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CANADIAN
ELECTRICAL NEWS
AND
STEAM ENGINEERING JOURNAL

OLD SERIES, VOL. XV.—No. 6.
NEW SERIES, VOL. VI.—No. 5.

MAY, 1896

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ELECTRICAL NEWS

AND

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VOL. VI. MAY, 1896 No. 5.

BOILER EXPLOSION AT RIDGETOWN, ONT.

BOILER EXPLOSION AT RIDGETOWN.

On the 6th of April a boiler exploded in the saw, stave and heading mill of Watson Bros., at Ridgetown, Ont., which completely wrecked the mill and has thus far resulted in the death of four persons. The accident occurred just as the employees were preparing to enter upon their days' work. The fire had been under the boiler for some time, but the machinery had only been in operation about a minute and a half.

The boiler was a horizontal tubular one, 54 inches diameter and 11 feet 6 inches long, with 58 tubes 3 in. in diameter, and a dome 20 in. diam. and 27 in. high. The plates were iron and were a little over one-quarter inch thick. The joints were all single riveted, the lap of plates being 2 in., and the rivets were 5/8in. diam. and 2 in. pitch. Manhole was 15 in. by 11½ in. and had a strengthening ring around it 1¾ in. by 3/8in. The boiler was in general good order and fairly clean inside.

After explosion there was no evidence that the boiler had been neglected or had been carelessly used. The back head had been renewed at some time and was in very good condition, and evidently was stronger than the front head. The boiler had been used at a pressure of nearly 90 lbs. per sq. inch, and was supposed to be quite safe for a higher pressure. It apparently gave way first at the manhole, or near to it, and was split open from the top across the boiler. The manhole cover was picked up about 60 feet from the original position of the boiler, complete and uninjured, with bridge and bolt attached.

The dome was thrown about 600 feet, and the plate to which dome had been attached went about 700 feet in a different direction. The position of the front part of shell and of the back part confirm the theory that the boiler gave way first at the upper part, as these pieces were thrown in opposite directions and appear to have been turned end for end in their flight.

A second boiler which had no steam on at the time was thrown bodily over the engine and badly ruptured.

The violence of the explosion is clear proof that there was plenty of water in the boiler at the time, and the back head showed no sign of ever having been overheated. The quality of the plates seemed to be common boiler iron, and the most probable cause of the explosion was that the pressure carried was too high for the strength of the shell at the manhole and at base of dome. The severe strain put upon these parts had gradually weakened the boiler, so that it gave way at the ordinary working pressure.

How best to prevent similar accidents is a question well worth considering. In Great Britain, where so many boilers are in use, Government inspection has been carefully avoided, but the Boiler Explosions Act requires the user of a steam boiler to report to the Government every accident, no matter how trifling, and an investigation is held and the owner has to prove that he was using all proper precautions. Under this system the fault which led to the accident is traced out to the maker, or seller, or user of the boiler, and the blame fixed upon the right person.

The coroner's jury, in their verdict, stated that the cause of the explosion is unknown, but recommended that the government make it compulsory to users of steam boilers of all kinds to have them periodically inspected by competent boiler inspectors.

HAMILTON, ONT.

(Correspondence of the CANADIAN ELECTRICAL NEWS.)

THE dissentions which arose at the annual meeting of the Hamilton, Grimsby and Beamsville Railway, and which resulted in the election of Mr. T. W. Lester as president, have not yet subsided. The ex-president, Mr. C. J. Myles, has again secured a controlling interest, and has reinstated Mr. A. J. Nelles as superintendent. At the adjourned meeting of shareholders, held a fortnight ago, the Myles faction represented the majority of the stock. A special committee reported in favor of doubling the stock, as there was sufficient surplus to do so; the report was adopted. A motion by C. J. Myles, seconded by R. S. Martin, that Mr. A. J. Nelles be reinstated as manager and superintendent of the road, caused an animated discussion which lasted two hours. Mr. Myles alleged that since the deposition of Mr. Nelles as manager, there had been a decrease in the quantity of freight and number of passengers. The appointment was finally carried by a vote of the shareholders present. It is claimed by the supporters of the Leister ticket, however, that the appointment rests entirely in the hands of the directors. It is said that an effort will also be made to compel the resignation of Mr. Adam Rutherford, secretary. The profits of the year amounted to $11,143.53. Beyond the bonded and mortgaged debt, there is a floating debt of $19,576.10. The directors decided not to urge the building of a line to Grimsby Park and Beamsville this year. It is to be hoped that an end will be put to dissentions within the company, which, if prolonged, must seriously affect its prosperity.

Mr. Powell, who was until recently engaged as engineer by the International Radial Railway Company, is maturing plans for the construction of an electric railway from Hamilton to Guelph, Berlin and Waterloo. Charters have already been granted for a road to connect these cities, and Mr. Powell will endeavor to secure one of these. If unsuccessful, a new charter will be applied for. The capital, it is said, will be furnished by capitalists of Toronto, Guelph and Cleveland. No bonuses will be asked from the municipalities.

If the various schemes projected by Mr. E. A. C. Pew were successfully carried into completion, his name would be handed down to posterity as one of the greatest promoters of electrical development of the nineteenth century. His latest project is to supply power to the city from the Welland river by overhead conduits, the plan being to tap the river about one and one-half miles from Wellandport and build a canal, six miles in length, to run the water at Jordan, where there is a fall of 322 feet.

The Hamilton Radial Railway Company, of which Mr. Pew is also the promoter, has been granted right of way by the City Council on a thirty-two year franchise, and have commenced the construction of the line between the city and Burlington Beach, which it is expected to have completed by Dominion Day. The power house will be located at Burlington, that village being almost midway between this city and Oakville. Tenders for engines and power machinery have been received, and the contract will be awarded at an early date.

The Simpson-Noble Electric Light & Power Company, the new concern organized to supply electric light in this city, turned on the current a fortnight ago. The poles are being erected on private property, as the company as yet have not permission to erect them on the streets. The offices are at 103 Macnab street.

The directors of the Hamilton and Dundas Railway have decided to convert the road from steam to a first-class electric line. The work will occupy about two months, and will probably be commenced by the first of July. A change will also be made in the equipment, the ties having already been contracted for. This step meets with the hearty approval of the citizens, who consider that the road in its present shape is not in keeping with modern developments in methods of railway construction and operation.

The Hamilton Street Railway Company have made application to the City Council for an amendment to the by-law whereby the company would not be required to pay the city such a large revenue. The matter has been left in abeyance until an audit is made by the city auditors of the company's books.

HAMILTON, April 30, 1896.

C. P. R. TELEGRAPH STORAGE BATTERY PLANT AT OTTAWA.

By W. J. CAMP.

THE Canadian Pacific Company's office at Ottawa, Ont., has been equipped with storage battery, and the old gravity entirely dispensed with. As there are some combinations different from those in use at other points, a description may prove of interest to your readers.

The cells used are those made by the Electric Accumulator Co., type E9, being used for locals, and type C 3 for mains. The charging circuit varies from 230 to 250 volts. The locals are in 3 banks of 2 cells each; No. 3 and 4 lg ing used for the local circuits in the main office, and No. 2 for supplying additional power on quad locals when extended to the Parliament buildings office (H. U.). These locals are charged through a small motor-generator, which gives a voltage of 6, with a capacity of 20 amperes on the generator side. The main batteries consist of 8 banks of 40 cells each, a total of 320. These are charged in groups of 80 cells each directly from the power circuit, a resistance being inserted to bring the current down to 1¼ amperes; or two banks can be charged simultaneously at the rate of 2½ amperes. All single wires are worked from 40 cells positive or 40 cells negative. These cells also furnish the "short end" for quads. These two banks are arranged in duplicate, one lot being charged while the other is in use. As quad is not worked during the morning while parliament is in session, and only occasionally during the balance of the year, and it is found that sufficient current can be stored in the morning to last the quads for the rest of the day, the remaining 160 cells are not duplicated, and can only be charged while the quads are idle. The same applies to the cells for the quad legs battery. The total current for quads is obtained from 80 additional cells on each pole. This gives the "short end" about 88 volts and the total 264. As the longest quad from Ottawa is to Toronto (256 miles), this gives a good working margin.

Fig. 1 shows the arrangement of the charging and discharging switches for the mains. Those for the locals are the same. These switches are known as "double pole, double throw." The dotted lines show the charging current and the straight lines the discharging circuits. (Only one bank of 40 cells is shown in the diagram.) The charging is done, for instance, as follows: 9 and 11 are charged for one-third of the morning, 10 and 12 for one-third, and No. 2 local for the balance. During the afternoon and

evening one day, Nos. 5 and 7 and No. 3 local are charged, and the next day Nos. 6 and 8 and No. 4 local. As so much more work is performed by these cells, a much longer time than that required for the cells for quad working is needed to replace what has been taken out. All cells are kept fully charged, and should the power circuit give out, there is always sufficient current stored to work the office for a week or ten days. The automatic circuit opener opens the charging circuit should anything happen to the power wires, and prevents the batteries discharging back.

The transmitting circuits of the quads are a modification of the Jones system as used by the Postal Telegraph Co., a single pole-changer being placed on the polar side, and two of them on the neutral side, as shown in fig. 2. Opening PC throws line to P, and closing PC throws line to N. P gives positive currents only, and N gives negative. N and P are worked simultaneously closing N and P gives the total current to the line, and opening them gives only the partial current of either polarity according to the position of PC. Each lead from the quads to batteries has a resistance of 700 ohms, made up by two 16 c.p. 110 volt incandescent lamps. The leads from the batteries to the single wires pass through one 16 c.p. 110 volt lamp for each wire.

It is intended to place storage for the locals in the H. U. office later, and the system for working locals in the main office has been designed with that end in view—the only change in the main office then being to move No. 2 local over to H. U. During

into quads, the same course is followed, except that switch S is not required on the repeater sets. To leg H. U. office on, the switch S remains on the left hand contact, the pegs for the sending and receiving sides are moved over to the two H. U. wires selected. The circuits now are as follows: For sending Earth, batteries No. 2 and 3, switch S, key, transmitter, discs, strip B, H. U. sounder, key, earth; receiving earth, batteries, relay, sounder, discs, strip C, H. U. sounder, earth. In each case the circuits have been increased to 40 ohms plus the line resistance to H. U., but at the same time the battery power has been increased so that the current is about of the same strength as before. In practice we found that the line resistance was so small that it could be neglected, and that the two additional cells were quite sufficient.

The Milliken-Hicks repeaters are connected up in a different manner from that in use at any other place. The governor circuit is (when closed) in multiple with the coils of the transmitter. This appears to give much better results than when it is a distinct circuit. By connecting the jacks of two half sets together through a double-ended cord they can be used as ordinary single line repeaters.

At H. U. there are two complete sets of single line repeaters, a spring jack main line switch, and 12 single sets. Six of the spaces allotted to the single sets are arranged with three point switches and additional sounders so that they can be used as quad

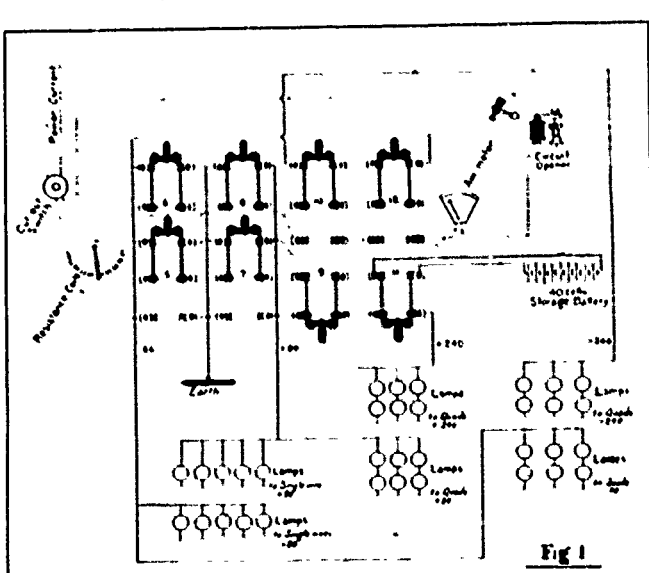


Fig 1

Fig 2

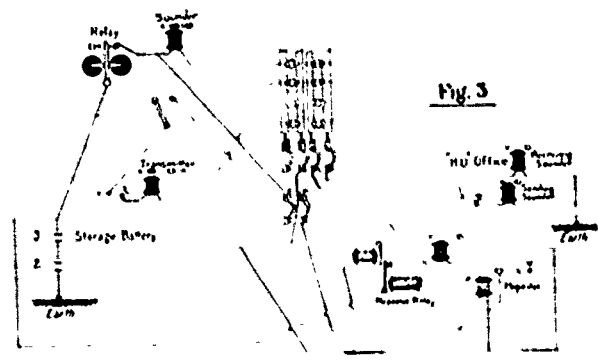


Fig. 3

Fig. 4

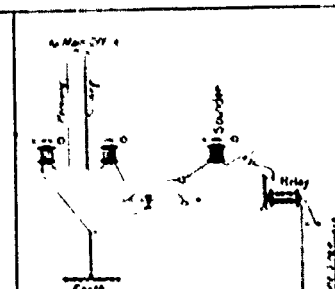


Fig. 5

C. P. R. TELEGRAPH STORAGE BATTERY PLANT AT OTTAWA.

session of parliament it is preferable to have all wires end at H. U. Instead of connecting loops to wedges at the main office as is usual, all H. U. wires are connected with the upright bars in the main switch, and the single lines pegged through, making the main office a way one for the time being. Two wires are used for battery leads to H. U., one for each pole. Owing to limited space in H. U., all quads, etc., are placed in the main office and the locals extended to H. U. as required. In the main office there are three quads and six half Milliken repeaters, which are all connected to jacks as shown in fig. 3.

