an electric combination range and three electric ovens. This range has a heating surface of six square feet, each square foot of surface consuming 15 amperes and having a switch that allows the current to be controlled at full or half heat. Of the three electric ovens two of them are small and one large. Each of the small ovens has three compartments, and consumes 23 amperes of current at 110 volts, while the large oven takes 50 amperes. This oven equipment is so arranged that four 25 pound roasts can be handled at one time.

In the butler's pantry there are electrically operated urns and a chafing dish. The urns are three in number, each of five gallons capacity. One of the urns is used for making tea, one for making coffee, and the other for heating water for use in the tea and coffee urns.

Down in the basement, standing close by the switch-

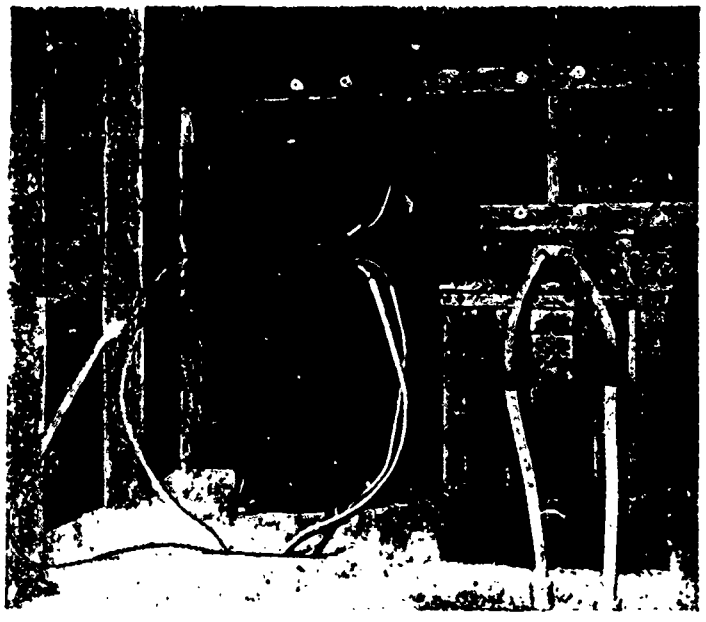


FIG. 1.—TRANSFORMER, CARMELITE HOSPICE.

boards and in the same room, there are two boilers electrically operated. One of these has a capacity of 400 gallons, while the other has a capacity of 150 gallons. The 400 gallon boiler is used for heating water for laundry and bath room purposes, and takes a current of 120 amperes, being divided in three heats. The small boiler is used for heating water for kitchen use, but can also be used in connection with the large boiler. The small boiler takes 125 amperes, being also divided into three heats. It is used principally for quick boiling. Both of these boilers are covered with 2½-inch asbestos covering. All water is boiled, so far as possible, when current is not being used for other purposes.

The electrical kitchen has been found capable of most successful operation, and on June 15th, on which day the building was formally blessed by His Grace, the Archbishop of Toronto, the Most Rev. Denis O'Connor, D D., of Toronto, dinner was cooked for 250 people. This did not include the soups, which, owing to their taking hours of time in their manipulation, were prepared in the kitchen the day before. But all meat and other food were cooked electrically that day. In the big boiler it is possible to heat from 60 degrees to 212 degrees in six hours with full heat. In the small ovens bread can be baked in 18 minutes. On the door of the big oven is a barometer which shows the heat and indicates the temperature through the different times of roasting and baking. The heat of the ovens is kept uniform from the start to the finish of the cooking.

The current used for water heating, cooking and lights costs $25 per h.p. or $625 a year, while the 75 h.p. used in heating the corridor and bedrooms is secured at about one-fifth this price per h.p. It is evident that the heating service is not in use only during certain months of the year, and in addition to this the power is obtained from a station where in winter time there is a surplusage, owing to the fact that not as many cars are operated in winter on the scenic line as during the summer time. But one important feature demonstrated to the owners of the plant during the past winter was that a combination fuel and electric hot water heating installation might be found more serviceable under present conditions than the separate electrical installation, for much trouble has been experienced on the Canadian side in winter in the matter of power development from anchor ice, in fact during last winter the ice was very troublesome on both sides of the river. At times the current was entirely cut off, and at such times and under such circumstances a fuel service under the boiler to heat water for general heating purposes would have been deemed ideal. The plant of the hospice was installed by Mr. A. Harth, and he has expressed a belief that such a system of heating would be most advantageous not only at Niagara but in other places where people seek to use electricity for heating purposes, whether in factory or residence. The idea thus expressed is, that instead of carrying the current through the building to heaters located here and there, it might, in many cases, be better to install a hot water heating plant and apply all the current to the boiler for heating the water for circulation through the building, and where the electric service is for any reason likely to be cut off have a fuel service at the boiler ready for immediate operation.

No doubt many other new ideas will be developed at Niagara in the matter of using electricity for heating, but the plant in the hospice has given great satisfaction, and is the wonder of all who see it. One very noticeable feature of the kitchen is the entire absence of dirt and soot on the various utensils used on the stove or in the ovens. The plant as a whole requires but little care for its operation and management.

[Since the above was written the power house of the Niagara Falls Park and River Railway, from which the current was obtained, has been destroyed by fire.—Ed. ELECTRICAL NEWS.]

It appears as if it were only a question of a very brief time, says the Engineering Magazine, before petroleum motors designed upon the principles demonstrated by Diesel, Banki and others will come into general use, not only for small powers, but also for general service.

A motor car is about to be put in operation between Ashcroft and the gold mines of Cariboo, B.C., a distance of 200 miles. The vehicle is now being built in Vancouver, and will be completed early in the spring. It will have accommodation for twelve persons, besides 1,000 pounds of freight, and if its operation is successful other carriages will be put on the line. Steam will probably be used as the motive power.

BY THE WAY.

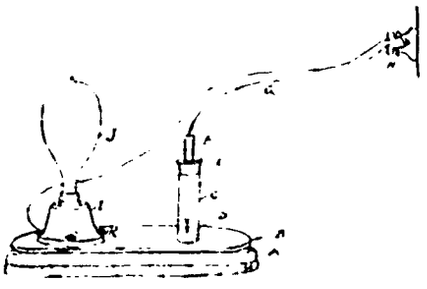
We have become accustomed to the phrases "The Sturdy West" and "The Effeminate East" as applied respectively to the new and older provinces of Canada. These phrases express the truth that battling with difficulties incident to the development of a newly settled country develops a sturdy and self-reliant manhood, while, on the contrary, the easy conditions prevailing in more highly civilized communities tends to weaken in men these desirable qualities. I was reminded of this fact by a recent conversation with a young man who has grown up with one of our western towns, and for quite a number of years has been identified with the electrical business. He had few advantages for the acquirement of technical knowledge, but lost no opportunity of improvement, and has fought his way up through many difficulties to an important and responsible position. When the street railway generators burned out, and the man in charge declined to undertake their repair, this young man was asked if he could do the job. Although having but a very limited knowledge of the machines, he promptly answered "yes." So dubious were the owners regarding his ability that they offered to pay him a fixed sum (not a very liberal amount) if he succeeded, but with the provision that he must furnish his own material, so that they might be put to no risk. It took two or three days and much worry to complete the work, but the young man was determined to succeed, and he did. In telling me the story he said: "Many of the young men I meet are too ready to say 'I can't' when a difficulty arises, and it is therefore not surprising that some who have been eight or ten years connected with electric stations, have made little or no advancement. They have not shown their employers that they are capable of doing the things which would earn for them promotion. The ease with which, in cities, someone can be got to make repairs, is a stumbling block in the way of young men, who under less advantageous conditions would be compelled to use their own hands and brains in overcoming difficulties. Another obstacle in the way of the young man's progress in the east, is pleasure in its many alluring forms, which makes it difficult for those not blessed with large powers of determination to pursue the more rugged and profitable path of duty."

× × ×

"It's surprising how Canadian business men allow themselves to be 'taken in' by Yankee sharpers," said the manager of a large industrial concern with whom I conversed recently. He went on to tell how a gentleman from across the line had brought into Canada what was claimed to be an entirely new method of lighting, designed to throw into the shade the present arc and incandescent systems. On the strength of his claims and his ability to produce a brilliant light some business men, including, strange to say, a lawyer, were induced to give up some of their hard earned dollars to assist in developing the enterprise. At this stage the idea occurred to the lawyer that it might be advisable to get the opinion of a friend of his who was qualified by experience to judge of the value of the new discovery. Accordingly a visit was made to a bicycle repair shop, where the invention was in operation. In reply to the enquiries of the lawyer's friend the inventor began a description of the modus operandi of his system, which, as a certain writer has expressively put it, was "as clear as mud," and was intended to pull the wool over the eyes of the uninitiated. The lawyer's friend did not, however, belong to this class. He took in the situation at a glance, and mentally stamped the word "humbug" in large letters on the whole outfit. What he saw was this: An iron receptacle resembling the upper part of a kitchen boiler, filled two-thirds full of a liquid which the sense of touch and smell declared to be coal oil. The space above this liquid was filled with air pumped in with a hand pump. Attached to the tank were small pipes through which the oil was forced by the pressure of the air in the tank, and discharged into the bottom of a vertical pipe of larger diameter heated to a high temperature, contact with which served to transform the oil into gas. The gas on rising to the top of the pipe became mixed with air supplied from pipes opening into the atmosphere. The gas and air thus commingled then passed downward and were fed into a group of Bunsen burners fitted with Welsbach mantles which were thereby heated to incandescence. The system embodied no new principle but simply accomplished by a very round about method what has been done for years by the direct use of gas and the Bunsen burner. The enterprising promoter, on realizing, by the questions and remarks of the lawyer's friend, that the bubble had been pricked and that he would be called on to refund the advances made to him, or in default face the courts, pleaded the receipt of a telegram urgently requiring his presence at home, as a reason for taking his hasty departure.

CIGAR AND PIPE LIGHTER.

A CORRESPONDENT sends the ELECTRICAL NEWS the accompanying drawing showing a cheap and simple form of cigar and



pipe lighter for alternating or direct current circuits any voltage, with the following explanation:

A—Wood base.

B—Mica or asbestos veneer.

C—Small wide mouthed phial.

D—Wood alcohol or methylated spirit.

E—Cork; hole drilled through centre.

F—Piece of vulcanized fibre rod, drilled through.

G No. 16 cotton incandescent cord, one end passed through fibre rod and insulation removed at exit from rod.

H—Pony wall receptacle, with fused attaching plug.

I—Pony wall receptacle, other terminal of No. 16 cord connected to one side clamp.

J—32 c.p. or 50 c.p. lamp, voltage—same as current supply; base to suit receptacle I.

To operate, wipe end of rod F across free receptacle clamp K and spirit absorbed will be kindled instanter. If done fairly quickly the lamp J will not even light up.

The town of Yarmouth, N.S., is furnished with water pumped by electricity, the current being supplied by the Yarmouth Street Railway Co., at a cost of $200 per month. The company have notified the corporation that they cannot continue to furnish the power at this figure after February 7th, 1900, and consequently the council is considering the advisability of putting in a steam plant to furnish power for pumping, and also for operating a dynamo for street lighting. The services of an electrical engineer will be engaged to give advice on the subject.

CORRESPONDENCE.

THE FIRST 220-VOLT PLANT.

TORONTO, Nov. 9, 1899.

EDITOR CANADIAN ELECTRICAL NEWS

DEAR SIR, In your November issue we notice an item stating that the Royal Electric Co are installing a 250-volt plant in the head office of the Merchants Bank of Canada, and that it is believed to be the first complete installation in Canada fitted out with 220-volt lamps. We beg to state that last September we installed a complete 250-volt direct connected plant for Messrs. Gowans, Kent & Co., in this city, which in addition to operating three elevator motors, is operating four hundred 250 volt incandescent lamps. We believe this to be the first complete installation in Canada using 250 volt lamps, as the Merchants Bank plant has not yet been installed.

We enclose copy of letter from Messrs. Gowans, Kent & Co., which explains the satisfaction derived from the above plant purchased from us.

Yours truly,
UNITED ELECTRIC CO., Limited.

TORONTO, Nov. 8, 1899.

UNITED ELECTRIC CO., Ltd.

GENTLEMEN, We are pleased to say that the electric plant which you installed for us in September last, consisting of 30 k.w. multipolar generator direct connected to 9 x 10 Robb engine and Mumford boiler, is giving the best of satisfaction. We are glad that we followed your suggestion to adopt the 250 volts presure instead of 110 volts as contemplated, thus enabling us to operate our light and motors jointly, with greater economy, and also to connect our circuits at any time to the commercial power circuit should we not desire to operate our engine.

We heartily recommend the adoption of this system for isolated power and lighting plants, and you are welcome to bring prospective customers to examine our plant.

Yours truly,
GOWANS, KENT & CO.

THE MONTREAL ELECTRIC CLUB.

MONTREAL, Dec. 4th, 1899.

EDITOR ELECTRICAL NEWS

DEAR SIR, "Club's letter in your November number recalls some pleasant recollections of our late Montreal Electric Club. There has not been, nor is, to the writer's knowledge, any other electric club here which exactly fills the place that this one used to occupy. Not until the club had terminated did the members really appreciate the benefit of those evenings. The writer, for one, gained valuable instruction from the various papers, discussions, debates and lectures. We met once a fortnight.

It must be remembered that in those days electrical applications were not nearly as widespread as they are to-day, the street railway was changing over from animal power; incandescent lighting was being introduced, arc lights were fewer, telephones were scarce; house bells a wonder; interior wiring a matter of individual taste, no rules being enforced or practiced; no college course could be had here that was of any use. We were seeking or experimenting for knowledge for our daily needs, and whenever we could get some visiting or well known expert to come before us, didn't we just pump him all we could.

The social side of the club was also important. The evenings were unspoiled by useless formality -merely a simple order of proceedings was observed.

One of the most interesting features of our evenings was the debates. These, at first, tried with hesitation, ended by becoming the best attended meetings, and it seems amusing now to think of the nerve with which we talked on leading questions of the day

"A FORMER MEMBER.

USE OF ENCLOSED ARC LAMPS.

