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CANADIAN
ELECTRICAL NEWS
AND
STEAM ENGINEERING JOURNAL

OLD SERIES, VOL. XV.—No. 6.
NEW SERIES, VOL. V.—No. 8.

AUGUST, 1895

PRICE 10 CENTS
$1.00 PER YEAR.

CANADIAN

ELECTRICAL NEWS

AND

STEAM ENGINEERING JOURNAL.

VOL. V. AUGUST, 1895 No. 8.

THE STREET RAILWAY CONVENTION, MONTREAL.

A representative of the ELECTRICAL NEWS had an interview a few days ago with Mr. Stonewall Jackson, of Montreal, the local secretary of the American Street Railway Association. The Fourteenth Annual Exposition of that association will take place in the Victoria rink, Montreal, the 15th of October next, lasting four days. The officers and executive board are as follows :—President, Joel Hurt, Pres. Atlanta Consolidated Street Railway Co., Atlanta, Ga. ; 1st Vice-President, W. Worth Bean, President St. Joseph and Benton Habour Railway and Light Co., St. Joseph, Mich. ; 2nd Vice-President, John H. Cunningham, Dir. Lynn & Boston R. R. Co., Boston, Mass. ; 3rd Vice-President Russel B. Harrison, Pres. Terre Haute Street Railway Co., Terre Haute, Ind. ; Acting Secretary-Treas., John A. Partridge, Brooklyn Street Railway Co., Brooklyn, N. Y. ; Executive Committee : the President, Vice-President and Hy. C. Payne, Vice-President Milwaukee St. Ry. Co., Milwaukee, Wis. ; Wm. H. Jackson, President Nashville St. Ry. Co., Nashville, Tenn. ; D. G. Hamilton, President, Cass Ave. and Fair Grounds Ry. Co. and St. Louis Ry. Co., St. Louis, Mo. ; Granville C. Cunningham, Man. Montreal Street Ry. Co., Montreal, Que. ; John N. Partridge, President Brooklyn City & Newton R. R. Co., Brooklyn, N. Y.

Exhibition of supplies and manufactures of every nature used in the street railway business will be displayed and electric power is to be provided for the running of machinery which may need it. All machinery, will, if possible, be exhibited in motion. Every precaution will be taken to guard against fire, and a full corps of watchmen will be on duty day and night. The association heartily invites all manufacturers, inventors and street railroads to exhibit their machinery and will make the utmost effort to devote the requisite space to all applicants. All the leading street railway men will attend this exposition, and the directorate will do all in their power to make it the best street railway exposition ever held. For full particulars address, Stonewall Jackson, Local Secretary, 17 St. Sacrament St., Montreal, Que.

LEGAL DECISIONS.

HARTFORD V. BELL TELEPHONE CO., TORONTO ELECTRIC LIGHT CO., ET AL.—The appeal from the judgment of Mr. Justice Rose in favor of the defendants in this case, was dismissed by Mr. Chief Justice Meredith in the Common Pleas Divisional Court, Toronto, in the following terms. "To have entitled the plaintiff to have succeeded against any or either of the defendants, it was incumbent upon her to prove that the defendant or defendants sought to be made liable, had been guilty of some wrongful or negligent act which was the proximate cause of the injuries received by her, and in respect of which the action was brought. On both branches of the case the plaintiff, in the view of my learned brother Rose, failed upon the facts, for he has by his findings of fact acquitted each of the defendants of the wrongful or negligent acts charged against them, and has found that, even if the defendants were guilty of the wrongful or negligent acts alleged to have been committed by them, those acts were not the proximate cause of the injury and damage to the plaintiff for which she sues. There was, we think, evidence which fully warranted the learned judge's findings. . . . Upon the facts of the case it was properly found (for it appeared upon the plaintiff's own case, and there was no evidence to the contrary) that the wires of the Electric Light Co. and of the Holmes Co. were brought into contact owing to the conduct of a boy who chopped off a branch of a tree which stood near the wires of the Holmes Co. and the Bell Telephone Co., between Portland street, where the contact, as I have mentioned, took place, and the building to which the fire was communicated, and the branch, falling upon the wires adjacent to and somewhat below it, brought the Holmes wire down upon and into contact with the Electric Light Co.,s wires, and, but for the boy's act, the negligence of the companies, if negligence there were, would have produced no damage to the plaintiff. It appears to me, therefore, that, according to both the principle acted upon in the Howard case (22 S. C. R 147), 'the wrong and the damage are not sufficiently conjoined or concatenated as cause and effect to support an action,' and, as put in the Howard case, the negligence and the injury are insulated by the intervening act of the boy—the causal connection between the negligence and the damage being broken by the interposition of independent responsible human action, and the plaintiff's case, therefore, failed. There are probably other difficulties in the way of the plaintiff's recovering, but it is unnecessary to refer to them. The result is that the judgment of my brother Rose is right and must be affirmed, and the appeal from it dismissed wirh costs. I do not feel, however, that I should part with with the case without expressing the hope that some provision of law may be enacted that will place under proper governmental or municipal supervision and control the vast network of wires which is to be found in a city like Toronto, and may at any moment become the cause of serious injury to life and limb, as well as to property, and for requiring companies and others, whose disused or 'vagrant' wires may become a source of danger, to remove them.'