The arrangement of the locals is fully shown in fig. 3. All sounders, transmitters, etc., are wound to 20 ohms. Normally the small 3 point switch (which is placed on the operating tables) is turned to the left, and each sending and receiving circuit of thteq uads are pegged to the upright strip marked R in the main switch. The receiving circuit can be traced as follows: Battery No. 3 (positive), relay armature, sounder, disc, strip R, to negative pole of battery No. 3. The leg from sounder through jack, being open at switch S, remains "dead." The sending circuit is as follows: Positive of battery No. 3, switch S, key, transmitter, disc strip R, to negative pole of battery No. 3. There being no earth on either circuit except on the negative pole of battery No. 2, that battery is not drawn on for any current. To work as repeaters the switch S on each set is turned to the right, and a double-ended cord connects the top of one jack with the bottom of the other, and vice versa. Although only one-half quad is shown, the circuits can be readily followed. For instance, starting with No. 1 set, battery, relay armature, jack (top) cord and wedges, bottom of jack for second set, switch S on No. 2 set, key, transmitter, disc, strip R, to negative pole of battery. Starting from No. 2 set a similar course is followed. The leg through sounder is not disturbed, and that circuit is the same as for ordinary working. It may be noted that each circuit has only a resistance of 20 ohms. To work single lines legs. There are also a couple of ingenious arrangements that are very convenient, and which I do not remember to have seen described before. They were put in by Mr. Bott, the Ottawa manager. One is to connect the legs of two half quads so that one operator is able to send simultaneously in both directions; this is shown in fig. 4; for the other ends of these circuits see fig. 3. The two point switch connects the two sets together, one key is left open, and the operator sends on the other. These sets are placed side by side, and the operator is able to hear the breaks on the receiving sounders. Of course the breaks do not carry through, but it is not necessary that they should do so. The other arrangement is to work a single line into a half quad, and is so clearly shown in fig. 5 that it is not necessary to describe it.

The shareholders of the London Street Railway Company will hold a special meeting on the 21st of May to authorize an increase of the capital stock of the Company to the amount of $750,000 or less, and also to authorize the issue of debentures to the same amount.

The Victoria, B. C., Electric Railway and Lighting Co.'s property and franchise was offered for sale by auction, on the 10th inst., by order of the bondholders. The bidding was opened at $200,000, and went up to $340,000, when the property was disposed of to Mr. F. S. Barnard, M. P., of the Consolidated Electric Railway Company, who represents an English syndicate. The new owners will continue to operate the road, and will make a number of improvements. The property is a valuable one, the total mileage now in operation including about thirteen miles of track and switches, with seventeen cars and two trailers. The tramway company was first incorporated in 1889 under the name of the National Electric Tramway & Lighting Co., Limited, and in 1894 the name was changed to the Victoria Electric Railway & Lighting Co., Limited.

POWER STATION RECORDS.

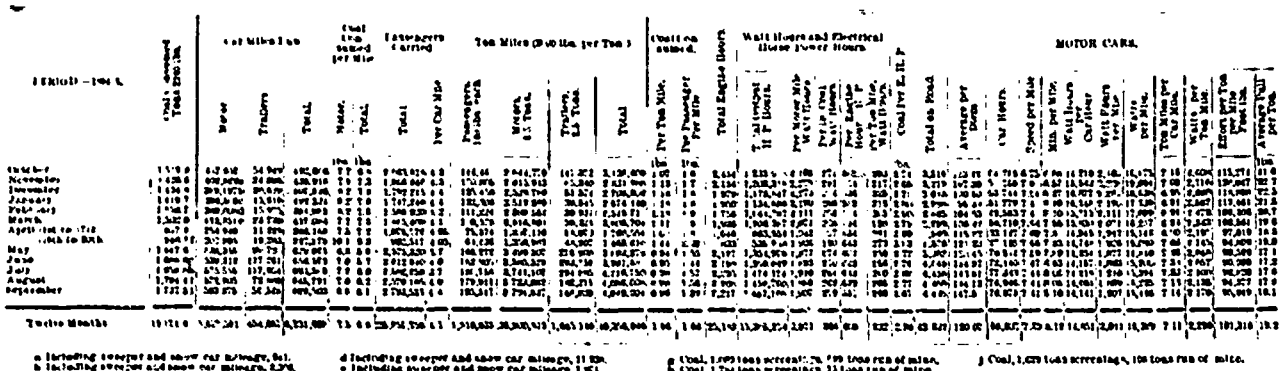
The advantages to be derived from keeping accurate records of the working of power plants are evidently thoroughly understood by the management of the Montreal Street Railway Company. An examination of the accompanying table, showing the results of the operation of the power station of that company for the year ending September 30, last, will, no doubt, prove interesting. Such records are very valuable for purposes of comparison, and should be kept by the managers of all electric light and railway power stations. We would be pleased to receive, at any time, similar tests for publication in this journal.

The route of the Montreal street railway are laid out on a slope which rises gradually northward from the river to the base of Mount Royal. The north and south lines, therefore, are on a continuous grade, but the lines running east and west are comparatively level. About 140 cars are in operation in summer, and 100 in winter.

The six engines used in the power house are of the cross compound Corliss type, belted direct to the generators. Their cylinders are 24 in. and 48 in. × 48 in. stroke. They are rated at 600 h. p. each, and the statement shows that they have averaged as high as 643 h. p. for an entire month. The engines were built by the Laurie Engine Company, of Montreal, and are run condensing. The boilers, fifteen in number, are of the Lancashire type, made in England, and are rated at 300 h. p. each. Two Green economizers are used, and the temperature of the feedwater, when both economizers are on, is 245 to 250 degs. F. When one economizer is off for cleaning and repairs, the temperature of the feedwater drops to about 190 degs. Fah. The fluctuations in the amount of coal consumed per electrical horse power, shown in the table, are due largely to changes in the temperature of the feedwater when the economizer is on or off.

The table shows a great increase in coal consumption per horse power when the engines were run non-condensing as compared with condensing, and also that screenings were used for fuel with satisfactory results, the consumption per horse power being no greater and the cost much less. In the column entitled "Watts per Ton Mile," the amount of power used to move a ton one mile on the system is shown. The power used was the highest in November and gradually decreased until May. Most of this decrease may be attributed to better weather, but a portion of it is due to improved controllers being put on the cars, and also that less power was used for light in summer than in winter.

The figures in the last column show the average draw pull per ton throughout the system, which was the most severe, as might be expected, throughout the winter months. The usual custom of starting with the draw bar pull as measured by a dynamo-meter and working up to the power station effort the average draw pull has been calculated.



GRANVILLE C. CUNNINGHAM,
Manager and Chief Engineer

POWER STATION RECORD OF THE MONTREAL STREET RAILWAY COMPANY FOR THE YEAR ENDING SEPTEMBER 30, 1895.

THE N. E. L. A. CONVENTION.

The National Electric Light Association of the United States will meet in convention in New York City, on the 5th, 6th and 7th inst. There will be held in connection with this convention an electrical exposition, illustrative of past and present developments in the applications of electricity. This exposition promises to be most complete, interesting and instructive, and will probably be the means of attracting an unusually large attendance.

Following is a partial list of the papers to be read and discussed at this meeting.

"Single-Phase Self-Starting Synchronous Motors," by F. H. Leonard; "Results Accomplished in Distribution of Light and power by Alternating Currents," by W. S. Emmet; "Acetylene Gas," by Mr. Ferguson, of the Chicago Edison Company; "Evolution of the Arc Lamp," by L. H. Rogers; "Steam Boilers, Their Equipment and Management," by Albert A. Cary; "Electrolysis," by William Brophy; "Evolution of Interior Conduits, From an Electrical Standpoint," by Luther Steiringer; Lecture. - "The Light of the Future," by D. McFarlan Moore. Topic. "The Desirability of a Standard Socket," discussion to be opened by Alfred Swan.

The sessions will be held in one of the large rooms in the Industrial Building, Lexington avenue and Forty-third street. The hotel headquarters will be the Murray Hill Hotel, Park avenue and Forty-first street, within two blocks of the convention hall. The hotel rates to delegates have been fixed at $2.00 per day and upward on the European plan; $4 and upward on the American plan.

Canadians will doubtless feel more than ordinary interest in this convention from the fact that in all probability Mr. Frederic Nicholls, manager of the Canadian General Electric Co., will be the next president of the National Electric Light Association.

A soft copper hammer makes an excellent tool with which to drive keys on an engine.

Eccentrics for steam engines that are made in halves may easily be procured, and where an old one has been split off from a crank shaft, one of them is much more easily applied than a whole one. If well made they should last as long as when made in one piece.

BY THE WAY.

As illustrating the many absurd arguments advanced by a certain class of electric railway "promoters," a gentleman named Beech has recently been endeavoring to get capital subscribed by the farmers in the neighborhood of Ridgeway for a single track elevated road to extend from Ridgeway to Crystal Beach on the shore of Lake Erie, a distance of 3 or 4 miles. Mr. Beech is an American and is gifted with a ready flow of language of the stump orator type. At a recent meeting of the residents of the locality, principally farmers, he occupied considerable time in expatiating upon the advantages of his particular system over the ordinary trolley system and stated among other things that the cost of operation of the overhead single track system would be but one-tenth of that of the ordinary trolley road. A gentleman in the audience acquainted with the subject, was asked to make an estimate of the cost per day of operating a trolley line, and he figured the amount at $17.00 per day. This estimate included the salaries of three men. This gentleman inquired of the "promoter" of the single track scheme if he had correctly understood him to say that a road built on that system would cost to operate but one-tenth of that required for a trolley road. Mr. Beech promptly replied that that was his contention. "Then," said the gentleman, "will you kindly explain to the audience how you propose to operate the road and pay three men's salaries out of the sum of $1.75 per day?" This problem proved to be a trifle beyond the mathematical ability of the "promoter," and remained unanswered. Strangely enough there were persons present at this meeting who would not have subscribed towards the construction of an ordinary trolley road, but were willing to pay out their good dollars for the overhead single track scheme. The absurdity of going to the expense of erecting an overhead system for a line designed to run along a country roadside does not seem to have occurred to the minds of the people who have been solicited to put up money for the enterprise. I understand that some $3,000 has been subscribed for the purpose of enabling the "promoter" to construct a piece of track with which to illustrate the advantages of his system. Speaking of the peculiarities of "promoters," I am informed that one of the most active individuals in this line in Canada is making a handsome income out of the business. His method is to project an electric railway and induce municipalities along the route to subscribe say $500 apiece for what he is pleased to term "preliminary expenses." He frankly tells them that in the event of the scheme proving unsuccessful they need not expect to get their money back, and it is hinted that the money thus obtained never goes any farther than his own pocket.

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THE Toronto Electric Light Co. had in their employ at one time a tall French lineman whose agility was such that he was accustomed to use only one hand when climbing a pole. At the corner of King and Yonge streets stood a pole requiring an additional cross-arm which this dexterous lineman undertook to carry up in his disengaged hand. When part way up the pole, the cross-arm slipped from his grasp and descended perpendicularly upon the crown of the silk hat of a gentleman on the street, driving the hat down upon his shoulders and entirely obscuring his face. He struggled unsuccessfully to get out of the hat until the Frenchman came down the pole and assisted in removing it. The victim had no sooner got his breath than he turned his attention to the unfortunate lineman, and bestowed on him all the anethemas which his recollection could muster. The victim took his punishment patiently, and at its conclusion invited the gentleman into a hat store near by and bought him a shining tile of the newest pattern, thereby metaphorically heaping coals of fire upon his head while at the same time getting rid of the possibility of a claim for damages against his company.

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I HAPPENED to witness an amusing incident in the office of the G. N. W. Telegraph Co. at Toronto, not long ago. A well-known business man came in and asked the price of a cable message. Having been given the rate, he began trying to get a reduction, advancing as a reason for his unusual request that he had been a good customer of the Company, and like all good customers was entitled to some extra consideration. An amused expression came into the face of the young man behind the counter as he remarked, "Let us see! you have paid us for cable messages altogether about twenty dollars." "Yes," said the customer, and the tone of his voice implied that he considered that a pretty large sum and quite sufficient to justify his claim. "You may be surprised to learn," said the polite young man behind the counter, "that out of this twenty dollars, the percentage to which this Company is entitled amounts to the magnificent sum of one dollar." After this explanation the customer did not see fit to press his claim further. The fact may not be widely known that the cable companies get the lion's share of the money paid for cable messages, and that the telegraph companies who despatch the messages overland across half a continent, receive but a fraction of the price.