MR L. B. Marks contributes to the Electrical World and Engineer some statistics showing the rapidity with which enclosed arc lamps have come into use. Up to 1895 open arc lamps were used very largely, but that year marked the turning point in arc lamp practice, brought about by the introduction of the enclosed arc lamp, which bids fair to almost entirely supersede the open type. In the year 1895 the number of open arcs in use was greater than those of the enclosed type, but has since dropped rapidly each year. The records for thirty-two cities in the United States show that in 1890 there were in use 23,605 open arc lamps and 1,203 enclosed arc lamps, while in 1899 the number of open arcs in use in these cities was 16,010 and the number of enclosed arcs 20,848. These figures show a decrease of open arcs in three years of thirty-two per cent., and an increase in enclosed arcs of 1,600 per cent. It is estimated that there are now in use in the United States about 150,000 enclosed arc lamps, of which more than half have been installed within the past two years. The total number of enclosed arc lamps in Great Britain and the Continent is given as 55,000, but it should be stated in this connection that the first commercial use of enclosed arcs abroad began about a year later than in the United States.

MR. R. B. WILLIAMSON, M. E.

THE features of Mr. R. B. Williamson, M.E., now principal of the Electrical Department of the International Correspondence Schools, Scranton, Pa., but at one time a resident of Canada, are shown in the accompanying portrait. Mr. Williamson graduated in Electrical Engineering at Cornell University. After graduating he spent two years at electrical construction work, including the complete installation and operation of electric light plants. This work also included the installation of steam engines, and involved a large amount of interior wiring. During the same time he also did considerable designing in connection with dynamos and motors. In 1895

MR. R. B. WILLIAMSON, M.E.

he was chief draftsman for the Canadian General Electric Company, at the same time engaged largely in designing work in connection with dynamos and motors, both for direct and alternating currents. While with that company he gained considerable experience in the construction and operation of street-railway apparatus, together with all kinds of switchboards used in street-railway and power plants. In 1896 he accepted a position as Instructor in Electrical Engineering at Lehigh University, going from that University to the International Correspondence Schools. While at Lehigh University he had complete charge of the courses in dynamo-electric machinery and the design of electrical apparatus. He also had charge of the work in connection with the electric street railways, and did considerable special work on alternating currents.

The School of Electricity of the Colliery Engineer Company, over which he has charge, includes seven courses, as follows: Electrical Engineering, Electric Power and Lighting, Electric Lighting, Electric Railways, Electric Mining, Wiring, and Bellwork.

The Hammond Reef Consolidated Mining Company, Ltd., are installing at their mine a cable derrick which will be operated by a 20 h.p. induction motor. This, together with the generating plant and mill motors, will be in operation within a week. The Canadian General Electric Co., who have the entire contract, have sent their expert to superintend the starting.

REPORT ON TRIALS MADE AT MAGOG, QUEBEC, TO TEST THE ECONOMY EFFECTED BY COMPRESSED AIR.

By Prof. T. H. Nicholson, D. S. (Edinburgh and McGill), M. Inst. C.E.

THESE trials were made during the month of April, 1899, at the Dominion Cotton Mill, Magog, Canada where there is installed a 150 horse power hydraulic air compressing plant on the system devised by C. H. Taylor, of Montreal. They were made at the instance of Mr. John A. Inslee, of St. Louis, and conducted under the auspices of Mr. Inslee, the Taylor Hydraulic Air Compressing Co., and the Dominion Cotton Mill Co., jointly.

The trials were conducted by the undersigned, assisted by Professor R. J. Burley, B. Sc., etc., of McGill University, but a number of prominent engineers from the United States were invited to be present and took part in the experiments. Among others I may mention Mr. A. Langstaff Johnson, of Richmond, Va., Mr. William O. Webber, of Boston, Mass., and Mr. John Birkinbine, of Philadelphia, Pa.

Experiments were made on five different methods of using compressed air in an ordinary steam engine of the Corliss type.

1st. The air was supplied to the engine cold.

2nd. Steam was injected into the air in the main pipe before supplying it to the engine.

3rd. The air was injected among the water in a steam boiler and heated by mixing with the water and steam of the boiler before being supplied to the engine.

4th. The air was blown upon the surface of the water in a steam boiler and heated, by mixing with steam in the same before being made to drive the engine.

5th. The air was passed through a tubular heating vessel and heated by a coke fire, afterwards being used to work the engine.

For all the experiments the air was drawn at a pressure of 53 lbs. from the 5-in. main air pipe of the Taylor air compressor, which supplies power to the mill, and was piped to a 12-in. diameter by 30-in stroke Corliss engine, supplied for the purpose of the trials by the Laurie Engine Company, of Montreal.

A friction brake was fitted on the fly-wheel of this engine and the engine in this way was worked up to its full power at about 75 revolutions per minute.

Connection was made to a Lancashire boiler 7 feet diameter by 30 feet long when it was desired to mix steam with the air for purposes of pre-heating.

When dry heating was resorted to the air pipe was led through a heater on its way to the engine, having been previously blanked off from the steam boiler. This heater was designed by the writer and built by Messrs. The Laurie Engine Co. for these experiments; but, as it was designed of such size as to heat the whole of the compressed air used in the mill, it was considerably larger than was required to heat the greatest quantity of air which could be used by the Corliss engine employed on the test. It was, therefore, a matter of some difficulty to prevent the heater and the small quantity of air passed through the same from becoming hotter than was desired.

For the experiments made without pre-heating the observations made were as follows:

The temperature of the air before entering the engine.

The same on leaving the engine.

The pressure of the entering air, indicator cards from each end of the cylinder, readings of the revolution counter and of the rope break weights.

A trial was conducted with cold air on April 27th, in the presence of Mr. Birkinbine, which gave the following results:

The air entered at 66.5 F. and was exhausted at −41 F., the revolutions being 74.6 and the cut-off about one-third of the stroke. The indicated horse power was 27 and the weight of air used per hour was 1,671 lbs. This gives about 841 cubic feet of free air at 60 F. per i.h.p. hour.

On another trial made under same conditions 850 cu. ft. of free air were used for per i.h.p. hour.

2. In the case of experiments made with the dry heating, the following observations were made:

The temperature of the air before entering the heater; after passing up the first row of tubes; upon leaving the heater; before entering the engine.

The temperature of the furnaces and flue gases of the heater were also taken, the former with a Callendar's patent electrical promoter.

The amount of coke (Sherbrooke gas coke) used was carefully weighed and the trial only began when the conditions had become steady, i.e., about three hours from the time of beginning the run with heated air. Cards were taken; the brake horse power and the revolutions were also observed.

With air entering the heater at a pressure of 53½ lbs. gauge and at a temperature of 58.2 F., it was raised to 225 F. after passing the first row of tubes, and 363 F. upon leaving the heater. Owing to undue length of air pipe and lack of proper covering, the air fell in temperature to 287 F. before entering the engine. It was exhausted at 88 F., and the pressure at the engine was 52½ lbs. by gauge.

The temperature of the gases leaving the fire was only about 700 F. and was reduced to 100 F. in the flue of the heater. It was difficult to use a small enough quantity of coke in such a large heater without letting the fire out altogether. A closed ash pit was used and the air for combustion supplied from the compressed air main and could be regulated to a nicety.

Under these conditions and with exactly the same cut-off as in trial of cold air, the indicated horse power being 26.7 and the revolutions 70 per minute, there used 1,310 lbs. of air per hour; this gives a consumption of 640 cubic feet of air per i.h.p. per hour, a reduction of 850—640 = 210 cu. ft. of free air per i.h.p. per hour due to pre-heating. Thus 210-850, a saving of 24.7 per cent. is effected in the quantity of air used.

This saving was effected by the burning of 9.3 lbs. of coke per hour, or of 9.3-26.7 348 lbs. per h.p. per hour.

These results may be stated otherwise as follows:

To produce 100 h.p. with cold air, 85,000 cu. ft. of air were *required in this engine; when pre-heated to 287 F., the horse*-power yielded was 85,000 - 640 = 133 h.p., and as this heating was effected by the burning of $\frac{9.3 \times 133}{27}$ 47 lbs. of coke per hour; the additional 33 h.p. were obtained by an expenditure of 47 lbs. of coke per hour, or at the rate of $\frac{47}{33}$ 1.42 lbs. of coke per hour additional.

If we assume that this gas coke had ¼ of the calorific value of good coal, it is seen that we obtained an additional horse-power for every (1.42 × ¼) 1 lb. of coal burnt in the heater.

As an ordinary steam engine and boiler of this size would require from 4 to 8 lbs. of good coal per h.p. per hour, it is seen what a very economical mode of using the heat this is. Heat is used 4 to 8 times as efficiently in a compressed air pre-heater as it is in a steam engine and boiler.

With regard to the results of this trial it ought to be remarked that a large radiation loss per lb. of air used was taking place, both on account of the undue size of the heater and on account of its distance from the engine. Much more favorable results can be, and in fact have been obtained, when the size of the engine and heater are properly proportioned.

Professors Riedler and Guttermuth have obtained an additional horse-power in air motors for every ¼-lb. of coal burnt to heat the air. This is an economy far surpassing that of any prime motor in existence.

In large plants with first-class air motors, where double or triple pre-heating might be resorted to, a better result than even this can easily be obtained.

In a large transmission plant consisting of a Taylor Air Compressor, a five-mile pipe line, air engines and electric generators, with coke pre-heating stoves, the full or gross power of the water fall can be obtained at the terminals of the dynamo, at a comparatively insignificant cost for fuel.

No other system of energy transmission can compare with this for economy of first cost and maintenace.

3. Tests were made of the economy to be obtained by heating the air by mixing it with steam from a boiler before allowing it to *do work in the engine.*

The results are of the highest scientific interest, and show the adaptability of compressed air to almost any condition of employment. As regards economy, this method is, however, inferior to that of dry heating. By mixing from 10 to 13 lbs. of steam per h.p. with the air, the quantity of air required was reduced from 850 cu. ft. to 300 to 500 cu. ft. per i.h.p. per hour. Thus the air required for 100 h.p. engine running with cold air would be sufficient to operate an engine of 85,000—400—210 h.p. if mixed with 12½ × 100—1,250 lbs. of steam per hour. This can be supplied by about 140 lbs. of coal per hour; so that 110 h.p. additional were obtained by the burning of 140 lbs. of coal or 140—110—1.3 lbs. of coal per i.h.p. per hour additional.

Such a method of heating, economical as it may appear, would, however, be unsuitable except for powers of over 50 h.p. unless waste steam is available from a boiler plant at times of low demand.

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EDITOR'S ANNOUNCEMENTS.

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

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

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Peculiar Method of Appointing a Chief Engineer

The city council of Toronto recently appointed Messrs. George C. Robb and A. M. Wickens to examine and report upon applications for the position of chief engineer of the new municipal buildings. It is surprising to learn on enquiry that applications for this important position were not publicly invited. It is further learned that no particulars were placed at the disposal of the experts regarding the duties of the position, and no one about the building appears to have any idea of what these duties will be. Under these circumstances, the experts have a somewhat difficult task to perform. They will be obliged to go over the building and estimate for themselves what duties should appertain to the position of chief engineer, and in the light of the information thus gained, examine and report upon the applications which are understood to be in the hands of the city officials. The number of these applications is reported to be large, but in what way they were received is not publicly known. The council's method of selecting a man for this important position is unsatisfactory. Applications should have been advertised for, and a date fixed for their reception. The duties of the position should have been clearly specified by the city engineer or some other competent person. The method of procedure adopted, leaves room for the suspicion that probably there exists some favored applicant, to whom the position has been promised, and that the engaging of experts to report upon the applications is simply a device to give the appearance of fairness to the appointment.

A Word to Lighting Companies.

WE have reason to believe that some of the owners and managers of electric lighting companies have not read with sufficient care the provisions of the Conmee Bill passed at the last session of the Ontario Legislature, defining the conditions on which municipalities may engage in the electric light business where a private company is established. One of the most important clauses in the Bill to electric lighting companies is Sub-section 26, which reads as follows: In case there is any gas or electric light company supplying gas, electric energy or light or water company supplying water in any municipality the council may, by by-law, fix a price and terms to offer for the supply by contract by such gas or electric light company of gas or electric energy or light for street lighting and other public uses, or for the supply by contract by such water company of water for street hydrants and other public uses for a term of not less than five years and not more than ten years, and after thirty days have elapsed after notice of such price and terms has been communicated to the company without the company's having accepted the same, the council may, under the provisions of this Act, as to arbitrations, name and give notice of an arbitrator to determine the price and terms of the contract for such supply of gas or electric light as aforesaid, and in case the company and the municipality do not agree, the said price and terms shall be dedetermined by arbitration under this Act." The important point in this clause to lighting companies is, that where an offer of purchase is made to a company by a municipality, and declined by the company, the company must, regardless of any action of the municipality, appoint, within thirty days after such offer of purchase has been made, an arbitrator to act on its behalf. If the company fail to thus appoint an arbitrator within thirty days after the offer of purchase, the municipality would seem to have the right to refuse to enter into ar-

bitration, and may proceed to purchase and install a lighting plant. There are other points of the Bill which are scarcely less important, therefore lighting companies should make themselves thoroughly acquainted with every detail and understand clearly the interpretatioh of every provision.

The Telephone Field.

THERE is evidence to justify the belief that the telephone will become much more generally used in the near future than it is to-day. In the large cities and towns it has been adopted very largely for business purposes, and even the farmer has to some extent recognized the advantages of telephonic communication. It is in this latter direction that we look for one of the most promising fields for the extension of the telephone business in the future. Particularly in the harvesting season does the farmer realize the advantages of having telephone connection with an adjacent village or town, by means of which he can order necessary repairs and supplies. The state of Ohio in the United States, is noted for its rural telephone system. Hundreds of farmers have telephones in their homes, and in addition to business advantage, their families are afforded some of the social privileges that are frequently lacking on the farm. The use of the house telephone in this country is, to our minds, restricted to a much greater extent than it should be or will be in the near future. There is also likely to be a considerable increase in the number of private exchanges. These effect a vast saving of time, and permit the heads of departments to communicate with all parts of the establishment without leaving their offices. In the United States the expiration of the Bell Telephone patents, and the competition thus permitted, has resulted in the development of the telephone business to a remarkable extent.

Electric Power Distribution and the Small Consumers.