PERSONAL.

Mr T. Ahearn, of the Ottawa Electric Co., is expected to return this week from his trip round the world.

Mr. James Ross, vice-president of the Montreal Street Railway Co., sailed for England on the 6th of April on a pleasure trip.

Mr. S. J. Stratton, of the Bell Telephone Company, Hamilton, accompanied by Mrs. Stratton, is at present in England, for the benefit of Mrs. Stratton's health.

Mr. E. B. Merrill, formerly lecturer in electricity at the Toronto Technical School has recently accepted a position with the J. H. McEwen Manufacturing Co., of Ridgway, Pa.

Upon severing his connection with the Kingston Light, Heat and Power Company, Mr. John Oldfin was presented by the employees with a beautiful oak secretary. Mr. Oldfin had been in the employ of the company for twenty-nine years.

Mr. O. Higman, chief electrician of the Inland Revenue Department, Ottawa, was recently offered the position of electrical engineer for the colony of Queensland, Australia, at a salary of $3,000. The Dominion government offered to Mr. Higman such inducements to remain in his present position, that he declined the foreign offer.

TRADE NOTES.

Messrs. Patterson & Corbin, of St. Catharines, Ont., have received an order for four cars for the Hamilton Radial Railway Company.

The attention of persons on the lookout for a bargain in second-hand alternating machinery is directed to the advertisement of Messrs. Ahearn & Soper in this issue.

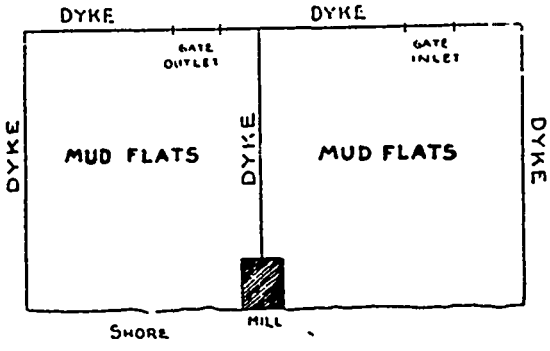
In the article in our April issue referring to the equipment of the Hull and Aylmer Electric Railway, mention was omitted of the fact that the contract for trolley, feed and bond wire, amounting to some 150,000 lbs., had been awarded to the Eugene F. Phillips Electrical Works, Montreal.

QUESTIONS AND ANSWERS.

H. S. P., Toronto, writes: "How many pounds pressure of air will be required to the sq. inch, taking the full piston plate surface, to force the rod (1 inch diameter) into dead cylinder against an air pressure of 50 lbs. to the sq. inch, speed say 1 ft. in 1 minute. Would it be a pressure a little over the difference in the dead cylinder pressure and the pressure raised by the rod displacing that amount of air?"

ANSWER. A pressure of 1 4/10 lbs. per sq. inch on the piston 6 in. diam. would just balance the resistance of 50 lbs. per sq. inch on end of rod. A pressure of 2 lbs. per sq. inch would probably start it in motion, and if pressure remains constant in the dead cylinder, that pressure would be sufficient to do what you require.

E. L. NASH, Lunenburg, Nova Scotia, writes: "Do you know of any place where the new style of tide mill is in successful use. I mean one working on the accompanying plan. We have a back harbor here

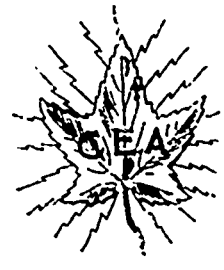


where the tide rises and falls about six feet, and want to know if it is feasible to build dykes and run our electric machinery by a tide mill. Where could I get hold of calculations that would enable me to tell how much would have to be dyked in to develop 500 horse power continuously?"

ANSWER.- It is difficult to give a definite answer to your question without considerable more data than you give. On general principles, however, it is doubtful if a tide of only six feet could be made available within the limits of commercial practicability. In the first place it would be impossible for the power to be developed continuously under ordinary circumstances, as at high tide, which occurs twice in twenty-four hours or thereabouts, there would be no fall whatever available, and consequently no power. On the contrary, at those times the reservoirs would be filling up. From the sketch you send, however, we suppose your idea would be to have several reservoirs and during high tide to empty from one into another and then from that out. If that plan were adopted you could only figure on an average head of about three feet. To produce 500 horse power at this head would require two reservoirs, probably about 3500 feet square and 6 feet deep, or nearly five miles of dyking, to say nothing of the heavy cost of machinery to produce power with such a small average head. There are no doubt a few tidal mills on a small scale in operation, where the power is not required continuously, but we do not know of any of the importance or capacity of the size you speak of. In fact in considering the matter of continuous power, and considering the fluctuation in level which would have to be taken into account, it is altogether probable that the reservoirs would have to be considerably larger than the size given above to obtain satisfactory operation. It would appear that the interest on the first cost and the amount required for repair and maintenance, would be infinitely greater than the cost of coal to produce an equal power, especially in the neighborhood you speak of.

"NOVICE" writes, in reply to "Induction's" enquiry in a previous issue: This open circuit business is the terror of arc light men as a rule. I would like to see the matter discussed through the ELECTRICAL NEWS and am sure some good would result from such discussion. The writer has had a little experience in finding breaks that could not be located by climbing every pole on the circuit, and pulling the wires, and if your space will permit, will be pleased to explain his method. I first divided the circuit into sections with small magnet wire, sometimes running it two blocks at a stretch, and found that the break was nearer the negative end of dynamo than the positive. Then I grounded that end of line at the dynamo, being careful to disconnect the positive wire. With the magneto bell I started out and every arc lamp I came to on the street I let down and fastened one wire of bell to binding post of lamp, and the other to the ground. As long as the bell would ring I knew I had farther to go. As soon as the bell would not ring I knew I had my break down to close quarters, and started back towards the last place where the bell would ring, testing from the line as we went, and very soon had only about 100 feet of line untested. The rest was easy. It may seem to some that this would be a tedious way of finding a break, but we were only about an hour at it. I would like to hear from some one else who has a scheme.

CANADIAN ELECTRICAL ASSOCIATION.



WEDNESDAY, Thursday and Friday, June 17th, 18th and 19th, have been selected as the dates of the annual convention of the above Association. It is somewhat unfortunate that the Dominion elections have been fixed for June, but it was not deemed advisable to postpone the convention on this account. So far as the election canvass is concerned, it will be practically concluded, and the nominations over by the 17th of June, while voting will not take place until the 23rd.

Those members of the Association who take an active interest in politics, should get their work done before the 17th, and spend two or three pleasant and profitable days at the Toronto convention before depositing their ballots. Then if the party of their choice should happen to be defeated, they will find themselves in good condition to put up with the disappointment, while if the vote goes to their liking, they will be in equally good trim to join in the enthusiasm of the occasion.

The program for the convention is an attractive one. Papers will be presented as follows: "Economics of Central Station Management," by P. G. Gosslin, Montreal; "Acetylene Gas," by Geo. Black, Hamilton, Ont.; "Meters," by James Milne, Toronto; "Electric Railway Construction," by F. C. Armstrong, Toronto; "Power Transmission by Polyphasal E. M. F.'s," by Geo. White-Fraser, E. E., Toronto; "Continued Use of Water of Condensation," by Wilson Philips, Toronto.

Several of these papers will be illustrated by means of a stereopticon, a new feature which will add greatly to the interest of the proceedings. Opportunity will be afforded for the consideration and discussion of the Government Electric Light Inspection Act.

It is in contemplation to hold the annual banquet of the Association at Lorne Park, Niagara-on-the-Lake, or some other popular summer resort in the vicinity of Toronto. The banquet will be followed by a moonlight sail on Lake Ontario, the steamer being attractively decorated and provided with music for the occasion.

There will likewise be visits of inspection to the power stations of the Toronto Electric Light Co. and Toronto Railway Co., an exhibition of Roentgen rays, excursions by street car, etc. Altogether, visitors are assured of an interesting and profitable time, and seeing that a large proportion of the members of the Association reside within a hundred miles of Toronto, there should be a bumper attendance.

The Hamilton Radial Electric Railway Co. have awarded the contract for the electrical generating apparatus required for the operation of their road to the Canadian General Electric Co., Ltd.

THE INCANDESCENT LAMP.

By George White-Fraser, E. E.

(Concluded.)

Diagram 4 also serves to illustrate the various wattages at which lamps can be run, and their effect on life and candle power. Running the lamps at 108 volts is equal to a wattage of 3.5 per c. p. Running them at 110 v. equals 3.3 watts per c. p.; at 112 equals 3.1 watts; at 114 equals 2.9 watts; at 116 equals 2.7 watts per c. p. The higher therefore the economy at which this lamp

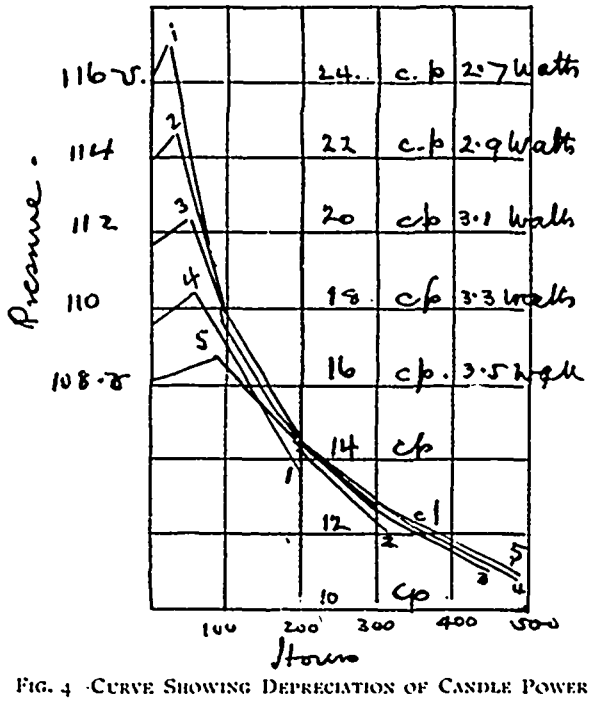


Fig. 4.—Curve Showing Depreciation of Candle Power Consequent on Using too High Voltage.

was run, the sooner did it come down to a low candle power, and the sooner did it burn out, so that the lower efficiency was in this case the higher economy. This point is well illustrated by the curves in diagram 5 which shows the results of burning a lamp of the same make at different efficiencies. At the highest efficiency - 2½ watts per c. p.—the lamp drops to 8 c. p. at 600 hours, and as the efficiency becomes less, that is as the wattage grows more per c. p.; *the reduction in c. p. becomes less and less, the life* longer and longer.

These curves are very suggestive to the observant central station man, as indicating the policy which should govern him in the supply of lamps, and in the system of wiring. It is evident from a careful study, that if his distribution system is so laid out that the variation in pressure between heavy and light load is relatively great, then he had better use his low efficiency lamps, for such variation will cause the lamps to drop in candle power and burn out soon, and cause dissatisfaction among his customers.

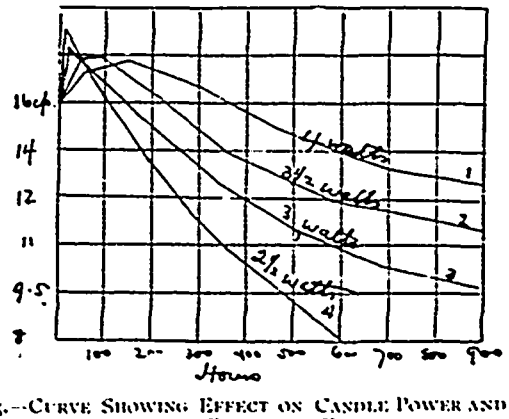


Fig. 5.—Curve Showing Effect on Candle Power and Life of Running at Different Efficiencies.

If, however he has used plenty of wire, so that the variation is small, then he can use high efficiency lamps. By this means he can put a good many more lamps on his dynamo, which means increased profits. The matter, however, is much more complicated when he furnishes light to meter customers. In this case he does not sell light merely trusting to the inexperience of his customers not to detect *the difference between the* 10 c. p. they contract for, and the 12 or 10 c. p. that they actually get. He sells current, and it is plain that the more current he sells, the better for himself, so that he should study how to increase the amount of current that the consumer takes. He cannot, of course, make that consumer keep his lamps burning, but a study of lamp curves will point out a way. Diagrams 1 and 2 show the decrease of candle power as a lamp grows older, No. 3 shows the increase of wattage per candle power during the same period; although the lamp takes a higher wattage per candle power as it ages, its candle power decreases more rapidly than the wattage increases, so that the absolute wattage, on which the central station depends for profits, keeps on diminishing slowly all the time. Profit therefore also keeps on diminishing in the same ratio.

Diagram No. 6 shows these changes in three curves, A B, C, taken from a 3½ watt lamp. Curve A shows its decrease in absolute candle power, giving actual candle power observed at 100 hour periods during its life; curve B shows the increase in wattage per candle power at the same periods, and curve C shows the resultant of the two at same periods, that is at 700 hours the actual candle power given is 12.25; the wattage per c. p. *is 3.79, and the actual watts absorbed by the lamp are* (curve C) 45.5. Now the lamp at the first 100 hours absorbed 57.2 watts, so at 700 hours it is absorbing 11.7 watts less, and what is interesting to the station man—is paying less in proportion—less by

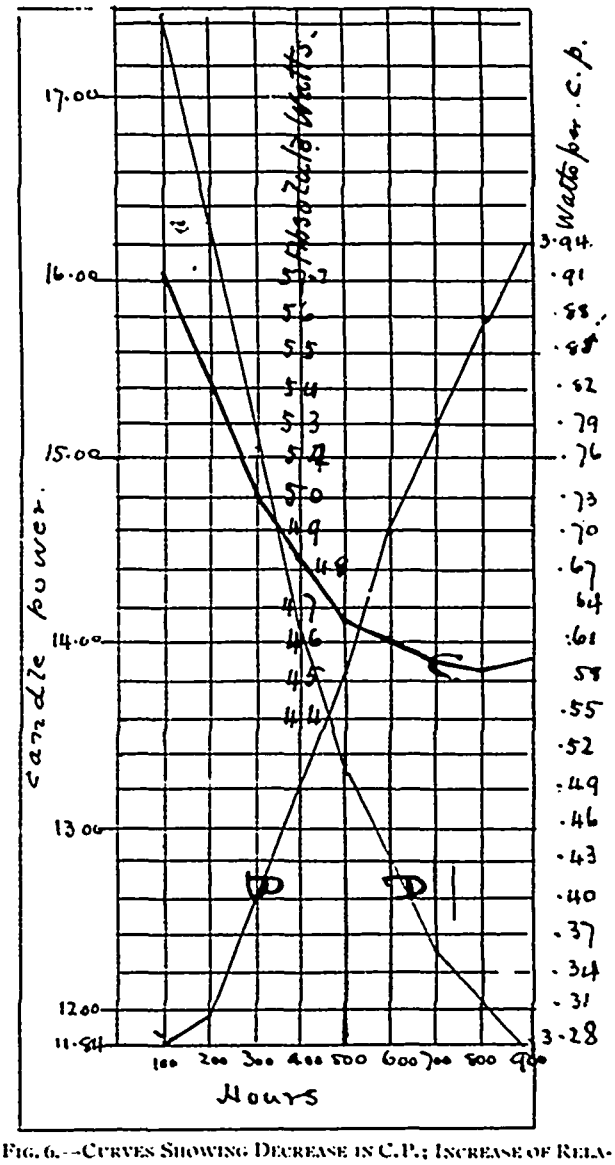


Fig. 6.—Curves Showing Decrease in C.P.; Increase of Relative Watts, and Decrease of Absolute Watts, at Lamp Ages.

21 per cent. Dividends can never be paid at this rate, for it simply amounts to a 1000 light plant installed at a 1000 light price, earning only 790 lamps worth of rent. So we must keep up the supply of current, and this can only be done by putting old lamps out of service, when they begin to take so little current, and putting in new ones that will take more. It seems extraordinary, but it would actually pay to break this lamp rather than run it 700 hours.

A study of lamps will reveal other apparently paradoxical results and the conclusion of the whole matter is (1st) Study your distribution system, and keep your pressure as constant as possible, even if it costs a little more money to reduce the drops on lines, (2nd) Don't assume that the cheapest lamp is the best, nor even that the one with the longest guaranteed life is the one you want, (3) Buy lamps to suit your work, for all lamps are by no means alike, and study what your work will be, (4) Don't imagine *that once you have put a lamp in its socket, the matter is disposed* of, and you need pay no more attention to it lamps may be actually losing money to you. Above all remember that your entire lighting business is worth careful study.

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

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Electric Railway Legislation.

THE Hon. John Haggart, Minister of Railways, recently made the announcement that the Dominion government is of opinion that all electric railway charters of a purely local character should be left to the jurisdiction of the provincial authorities. The Railway Committee of the Dominion Parliament is not in accord with this view, and has reported to the House several bills of the character mentioned contrary to the wishes of the government.

Electric Light Inspection.

COMPLAINTS have reached us lately concerning the system of electric light inspection inaugurated by the Dominion Government a year ago. There seem to exist doubts in the minds of some, first, regarding the necessity for such a system, and secondly, concerning the fairness of the charges imposed and the efficiency with which the Act is administered. Our attention has been called to instances in which meters, after having been tested and sealed up by the government inspectors, shortly afterwards ceased to operate owing to the formation of a substance upon the brushes which retarded and eventually stopped entirely the action of the commutator. We have likewise heard complaints of the action of some of the government inspectors in posing as electrical engineers, and advising central station owners as to the means they should adopt to overcome difficulties experienced in the operation of their plant. It is affirmed that the inspectors are without the training necessary to qualify them to act in this capacity, and that in some instances their advice has caused unnecessary friction between central station owners and the manufacturing companies. We propose to investigate this subject and if possible learn to what extent these complaints are well-founded.

Effect of Electric Railways on the Labor Problem.

Mr. Bronson, in moving a resolution in the Ontario legislature setting forth the desirability of forming societies in cities to assist in placing unemployed persons on the unoccupied lands of the province where they might become self-supporting and even contributors to the development and wealth of the country, expressed the opinion that electric railways would prove important factors to this end. While it is undoubtedly true that the means of intercommunication afforded by electric railways will do away with the isolation, which is one of the greatest objections to country life, the lands upon which the class in question could be settled are likely to be situated in localities where electric railways will not be built for many years to come. Therefore the electric railway is not likely to prove a factor in their welfare.

Anchor Ice.

The difficulties encountered by electric stations operated by water power, in consequence of the formation of anchor ice, was the subject of some discussion at the convention of the Canadian Electrical Association at Ottawa last September. The consensus of opinion seemed to be that there was no method by which the difficulty could be avoided. In the Scientific Machinist of Cleveland, this method is given of keeping the turbines free of ice, "bore a hole in the top of the wheel case, or drill a hole if the case be an iron one, and connect on a steam pipe. When a wheel freezes up, or shows signs of freezing, just turn on steam for a few minutes, and away goes the ice, slick and clean. The wheel, of course, must be shut down before the steam is turned on, or all the heat will be carried off with the water, leaving the ice as good as before steam was turned on." Mr. James F. Ward, in a letter to the Engineering Record, states that while chief engineer and superintendent of the Jersey City waterworks he remedied trouble from this cause, by moving across the screen of the intake chamber a raft made out of some 12 inch square logs. His explanation of the success of the remedy is that in consequence of the length of the line around the edge of the raft being, say four times greater than the width of the screen, the force available to draw in the anchor ice is reduced in the same proportion. This very simple and apparently effectual remedy is within the reach of all who annually experience difficulty from the action of anchor ice.

The Adaptability of Machines to Requirements.

The popularity of electricity as a means for the transmission and utilization of power, and the recognition of its thoroughly satisfactory results, are in no way more evident than in the rapidity with which it is being applied to every conceivable purpose; and in the number of electrical manufacturing establishments that are going into the business. A perusal of the Patent Office Records shows how immense is the activity in the field of inventing new, and improving old types; and the establishment of electrical engineering courses in all large colleges, and the equipment of laboratories with the most expensive instruments, shows that practical electricity is now well out of the "rule of thumb" stage, and is recognized as being based on scientific principles. Electrical knowledge being so widely disseminated, the improvement in the designing, constructing, and operating of electrical machinery and apparatus has taken place all along the line simultaneously, and electrical investors now have the assurance, not only that what they buy represents the results of scientific investigation, but that the market is full of excellent machinery, with something to suit every purchaser, and meet every want. Not so long ago, when electrical machinery was built by experiment rather than by calculation, it was only reasonable to believe that the inventor with the longest purse would produce the best apparatus, because he was better able to experiment until he overcame his difficulties, than another person without those financial advantages. But now that the design and construction of the highest class electrical machinery is a matter of certain knowledge; and is no more a matter of doubt than is the design of a steam engine or any other perfectly understood apparatus, it must be evident that any properly trained engineer will be able to produce good machinery; and not only this, but that suitable machinery can easily be built to meet the conditions of any particular case. The immediate result of the establishing of the principles governing electrical design and construction on a thoroughly satisfactory rational basis, instead of heretofore on a constantly changing empirical one, has been that nearly all large engine or machine manufacturing companies have added to their former business an electrical manufacturing department; and the result is that, whereas even five years ago the different makes of electrical machinery might be almost counted on two hands, to-day they are well up among the scores, and every one of them good. Another very important result is the splitting up of electrical manufacturing business into specialties, whereby the very highest perfection is attained along the several lines followed. Five years ago the few manufacturing companies there were, manufactured complete "systems," covering generators, motors, lamps, instruments, etc., etc., and to do business with them meant committing oneself exclusively to the particular company at first chosen, because one generally found that the use of a particular generator necessitated the use of a particular motor, and so on. Now, however, there are highly trained electricians who devote themselves exclusively to the perfection of one particular line of apparatus—be it motors, or arc lamps, or electric fans; and hence it is that the market presents a whole host of first-class machinery and apparatus from which the purchaser can choose.

Of course it is true, however, that while there are very many good makes, there are also a great number of types which have been long left behind in the race of improvement and which represent the earlier stages of design when scientific investigation had not clearly lighted up the subject. There, naturally, will also be found manufacturers, who, to meet competition, will purposely lower the quality of their goods, trusting to favorable circumstances not to be found out. Against these the purchaser will have to adopt such precautions as commend themselves to *him*, remembering that cheapness is prima facie evidence of relative inferiority. A really good machine costs money to build; both because high class material is expensive, and because skilled workmanship cannot be obtained for the price of day labor. But, the difference between good and inferior machinery is not merely a question of first cost; it includes the consideration of probable differences in repairs, maintenance, life, efficiency which, in nearly every case will

clearly demonstrate that the more expensive apparatus is really the cheapest to buy.

It is interesting to note the difference between European and American manufacturing practice, with reference to their respective methods of supplying demands for particular machinery. On this side of the Atlantic all types and sizes are standardized; and manufacturers endeavor not so much to design machinery which will meet the conditions of any particular case, as to show that those particular conditions require the use of such and such a particular machine of their make. That is, the machine is not manufactured for the case, but the case is manipulated to suit the machine. If a 95 horse power machine is sufficient and necessary, the manufacturer who has standardized a 100 h.p. and a 90 h.p. machine will sell his 100 h.p., although it is not only *larger than necessary, but also will have to operate at* less than full load and therefore at reduced efficiency. In Europe, the manufacturer, not having any rigid standard, would actually design and build a 95 h.p. machine. The standardizing of machinery results, no doubt, in somewhat less shop costs, and in consequent lower selling price, but the disadvantage is evident, when it is considered how very rarely will the circumstances governing the size and type of machinery be such as to exactly meet some particular standard. Of course this disadvantage is largely counterbalanced by the fact that manufacturers' standards include many sizes and types, some or one of which will be pretty certain to come close to the actual requirements. And then again all manufacturers have not the same standards; they will generally be found to be "staggered." If A makes generators of 50 h.p., 100 h.p., 150 h.p., etc.; B will generally make 70 h.p., 120 h.p., 170 h.p.; while C will adopt 60 h.p., 90 h.p., 130 h.p., and so on; so that one can generally come pretty close to what is wanted. The same will apply to motors, etc., but there comes in the question of voltages, etc. However, in every case it will be possible to work out a reasonably satisfactory scheme, if only care and attention be devoted to enquiring what the market has to offer in the way of suitable types and sizes and then selecting those that come nearest to practical requirements. In doing this it should be remembered that the efficiency of machines is a most important consideration, and that, unless they be specially designed differently, their efficiency will be highest at their rated full loads. Taking, for example, a case where study shows that 800 lights is the maximum that can be expected (and there is a very fairly sure proportion between number of inhabitants and number of lights), in this case it would be inadvisable to put in a 1,000 light machine for two very good reasons: first, it is larger than necessary, and therefore needlessly expensive; and second, which is really even more important, it will be operating at never more than 8 10's of full load, and for the very large proportion of the time at very considerably less. Everyone knows that there is a period of large load, say from 7 o'clock to 9 o'clock, and that after that time the people go to bed and the load goes away down. In a plant of the above size, probably for 4 hours the full 800 lights or nearly would be going; and for the whole of the rest of the night not more than 200 or 250; so that if a 1,000 light machine were installed, it would have 80 per cent. load for 4 hours and 20 to 25 per cent. for 8 hours. All the above considerations emphasize the importance of studying the conditions of every installation, and of buying apparatus with reference to its suitability to the peculiar circumstances.