IN an interesting article under the above title, in the Engineering Magazine for November Dr. Louis Bell discusses the advantages afforded by electricity to small consumers of power. He also points out to electrical companies that the supply of current for power in small units can be made profitable where a sufficient number of such consumers can be obtained. He estimates that few consumers of steam power of 50 horse power or under can obtain their power for less than 5 cents per horse power hour actually employed, and that where an ample load can be obtained large generating stations can put electrical energy upon their circuits at a total cost somewhat under one cent per horse power hour, thus enabling them to supply the consumer at a large reduction. The possibilities of electrical distribution of current for light and power from a central water power generating station are likewise considered. As an example of a successful enterprise of this character the writer calls attention to what has been done by the Compagnie Electrique de la Loire at St. Etienne, France, where, by means of the three phase system, power is supplied in small units to 2,500 ribbon looms which formerly were operated by hand, but found themselves unable to compete with the large manufactories in the cities operated by power. A quarter horse power motor serves for each loom, so that the total load connected amounts to about 1,400 horse power. The charge for each quarter horse power motor is 10 francs per month. The company also operate 100 horse power in miscellaneous motors and 8,000 incandescent lamps, and are said to have made a success of their enterprise. Dr. Bell points out further that the utilization of electricity in the manner described would be the means of restoring prosperity to many of the towns throughout the country where manufactories were formerly located, but which are suffering from centralization of the manufacturing business in cities, where advantages in the way of cheaper power and improved transportation facilities are available. So far as the latter advantage is concerned, it is shown that the same system which supplies light and power might also be used to operate electric railways for passenger and freight purposes, which would tend to equalize transportation advantages.

Operation of Electric Street Railways.

THE system of electrical distribution adopted by the Metropolitan Railway Company represents a new practice in the operation of street railways in Canada. This road is, we believe, the first in this country to employ both direct and alternating currents for the propulsion of cars, but the system will undoubtedly gradually grow in favor in connection with the operation of long distance lines. It has only recently come into use in the United States, the Chicago & Milwaukee Electric Railway being one of the first to be so operated. This road is divided into sections, each section, except the one contiguous to the power house, being operated from a sub-station containing an equipment of transformers and rotary converters. This is the method adopted by the Metropolitan Railway Company, but a further step in advance has been taken, inasmuch as both direct and alternating current is generated by the same machine. The direct current passes direct from the generator to the line, and is employed to operate that portion of the road adjacent to the power house. The alternating current, generated at low pressure, is stepped-up by means of transformers to a high voltage and transmitted to a sub-station sixteen miles distant, where it passes through transformers and converters and goes to the line at low pressure direct current for operating that portion of the road remote from the power house. It is admitted that this system of electrical generation and distribution has many advantages, as, for instance, making at once available direct current for use in the three-wire system without passing through auxiliary machines. The alternating current, however, in order to be suitable for service at a distance, must be raised in pressure by means of transformers. This system is, therefore, open to the objection--perhaps overbalanced by its advantages--that it necessitates an expensive station equipment because of the rotary converters and transformers required for changing the pressure and kind of current. There is reason to expect that this object will eventually be overcome in some way, probably by the introduction of machines capable of generating both direct and alternating current at the desired pressure, or, in other words, by high voltage alternating and low voltage direct current generators. This would obviate the necessity for auxiliary apparatus in the generating station. The certainty of the rapid extension of interurban electric railways in this country makes of paramount importance the question of the most practicable and economical system of operation.

Tooke Bros., Montreal, have bought three more 8 h.p. motors from the Canadian General Electric Co., for use in their factory.

MONTREAL

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

MONTREAL, Dec. 2nd, 1899.

It need not surprise anybody if it is found shortly that a prominent Canadian electrical company will not only do the lighting but the wiring for the Canadian building of the Paris Exposition. It is said that if they are the successful tenderers they will send their own wiremen and material from this side of the water, also generators, and follow our usual practice. National Board rules, it is said, are to govern.

It may interest some of our readers to know that the steamship Arawa, being used by the British government as a troopship, and which is reported as being delayed owing to a break-down in her electrical machinery, belongs to the Elder Dempster Co., and lately ran to Montreal. Her electric machinery referred to is the lighting plant, which is in duplicate, and consists of alternators of the Ferranti type delivering current to the lighting circuits at a potential of 110 volts.

According to a contemporary all fires not put down to "electric lights" are put to "Israelites."

The apartment building being built on Dominion square, Montreal, for Mr. M. S. Foley, is to be lighted throughout by electricity, the tenderer for the wiring being Messrs. Mount Bros. The architects are Messrs. Saxe & Archibald, Montreal. Iron armoured conduit is specified.

In the person of Mr. R. Whyte, the Lachine Rapids Company have a rarity—not alone for the fact that everybody has a good word to say of him, and he has a good word to say for them all in the trade, but because as secretary-treasurer of the company he has also a fair practical knowledge of the electric lighting industry. Mr. Whyte was first connected with Mr. Lawson, who, we believe, first represented the Brush interests, and later was with the Edison Company. Later still he was employed by the Canadian General Electric Company and the Royal Electric Company successively, to assume finally his present duties, where he carries the best wishes of not only his old practical friends, but also of the new Lachine Rapids Company's customers.

The Montreal Wire & Cable Company expect shortly to be in operation. They are now awaiting alternating motors ordered, by which they intend to operate their various machines. It is understood that it is not the intention to direct-connect, but to use a motor on each flat or section. The building chosen is that formerly occupied by E. A. Small & Co., wholesale clothiers, at the foot of Beaver Hall Hill. There is ample floor space and each flat has sufficient windows to constitute a well lighted factory. Incandescent light will be used for artificial illumination, the current being supplied by one of the lighting companies in the city. Alex. Barrie, manufacturer of rubber covered wires, together with his plant (which will be augmented), has been absorbed by the new concern, and Mr. Barrie will attend to the practical work. The management will be in the hands of Mr. Sise, jr., who was formerly with the Western Electric Co., of New York.

The recent disclosures in the daily press of crooked dealings of officials of several departments of the city service reminds me of a conversation had recently with a gentleman representing an Ontario company who do business in the city of Montreal, and who have found it difficult to conduct business here owing to their refusal to pay commissions to certain individuals connected with the city service. I heard of an instance the other day where the inventor of a non-freezing valve stated that after having found it impossible to introduce the invention in this city, he at last succeeded in doing so by following the advice of a friend who told him that a certain amount of money placed with a certain individual would remove the obstacles out of his way. The money was placed accordingly, and the obstacles immediately disappeared. An amusing story was also told me which serves to define the standard of business probity existing in this locality. A director of the Montreal Park & Island Railway who was also interested in the toll-gate system, was asked by a gentleman, while passing through the toll-gate one day, what check was kept upon the toll-gate keeper to insure his making proper returns of the money paid to him. The director's reply was: "Oh, we do not keep any check on him; he's an honest man; he would not steal more than a dollar or two per week."

"What we have we will hold," said the person who held the electrodes of the induction coil!

Mr. John Forman has purchased the entire stock in hand of the Canadian Bryant Electric Co., who lately decided to close their Canadian factory.

Mr. C. E. Shedrick, electrical instrument manufacturer, of Sherbrooke, Que., paid a visit to his trade friends in Montreal last week, and, I understand, secured some orders.

Mr. A. F. Gault is the owner of the flat apartments being built on Milton street, and named "The Marlboro." They are to be wired for electric light thoughout. Messrs. Taylor & Gordon are the architects.

Messrs. Collyer & Brock, of this city, have secured a contract to re-arrange and add to the incandescent light equipment of the Montreal Rolling Mills Company, also to add to their D.C. series arc equipment in the yard.

The Lachine Rapids people are looking forward with interest to the approach of winter, which they claim will this year have no terrors for them. The new steam power reserve is installed for emergencies and the engines have been tested.

The Richelieu and Ontario Navigation Company contemplate building a large hotel at Murray Bay, Que., during the winter. An electrical plant will probably be installed for lighting. Tenders for the wiring have already been called by Messrs. Maxwell & Shattuck, architects.

Look out for the next legal electric fight at Quebec. The poles of the Jacques Cartier Company are going in pretty near to those of the Montmorency Electric Co., and a struggle in the courts similar to one recently held in Montreal may be expected when the lines get strung and into operation.

The Royal Electric Company have a "good thing" in their new Stanley meter, "magnetic flotation" type. It will have to be a remarkably high efficiency lamp that this meter will not only start on, but keep an accurate note of the consumption, and that lamp need not be a 16 c.p. one either, by any means.

Mr. R. A. Ross, electrical engineer for the Canadian Pacific Railway Company, is back again in Montreal. He has been for a time in China, and came back via Burmah, making a tour of the world. Mr. Ross does not speak in very glowing terms of some of the electrical construction work he witnessed abroad.

The block of four houses, with grey limestone fronts, lately built on Dorchester street west, corner of Hallowell street, in the suburb of Westmount, are the property of Mr. D. J. Darling. The architect for same was Mr. A. J. Cooke, and the electric light wiring and bells was done by the Montreal Electric Company.

Mr. C. J. McCuaig, of McCuaig, Rykert & Co., mining brokers, Montreal, is building a couple of handsome red stone houses on Sherbrooke street, adjoining the property of Mr. Jas. Linton. Messrs. McVicar & Heriot are the architects. The wiring for electric light and annunciators fell to the Montreal Electric Company.

It is currently rumored that a new lamp factory (incandescent) will shortly be operated in Montreal or vicinity. It is said that the Bryan Marsh Co. (who conduct a similar industry in the United States) will manufacture their lamps here, in company with three or four local men of capital connected with the electrical business. The output is placed at 1,000 lamps per day.

The Montreal Street Railway Company already have the sympathy of the electrical trade in their gallant fight to try and resist what seems an unjust mode of taxation; they might also have the sympathy of the general public if they would provide increased car accommodation for business men at business hours. Some say lack of cars is the trouble, but one electrically versed says it is lack of copper. It is a well known fact that Quebec, with fewer cars, etc., is wired heavier than Montreal, so it would appear as if the latter view was not far out.

About a year ago a prominent Notre Dame street furrier had an acetylene plant and fixings installed, and threw out his electric light. Some months later the Underwriters' inspector visited him and caused some expensive changes to be made. Now he has electric light re-installed, and the plant for light which ruined the eyes of his operatives and made a nasty odor in the establisment is for sale.

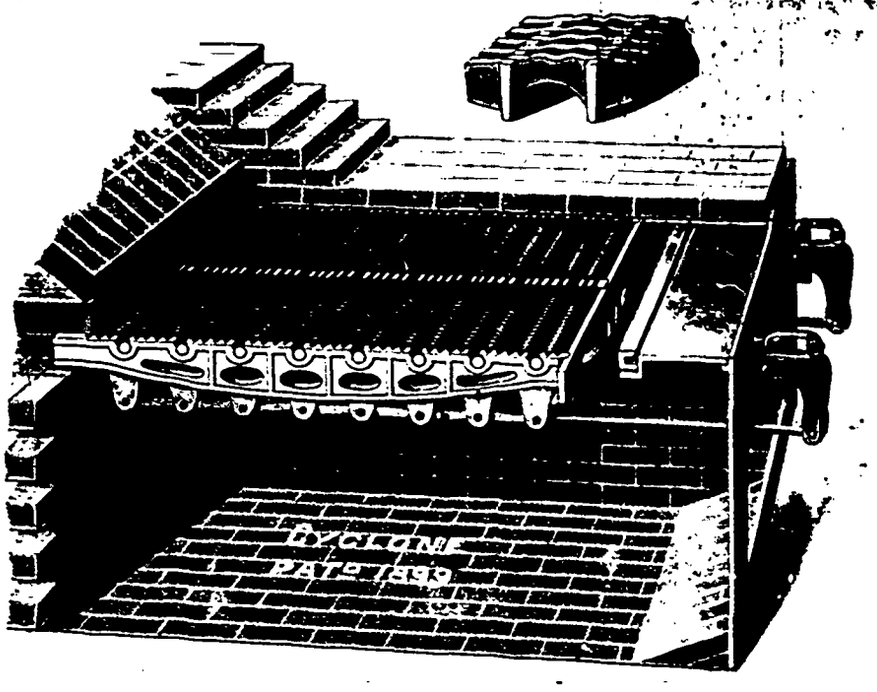
A gentleman who resides out of town during the summer months entered an electrical store the other day to get a figure for a couple of telephones and cable sufficient to connect them, one each side of a small river, virtually a canal. The gentleman wished to call his man with his boat to row him over to his house on arrival of the train. Naturally, the job was expensive, as the cable had to go under water, and the pseudo-customer was aghast. He was then asked: "What's the matter with a tin horn?" The very simplicity of the idea did not seem to have struck him; needless to say it was adopted, and no "grounds" or "short-circuits" have been reported.

THE CYCLONE GRATE BAR.

PRESUMING the majorty of our readers to be interested in methods of economizing fuel, we present herewith some particulars of the Cyclone grate bar, one of the most improved devices for this purpose. In the invention and manufacture of this device, the fact has been kept in view that an enormous waste of fuel is constantly taking place by reason of the escaping of the carbonic oxides of the fuel. This is the result of inperfect combustion caused by imperfect draught, combustion chambers and bridge walls in boilers, together with unperfectly managed fires. While the inventor and manufacturers of the Cyclone grate bar do not claim it to be a smoke consumer, they do claim to reduce by from 40 to 65 per cent. the amount of carbonic oxides escaping through the chimney, which is a proof of its value as a fuel economizer.

It is claimed for this grate that it embodies the three most essential qualities, namely, durability, simplicity, and economy of fuel. An examination of the accompanying illustration will, it is believed, show these claims to be well founded. The air is passed up and through the grate without a break in the current. There are no complicated parts to obstruct the draft and get out of order, while the sifting movement alone with the downward and backward movements cuts the ash evenly and cleanly from the bottom of the fire over the entire surface of the grate.

It is not claimed for this grate that it will grind up clinkers and separate them from the unconsumed coal without losing any of



THE CYCLONE GRATE BAR.

the latter material, but that it is so constructed as to prevent the formation of clinkers, by admitting the necessary amount of air through the grate to insure perfect combustion, and cause the heat to pass out of the fire box as fast as it accumulates, instead of allowing it to remain and melt the coal and form a melted clinker that no grate could break. It has been found in practice that the weight of air required to support combustion is much larger than that theoretically required in order to effect complete combustion. Complete combustion can be obtained with a supply of air not less than 50 per cent. in excess of the quantity necessary for theoretical combustion with natural draft, but it is usual to provide double the quantity of air theoretically required.