DEFECTIVE WIRING.

We present herewith a sample of wiring which was recently unearthed in a neighboring city. Our readers will admit that it is a truly wonderful example of how not to do it. Nevertheless it is not altogether an exaggerated case. There has been a vast amount of work of this character done in the past in every city on

this continent. It can scarcely be a matter for surprise that the discovery of such work should have given rise to the suspicion that many of the fires in recent years were the result of stray electric currents.

It is satisfactory to know that the danger resulting from the employment of careless and incompetent workmen has now come to be so well understood that in future proper workmanship is likely to be the rule rather than the exception.

CANADIAN ELECTRICAL STATISTICS.

Mr. Geo. Johnston, the Dominion statistician has collected and embodied in the Year Book of Canada, the following statistics relative to the electrical progress in the Dominion: The amount of capital invested in electric telegraphs and cables in Canada is $7,000,000; in electric railways the paid up capital is rather more than $13,000,000; in electric light works, $4,113,771; in electrical appliances, $1,389,365; or in round figures about $27,000,000. In 1881 there were found only two hands with electric works outside of those connected with telegraphy, while in 1891 there were 1190 hands, not including those connected with the electric cars. The employees in 1894 connected with the electric cars numbered 2614; passengers carried 57,000,000; miles run during 1894 by the electric railways, 15,500,000; miles of track for Canadian electric railways, 368 or 73 miles to each million of the people. The number of motor cars in Canada are calculated as 658; trailers, 341; snowsweepers, 39; and motors, 891. The steam railways in Canada in 1894 carried 14,500,000 passengers, which, contrasted with 57,000,000 carried by the electric railways, shows that four times as many passengers were carried by electricity as by steam, and that, on an average, every person in Canada had been carried 11 times in the year by electricity.

TESTS OF A 10 HORSE-POWER DE LAVAL STEAM TURBINE.*

By Wm. F. M. Goss.

THE De Laval steam turbine experimented upon constitutes part of the permanent equipment of the Engineering Laboratory of Purdue University, and the present paper is based upon data secured chiefly through the assistance of Charles E. Bruff, B.M.E., author of the thesis "Tests of a 10 Horse-Power De Laval Steam Turbine."

In the De Laval steam turbine jets of steam, delivered from suitable nozzles, are made to impinge against the buckets of a light turbine wheel. The steam enters the buckets from one side of the wheel, and passing through is discharged or "exhausted" from the opposite side. The arrangement of nozzle

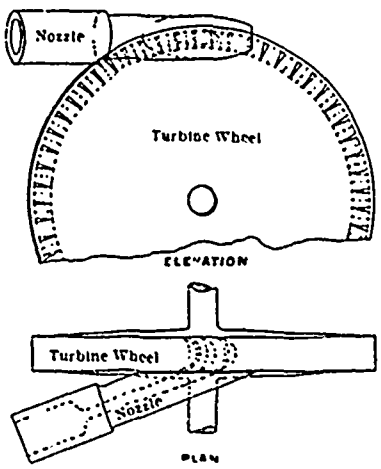


FIG. 1.

and wheel is shown in Fig 1. The motion of the turbine shaft, which under the actions of the jets is extremely rapid, is communicated by gearing to a heavier and slower-moving driving shaft carrying a fly-wheel of small diameter, from which the power of the engine is delivered. Regulation of speed is secured by means of a throttling governor, which controls the pressure of steam admitted to the nozzles.

The important moving parts, with approximate dimensions, are shown in Fig. 2. The turbine wheel is built of sixty-three steel segments, each carrying a bucket and a portion of the light outside rim. The segments are held in place by means of suitable collars, which grip them on either side. The wheel is mounted upon a long, slender shaft, having sufficient flexibility to allow the system at speed to revolve about its centre of gravity, even though this may not agree with the geometrical axis of the shaft. The gear upon the turbine shaft is of steel, solid with the shaft; that upon the drive shaft has its teeth formed in a bronze ring, which is carried by a solid iron centre. The smaller gear has twenty-one teeth, the larger one two hundred and eight teeth, giving a ratio of 1 to 9.90476.

The shafts run in bronze boxes completely lined with babbit or other soft metal. To assist in the distribution of oil a spiral curve, the pitch of which is about half the diameter of the journal, is cut into the metal of the bearing. The outboard bearing on the turbine shaft is closed at the end, and a small pipe runs from the closed end to a point over the gears. The pumping action, resulting from the presence of the spiral oilway, gives a constant, though small, supply of oil upon the gears. The gears do not dip in oil, though the case which encloses them receives drainage from all the bearings.

The governor is connected with the driving shaft, of which, at first sight, it appears to be but an extension. It is shown in detail in Fig. 2. The weights, W W, with their arms, C C, are in the form of a split cylindrical cup. Upon the outside and at the base of each weight a knife edge, E E, is found, which bears upon a suitable surface in the governor frame, A A. A spiral spring is fitted at its inner end with two projecting pins, which bear upon the arms, C C, of the governor weights. The outer end of the spring is connected with the frame by the threaded plug D. When the governor is at rest the concave surfaces of weights are in contact with the frame, and the tension of the spring keeps the knife edges upon their seat. When the governor is revolving at speed the weights are under centrifugal action and move outward, swinging upon their knife edges against the resistance of the spring. The motion of the weights is taken up by the pin F, by which it is communicated, through suitable mechanism, to the governor valve above the engine.

The nozzles which serve to deliver steam to the wheel are four in number, and are so fixed in the frame of the engine as to act upon the turbine at points which are equally distant from each other. Two of the four are provided with stopcocks, which, when closed, put out of action the nozzles with which they are connected. By means of the stopcocks, therefore, the engine may be run under the action of two, three or four nozzles, at the will of the engineer.

The distinguishing feature of the engine is, perhaps, to be found in the form of the nozzles. All are diverging, the throat being approximately two inches from the discharge end. Three have a diameter of 0.138 inch, and one a diameter of 0.157 inch.

THE TESTS.

The power of the engine was absorbed by a pony brake, cooled by constant streams of water. The exhaust steam was piped to a Wheeler condenser, open to the atmosphere. The water resulting from condensation was drained into tin buckets, which were changed and weighed at regular intervals. Gauges were used to show the steam pressure both above and below the governor throttle, the former giving the pressure available at the engine, and the latter the pressure under which, in consequence of the action of the governor, the steam was admitted to the nozzles. A manometer was also attached to the exhaust pipe, but as this pipe is large (3 inches diameter) and the connection with the condensor close, the observed pressure was never appreciably different from that of the atmosphere.

The boiler pressure for all efficiency tests was 130 pounds by

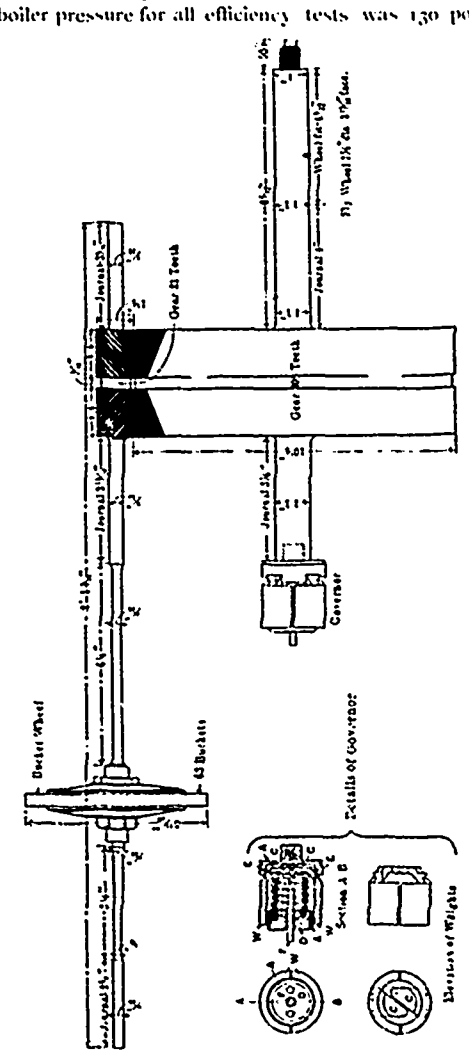


FIG. 2.

gauge, for which pressure the particular nozzles used were designed. The rated speed of the fly-wheel is 2,400 revolutions per minute (23,771 for turbine wheel), but this standard was not maintained for all the tests. The governor was adjusted several times as the work progressed, and it was not until several tests had been run that the proper speed was secured. It is believed, however, that the differences of speed recorded do not materially affect the value of results for purposes of comparison.

The tests are grouped into three series, the first including those for which all four nozzles were in action, the second those

*Abstract of paper read at the New York meeting of the America Society of Mechanical Engineers, December, 1895.

with three, and the third with two. The several tests in each series were intended to vary from each other only in amount of power delivered from the wheel. All tests were of 30 minutes' duration, and all observations were taken at five-minute intervals.

With all four nozzles in action, and with the engine developing a little more than its rated power, the steam consumption per horse-power hour was as low as 47.8 pounds. In comparing this result with results obtained from other engines, the small size of the engine tested should be kept in mind, and also the fact that the rate of consumption stated is based upon brake power. The *efficiency of the engine falls off rapidly* as the load is decreased, and, as would be expected, the effect is not marked when all the nozzles are in action. This may best be seen by the heavy curves shown in Fig. 3. Assuming the nozzles to be cut out of action

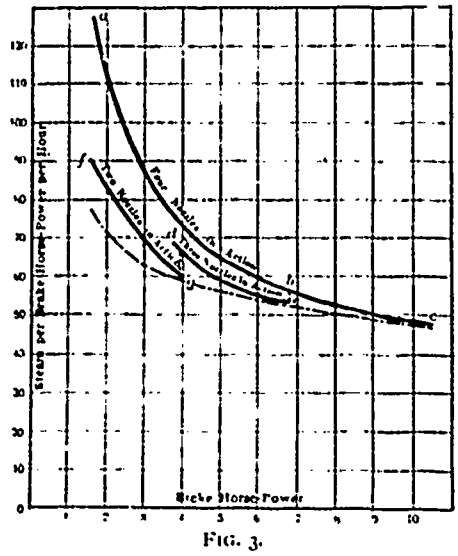


FIG. 3.

one at a time, as soon as the reduction of load becomes sufficient to permit the work to be done without them, the minimum steam *consumption at different loads, for boiler pressure and speed employed*, is represented by the broken line fgdebc, Fig. 3. Again, if instead of four nozzles, an infinite number could be employed, and if the governor could be arranged so as to regulate the number in action rather than the pressure admitted to them, the steam consumption of the engine in question might be made to follow a line somewhat similar to the light broken line g e c. But the heavy lines indicate the results which were actually obtained.

The engine requires very little attention and is almost noiseless in action. The governor is quick to act, and its speed regulation appears to be fair, except when changes of load are large and suddenly made. After such a change, the engine requires a little time before settling down to steady running under the new conditions.

As the speed of the De Laval engine is high, it is evident that the force in action must be comparatively low. To determine the maximum resistance under which the engine might be expected to start, the brake was clamped upon the fly-wheel so that the latter could not turn within it. Steam was then admitted to the engine, and readings were taken from the scale under the brake arm. The result of this process, of course, depends upon the steam pressure and the number of nozzles in action. With all nozzles, and with a steam pressure of about 125 pounds by gauge, the maximum starting-power is equal to a force of 30 pounds acting at a radius of one foot. With three nozzles the equivalent force was but 21 pounds; with two nozzles 14 pounds.

IN the case of the Ontario Western Lumber Co. v. Citizens Telephone and Electric Co., Chief Justice Meredith decided that contracts not under the corporate seal made with trading corporations relating to purposes for which they are incorporated, or, partly performed and of such a nature as would induce the Court to decree specific performance thereof if made between ordinary individuals, will be enforced against them. Where, therefore, an electric light company, while they were making changes in their factory, entered into a contract by correspondence, merely for the use at a specified amount, of one of the wheels in the plaintiffs mill which was used and a part payment made the contract was held to be binding on it, and the plaintiffs entitled to recover the balance due, notwithstanding the absence of the corporate seal.

ENGINEERING NOTES.

AN engine may appear to be keyed up all right, and still, when it is started up, the crank pin or some other part may heat because the key was driven too far, therefore all of the parts should be closely watched until it is known that they will run cool.

To ascertain the throw of an eccentric, measure the distance from the crank shaft to the outside of the eccentric on the heavy side and also on the light side. Subtract one from the other, and the difference will be the throw of the eccentric.

If you have a bearing so located that it is necessary to have a tube or pipe to carry the oil to it, be sure that the tube is perfectly clean when first put in, and take measures to keep it so after it is in use.

Always have a steam gauge on the feed-water pipe, and locate it as near the pump as may be convenient. If the pipe becomes partially choked with sediment, the increase in pressure will warn you of it.

Don't put a poor lubricator on a good engine, or on a poor one either. It will ruin the good one by failing to deliver oil when it is needed, and make the poor one worse for the same reason.