This grate is especially adapted to burn cheap fuel, soft and hard coal, screenings, etc., and for use in marine boilers. Among the claims made for it by the manufacturers are the following:

It is the best draft grate in the market; has no rockers and no complicated parts to get out of order underneath the bar or obstruct the draft; the rolling and lifting movement when shaken keeps the air space open and causes no friction on the draft passing through the bar; has ninety per cent. under draft; the frame locks together without bolts, and is easily placed under boiler; will not lock in frame, will not bind in frame; always shakes freely; space in ash-pit same as in ordinary bar, which is four inches; is a perfect bar for all internal fire boilers, no part is in the way to prevent the fireman cleaning out the ashes; the air is passed through and over top of frame—keeps frame cool and prevents warping; all parts of the bar and frame are trussed and bridged; will burn the cheapest fuel with the best results; will evaporate more water per pound of coal than any other device; is level at all times when locked; no bars stick up in fire and burn off; will not break boiler front when shaking.

This important fuel-saving device is manufactured by the Cyclone Grate Bar Company, 10 King St. West, Toronto, who will be pleased to furnish, on request, to any of our readers further information with regard to it. The attention of readers is also directed to the company's advertisement in this issue, and to the testimonial of the Canadian Pacific Railway Co. appearing therein.

PERSONAL.

Mr. J. A. Hicks, graduate of the Canadian General Electric Company's works at Peterboro, Ont., has recently been appointed inspector for the Royal Electric Company in Montreal.

Mr. J. Eastland, who for six years has held the position of foreman of the London Electric Company, of London, Ont., has removed to Detroit, where he has secured a lucrative position with the Bell Telephone Company of that city.

Mr. Granville C. Cunningham, formerly manager of the Montreal Street Railway, but who later was associated with the street railway at Birmingham, Eng., has accepted a position as manager of the London Central Electric Tramway Co., of London, Eng.

Mr. James Wallace, road-master of the Toronto Railway, has been appointed to a responsible position in connection with the management of the Winnipeg Street Railway, and left for that city a fortnight ago. Mr. Wallace had been in the service of the Toronto Railway Co. for many years.

Mr. A. F. Nash, of Windsor, Ont., has been appointed inspector of electric light and gas for the London district, as successor to the late Mr. Williams. Mr. Nash was for a number of years manager of the Windsor Gas Co., and also owned the electric light plant before it was purchased by the city.

By invitation, Mr. Frederic A. Hamilton, electrical engineer, Halifax, N. S., paid a visit to Mr. Marconi on board the steamship La Grand Duchesse on the occasion of the International yacht race at New York. Mr. Marconi very kindly transmitted a telegram for Mr. Hamilton from that vessel when off Sandy Hook to Sir Sanford Fleming, as follows:—"Off Sandy Hook light-ship—this is a wireless message." We regret to learn that Mr. Hamilton has recently been incapaciated by illness from attending his usual duties, but is now on the way to recovery.

Among recent visitors, the ELECTRICAL NEWS had the pleasure of a call from Mr. Thos. H. McCauley, of Port Arthur. Mr. McCauley is local manager at Port Arthur for the Bell Telephone Co., and superintendent of the Port Arthur Electric Street Railway and Light Systems, which are the property of the municipality. Mr. McCauley spent a couple of weeks in the east, during which he visited a number of the most interesting electrical installations, including that of the Cataract Power Co., the Chambly Mfg., Co., and the Lachine Rapids Hydraulic & Land Co. The municipal authorities of Port Arthur are at present considering the question of operating their plant by water instead of steam. The belief is that by making the change a saving of several hundred dollars per month could be effected in the fuel account.

The Massey-Harris Company, of Toronto, have placed their order with the Canadian General Electric Company for a complete switchboard outfit for their new plant.

Incorporation has been granted to the Renfrew Electric Co., Limited, of Renfrew, Ont., to carry on the business of supplying electric light and power. The directors are A. A. Wright, Chas. Wright, Howard Wright, A. H. Hough and William Ringseben.

TELEGRAPH and TELEPHONE

C. P. R. TELEGRAPH APPOINTMENTS.

A SUCCESSOR to Mr. Chas. Hosmer, manager of the C. P. R. Telegraphs, has been named in the person of Mr. James Kent, whose portrait appears herewith. Mr. Kent entered the service of the Montreal Telegraph Co. as messenger shortly after leaving school in 1868. He soon became an operator, and after working at such for five years was appointed night chief, and subsequently day wire chief. The latter position he held until 1886, when he resigned to accept the position of chief operator of the C. P. R. Telegraphs at Montreal. In 1890 he was promoted to the superintendency of the Eastern division of the same system, which position he held until receiving his present appointment.

Mr. Kent is succeeded as superintendent of the Eastern division by Mr. W. J. Camp, with headquarters at Montreal, while Mr. A. W. Barber, local manager at Toronto, becomes superintendent of

MR. JAMES KENT.

the Ontario division. Mr. C. S. Jenkins, superintendent at Winnipeg, is given the superintendency of lines west of Fort William, with head office in Winnipeg. All the appointments are well deserved.

MARCONI'S WIRELESS TELEGRAPHY.*

BY W. B. BRADFIELD

As is, of course, well known, the Marconi system is worked by means of Hertzian waves, so called after the late eminent German professor, Heinrich Hertz, who first experimentally proved their existence 30 years or so after Clerk Maxwell had mathematically predicted them.

At his New Jersey station Mr. Marconi employs the following apparatus to generate and collect these waves: The first thing that is apparent to the observer is a tall mast, 150 feet high, from the top of which is suspended a wire—it is actually an ordinary insulated copper wire, such as is used for electric-lighting purposes which passes through a window of the operating room and is joined up inside with the apparatus. There is nothing strange in the appearance of the mast itself, and no effort is made to clothe this part of the apparatus with mystery. With regard to apparatus within the room, simplicity is the most amazing part of it. The whole apparatus is fixed on a small table about four feet long and two feet wide, and the battery for supplying the power is packed underneath it.

This battery consists of 98 dry cells, which are connected up 14 in series, and seven in derivation, and is joined up in parallel with eight accumulator cells to give a steady current of six amperes. The actual generator of the waves is an ordinary inductor or Rhumkorff coil, such as is used for the production of X-rays, and is capable of giving a 10-inch spark. Each end of the secondary winding of this coil is fitted with a sparking rod, to which is attached a brass ball 1½ inches in diameter.

To one of these balls is connected the vertical wire; the other is joined to earth. With the single addition of a Morse key in the primary circuit the transmitting apparatus is complete.

Consider for a moment what happens when this key is depressed. The immediate and apparent result is a loud, crackling spark discharged between the two brass balls which are adjusted to be about two centimeters apart. The more important result is that the vertical wire at the moment the spark passes emits waves which go out into space in all directions, and continue to do so as long as the key is depressed. It is quite easy to understand, therefore, that by depressing the key for a short or a long period short and long series of waves or oscillations are emitted, and the Morse alphabet, which is used in ordinary telegraphy, may be employed.

The only thing that remains is to get something that will pick up and indicate the presence of these oscillations.

The apparatus which Marconi employs to do this is what is commonly known as a "coherer," a name which is due to Professor Oliver Lodge, of Liverpool. An Italian, named Calzecchi, was the first to discover the sensibility of coherers and filings tubes to Hertz waves. He found that metallic filings in a loose state of contract offered an appreciable resistance to the passage of a current. He found, also, however, that on exposing these filings to the action of Hertzian waves the resistance fell enormously, but that on shaking them up the resistance was increased again to its original value. Marconi's coherer works on on the same principle, but is vastly more sensitive and reliable than those used by Calzecchi, Branly and others.

It consists of a small glass tube about two inches long, in which two small silver plugs a quarter of an inch long are tightly fitted and separated from each other by about one-thirtieth of an inch, the gap between them being partially filled with a mixture of nickel and silver filings, these metals having been found to be the most sensitive and reliable after a long series of experiments. The coherer is exhausted to a vacuum of four millimeters.

So much for the coherer. The rest of the receiving apparatus is perfectly easy to understand. In circuit with the coherer is a single dry cell and a telegraphic relay of the ordinary type. This relay is used to close the circuit of a local battery, which works a Morse writing instrument, and also an electric bell hammer, which strikes the coherer a smart tap to restore it to its normal high resistance after it has received an impulse from the distant transmitter.

To protect the coherer from the too powerful effects of the local transmitter the whole receiver is enclosed in a metallic box.

To receive a message all that is now necessary is to connect the vertical line either directly or through a small induction coil to one end of the coherer, the other end of it being connected to earth.

Such is the Marconi apparatus in use at the Herald's New Jersey land staton, and it is in exact duplicate aboard the steamer Ponce. She has been specially rigged with a new topmast to give the same height of wire as that at the land station, and the instruments are installed in the chart house.

The distance that will have to be bridged will probably not exceed 35 miles; the apparatus employed would, however, be capable of sending and receiving messages at a distance of nearly 80 miles.

The chief factor in determining the distance possible is the height of the vertical wire. Mr. Marconi finds that by doubling the height the distance becomes quadrupled. That is, assuming 20 feet will give one mile, 40 feet will give 4 miles, 80 feet 16 miles, and so on. There are, of course, other factors, such as the sensitiveness of the coherer and the adjustment of the apparatus generally, but apparently they are not so marked in their effects.

Why this vertical wire is necessary for long distances is not very certain. It has been suggested that the earths curvature may have something to do with it. Compare this, however, with Mr. Marconi's results in the English naval manoeuvres this summer, when with 150 feet of wire at each end he succeeded in telegraphing 75 miles. To do this the waves must have passed through a "hill" of water 35 miles long and 700 feet high. More probably, the vertical wire is necessary because its use lengthens the waves and propogates them in a plane vertical to the surface of the earth, and they are, therefore, less likely to be absorbed by it. The fact that the waves are lengthened, of course, causes them to be more penetrative and capable of effecting a receiver at a greater distance

Of the working of a wireless-telegraph station there is not much to say, as it is essentially the same as that of any other telegraph office. At present the speed of transmission is rather less; it does not ordinarily exceed about 15 words a minute, but this will, of course, increase with time. A call is indicated by a bell which is switched off during the reception of a message. As before

* From the New York Herald. Mr. Bradfield is Mr. Marconi's assistant

stated, the telegrams are printed in dots and dashes on an ordinary Morse inker, the operator having merely to read them from the tape.

The key used is of a slightly different form from the usual Morse key, the back contact being used to connect the vertical wire to the receiver, so that no changing over from the transmitter to the receiver is necessary after sending a message.

[This article was referred to editorially and intended to have been published in our November issue, but was inadvertently omitted. - THE EDITOR.]

AUTOMATIC TELEPHONE EXCHANGES.

An English contemporary gives an interesting description of the automatic telephone system controlled by the Direct Telephone Exchange System of London. In the case of a small exchange of one hundred subscribers, such as would be used for a small town or in a large office or hotel, the subscribers would be numbered from 101 to 199. The instrument (Fig. 1) which each subscriber has is very similar to an ordinary telephone set. In front there is a rotating disc D provided with holes numbered 1, 2, ... 0. Suppose that a subscriber wants to make connection with No. 139. He inserts the tip of his finger in 1 and pulls the dial round until his finger reaches the stop S; he then

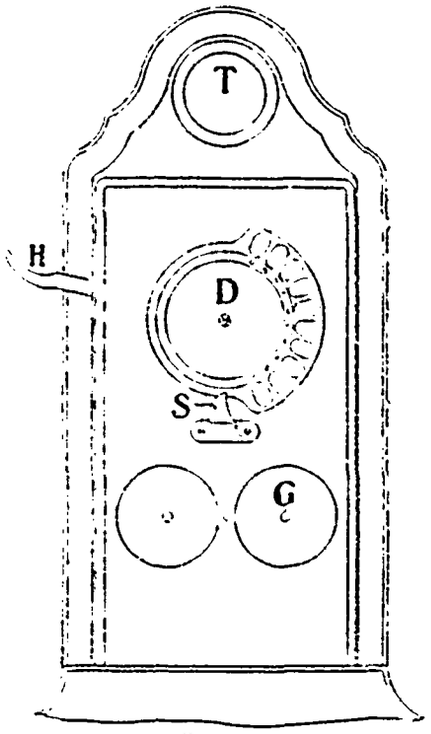


FIG. 1.

lets it go, and it automatically rotates back to its original position. He next does the same operation at 3 and then at 9. This makes connection between his telephone and that of No. 139. He now rings his magneto bell in the ordinary way, and if his own bell G rings at the same time, he knows that No. 139 is not engaged; if, on the other hand, his own bell does not ring, he knows that it is engaged. In the former case he takes his telephone off the hook H and talks into the transmitter T. Whilst he is talking with No. 139 it is impossible for any one else to ring either of them up. When the conversation is finished the mere act of hanging up the telephone on H moves their switches at the exchange back to their normal positions and so leaves them both ready to be called up by any other subscriber.

It will be seen that all the exchange work is done by the subscriber himself, the time required to do it being only from three to five seconds. Again, as they are not at the mercy of the exchange girl, the conversation is absolutely secret, and cannot be interrupted except at the option of those talking.

From each subscriber's telephone two wires go to the central station, and the electric impulses that are sent along them operate the apparatus at the exchange. The mechanism of the dial on each telephone is not unlike that of the apparatus used in messenger call systems. Turning round this dial winds up a spring, which, as it runs down, operates a toothed wheel, and so sends a definite number of electric impulses along the line. The tension of the spring admits of easy adjustment, and there is a governing arrangement to regulate the speed. At the exchange there in an elaborate switch for each subscriber, which he alone can operate by his dial, and only when this switch is in its normal position can he be called up. Although highly elaborate, the design of this switch is sound, and occasional attention from a mechanician would be sufficient to keep it in thorough working order. Part of it consists of a concave surface (fig. 2) formed of plaster of Paris in which is embedded a number of contact pins corresponding to the number of subscribers, each of which is in connection with a subscriber's wire. In the figure, part of one of the hundred switches in a hundred exchange is shown. It will be seen that there are ten rows, and ten contact points in each row. The arrangement of the contact pins in the insulating ma

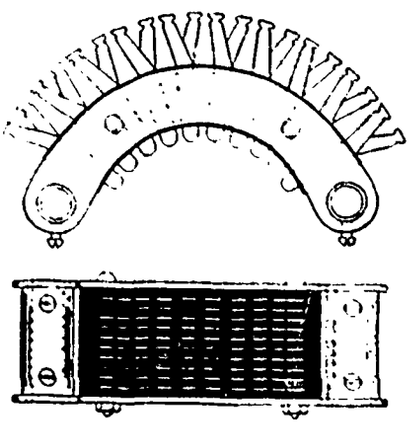


FIG. 2.

terial is also shown. In the axis of the cylinder of which this surface is a portion there is a rotating axle carrying a radial contact peice or wiper, which can be made to have contact with any of the contact pins. The first current impulse sent over the line brings the wiper into position, one tooth behind the first pin. The second series of impulses raises the rotating axle so that the wiper comes opposite the required tens line. In the case supposed it would be raised so that it was opposite third row. The third series of impulses rotates the shaft bodily, so that the wiper comes in connection with the ninth pin on the third row. The subscriber is now through to 139. The fact that these two are in talking connection does not interfere with the other subscribers, except in so far that neither of them can be called up by any one until they have finished their conversation. It would be quite possible for ten or twenty different calls to be accomplished at the same time, as the action of each switch is practically independent, and the accumulators at the central station can supply a large current.

The automatic exchanges are built in three sizes: the first includes the 100 to 400 system in which only a single switch is used for each subscriber. The second and third, which are for 1,000 and 10,000 subscribers respectively, need two switches per subscriber. In the larger exchanges the "bridging system" is used. In this the electro-magnets do not form part of the talking circuits, and so they can be made of relatively high resistance and consequently can be operated by a smaller current. Inh the ordinary exchange each subscriber takes about 0·5 of an ampere to operate his switch, but when the bridging system is used 0·2 of an ampere is ample. To give an idea of the size of each switch, it may be mentioned that in a 200 exchange each switch occupies a lineal space of 12 in. by 4 in. and projects 9 in. from its base. It is stated that a room 40 by 45ft. in floor space is large enough for a 5,000 exchange. It is also stated that one man can look after 1,000 instruments. When it is remembered that in an ordinary manual exchange one operator can only attend from 50 to 100 subscribers, there is an obvious economy in labor.

SHORT CIRCUITS.

The Citizens Telephone & Electric Company, of Rat Portage, Ont., has installed a new telephone switchboard.

The residents of Danford Lake, Que., purpose forming a joint stock company to build a telephone line from Danford to Kazubazua Station.

Doctors Paul and Eckhert, of Sebringville, Ont., have obtained right of way to erect a telephone line from that place to Avonton and Carlingford.

The Pennfield & St. George Telephone Company are building a telephone line from St. George to Black's Harbor, Beaver Harbor and Pennfield, N.B.

Incorporation has just been granted to the Carman Telephone Exchange Co., composed of merchants of Carman, Man. The company purpose building a telephone system.

The Dominion Government are believed to have decided to adopt the wireless telegraphy system between the Labrador coast and Belle Isle, where the steamer Scotsman was wrecked.

Messrs. James Kent, superintendent, and W. J. Camp, electrician C. P. R. Telegraphs, returned to Montreal last month, after having fitted up the new telegraph office at Vancouver.

Mr. D. Budge, of Halifax, has been appointed general superintendent on this side of the Atlantic of the Halifax & Bermuda Cable Co. and the Direct West India Cable Co. His headquarters will be in Halifax.

The North-Western Telephone Exchange Co., which controls the long distance lines in the North-West, has given notice that the company has decided to extend its system to include the line of the Great Northern road to St. Vincent.

The British Columbia Telephone Co. intend to connect Victoria and Vancouver, a distance of 20 miles, by a telephone cable. This cable will be equal in length to the longest submarine cable in the world, that between England and France, crossing the English channel.

ELECTRIC RAILWAY DEPARTMENT.

THE METROPOLITAN ELECTRIC RAILWAY.

For some years previous to 1890 the Metropolitan Railway Company operated a horse car line on Yonge street from the C.P.R. tracks at the northern city limits of Toronto to Glen Grove, a distance of two and three-quarter miles. In that year electricity was substituted for animal power for the propulsion of the cars, the power house being situated about midway between the two terminals of the road, and current being furnished by a Thomson-Houston dynamo. Gradually extensions were made northwards, and in 1897 the line had reached Richmond Hill, a distance of fourteen miles. Encouraged, perhaps, by the success of this extension, the company concluded to undertake further extensions which had been under consideration, and during the past summer the line was completed and put in operation as far as Newmarket, a distance of about thirty miles. The route for almost the entire distance follows the public highway of Yonge street, and passes through a chain of suburban villages and country residence districts, as well as the town of Aurora. In order to obviate possible objections by any municipality, the company secured the passing of an act whereby the whole of Yonge street north of the C.P.R. tracks was placed in the control of the county of York. It is understood to be the intention of the company to eventually reach Lake Simcoe.

Fig. 1.—Power House.

The system of the Metropolitan Railway Company presents many interesting features. One of these is the unusually heavy grades encountered, another the method of generating and distributing the current, which we believe represents an entirely new practice in street railway operation in Canada.

THE POWER HOUSE.

The extensions to the road necessitated the erection of a new power house, for which Nature had provided an ideal site. About twenty miles from the southern terminus of the road, Yonge street converges slightly to the west for the purpose of rendering unnecessary the crossing of a valley. In this valley, and occupying almost the total area, is situated Bond's Lake, which covers an area of forty-eight acres and has a depth at some points of over 100 feet, and around which the land rises to a considerable height, making a very picturesque view. It is in this valley, and bordering on the lake, that the new power house is located, the top of the building being but a few feet above the level of the land. The advantage of this location is that an unlimited supply of water is always obtainable for condensing purposes without the necessity of pumping.

The power house, shown in Fig. 1, was designed by Messrs. Gordon & Helliwell, architects, of Toronto, Mr. John Aldrich being the contractor for labor and the Metropolitan Company supplying all material. It is an imposing white brick structure, with stone foundation and iron and slate roof. The floor is of concrete supported by steel girders, and the window frames and sashes are of cast iron, the object of the company being to erect an entirely fireproof building. Owing to the advantageous location, very little excavating was necessary. The building has a white brick chimney, with 23 feet base, towering to a height of 125 feet. The boiler room, 50 x 47 feet, is situated directly to the south of the engine room, from which it is separated by a brick partition wall. The engine room is 74 x 90 feet, and affords an abundance of room. It is unusually well lighted, having 15,000 feet of window surface.

The boiler room contains a battery of four steel return tubular boilers, 73 inches in diameter and 16 feet in length, with ninety 3½-inch tubes. The boilers, which are of the Goldie & McCulloch Company's well-known make, are fitted with Jubilee shaking bars, manufactured by the Jubilee Grate Bar Company, of Toronto, and are connected to a steam main, from which there is a branch to each engine. The total boiler capacity of 700 h.p. will, it is expected, be sufficient to meet the demands for some time to come. Water is fed to the boilers by two duplex boiler feed pumps, 6 x 4 x 7, manufactured by the Northey Manufacturing Company, of Toronto, and there are two Northey jet condensers, 10 x 15 x 15. When connection is made with the C.P.R., as intended, railway freight cars will run close to the power house, from whence the coal will pass by means of a chute direct into the boiler room.

The engine equipment consists of two cross compound Wheelock condensing engines, furnished by the Goldie & McCulloch Company. They have a capacity of 350 h.p. each, running at 86 revolutions per minute. The high pressure cylinders are 17½ inches in diameter, the low pressure cylinders 32 inches in diameter, with a stroke of 42 inches. The massive pulley fly-wheels are 18 feet in diameter and 42 inches in face. A view of the engines is shown in Fig. 2, the second engine appearing in the background. These engines, with their accompanying generators, take up little more than half the space in the engine room, the balance being reserved for additional equipment whenever the traffic of the road shall demand it. The floor is not yet completed, as will be seen by the illustration.

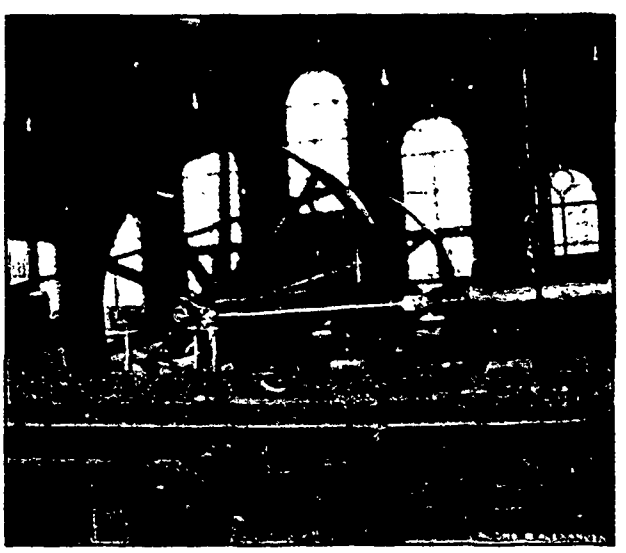


Fig. 2.—Pair of Compound Engines.

Each engine drives one 275 k.w. A.C.D.C. 60-cycle three-phase multipolar generator, connected by means of a 40-inch belt supplied by the Beardmore Belting

Company, of Toronto. These generators, operating at 600 r.p.m., give 550 volts direct current on one side and 350 volts alternating current on the other. The direct current is fed direct to the line and used to operate the section of the road from the power house north to Newmarket, a distance of about 10 miles. The alternating current is delivered to 500 k.w. static transformers, of which there are four, wound for 400 volts primary, situated in the power house, where it is stepped up to a pressure of 16,500 volts. It is then conveyed by the

FIG. 3.—ONE OF THE GENERATORS.

three-wire system a distance of 16 miles to the sub-station at York Mills, where it is passed through step-down transformers and rotary converters and reduced to 550 volts direct current, at which it is delivered to the line for operating the southern portion of the road.

The generators above referred to are of the Westinghouse make, and are separately excited by means of exciters belted from the shaft of the generator. The step-up transformers were also manufactured by the Westinghouse Manufacturing Company and are of the self-cooling oil type. Paraffine oil is used, and has been found very satisfactory.

The switch-board in the power house is of marble, mounted on an iron base, and stands six feet from the wall, giving access to all connections back and front. It is 16 feet wide and 8 feet high, and contains eight

FIG. 4.—GENERATOR SWITCHBOARD.

panels, of which two are alternating current, four direct current, and two double feeder panels. There are in all 13 meters, including 10 ammeters, one direct current volt meter and two alternating current volt meters, the volt meters being hung on swinging brackets so that they can be moved to be visible from all parts of the room. On each panel there are the necessary high tension fuse switches and circuit breakers, and on the back a No. 3 type R 15,000 volt lightning arrestor and one railway tank lightning arrester connecting between the line and the switchboard.

A general view of the switchboard is show in Fig. 4.

The old power house has been closed, and it is the intention to remove the direct current machine therein to the new station at Bond Lake.

THE SUB-STATION.

The sub-station is located at York Mills, about four and one-half miles from the southern terminus of the road. It is 30 feet wide and 45 feet long, of red brick, but in other respects its construction is very largely a duplicate of the power house.

Its equipment includes four 100 k.w. static transformers wound for 16,500 volts primary and 400 volts secondary. The current is received into these transformers from the power house at 16,500 volts alternating and reduced to 350 volts. At this pressure it is delivered to two 200 k.w. three-phase rotary converters, where it is changed to 550 volts direct current. These converters are operated at 710 r.p.m. and each are excited on one side by an induction motor of 25 h.p., a synchronizing motor for operating the plant being on the other side. The current thus produced is utilized to operate the southern portion of the road, that is, from the C. P. R. tracks to the power house, a distance of about 20 miles.

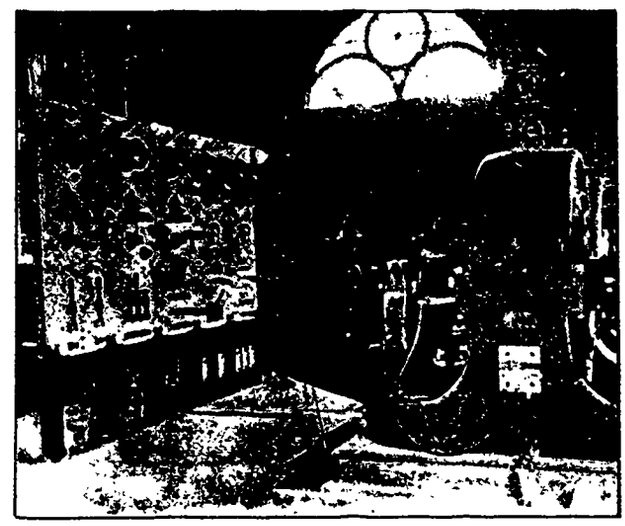


FIG. 5.—INTERIOR OF SUB-STATION.

The switchboard in the sub-station is of marble, containing five panels, two for alternating current for operating the machines, two containing equipment for direct current, and the fifth containing two automatic circuit breakers connected into the line. The first two panels contain three A. C. ammeters, rheostat for controlling the current and switches for controlling the starting motor and the synchronizing motor, all of Westinghouse make. The next two panels contain one D.C. ammeter, one D. C. circuit breaker of latest type, and a three knife switch. The fifth panel contains two circuit breakers, two single knife switches and Weston volt meter. The switches are of the latest type of automatic quick breaking. The equipment of the sub-station includes also a 15,000 volt lightning arrester and a Westinghouse tank lightning arrester. The apparatus enumerated occupies but one-half the space in the station, the balance being reserved for additional equipment, if found necessary.

THE POLE LINE.