Try the nuts on your foundation bolts occasionally and see if they are still tight. Because they were all right six months ago, it does not necessarily follow that they are now.

After cleaning your boilers fill them with hot water if possible. If one of them is fired up, use the steam from that one to heat the water that is going into the others.

When water has a temperature of 39 degrees Fahrenheit, it has attained its maximum density, or in other words, it is in its most compact form. If you make it warmer it expands and if you make it colder it also expands. A study of some of the results of this property of water will prove interesting.

When fitting up a water tank for use in the shop, mill or factory, if you wish to arrange it so that the discharge pipe will prove the most efficient, do not allow it to project on the inside, but let it be so arranged that there will be no sharp corners around the outlet, for it should be funnel shaped.

When about to key up his engine, an engineer should know just *where his keys are before he touches them, and in order to do this* he must have marks on them. If these marks are made with a sharp steel scribe they disfigure the machine and in the course of time he will get so many marks that they will be confusing. It is much better to mark them with a lead pencil, then if he finds that a key has been driven too far he can easily put it back to its former position, and when the machine is running in a satisfactory way the marks can easily be removed.

Many engines are so constructed that the space around the piston rod gland is quite small, and so we would suggest that a short solid wrench be made for use in such cases, and always be kept in a convenient place. As it is seldom or never necessary to use much leverage here, a large one will not be needed and it will be much more convenient than to try to use an ordinary monkey wrench.

In some cases it is necessary, in oiling up an engine, to drop oil into a tube in order to have it go where it is needed. Sometimes this cannot be done easily, as a bubble will form and prevent it. In such a case, insert a piece of fine wire or a broom splinter in the tube, and the oil will run down this and cause no trouble.

In selecting a lubricator for a steam engine it is well to get one that is so constructed that when it must be filled, the cylinder oil will go directly into the cup, without having to go through a long crooked passage, for many good oils are thick and it is not always convenient to warm an oil before using it.

If the sight feed glass on your lubricator fills with oil, and it is so constructed that you cannot easily clean it out, if the oil is removed from the body of the cup and it is filled with water and started up *in the usual way, the water will float the oil out* without further trouble.

Remember that if your eccentric gets cut and is worn out or round so that it becomes necessary to put it in a lathe and take one or two cuts off from it, the reduction in diameter does not alter the throw of it.

In our opinion it is better to key up an engine in the morning rather than at night. If it is done at night, what proof does the engineer have that he will be there to attend to it the next morning?

Every piston rod gland should be lined with soft brass to prevent cutting of the piston rod.—Power and Transmission.

TORONTO TECHNICAL SCHOOL EXAMINATIONS.

For the past two weeks the examinations at the Toronto Technical School have been in progress, the term closing on the 1st of May. The classes during the past winter have been very successful, a large number of students availing themselves of the opportunity thus afforded of securing a technical education. Below will be found a copy of the examination papers in "Electricity" and "Steam and the Steam Engine," which will no doubt prove interesting to many of our readers. The lecturer on these subjects is Mr. James Milne, who, it will be observed, has covered considerable ground, and the results of the examination are said to be satisfactory. In our next issue we hope to be able to publish correct answers to the questions asked in the following papers:

ELECTRICITY.

Maximum number of marks = 235. 175 marks constitute a full paper.

The value of each is shown in brackets after the question.

SECTION 1.

1. State clearly Ohm's Law. What is the unit of resistance? the unit of Current? and the unit of Electro-motive force? (10)

2. A battery of 15 cells, arranged five in series and 3 abreast, produces a current of .5 amperes through an external R of 5 ohms. Find the E M F of each cell if its internal R is 3 ohms. (15)

3. What is the best way of arranging 28 cells, each having an R of 4 ohms, so as to produce the strongest current in a circuit of 28 ohms. (15)

4. Compare the resistances of a wire 30' long, .06" diameter, and that of another wire 15' long and .03" diameter. (10)

SECTION 2.

1. 1000 feet of copper wire .102" diameter is wound on an armature of a bipolar generator. *Find* (1) the total resistance of that wire, and (2) the resistance as measured at the brushes of the machine. One mil foot = 10.4 ohms. (15)

2. Take the above question but substitute iron wire. What is the thickness so that the resistance will be the same in each case? The specific resistance of copper to that of iron is as 1 : 6. (10)

3. Prove that 746 watts make a H. P. Answer this fully. (15)

4. 1000 feet of wire No. 6 B and S has a resistance of .4 ohms. Find the watts lost in an arc light circuit 5 miles long. Each lamp takes 10 amperes of current. (10)

SECTION 3.

1. The E.M.F. of a certain dynamo machine is 100 volts, and the total R of the circuit is 1 ohm. What H.P. would have to be expended in working under these conditions? (10)

2. Distinguish between work and power. What is the unit of each? What is the British heat unit [772 ft. pounds] equivalent to in electrical units of power? (10)

3. Describe fully the Edison Chemical meter, knowing that 1 ampere passing for 1 hour between zinc plate immersed in a solution of salt of that metal will remove from 1 plate and deposit 1225 milligrams on the other. What would be the amount of current that would pass in the above meter if the resistance of the German silver shunt was .02 ohms, and the resistance of the other circuit in which the zinc voltameter of 2.5 ohms is inserted in series with another R of 46.46 ohms, if the deposit was 200 milligrams? Make a sketch of the arrangement. (20)

SECTION 4.

1. Describe the Wheatstone's bridge as fully as you can, and illustrate the application of the instrument by an example. (10)

2. How are very high resistances measured? A galvanometer of 6000 ohms shows a deflection of 10 when a certain resistance is in circuit with it. Knowing that the same galvanometer shows the same deflection with a resistance of 1-10th megohm in circuit when shunted with a 1-99th shunt, find this certain resistance. The resistance of the battery is neglected. (15)

3. An ammeter is simply a galvanometer of low resistance, and is generally placed in series in a circuit. What would be the effect if you placed this meter in multiple, say on an incandescent lighting circuit; and also if you had placed a voltmeter (a galvanometer of high R) in series in a circuit carrying large currents. (15)

4. Make a diagram showing clearly the connections on a shunt wound dynamo, placing in the circuit a voltmeter and ampere meter. (10)

SECTION 5.

1. Show by a diagram the general arrangement and connections of generators running on a 3-wire system. Show by an arrow the direction of the currents if (1) both machines are doing exactly the same amount of work; (2) if one machine is doing more than the other. Place in position ampere and voltmeters. (15)

2. 880,000 lines of force (N) are to be forced through a bar 20" long and 8 sq. inches in area. *Find the reluctance and the magnetizing force* in ampere turns to effect this magnetization. Permeability = 166. (15)

3. In a generator which is driven by a 100 H.P. engine, belt speed 5,000 ft. per minute, there are 200 conductors in the armature winding 100 sections in commutator, the gap is 45. Find the tongue and the drag on the active conductors. (15)

STEAM AND THE STEAM ENGINE.

120 marks constitute a full paper.

1. What is the latent heat of steam at 212 Fah., expressed in foot pounds? What is the difference between *latent* and *sensible* heat? If one pound of steam at 212° Fah. is mixed with 10 lbs. of water at 60 Fah., find the resulting temperature. (15)

2. Steam expands in the cylinder of an engine from 30 lbs. pressure above atmosphere to 5 lbs. below atmosphere, at what part of the stroke was the steam cut off? Atmospheric pressure may be taken at 15 lbs. (15)

3. Define the lap of a slide valve, and explain answer by reference to a sketch. For what purpose is it employed? Account for the difference in the working of two engines, one of which has lap on the steam side of the valve and the other has not. (15)

4. Describe Savary's engine. Show by a sketch the principle on which it worked. What was the greatest depth the water could be lifted by this engine! Why was it limited to this extent? (15)

5. The diameter of a steam engine is 24", and revs. per minute = 60. M. E. P. = 40 lbs. What should the length of the stroke be so that the engine will develop 330 H.P. (15)

6. Sketch Newcomen's engine. During what portion of each stroke, and in what manner was unnecessarily wasted by Newcomen's arrangement? How did Watt propose to lessen this waste, and in what way did he carry out his idea? (15)

7. What is meant by the term "clearance" and "cushioning?" At what part of the stroke does cushioning occur? Show by an indicator diagram the manner in which the slide valve produces cushioning. (15)

8. Describe Stephenson's Link motion. How is an engine reversed by this arrangement? Make a sketch to illustrate. How would you arrange a link motion with one eccentric only? What is shortening the travel of the valve equivalent to? (20)

9. A safety valve 3" diameter is held down by a lever weight. Lever 36" long. The valve centre is 4" *from the fulcrum.* Weight 56 lbs. Omitting the weight of lever and valve, at what pressure would the valve be lifted? (15)

10. Show the various methods of connecting the heads of tubular boilers to the sheets. *What are the relative strengths of a* single and double rivetted lap joint to that of the original plate? (15)

11. You have two engines exactly the same size; one has steam cut off at ¼ stroke, the other has steam cut off at full stroke. Show by calculation what is gained by using the steam expansively. (20)

12. Describe as fully as you can the Hydraulic Ram. Show the arrangement by a sketch.

13. A hydraulic ram has an efficiency of 70%. 40 gallons of water are spent on same, with a fall of 10 feet. How many gallons will it raise to a height of 400"? What is the pressure at the bottom of a column of water 400' high? (15)

The force of a stroke of lightning in horse power is indicated by the following incident: During a recent storm which passed over Klausthal, Germany, a bolt struck a wooden column in a dwelling, and in the top of this column were two wire nails 5-32 inch diameter. The two nails melted instantly. To melt iron in this short time would be impossible in the largest furnace now in existence, and it could only be accomplished with the aid of electricity, but a current of 200 amperes and a potential of 20,000 volts would be necessary. This electric force for one second represents 5,000 horse power, but as the lightning accomplished the melting in considerably less time, say 1-100 of a second, it follows that the bolt was of 50,000 horse power.

THE DAKE ENGINE.

The extremely compact type of engine shown in the accompanying illustrations is unusually interesting on account of the ingenious mechanical principles involved in its design. As a steam engine, aside from questions of design, the manufacturers claim that experience has demonstrated that in reliability, and especially durability, it is not exceeded by any of the types of usual design. On account of its compact form, this engine is claimed

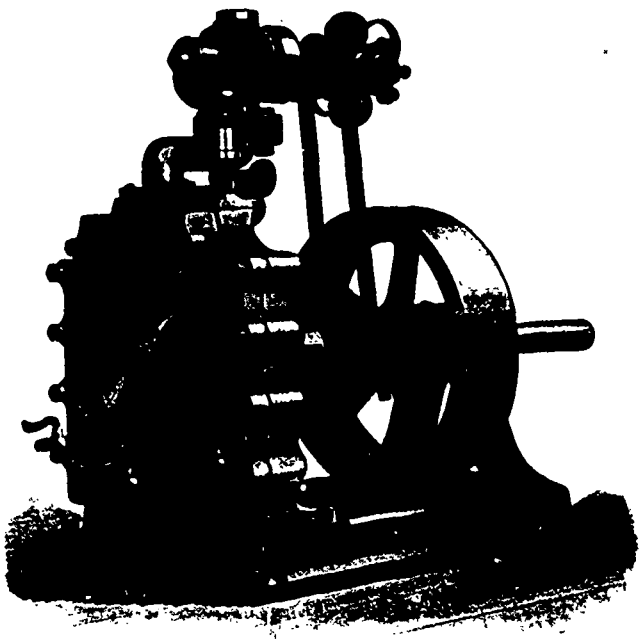


Fig. 1.—Dake Stationary Engine.

to be particularly suited for running ventilating fans, centrifugal pumps, incandescent lighting dynamos and saw mill carriages. Being strongly built, self-contained, and not affected by ordinary jars, it also gives reliable service when used to run smoke-consumers and head-light or other dynamos on railway trains, and when employed for various auxiliary purposes aboard vessels.

Fig. 1 illustrates the engine complete, and in Fig. 2 the pistons are removed, showing the interior of the case with the crank in position, this latter revolving in the chamber shown in the back of the case in the central cut. This chamber is supplied with oil and water from an opening in its back, thus securing lubrication to every part of the interior of the engine.

Both side pistons have a horizontal movement sliding from side to side, and at the same time an inner piston to which the crank pin is attached has a vertical or up and down motion, the two movements imparting rotary motion to the crank. Steam is admitted through channels in the cover, one opening into a central aperture and another into an annular opening on the inside of the cover. Four channels are cored through the inner piston, one leading to the top and another to the bottom, and one to each end of the inner piston, the latter also leading through the ends of the outer piston. Four parts corresponding with the channels in the interior of the inner piston are cut through the face (or side next to the cover) of the inner piston in the proper position to register over the central aperture in the cover. The steam entering the port in the inner piston, through the central aperture of cover and re-acting against the side of the case, imparts motion to the crank, the port passing over the annular ring and exhausting into it after having done its work. There are four distinct impulses of steam to each revolution of the crank, and the arrangement of the ports to the crank are such that each impulse of steam is given at a point where it has the greatest power. The expansion of steam is secured in the passage of the ports of the inner piston over the central aperture in the cover.

With the reversing engine, the channelling on the cover and in the piston is the same as in the engine built to run one way, but the ports in the inner piston are shaped so that they register over both the central and the annular openings, using each alternately as steam and exhaust. The ports on the top of the case being fitted with a suitable valve which connects the channels leading to the working parts of the engine, motion is given to the engine either to the right or left, as desired. The reversing engine is the same as a

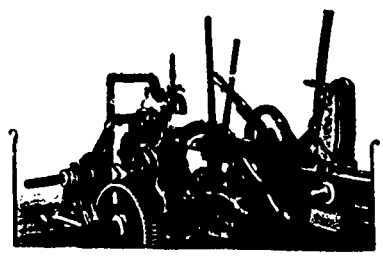


Fig. 3.—Carriage Engine.

stationary engine, only with reversing throttle instead of governor.

Provision is made for taking up the wear of the working parts of the engine in a simple and effective manner. The inner piston is fitted with phosphor-bronze slides that admit of a thin piece of tin or sheet iron being inserted when the wear is sufficient to allow it A wedge-shaped plate on which the lower slide rests is arranged with set screws on the outside of the case (Fig. 2), which keeps the piston steam tight, top and bottom. The packing of the cover to the pistons is effected by thin copper joints placed between the edge of the case and cover. The pistons are made so that they are slightly thicker than the case they occupy, and enough copper strips are put in to fill up the space; these joints are removed one at a time as the pistons wear down, and where it is seen that repacking is needed and a copper joint is too much to take off at one time, a piece of thin paper to take its place will repack the cover perfectly. The repacking of the cover as above described, and replacing the nuts or cap screws (as found on the different sizes of engines) evenly, is the only point about the engine that requires careful attention and judgment on the part of the person in charge, and repacking is not required except at long intervals.

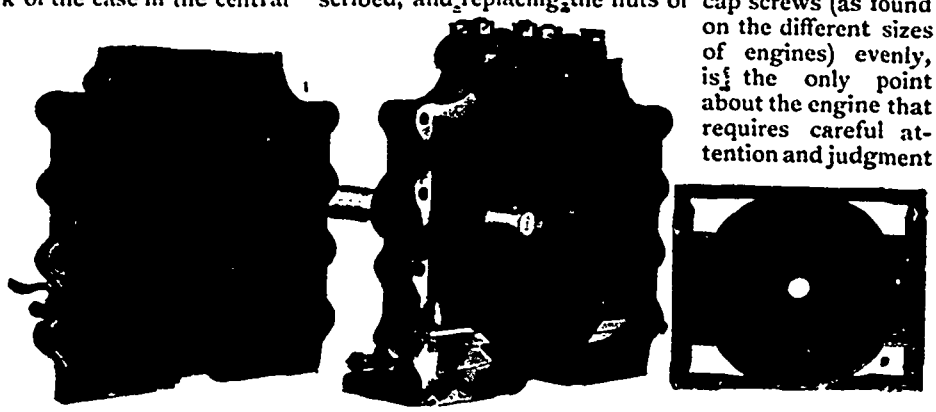


Fig. 2.—Dake Engine, Showing Piston with Cylinder Cover Removed.

There is very little friction, and consequently slight wear on the pistons, from the fact that the steam pressure is inside of the inner piston, instead of against it, making the pistons similar to balanced valves. The bearings for the main shaft and crank pin are in the form of bushings and made from phosphor-bronze. From the manner in which steam is applied to the pistons the wear is slight compared with the ordinary engine. When they need renewing the worn ones are driven out and the new bushings driven to place, which can be done by any good machinist at a small cost to the purchaser. The crank and pin are made from the best quality of cast steel, and the shaft, which is ma-

chinery steel, is shrunk into the crank in a solid manner. The outer piston is also made from best quality of cast steel. Every part of the interior of the engine is fitted with the greatest care. The inner face of the cover and all of the working parts of the engine are ground surfaces, made with tools especially designed for the manufacture of this type of engine, thus ensuring that the engine is practically steam tight from the start. Everything about the inside of the engine is made interchangeable, and can be duplicated in case of accident on short notice.

Fig. 3 shows the carriage engine for setting up and receding head blocks.

In Fig. 4 is shown the steam feed, which is recommended to the consideration of saw mill owners and operators. The claims made for it are simplicity of construction, positive operation and easy management, economical use of steam, small space occupied, cheapness, and easy adaptation to either new mills or those now in use. In placing the engine in position, it is not necessary to move the husk frame, as it can be lowered from above through the frame onto foundation. The movement of the engine in either direction is under absolute control of the sawyer by lever connecting with reverse valves on top of engine, thus accommodating the speed of the feed to the size and conditions of logs.

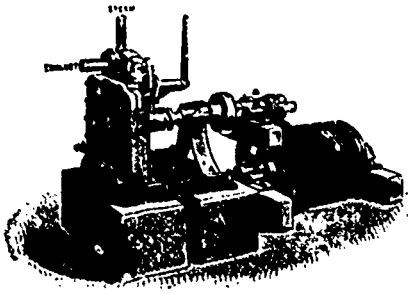


FIG. 4.—STEAM FEED.

The Dake engine has been placed upon the Canadian market by the Phels Machine Co., of Eastman, Que., who will gladly furnish any further information.

SPARKS.

The town of Magog, Que., is inviting tenders for electric street lighting.

An incandescent plant will be installed by Hewson Bros., of Durham, Ont.

The ratepayers of Alexandria Bay, Ont. have voted $1,000 per year for electric light.

The electric light plant at Three Rivers, Que., is offered for sale by tender. The date limit is the 15th inst.

Mr. W. H. Pearson, of Toronto, manager of the Trenton Electric Co. is seeking a franchise for electric lighting in the city of Belleville.

The Toronto Electrical Works, Toronto, suffered damage by fire recently to the extent of $2,500. Considerable valuable machinery was destroyed.

The town of Orillia, Ont., will likely enter into an agreement with Mr. Tait to furnish incandescent lights on the present dual basis for five years from January 1st, 1895.

The city engineer of St. Thomas, Ont., has been instructed to prepare an estimate of the cost of constructing an electric plant to supply heat, light and power and to operate an electric railway.

The city of Vancouver, B. C., has accepted the proposition of the Consolidated Tramway and Lighting Company to light the city, at 27½ cts. per light for 200 lights, or 27 cents for over 200 lights.

The Canadian General Electric Co. are placing an electric light plant for the town of Niagara Falls, Ont., including two dynamos with a capacity of 5,000 lights, together with two engines of 535 horse power.

Mr. A. W. White, London, Ont., has been appointed one of the umpires on the Cosmopolitan motocycle race in New York, to be held on May 30th next. Mr. White, it will be remembered, was umpire on the Duryea motor, which won the moto-cycle race at Chicago.

R. McGowan has purchased from the Johnston Electric Company a 1,000 light alternator and equipments for 1,000 incandescent lights for Durham, Ont., where he has an arc plant at present. He also owns the electric light plant at Oakville, Ont. The installation work in connection with the new plant at Durham will be carried out under the direction of Mr. R. McGowan, jr., of Oakville.

ELECTRIC RAILWAY DEPARTMENT.

THE MONTREAL PARK AND ISLAND RAILWAY.

The Montreal Park & Island Railway was incorporated in 1885 by Statute of Quebec. At subsequent dates, viz., in 1886 and 1893, amendments to the original charter were passed by the Quebec Legislature, and in 1894 the railway was declared for the general advantage of Canada, and came under the jurisdiction

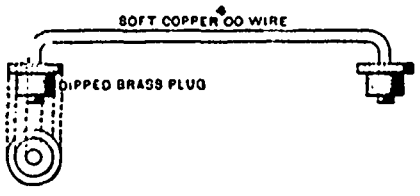


Fig. 1.—The Marple Rail Bond.

of the Federal Parliament. New powers were then granted the company, and in 1896, during the last sitting of Parliament, further powers were obtained, and the company now is in a position to complete the construction of the various electric railways contemplated.

Of the gentlemen who were originally instrumental in bringing forward this project, Hon. J. R. Thibaudeau, Sheriff of Montreal; Mr. Henry Hogan, the well-known proprietor of St. Lawrence Hall, Montreal, and Hon. Louis Beaubien, are at present directors of the company.

The first construction undertaken was the line through Mile-End, to reach the River des Prairies, and thence down the right bank of the river to Sault au Recollet

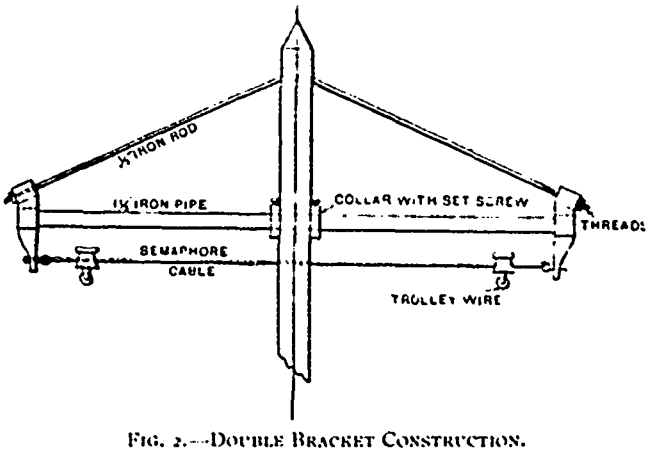


Fig. 2.—Double Bracket Construction.

Village. This was built in 1893. This line, like nearly all suburban lines, has had the usual pioneering difficulties to overcome, and as the proprietors of the road determined to make the project a successful one, they persevered with the work and they have succeeded in putting this line in good condition, both physically and financially.

This piece of track, commonly known as the Back River line, extends for nearly 7 miles from the city limits. It is double track from the city limits to the Shamrock grounds, from which latter point it is single track to the terminus. It is the company's intention to extend this line about four miles farther in order to reach St. Vincent de Paul. This work will probably be commenced during the current year.

In 1894 a double track line was built from the city limits at Mount Royal Avenue around the mountain through Outremont as far as Cote des Neiges Road, thus reaching the cemeteries. In 1895 this line was continued around the western mountain to the westerly limit of Westmount, connecting there with the Montreal Street Railway, Sherbrooke Street line, thus completing a double track electric circuit 11 miles long around the two mountains, and furnishing a line of communication for many outlying municipalities which will tend to develop them at a very rapid rate. Not only this, but it furnishes for the people of Montreal a most delightful trip during summer, which they are not slow to avail themselves of, and on pleasant afternoons and Sundays the company's resources are taxed to provide sufficient accommodation to carry the thousands of people who go out to spend a half hour in riding over the lines, which affords an opportunity of looking at some of the finest scenery of which this country can boast.

During the present season the Company expects to complete its system. Among other lines, they will build to Lachine and to Bord 'a Plouffe by way of St.

Fig. 3.—Two Cars on the Outremont Division.

Laurent, in addition to the already mentioned extension to St. Vincent de Paul.

The mileage of track at present operated is 22, and by the end of the year the length of track operated will be in the neighborhood of 50.

From the peculiar development of Montreal, being as it is so densely populated in certain districts, it is evident that the opportunity for developing suburban business is considerable. The population being concentrated, the necessity for moving out becomes more apparent every year as the necessities arise for factories and business houses occupying sites in the older residential portions of the city, gradually forcing the residents further away where they can secure fresh air and more room.

The building of a suburban electric system affords every opportunity for the people improving their condition, and although the people of the working class of Montreal are very conservative in their ways of living, yet they are beginning to be convinced of the desirability of changing their places of residence from the

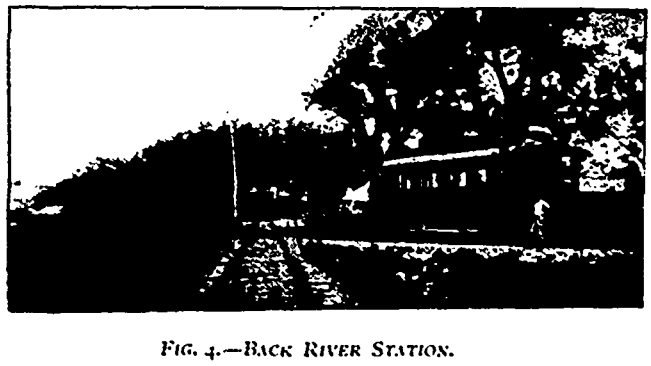


Fig. 4.—Back River Station.

smoky, unhealthy portion of the old town to the delightful country surrounding the city, to say nothing of the reduced cost of living, and this is all made easily possible by the Montreal Park & Island Railway Company, which has persevered in preaching this doctrine to a most conservative community.

By an arrangement existing with the Montreal Street Railway the cars of "Park & Island" system come over the tracks of the street railway to the centre of the city, the street railway having the benefit of the cars for their purposes on their lines in going to and from the city limits, and the passengers to and from the suburbs thus not having the necessity to change cars.