The poles are of cedar and are set 100 feet apart. They are 38 feet in length, 6 inches at small end, with suspension trolley arms. The insulators are of the ordinary porcelain pattern, and were manufactured by the Imperial Porcelain Works, of Trenton, N.J., and tested to a pressure of 40,000 volts. They are placed 15 inches apart. The high tension line is of No. 4 covered copper wire made by the Montreal Rolling Mills Company. Since the plant was put in operation no trouble has been experienced excepting on one occasion,

when, during a heavy east wind, the branches of a poplar tree were blown over the line, causing the two wires to touch and blowing out the circuit breakers in the station. The trolley wire is No. 2 0 and the feed wire No. 4 0 bare copper, with a feeder into the trolley wire every tenth pole. Switches are so arranged that should necessity demand, the road may be entirely operated from either the power house or sub-station.

THE ROAD BED.

As previously stated, the line follows the Yonge street thoroughfare. The construction of the road represents the best engineering practice. There is a ballast of about six inches under the ties, which are of cedar and tamarac and placed about two feet apart. The track is covered in with gravel and ordinary earth. The rails are of the ordinary T pattern, 50 pounds to the yard, bonded to each other with No. 4 0 copper bond and cross-bonded every one thousand feet. It is a single track, with 13 spring switches, which are always open to a car running towards them. The track is placed on the side of the road, so that the ties will just clear the ditch. From the city limits to York Mills it is on the west side, and for the balance of the distance on the east side, it being found that this plan would give the least interference by snow. The track practically follows the grade of the road, the southern portion near the city being fully three inches below the level of the crown of the road, and further north on the

FIG. 6.—BALDWIN-WESTINGHOUSE ELECTRIC LOCOMOTIVE.

level with the crown. Box drains are provided for carrying away the water.

The road leaves Yonge street at two points. At Aurora it makes a detour to the west in order to cross the G.T.R. by an overhead steel trestle bridge 125 feet in length, built by the company. The second time is at the side-road at Hon. Wm. Mulock's residence beyond Aurora, where it cuts diagonally across private property for one and one-half miles, and thus reaches the town of Newmarket, where it passes up the centre of the main street. Besides the bridge mentioned, there are two steel girder bridges over the Holland river north of Aurora and a steel bridge 100 feet in length over the Don river at York Mills, all calculated to carry a load of the heaviest steam railway coal cars covering the entire bridge. These bridges were also built by the company.

During the summer the gauge of the road-bed was changed from 4 feet 10¾ inches to the standard gauge of 4 ft. feet 8½ inches. This was done done to permit connection with the C.P.R., it being the intention to connect with that road at North Toronto.

THE GRADES.

The grades on this road are, it is believed, more severe than on any other suburban electric railway in Canada. Starting at the southern terminus the first grade is encountered at Gallow's Hill, it being a north-bound grade of seven per cent. for a distance of 260 feet. At the old power house, about one mile further, there is a south-bound grade of five per cent. for a distance of 132 feet and a north-bound grade of 6.2 per cent. At York Mills, four miles from the southern terminus of the road, there are south-bound grades of 6.4 per cent. for 400 feet and 6.8 per cent. for 700 feet, and one-half mile further on, at the North York Mills hill, 200 feet of 6.2 per cent., 200 feet of 6.4 per cent., 300 feet of 5.8 per cent. and 400 feet of 6.35 per cent., all north-bound grades. At Willowdale there are 1,300 feet of 2.0 per cent. north-bound grade, and at Morgan's Hill, three miles further on, 400 feet of 5.7 and 400 feet of 6.1 per cent. south-bound grades. The steepest grades are found at Thornhill, where there are 100 feet of 5, 100 feet of 6.3, 100 feet of 8, 100 feet of 7.3, and 100 feet of 4.7 per cent. south-bound, and 100 feet of 4.8, 100 feet of 7.8, 200 feet of 8, 300 feet of 7.35, and 100 feet of 5.1 per cent. north-bound grades. At Richmond Hill there is a north-bound grade of 4.25 for a distance of 1,800 feet. Although the main ridges are crossed above Richmond Hill, some of the grades exceed those above given. There are six north-bound grades, varying from 4½ to 5½ per cent. and from 400 to 1,000 feet in length.

ROLLING STOCK.

The company is well provided with rolling stock, having 19 passenger cars built by the Pullman Company and recently overhauled by the company's own mechanics. These cars are double vestibule, heated by coal stoves, and with one exception are mounted on single trucks. Each single truck car has two 30 h.p. motor equipment, the double truck car having four 30 h.p. motors. Five of these equipments are Canadian General and the remainder Westinghouse. They have also four flat cats for hauling local freight. These will be drawn by a Baldwin-Westinghouse electric locomotive of 200 h.p., of which an illustration appears herewith. This locomotive has 33 inch driving wheels, wheel base 16 feet, length over platform 22 feet, and its total weight is 54,700 pounds. It is fitted with four standard 38 B 50 h.p. motors, together with special controllers.

NOTES.

The entire electrical equipment of the system, including the electric locomotive, was furnished by the Westinghouse Manufacturing Company, of Pittsburg, Pa., and installed by the United Electric Company, Limited, of Toronto. The plant is modern in every respect, and notwithstanding the great fluctuations of load caused by steep grades, its operation has been found satisfactory.

Mr. James McDougall, C.E., was engineer in the interest of the county of York and prescribed grades and alignment and looked after the details of construction in that behalf. Mr. W. T. Jennings, C.E., also acted as consulting engineer in a semi-private capacity.

The president of the road is Mr. C. D. Warren, and the superintendent and manager Mr. J. W. Moyes. Mr. Moyes has held this position for about eight years, he having had charge of the road when it was a horse car line. The chief engineer is Mr. John W. Marr, who has been with the company for two years. Previous to accepting this position he was employed by the T. Eaton Company and the Toronto Incandescent Light Company. Messrs. Joseph Lappin and John Mitchell are electricians at the sub-station.

At Bond Lake the company have built a stone, brick and iron car barn, 90 x 36 feet, capable of housing nine cars. The balance will be stored in the old car barn at Deer Park.

The company have purchased 400 acres of land and an hotel at Bond Lake, and it is the intention to establish picnic and camp grounds.

The company have been given the contract for carrying two mails per day each way between Toronto and Newmarket.

Notwithstanding the heavy grades the cars average a speed of about 20 miles per hour without difficulty. A 15 minute service is provided between Toronto and Glen Grove, and between Toronto and Newmarket there are on an average eight cars daily each way.

ENGINEERING and MECHANICS

POWERS, ROOTS, AREAS AND SURFACES.*

By C. R. T. Fessenden.

As engineers have much to do with measuring areas, surfaces, and volumes, a knowledge of powers and roots is necessary.

Powers.—When a given number is multiplied by itself, and the product multiplied again by the number, and so on, these products are called powers of the given number, and what power, or the number of times the given number is used as a factor, is shown by a smaller number written above and to the right; thus 5^2, read five squared, means 5×5, or 25; 5^3, or five cubed, means $5 \times 5 \times 5$, or 125; 5^4, five to the 4th. The 2nd power is called square, and the 3rd the cube.

Roots.—A square root of a given number is that number which, multiplied by itself, will yield the given number. Cube root is that number which, used as a factor three times, yields the given number; and if two numbers are given, the first being a power of the 2nd, then the 2nd is that root of the first, viz., 5 and 25; 25 is the 2nd power or square of 5, and 5 is the 2nd root or square root of 25. When the root of a number is indicated the sign $\surd$ is used. As used alone $\surd_{25}$ means square root, any other root being shown by a number placed thus, $\sqrt[4]{625}$, reads 4th root of 625. To extract or find the square root of a number, divide it into groups of two, counting from the decimal point. If the last group to the right of the decimal is incomplete, a cipher must be affixed to make it complete. Thus the number 9158.49 is divided into groups of 58, 91 and 49.

```
                9158.49 | 95.7
                  81
180             1058
  5
185             925
              1900 | 133.49
                 7 | 133.49
              ----
              1907
```

Then set down as first figure of root the largest number whose square is not greater than the left hand or first group (1st group 91, largest number 9); place its square (81) under first group and subtract (91 − 81 = 10). Bring down next group (58), making a dividend (1058). Multiply the root so far obtained by 20 for a trial divisor (9 × 20 = 180), divide dividend by trial divisor and place quotient (5) as next figure of root, also add it to the trial divisor (180 + 5 = 185); multiply sum of trial divisor and last root figure by last root figure (185 × 5 = 925), and subtract from trial dividend; to the remainder (133) annex next group, which is a decimal, ∴ place decimal (.) in root, multiply root (95) by 20, and proceed as before. If there is a remainder, bring down groups of ciphers, always remembering when you come to decimal point to place it in the root.

To extract $\surd$ of vulgar fraction reduce to a decimal, unless both numerator and denominator are perfect squares, when their $\surd$ may be written down as $\surd 1/2 = 1/4$, $\surd 1/2 = \surd .5 = \surd .50$.

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                480048.687 | 78.3
                  343
14700           137048
 1680
   64
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16444           131552
1825200        5496687
   7020
      9
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1832229        5496687
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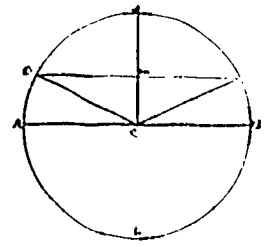
To extract cube root point into groups of three figures, beginning at decimal point; place in root the largest number (7) whose cube is not greater than first group (480), placing its cube (343) under first group. Subtract, and to the remainder (137) bring down next group (048.), making a dividend of 137048. Next, for a trial divisor take 300 times the root squared ($7^2 \times 300 = 14700$), divide, and place quotient (8) as next figure of root; multiply root by last figure added and multiply product by 30 ($7 \times 8 \times 30 = 1680$), which add to trial divisor, also add square of last figure ($8^2 = 64$). Multiply this sum (16444) by the last figure of root (8); subtract from dividend 137048, and to the remainder bring down next group (.687), placing decimal in root; square 78 and multiply by 300 for trial divisor (1825200); quotient is 3; place in root and multiply root 78 by 3 and product by 30 ($78 \times 3 \times 30 = 7020$). Add last root figure squared (3^2 or 9), making 1832229; multiply by last root figure, and proceed as before. If remainder of the last group is brought down, bring down groups of ciphers.

In case other roots are wanted than square and cube, it is necessary to use a table of logarithms, except $4\surd$, which is the square $\surd$ of the square $\surd$.

Areas and Volumes.—The principal figures the engineer uses are circles and cylinders and their parts, and for the volume of cylinders: In the circle A H B the line A B is a diameter, the lines D C, H C and F C are radii; the space inside the line A D H F B L is the area of the circle; the space inside A D H F B is a semi-circle; the space C D H F C is a sector of the circle; the space D F H is a segment; the line D F is a chord; the line D F H is an arc of sector C D H F.



Diameter × 3·1416 = circumference.
40 × 3·1416 = 125·664".
Diameter² × ·7854 = area. Suppose circle is 40" in diameter.
Thus area = 40 × 40 × ·7854 = 1256·64 sq. in.
Radius² × 3·1416 = area. Radius = ½ diameter.
$20^2 \times 3{\cdot}1416$ = area = 1256·64 sq. in.
$\text{Diameter}^2 \times {\cdot}7854 \div 2$ = area of semi-circle.

Area of sector is radius × arc and product divided by 2, thus radius = 20, arc = 45, area = $\frac{20 \times 45}{2}$ = 450 sq. in. Area of segment D F H = area of sector C D H F C minus area of triangle C D F; area of triangle C D F = chord D F × ½ height of triangle M C (12"). Chord D F = 35 = $\frac{12 \times 35}{2}$ = 210 sq. in. Surface of tube = circumference in inches × length in inches. Thus a 3" tube 12 ft. long is 3 × 3·1416 × 12 × 12 = 1671·3312 sq. in.

Volumes of cylinders are found by multiplying area of end by length, both in inches or feet; thus a boiler 60" in diameter by 14' long, area of end = $60^2 \times {\cdot}7854$ = 2827·4 sq. in.; volume = 2827·4 sq. in. × 14 × 12 = 374763·2 cu. in. Volume of segment of cylinder = area of segment of end × length; thus steam space in 60" boiler, water 45" deep; by rule area of segment of end 15" deep = 120 sq. in.; length = 14 × 12"; steam space = 120 sq. in. × 14 × 12 cu. in. = 19160 cu. in.

Volume of box = area of end × by length; thus box 8 ft. deep by 4 ft. long by 5 ft. wide = 8 × 4 × 5 = 160 cu. ft.

* Paper read before Hamilton No. 2, C.A.S.E.

AMONG THE ENGINEERS.

Mr. James Newton has been appointed engineer at the waterworks at Hintonburg, Ont., which were recently completed.

Mr. James May, of Essex, has accepted the position of engineer in the wood-working factory of Gardner Bros., Leamington, Ont.

Mr. Thos. Eversfield, who for upwards of twenty years was engineer at Toronto University, is now representing the James Morrison Manufacturing Co., of Toronto, on the road.

Mr. D. C. McLean, who for many years has been chief engineer at the power house of the Toronto Railway Company, recently resigned to accept a position in Glasgow, Scotland. He has been succeeded by Mr. Thomas Merry.

Mr. Peter Peterson, first engineer in the Canadian Packing Co.'s factory at London, Ont., was caught in the belting while oiling some shafting and instantly killed. Deceased had but recently qualified for the position of engineer.

The employees in and around the power house of the Toronto Railway Company have organized the Toronto Street Railway Company Electrical and Mechanical Association. The main object of the association is to provide sick benefits. The president is Mr. G. J. McCullough, chief electrician, and the secretary Mr. William Cox.

Mr. John Tucker, of Hintonburg, Ont., was almost instantly killed by the explosion of a 15-horse power boiler at the Chaudiere in Ottawa. The boiler was being used to provide power for running a stone crusher, and it is said that there was 60 pounds of steam on and plenty of water in the boiler. Deceased was 90 feet away at the time of the explosion, driving a cart, and was struck by the driving wheel. The jury empanelled to inquire into the circumstances brought in a verdict that the explosion was caused by a deposit of dirt in the bottom of the boiler, which resulted in overheating and consequent sudden expansion. They also found that the by-laws relating to steam boilers had not been enforced, and recommended that the government, in the interest of the general public, appoint a provincial boiler inspector.

The Consumers Cordage Company, of Montreal, have lately improved their engineering department, having put in a Wheelock engine of 250 h.p., low pressure, a Brown low pressure engine of 400 h.p., condensing engine and six steel tubular boilers built by White & Company, of Montreal. The Brown engine was built by the Polson Company, of Toronto, and the Wheelock engine by the Goldie & McCulloch Company, of Galt. When these engines are in operation there will be 700 h.p. installed. The boilers are 75 h.p. The plant is under the supervision of Mr. John Killfeather and Mr. M. Rochford.

SPARKS.

Messrs. Young Bros., of Almonte, Ont., have installed a dynamo for lighting their works.

In Athens, Ont., there is an agitation on foot to install an electric plant for street lighting.

The citizens of Oakland, Man., are endeavoring to secure telephone connection with Portage la Prairie.

The Schofield Woollen Company, Paris, Ont., are installing a 12 k.w. Edison dynamo for lighting their works.

The Maritime Electric Company, dealers in electrical supplies, Halifax, N.S., are reported to have assigned.

A by-law will shortly be submitted to the ratepayers of Nelson, B.C., to raise $7,000 for electric light purposes.

A by-law to raise $7,000 for electric light purposes was carried by the ratepayers of Campbellford, Ont., a fortnight ago.

J. G. Field, of Tavistock, Ont., is installing a 30 k.w. standard alternator of the Canadian General Electric Company's make.

The city council of St. Thomas, Ont., have awarded to the Bell Telephone Co. the contract for supplying a fire alarm system.

The Poorman Mine, Nelson, B.C., is installing a 50 h.p. induction motor of the Canadian General Electric Company's make.

The Toronto Railway Company are adopting electric welding of rail joints, the intention being to apply this method to the entire system.

The Linde British Refrigeration Company have bought from the Canadian General Electric Company one 30 h.p. and one 10 h.p. induction motor.

At the next meeting of the city council of Brockville, Ont., an estimate of the cost of installing an electric plant for street lighting will be submitted.

Mr. A. B. Rice has made application to the town council of Toronto Junction, Ont., for permission to supply electricity for light and power purposes.

The Montague Electric Company, Prince Edward Island, have purchased a 500-light standard alternator from the Canadian General Electric Company.

A committee of the town council of Milton, Ont., have asked the Milton Electric Light Company to state upon what terms they will sell the plant to the town.

The Canadian Colored Cotton Company, of Milltown, N.B., have bought two 55 k.w. multipolar 125-volt generators from the Canadian General Electric Company.

The town of Levis, Que., is about to install an electric light system, for which plans are invited by F. Roy, secretary treasurer of the municipality, up to January 1st.

The Canadian Pacific Railway has given a contract for one 200 h.p. 550-volt induction motor for the Trail Smelter at Nelson, B. C., to the Canadian General Electric Company.

The Sarnia Street Railway Co., at a recent meeting, decided to take steps at once to convert the road into an electric system. Mr. J. S. Symington is president of the company.

The California Mine of British Columbia have ordered from the Canadian General Electric Company one 150 h.p. 2,080-volt induction motor for operating their compressor plant.

The Montreal Cotton Company, of Valleyfield, Que., have ordered one more 100 h.p. and six more 50 h.p. induction motors from the Canadian General Electric Company.

Before the Canadian Institute in Toronto Prof. C. A. Chant, of Toronto University, *delivered a lecture on wireless telegraphy*, with lantern illustrations and instrumental demonstrations.

Tenders have been taken for building a power house for a municipal electric light plant at Halifax, N.S. The city engineer is to furnish an estimate of the cost of electrical equipment.

The Montmorency Cotton Mills Company, Montmorency, Que., have purchased a 60 k.w. direct-connected unit, with Robb-Armstrong engine, from the Canadian General Electric Company.

The St. Croix Gas Light Company, St. Stephens, N.B., have purchased from the Canadian General Electric Company an A.S. 8-120-900-2,080-volt alternator, with exciter and switchboard.

The Arnprior Electric Light and Power Company have been given a contract to light the streets of the town by arc lights. It is understood to be the intention of the company to remodel their plant.

The Penman Manufacturing Company, of Coaticoke, Que., have bought an M.P. 4-30 1050-125 volt generator for lighting purposes in their factory. The contract also includes the wiring of 350 16-c.p. lamps.

The Metropolitan Railway Co., of Toronto, which have now built their line to Newmarket, are said to have decided upon further extensions northward, for which the contracts will likely be let an early date.

Chief Buchanan, of the Winnipeg Fire Brigade, has submitted to the city council an estimate of the cost of a repairing plant. Using gasoline engines the cost is placed at $5,840, and using electric power, $5,340.

The council of Toronto Junction, Ont., are considering the question of increasing the municipal plant to such an extent as to furnish commercial lighting. It is estimated that this would entail an expenditure of $3,000.

Mr. Wm. Shaw, while showing a friend through the electric light works at Brandon, Man., accidentally walked into a large fly wheel revolving at a rapid speed. He was seriously injured and died a few days afterwards.

The Lachine Rapids Hydraulic & Land Company, of Montreal, are supplying to the Colonial Bleaching Company, of that city, induction motors aggregating 475 h.p., all of which are to be made by the Canadian General Electric Company.

The corporation of Prescott, acting under advice of their consulting engineer, have purchased their electric plant from the Canadian General Electric Company. This will consist of a 2,000-light 2,080-volt alternator with switchboard complete.

Plans have been prepared for the electric power transmission plant of the Kalamazoo Valley Electric Co., of Allegan, Mich. It is proposed to transmit the current, at a pressure of 40,000 volts, from Allegan to Jackson, a distance of 90 miles.

The Sutherland Improvement and Development Co., of New York, have deposited with the town council of Niagara Falls, Ont., a cheque for $1,000 in connection with the proposed conversion of the local street railway line to an electric system.

The Niagara Falls Park Commissioners have reached an agreement with the Fort Erie Electric Railway Company under which the latter agrees to extend its line for a distance of 13 miles along the bank of the Niagara river to Slater's Point.

The Dominion Steel & Iron Company, of Sydney, have placed their order with the Canadian General Electric Company for their electrical requirements. The initial plant will consist of two 125-k.w. 250-volt generators, with generator and feeder panels, and one 100 h.p. 250-volt motor.

The St. Thomas Gas Company, St. Thomas, Ont., have just finished the installation of a Brush arc dynamo having a capacity of 125 lamps. This machine embodies all the latest improvements in arc dynamo construction, and was purchased from the Canadian General Electric Company.

The council of Shelburne, Ont., recently submitted an offer to the Shelburne Electric Light Company to purchase their plant. This offer was refused, and as an arbitrator was not appointed by the company within thirty days thereafter, the council submitted a by-law to the ratepayers to authorize the purchase of a municipal lighting plant. *The vote was taken on November 24th, and* resulted in the defeat of the by-law by 32 votes.

The Niagara, St. Catharines and Toronto Railway Company have placed their order with the Canadian General Electric Co. for their entire motor equipment, consisting of six 4 motor and four 2 motor equipment. It will be remembered that this company has taken over the Niagara Central railway, with the intention of extending it ultimately to Toronto, and the Canadian General Electric Company is to be congratulated upon securing such an important order.

Mr. W. A. Turbayne, E.E., of Hamilton, has reported to the council of Woodstock, Ont., on the value of the plant of the Woodstock Electric Light Company, the taking over of which is under consideration by the council. He reports that $1,050 would be required for improvements, including $800 for reserve arc dynamo, $550 for lamps and weatherhoods, and $300 for alterations on line. To provide for an all night service a reserve engine and boiler would be required, at a cost of $3,200.

THE AUTOMOBILE.

It doesn't shy at papers
As they blow along the street ;
It cuts no silly capers
On the dashboard with its feet ;
It doesn't paw the sod up all around the hitching post,
It doesn't scare at shadows as a man would at a ghost ;
It doesn't gnaw the manger,
It doesn't waste the hay,
Nor put you into danger
When the brass bands play.

It makes no wild endeavor
To switch away the flies ;
It sheds no hair that ever
Gets in your mouth and eyes :
It speeds along the highways and never looks around
For things that it may scare at and spill you on the ground !
It doesn't mind the circus,
It's not at all afraid ;
And it doesn't overwork us
When the elephants parade.

It doesn't rear and quiver
When the train goes rushing by ;
It doesn't stand and shiver
When the little snowflakes fly ;
It doesn't mind the thunder nor the lightning's blinding flash ;
It doesn't keep you chirping and connecting with the lash ;
It never minds the banners
They display on holidays,
It's a thing of proper manners,
Which it shows in many ways.

When you chance to pass its stable
You do not have to care
Or cluck for all your able
To keep from stopping there !
It will work all through the daytime and still be fresh at night ;
There is no one to arrest you, if you do not treat it right !
Its wheezings ne'er distress you
As it moves along the way—
Farewell old Dobbins ; bless you !
You were all right in your day.

—Chicago Times Herald.

TRADE NOTES.

The corporation of Goderich, Ont., have accepted the tender of Sadler & Haworth, of Toronto, for supply of leather belting, at the price of $1.10 per foot for 13 inch and $2.05 per foot for 28 inch

The Dominion Iron & Steel Co. has placed an order with the Robb Engineering Co. for two 150 horse power engines for electric lighting purposes. They have also recently bought from the Robb Co. a number of smaller engines and boilers for temporary use during the erection of their extensive plant.

The Goldie & McCulloch Co., Limited, Galt, Ont., continue to be busy in all their departments. As an indication of this we give a partial list of their shipments for the week ending November 25th.: Several large safes and vault doors, gas engines, 3 cars of flour mill machinery to different parts of the North-West, one car of same to Lucan, one carload of machinery, including boiler, etc., to Hamilton. There was also the usual amount of minor shipping.

The Macdonald Mfg. Co, of this city, will use in their new factory on Catharine street all the latest devices for the successful production of tinware, and among the rest they have decided to use electricity as a distributing medium in their power plant. They will use the Canadian General Electric Co.'s well known apparatus, consisting of a 60 k.w. direct connected generator and several motors of various sizes which will be either direct connected to the individual machines or to lines of shafting. The building will also be lighted throughout with incandescent lamps.

We were pleased to notice above the entrance to No. 30 Wellington street east, Toronto, a sign bearing the familiar name of "F. E. Dixon & Co". Enquiry elicited the fact that Mr. F. E. Dixon, who was for many years engaged in the manufacture of leather belting in Toronto, has resumed business in the same line. The firm have been appointed agents for Messrs. Morris & Co., manufacturers of leather and leather belting, London, Eng. (established 1775). Mr. Dixon reports that some of his old customers have already found their way back to him, and he hopes to see others in addition to many near ones.

The United Electric Co., Limited, of Toronto, report the following recent sales of motors. E. S. Stephenson & Co., St. John, N. B., four standard type motors; Shaw, Cassels & Co., Bracebridge, Ont., one 40 h.p. multipolar motor; Bertram & Sons, Dundas, Ont., two slow speed multipolar motors for direct gearing to large iron-working tools; McLaren Manufacturing Co., Montreal, Que., one motor; Oelschlager Bros., Berlin, Ont., one elevator motor; Northey Manufacturing Co., Toronto, one standard motor; Ryrie Bros., jewelers, Toronto, motors for operating their cash system; Montmorency Cotton Mills Co., three standard motors for service in their mills at Montmorency Falls, Que.

MOONLIGHT SCHEDULE FOR DECEMBER.

Day of Month	Light.	Extinguish	No. of Hours.
	H.M.	H.M.	H.M.
1	P.M. 5.00	A.M. 6.00	13.00
2	" 5.00	" 6.00	13.00
3	" 5.00	" 6.00	13.00
4	" 5.00	" 6.00	13.00
5	" 5.00	" 6.00	13.00
6	" 6.00	" 6.00	12.00
7	" 7.50	" 6.00	10.10
8	" 10.00	" 6.00	8.00
9	" 11.00	" 6.10	7.10
10	" 11.10	" 6.10	7.00
11		" 6.10	5.50
12	A.M. 12.20		
13	" 1.30	" 6.10	4.40
14	" 2.40	" 6.10	3.30
15	No Light.	No Light.	
16	No Light.	No Light.	
17	No Light.	No Light.	
18	P.M. 5.00	P.M. 9.20	4.20
19	" 5.00	" 9.20	4.20
20	" 5.00	" 9.20	4.20
21	" 5.00	A.M. 2.30	9.30
22	" 5.00	" 2.30	9.30
23	" 5.00	" 2.30	9.30
24	" 5.00	" 2.30	9.30
25	" 5.00	" 2.30	9.30
26	" 5.10	" 2.10	9.00
27	" 5.10	" 3.10	10.00
28	" 5.10	" 4.20	11.10
29	" 5.10	" 5.20	12.10
30	" 5.10	" 6.20	13.10
31	" 5.10	" 6.20	13.10
		Total	252.30
		Grand Total.	2,196.40

The Hamilton Steel & Iron Company have placed a contract with the Canadian General Electric Company for a direct-connected 75-k.w. 250-volt generator for operating their electric cranes.

A company of Canadian capitalists has been formed to construct and operate an electric railway system at Georgetown, Demarara, West Indies. Sir Wm. Van Horne is president of the company, and Mr. W. B. Chapman, of Montreal, an active director.

SPARKS.

The Ottawa Electric Co. are installing a storage battery equipment to regulate the current on power circuits.

The Lake Megantic Electric Company are replacing their 30 k.w. alternator with one of 60 k.w. output. The Canadian Electric Company have the contract.

The Chambers Electric Co., of Truro, N.S., are installing another 55 k.w. multipolar generator of the Canadian General Electric Company's make.

The Palmerston Carriage Co., of Palmerston, Ont., are installing in their factory an electric light plant, furnished by the Royal Electric Company.

The Stanstead Electric Light Company, of Stanstead, Que., have lately made improvements to their plant, putting in new armatures and changing the voltage from 1,000 to 2,000 volts.

The Berlin Rubber Co., of Berlin, Ont., are installing a 17 k.w. direct current 125 volt generator in their factory for lighting purposes. The order has been given to the Canadian General Electric Co.

The Winnipeg Street Railway Company are installing another 150 k.w. monocyclic generator with panel, to supplement those already in use. The order was placed with the Canadian General Electric Company.

The Consumers Cordage Company, of Dartmouth, N. S., are installing a multipolar 6-30-125 volt generator of the Canadian General Electric Co.'s make, which will be driven by a Robb-Armstrong engine.

The Canada Electric Co., of Amherst, N.S., whose generating plant was recently destroyed by fire, has purchased two direct current 55 k.w. multipolar generators and switchboard from the Canadian General Electric Co.