ROADWAY.

The track is laid throughout with 56 lb. Cammell steel rails of Sandberg section. The joints are four bolt angle bars, and the track is laid with broken joints, except in street work, where the joints are square. The roadbed is built up high wherever it can be built. Ballast of broken stone, gravel and cinders are used according to circumstances. The bond is of No. 0 soft copper wire, soldered to a brass plug, which is pressed through a drilled hole in the web of the rail.

OVERHEAD CONSTRUCTION.

This is on the general plan of the "west end," though malleable iron parts are being substituted for bronze. The hangers are attached to cable supports both in bracket and span construction in order to provide flexibility. The ears are for the most part soldered, but a mechanical clip will in future be used instead. The trolley wire is No. 0 hard drawn wire. The posts are cedar 8 inches diameter at top.

POWER PLANT.

This consists of an installation of steam engines driving two generators, one of 200 k. w. and one of 100 k. w. capacity, made by the Royal Electric Company, of Montreal. The power station, however, is but a temporary installation, and a description of the permanent power station will appear in a future number. The construction of the new plant will soon be commenced.

ROLLING STOCK.

This consists of twenty motor cars, ten of which are closed cars, six are nine-bench open cars, and four are thirteen-bench double truck motor cars, 38 feet over all. In addition to these above there are four open trailer cars. The motors are for the most part of the "Royal 30" type, made by the Royal Electric Co., of Montreal, and the severe tests that these motors were put through during the extraordinary severe winter of February and March of this year, as well as on previous occasions, justify very high praise for the Royal Electric Company. The motors are mechanically excellent, and electrically they are highly efficient. For heavy or light work these motors are very satisfactory. The small truck which has given the greatest satisfaction is that made by the Canada Switch and Spring Co. The double trucks are all of Brill No. 23 pattern.

TELEPHONES AND SIGNALS.

The lines are equipped with telephones, and connecting wires are led down the posts at close intervals, the telephone instrument being portable and merely hooked to the contacts on the posts, so that connection may be had with head office from any point of the line. Each regular car carries a telephone.

On single track lines the Skeen signal system is being installed, and will be used no doubt on other single track lines to be built, as it enables a maximum number of cars being operated on a single track.

The officers of the company are:—Hon. Louis Beaubien, President; Hon. J. R. Thibaudeau, Vice-President; Henry Holgate, manager and engineer.

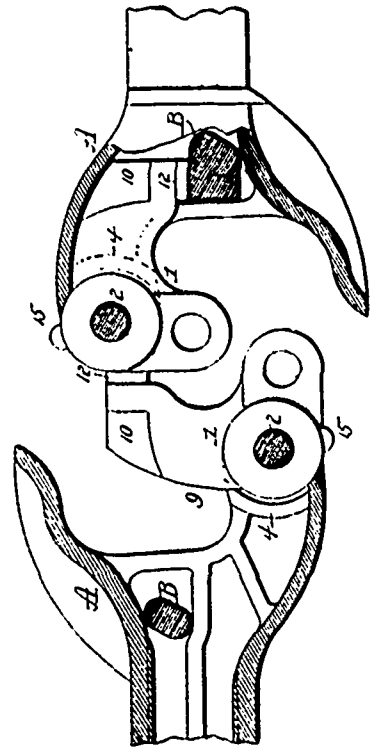
Mr. Holgate was from 1878 to 1888 connected with the Northern and Northwestern Railways, and upon those railways uniting with the Grand Trunk Railway in 1888, he continued in his former capacity as chief engineer of the division until 1893, assuming his present position in June, 1895.

A more complete description of the Park and Island system will be given in a future number, when the new work becomes sufficiently advanced.

Col. John Stacey has purchased the franchise of the St. Thomas Street Railway Co. from Messrs. Cameron & Hunt, of London. It is proposed to electrify the system.

IMPROVED AUTOMATIC CAR COUPLER.

RAILWAYS to-day demand an automatic coupler that is strong, cheap, reliable, decisive in its action, self-adjustable and interchangeable with the present rolling stock of the world. At an exhibition held in the Park Avenue Hotel, in the city of New York, attended by the railway managers of the amalgamated roads of the United States, the invention of Otto Flohr, of which we give an illustration, was unanimously voted as being the only invention of its kind worthy of consideration from all points ethical and economic. The chief advantage of this device in the eyes of practical railway men are that the couplers are interchangeable with any of the vertical plane couplers now in use; absolutely automatic; simple in construction; undoubtedly cheap; certain in action; durable; can be handled with ease



IMPROVED AUTOMATIC CAR COUPLER.

and without hanger, and will lock on a curve as readily as on a straight line.

The coupling obviates the necessity of any one going between the cars and the parts are so ingeniously constructed that the resistance in uncoupling is reduced to a minimum. The locking arm rises automatically by being pressed by the locking arm, which has a slight taper at the end, which engages with an incline face upon the pin, forcing the pin up during the concussion until the arm swings by and clears it.

The knuckle swings open the moment the pin is released, as the result of its own gravity it resting on the highest point of resistance on a spiral-way, when closed from which it naturally descends from its own weight. The outer edge of the knuckle has a stop that prevents the possibility of the locking arm swinging out too far to be of service.

It is a coupler that is wonderfully clever in its mechanism and is entirely different to any now in use. Patents have been granted in Canada, United States, England, France, Belgium and Russia. The Dominion Government passed a bill last session that if enforced will cause all railways in Canada to adopt within two years some such automatic coupler.

The Winnipeg Electric Street Railway Company have in connection with their road two parks situated about four miles from the centre of the city. In River park they have a half-mile race track, large grand stand, bicycle track, field for lacrosse and such sports, roller skating rink, etc. Elm park is situated just across the river from River park, and is reached by a pontoon bridge. It also contains the necessary requirements for a pleasure resort, and being thickly studded with trees, is used largely by pic nic parties. The traffic to these parks in the summer is very large, and they are considered excellent investments.

PIONEER ELECTRIC RAILWAY WORK IN CANADA.

To the Editor of the ELECTRICAL NEWS.

SIR, I observe in your March issue a letter from Mr. James W. Easton, in which he claims that the first successful attempt in Canada to propel cars by electricity was made in 1883 on the Industrial Exhibition grounds at Toronto, the motor and power equipment consisting of three old Ball machines designed for arc lighting. Inasmuch as Mr. Easton admits that the efforts of a couple of men were required to push the empty car up the grade, and that no passengers could be carried, I think it is tolerably clear that so far as practical results are concerned, the experiments referred to cannot be considered to have been successful. I am informed by persons who witnessed the experiments that the only way the cars would run was down hill.

Very truly yours,

OLD TIMER.

Directors of the Sherbrooke, Que., Street Railway Company have been elected as follows: Walter Blue, Wm. Morris, J. W. Burke, J. E. Flood and F. J. Griffith. Mr. Burke has been elected president, and Mr. Griffith, secretary.

The Rathbun Company, of Deseronto, are now building an electric self-loading street car for A. Jackson Reynolds & Co., of Montreal, which, it is claimed, will revolutionize street cleaning in all towns and cities. One car, it is said, will clean 25 miles per day and take the sweepings out of the municipality at a saving of 60 per cent.

CANADIAN GENERAL ELECTRIC CO.

(LIMITED)

The following Letters speak for themselves:

PORT HOPE, Feb'y 27th, 1896.

MESSRS. CANADIAN GENERAL ELECTRIC CO.,
Toronto.

DEAR SIRS:—The 75 Kilowatt Monocyclic Alternator purchased from you was started up on Sept. 2nd, 1895, and has since been giving us an uninterrupted service of 160 hours each week, starting at four o'clock on Sunday afternoon and running till eight o'clock the following Sunday morning, without a hitch of any kind whatever. We expect a large increase to our business from motor service, and appreciate the excellent features of the Monocyclic system of this combined light and power service. There is, of course, no unbalancing, as the lighting is single phase, and the operation of the motors does not disturb in any way the evenness of the lighting. After an experience of six months we feel warranted in saying that we consider the Monocyclic as superior to any of the polyphase systems which we are acquainted with, and intend in the near future to duplicate this machine.

Yours truly,
R. A. CORBETT,
Pres. & Mgr. Port Hope Elec. Light & Power Co.

PARRY SOUND, Feb. 27th, 1896.

THE CANADIAN GENERAL ELECTRIC CO., Toronto.

DEAR SIRS:—Having now made a thorough trial of the Monocyclic system of Electrical distribution as supplied by you, I have much pleasure in informing you that it is giving entire satisfaction.

The machine, a 75 K.W., is a beautiful specimen of dynamo building, being strong and compact. Ventilation of the armature is excellent, and the general design of that very important part of the machine is good. Electrically and mechanically, I consider your machine to be superior to any I have seen.

We have not had occasion, as yet, to test the machine on the operation of motors, but speaking from the lighting point of view, I can fully endorse what you claim for the system.

We have 700 lights now wired and expect to increase to 1,200 before 1897.

Yours truly,
W. B. ARMSTRONG,
Manager Parry Sound Electric Light & Power Co., Ltd.

HANOVER, Feb. 21, 1896.

CANADIAN GENERAL ELECTRIC CO., Toronto.

DEAR SIRS:—In answer to your enquiry as regards the operation of our Electric System, I beg to say that we have now been running one of your 75 Kilowatt Monocyclic Dynamos for the past two months, and it is giving entire satisfaction in every respect. We have not had the slightest trouble with it in any way, and although it is being operated about 15 hours a day, it runs exceedingly cool, and requires practically no attention whatever.

The machine itself I regard as a model of simplicity, in fact to show my confidence in the apparatus I have placed the plant in full charge of my brother, who, previous to the starting up of this machine, had no experience whatever with electrical apparatus of any kind.

The perfect regulation of the Dynamos, and the simplicity of the wiring are also strong points which should recommend the use of this style of apparatus to anyone contemplating the installation of an electric plant.

In conclusion, I might say that after having decided upon adopting the Monocyclic system, my opinion became somewhat prejudiced against its adoption by representations made by other manufacturers, but I now fail to see wherein I could have secured anything better to that installed by your company.

Yours very truly,
D. KNECHTEL.

DUNNVILLE, February, 1896.

MESSRS. CANADIAN GENERAL ELECTRIC CO.,
Toronto, Ont.

DEAR SIRS:—We are pleased to be able to express ourselves as entirely satisfied with the Monocyclic system installed by you last fall. We are now in a position, having covered a considerable portion of the town with our lighting mains, to appreciate the value of the three-wire system for secondary distribution from the transformers, and the great advantage gained in simplicity by the Monocyclic from its being a single-phase system for the lighting distribution.

The workmanship and finish of the dynamo itself certainly does credit to your factories, and in operation it has proved itself to be exceedingly simple and satisfactory.

The commutator and brushes run without any sparking whatever, and do not give us a particle of trouble. We feel fully justified in saying that the Monocyclic system in operation has shown itself to possess all the points of excellence claimed for it by you at the time when we made the selection for our new plant.

DUNNVILLE ELECTRIC LIGHT CO.

MATTAWA, Feb. 27th, 1896.

MESSRS. CANADIAN GENERAL ELECTRIC CO., Toronto.

DEAR SIRS:—We are pleased to be able to express complete satisfaction with our Monocyclic plant, which has now been running since 27th Sept. We are especially pleased with the ease with which our former single-phase system has been changed into one suitable for the distribution of both light and power. The only change made in our case was the installing of the Monocyclic machine in place of our former single-phase alternator, and the running of a third wire to the points where power is to be supplied. Altogether the system is admirable, both as to simplicity in the wiring, and distribution and perfect freedom in operation from any trouble or complication. We are quite sure that the Monocyclic system will prove a means of increasing largely the revenues of alternating lighting stations by the sale of power without adding any complications to their operation. You will be pleased to know that the 5 h.p. induction motor geared to a triplex pump is now in successful operation pumping water for the C.P.R. water tank. It is certainly a very simple and substantial piece of machinery.

Yours truly,
MATTAWA ELECTRIC LIGHT & POWER CO., LTD.
A. F. HURDMAN, Sec'y-Treas.

SPARKS.

The Galt, Preston and Hespeler Electric Railway carried 13,000 passengers and 800 tons of freight during the month of March.

An electric trolley road has been built at Kioto, Japan. Tokio, Yokohama and Osaka have decided on adopting similar lines.

The Toronto Suburban Street Railway Company propose extending their line from Toronto Junction to Lambton Mills and Islington.

Messrs. J. E. Flood and J. W. Burke, of New York, are interested in the construction of the proposed electric railway at Sherbrooke, Que.

The Niagara Falls Electric Light & Power Co., of Niagara Falls, Ont., have awarded the contract for a 5,000 light incandescent plant to the Canadian General Electric Co., Ltd.

An electric railway is projected to run from Bell's Corners to Richmond West, Ont., a distance of ten miles. The promoter is Mr. John Moodie, proprietor of the Richmond and Nepean Macadamized road, who intends asking the municipalities interested for a bonus towards the construction of such a line.