It is pleasing to note the increase of power business in connection with alternating lighting plants, especially when monocyclic machines of the Canadian General Electric Company are in use. The Hanover Electric Light Company are just putting on another 20 h.p. induction motor.

The capital stock of the Electrical Maintenance and Construction Co., of Toronto, is about to be increased from $20,000 to $250,000. This step has been rendered necessary by the unexpectedly large amount of business which has come to the company since its organization last year. They are understood to have now in hand contracts amounting to $100,000.

A serious but peculiar accident occurred at Point St. Charles, Que., by which Geo. Pierce was instantly killed. Deceased was pressing ashes into a cylinder, holding in his hand a long iron pole which he was using. The pole met an obstruction, causing him to raise it up quickly, thus breaking the globe on an arc light above his head and forming a circuit, by means of which the current passed into his body, death resulting immediately.

The corporation of Weston, Ont., have placed a contract with the Canadian General Electric Company for a complete lighting plant for the town. They will use alternating arc lamps for street lighting, and the generating plant will consist of a standard 30 k.w. alternator and switchboard operated by an Ideal engine.

The premises of the Toronto Carpet Mfg. Co., of Toronto, are now lighted by electricity. The Canadian General Electric Company have just completed the work of installation, which included the supplying of a steel frame 55 k.w. generator with switchboard, and the wiring up of about 300 16 c.p. lamps.

The Helois Company of Colonge, Germany, will begin early next year to erect a large plant in the province of Posen, for the distribution of electricity for lighting and power purposes over an extensive agricultural district. The distributing mains will extend for a distance of 15 miles around the station. Not only is it intended to supply current for lighting purposes and operating dairy machinery, but also for driving agricultural implements, such as threshing machines, plows and chaff cutters. It is estimated that the undertaking will cost about $1,300,000. The Helois Company have already made arrangements with land owners in the district in which the plant is to be erected for the annual plowing of their land. For this purpose 40 plowing machines will have to be provided, and the work must be done, according to agreement, between July 15 and Dec. 1 every year.

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. Every one 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.

If we promise to show you how you can extricate yourself from the ever present losses, difficulties, trouble and vexations you are meeting with in the operation of your Arc Lighting Plant, will you send us your address?

WE HAVE SOMETHING THAT WILL INTEREST YOU

Series Arc Lighting Supplied From Your Present Alternating System

MANHATTAN GENERAL CONSTRUCTION CO.

Newark, N.J.

We guarantee the results we specify. Read the next page and then if you are interesied write to us. Our Canadian Office Address is—

Temple Building
TORONTO

PUBLICATIONS.

A neat catalogue of Lundell generators, direct connected and belted types, is to hand from Messrs. Jack & Robertson, of Montreal, sole agent for Canada of the Sprague Electric Co., of New York. The split pole machines are the latest and most modern construction for these generators. The booklet contains numerous tables and diagram showing regulation and efficiency curves.

The Official Messenger is the title of a booklet to be issued monthly by the Colliery Engineer Company proprietors of the International Correspondence Schools, of Scranton Pa. It is intended to serve as a medium of communication from the home office to the staff of solicitors, collectors and assistant superintendents. The initial number is beautifully illustrated, and is devoted to a detailed account of the gradual evolution of the International system, a description of the building, method of instruction and the business relations of the home office with the men in the field. The editor is Mr. Geo. F. Lord.

The Maritime Newspaper Company, of Halifax, N.S., publishers of the Industrial Advocate, in their special supplement devoted to the city of Halifax, have issued a most commendable number, and one which is indicative of the progressive spirit of the publishers. The supplement is profusely illustrated and includes carefully written articles bearing upon the industries of Halifax. Among these is a description of the street railway system of that city as operated by the Halifax Electric Tramway Company. This is accompanied by an illustration of the offices of the company and by portraits of the officers. The advertising patronage bestowed upon the number is an evidence that the public have confidence in the publishers.

SPARKS.

Mr. R. J. Holley has been appointed electrician of the electric light plant installed by the town of Weston, Ont.

It is understood to be the intention of the authorities of Kingston penitentiary to install a new electric light plant in the building.

It is understood that the power house of the Niagara Falls Park & River Railway, at Niagara Falls, Ont., which was burned recently, will be rebuilt.

The feasibility of building an electric railway between Rossland and Trail, B.C., is receiving consideration, Col. Topping being a strong advocate of the project.

Mr. V. M. Roberts, C.E., of Niagara Falls, Ont., is understood to have been engaged by an English syndicate to report on the water powers of the Sturgeon river.

John Sheffield, an electrician employed by the Union Carbide Works, Niagara Falls, N.Y., and a native of Kingston, Ont., was killed by falling against the primary terminals of a switch.

It is proposed to establish in Hamilton a motor vehicle stable, where automobiles will be taken care of and recharged.

It is expected that the Keewatin Power Co. will proceed to further develop their water power at Norman, Ont., next year.

The town of St. Paul, Que., will ask authority from the provincial legislature to construct and operate an electric railway to connect with St. Henri and Montreal.

Mr. J. B. Charleson, who superintended the construction of 740 miles of telegraph line from Bennett to Dawson City, states that the line cost $137,000, or about $280 per mile. Before proceeding with the work, he says, the C.P.R. and the G. N. W. companies were asked what it would cost and the figures given were $350 and $400 per mile respectively.

A telephone cable across the St. Lawrence river between Prescott, Ont., and Ogdensburg, N. Y., was completed by the Bell Telephone Company last month. The cable, which was made by the Safety Submarine Company, of New York, is one and one-quarter miles long, one and one-half inches in diameter, and weighs 14,000 pounds. The work was executed under the superintendence of W. H. Winter.

The Owen Sound Electric & Illuminating Co., of Owen Sound, Ont., are installing a 65-light dynamo of the latest pattern. The new machine will be placed in the water power station. The two dynamos, including the newly repaired street circuit dynamo, will then be placed in the steam power house, which will thus give the company a duplicate plant to meet any emergency, besides making it possible to supply electric power as soon as the industrial development of the town demands it. The company have installed a plant in factory A of the North American Bent Chair Co., and are about to extend it to factory B, to supply both light and power.

California miners are putting in extensive apparatus at the Consolidated Cariboo Hydraulic Mining Co.'s property, near Quesnelle Forks, B.C. Two lines of sluices, 7 feet wide, were placed in the bed of the gulch, paved with steel riffles, weighing in the aggregate 791 tons. A canal 7 by 13 feet, 10 miles long, was commenced in June and completed November 15, 1899. A dam 485 feet long on top and 50 feet high was constructed across the outlet of a lake at the head of the canal for storage of about 550,000,000 cubic feet of water. The construction of this dam and the canal furnished employment for 350 men and 120 horses, and cost $125,000. About 75,000 pounds of dynamite, 75,000 pounds of black blasting powder and 100,000 pounds of other miscellaneous mining supplies are used annually at the mine, which has now completed thirty-three miles of canals and three storage reservoirs having a total area of 2,184 acres and a storage capacity of 1,016,000,000 cubic feet of water.

SPARKS.

The Toronto Street Railway Company are now extending their line into the town of Toronto Junction.

The Kinney-Haley Manufacturing Company are installing an electric light plant in their works at Yarmouth, N.S.

The town of Gorrie, Ont., is to be lighted from the plant sold by the United Electric Co. to the Wroxeter Electric Light Co.

The council of Midland, Ont., is negotiating with the Midland Electric Light Co. for the renewal of the contract for street lighting.

Mr. F. C. Coffin, M.E., of Boston, has been engaged to prepare plans and specifications for a steam pumping plant for the town of Yarmouth, N.S.

It is proposed to submit a by-law to the ratepayers of Parkhill, Ont., to raise a sum of money to establish an electric light plant and waterworks system.

The Stormount Electric Light Co., of Cornwall, Ont., has installed a new 2,000-light dynamo, furnished by the Canadian General Electric Company.

A recent report from Morden, Man., states that the council will probably lease the electric light plant there for one year, with the privilege of purchase at the end of that period.

John Harrison & Co.'s new factory at Owen Sound, Ont., is being wired electrically, the company having given a five years' lighting contract to the Owen Sound Electric & Illuminating Co.

The Waterloo Electric Light & Power Company have decided to thoroughly overhaul their plant. The three machines at present in use will be replaced by a 60 k.w. multipolar generator.

Mr. S. F. Ritchie, of Aylmer, Que., has purchased a mining property near Eardley, and it is probable that an electric plant will be installed for operating the mine, power to be obtained from a stream near by.

The acetylene gas plant in the post office at Fort Steel, B.C., exploded on November 19th, severely injuring the post master and his assistants. The accident resulted while searching for a leak with a lighted match.

Telephonic communication has just been completed between the lighthouse on Belle Isle, situated 600 feet above the sea, and the power house, near the sea level, two miles distant on the southwest extremity of the island.

An automobile contest is to be one of the features of the Paris Exhibition. One hundred thousand francs will be expended on the construction of a track and grand stands at Vincennes, where a charging station will also be provided.

The United Electric Co., Toronto, have been requested by the South African Mutual Life Assurance Co., of Cape Town, to submit price to them for two direct connected units and system of accumulators for power and light for their new office building in Port Elizabeth, South Africa.

The United Electric Company, Limited, Toronto, have recently sold their improved arc lamps to the Niagara Falls Electric Co., Colborne Electric Light Co., the Harriston Pork Packing Co., Dominion Bridge Co., Montreal, the Owen Sound Electric Illuminating & Manufacturing Co., Shaw, Cassils & Co., Bracebridge, and others.

Low & Farrell, of Hamilton, have brought suit against Chas. Hardy, A. L. Pentecost and Wm. Stewart to recover an account of $300 for the electric wiring of the Pentecost store. The action was primarily against the landlord, Mr. Hardy, but the tenant and architect were brought into it as co-defendants. Mr. Hardy claimed that the plaintiffs exceeded their orders in the work, having put in both electric light and gas when only gas was ordered. The architect states that it was necessary to have electric lighting in part of the store, and the cost was no more than it would have been with gas alone. Judgment has been reserved.

The Quebec Railway, Light & Power Co. has taken an action to compel the Jacques Cartier Water Power Co. to remove the poles that the latter have placed on the city streets. The plaintiff alleges that the defendant company is incorporated in the State of New Jersey, but that it has no power to supply electricity in the city or district of Quebec; further, that the high voltage of the wires which will cross and intersect the established electric wires will be a menace to the lives of the employees of the plaintiff and a public danger. It is asked that the defendant be enjoined perpetually from interfering with the electric wires of plaintiff, and compelled to remove the poles within fifteen days, or that the court authorize the plaintiff to remove said poles and to charge the defendant with the cost.

It would appear from data now in our possession, says the Electrical World, that in Europe there are now well over 7,000 owners of automobiles. Many of these own more than one vehicle, so that perhaps the number of vehicles could be put at 10,000. Of the 7,000, no fewer than 5,600 are in France. The general idea has been that in France the interest was centred in Paris, but this is erroneous, there being of the 5,600 no fewer than 4,541 scattered all through the departments. In France, moreover, there are 619 manufacturers of automobiles, not including makers of detail parts, 998 dealers in them, 1,095 repair shops, 3,039 stores for oil, gas, etc., and 265 electric charging plants and posts. For the remainder of Europe the figures are far from complete, but it would appear that there are 268 owners of automobiles in Germany, 90 in Austro-Hungary, 90 in Belgium, 44 in Spain, 304 in Great Britain, 111 in Italy, 68 in Holland, 114 in Switzerland, and 35 in Russia, Denmark, Portugal, etc.

SPARKS.

The West Kootenay Power & Light Co., of Rossland, B. C. will probably increase its stock from $1,000,000 to $2,000,000.

Mr. McIntosh has submitted a proposition to the municipal council of Greenwood, B. C., to establish an electric tramway to Phoenix and an electric light plant.

Mr. C. B. Hunt, manager of the London Electric Co., presented gold fountain pens to Messrs. Wm. Adams and Chester McLaren, members of the London company of the South African contingent who were employed by Mr. Hunt.

The electric light plant at Niagara Falls, Ont., was taken over by the corporation on November 1st.

Mr. D. J. Kennedy has made application to the council of Sydney, C. B., for a franchise for a street railway.

The Ottawa Street Railway Company have ordered from the Ottawa Car Company four new open cars for the Brittannia line. These will be fifty feet long, with an aisle down the centre and fourteen benches an either side of the aisle. The railway company have purchased twelve acres of land at Britannia for park purposes.

A fire alarm system will probably be installed in the town of Woodstock this winter.

Mr. Cooke, of St. Catharines, Ont., has ordered a new water wheel and additional equipment for his power station.

A fire alarm system has been installed for the corporation of Harriston, Ont., by the United Electric Company, Toronto.

The council of Thamesville, Ont., has decided to take a vote of the ratepayers on the question of purchasing an electric light plant.

At the municipal elections in January the ratepayers of Pembroke, Ont., will vote on a by-law to a raise $30,000 to purchase a municipal electric light plant

The United Electric Company, of Toronto, announce the following sales of lighting plants: D. W. Karn & Co., organ manufacturers, Woodstock, Ont., a complete 400 light incandescent plant; Goderich Organ Co., 100 light dynamo; Peter Hay, Galt, Ont., incandescent lighting plant; Wroxeter Electric Light Co., 25 k.w. inductor alternator complete with switchboard; Henry Cook, Hensall, Ont., 45 k.w. inductor alternator, and two direct current generators to be used for furnishing light and power in the town of Zurich, Ont.; Harriston Pork Packing Company, Harriston, Ont., complete arc and incandescent lighting plant; Louisville Shirt Manufacturing Co., Louisville, Que., incandescent lighting plant; Board of Trade, Toronto, incandescent dynamo; town of Mitchell, Ont., direct current incandescent dynamo, Waterloo Electric Light Co., Waterloo, Ont., 60 k.w. 250 volt multipolar generator; A. Barratt & Co., Mitchell, Ont., incandescent dynamo for lighting their mills; Guest and Stead, Pattenham, Ont., incandescent dynamo; A. H. Ingram, Seaforth, Ont., 100 light dynamo; Globe Fde Co., Port Hope, Ont., complete incandescent lighting plant for their new factory.