The gross earnings of the Toronto Street Railway Company for July amounted to $93,049.94.

John F. Payzant has been elected president, and W. B. Ross, secretary, of the Halifax Electric Tramway Co.

Mr. Chas. W. Wasson, of Cleveland, Ohio, has been elected a director of the London Street Railway Co., to succeed the late Hon. Greene Pack.

The electric light inspection branch of the Inland Revenue Department will be self-sustaining, as up to the present $2,000 has been collected in fees.

The first truck with electric motors for locomotive work to be used in Canada was shipped last week to Oshawa by Ahearn & Soper, of Ottawa. It is a specially constructed truck of heavy steel and weighs with the motors something over eight tons. The motors combined have a capacity of 120 horse power. The truck will be used in hauling freight cars to and from the G. T. R. at Ottawa.

Mr. Thos. Ahearn, of Ottawa, has devised a method for preventing variation of E. M. F. occasioned by sudden withdrawal or addition of load in connection with self-excited water driven dynamos. An independently driven water wheel is employed to generate current exclusively for the purpose of exciting the field of the generators. An ammeter is included in each dynamo field circuit, and upon each dynamo is placed a small double throw switch so that in case of accident, the several dynamos could be self-excited by throwing the switch on each dynamo, thereby connecting the armature of each to its own field. The advantages claimed for this method are : Steadiness of voltage, removal of the danger of burning out fields by abnormal armature speed, relief to the driving machinery, removal of fields from the line circuit preventing any possible damage to them by lightning or other cause, the prevention of damage to commutators formerly caused by short circuits upon the line throwing open the circuit breakers and short circuiting the current across the commutator. Considerable time is also saved in throwing in dynamos, which is now done without delay after the circuit breakers are reset. This formerly required a very considerable time in synchronizing fields.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

Note.—Secretaries of the various Associations are requested to forward to us matter for publication in this Department not later than the 20th of each month.

TORONTO ASSOCIATION NO. 1.

IN the absence of the President, E. J. Philp, the last regular meeting was presided over by A. E. Edkins, Dist. Deputy. After general business had been disposed of, the newly-elected officers were installed as follows:

Pres., Walter Lewis; Vice-Pres., Samuel Thompson; Rec. Sec., T. Eversfield; Cor. Sec., Jas. Huggett; Treas., A. Wickens; Door-Keeper, A Slute; Conductor, Martin Mose.

Bros. Fox, Huggett and Wickens were appointed delegates to the annual convention.

At a recent regular meeting the following resolutions of condolence were adopted:—

"*Whereas, it has pleased our Heavenly Father to remove from the family* of our esteemed and worthy brother, W. G. Blackgrove, two of his children, therefore be it resolved that we deeply sympathize with our brother, his wife and family in their sad bereavement, but commend them to that all-wise Supreme Ruler *who*, though sometimes inscrutable in His dispensations, yet doeth all things well. And be it further resolved, that these resolutions be spread on the minutes of this Association, and a copy of same be sent to the bereaved family and also to the mechanical press.

GEORGE FOWLER,
GEORGE C. MORRING, } Committee.
WILSON PHILLIPS,

MONTREAL ASSOCIATION NO. 1.

A representative of the ELECTRICAL NEWS called on the Montreal No. 1 Canadian Association of Stationary Engineers at their handsome and comfortable quarters at 666½ Craig St. They had just completed business, and the secretary, Mr. B. A. York, stated that they had just elected delegates to the annual convention to be held in Ottawa in September next.

The following are the delegates elected: Brothers T. Ryan, J. G. Robertson and E. Valiquet, with alternates, Bros. Hy. Nuttal, Jos. Marchand and J. Murphy. The delegates will be accompanied by Bros. J. J. York, (President C. A. S. E.), Geo. Hunt and O. E. Granberg, members of the C. A. S. E. executive.

An invitation was extended to our representative to attend their annual picnic, Aug. 3rd, and make an inspection of their lodge room, which is the best equipped for the study of steam engineering of any in Canada. On the walls are drawings of Babcock engines and designs of different engine and boiler makers, together with photos of the past and present officers and groups of the members of the association. They have the latest models and appliances, and a library of no small size which they hope to add to from the proceeds of their picnic.

Bro. B. Cowper, chief engineer of the Canadian Rubber Co., presented the association with a model double plunger pump with glass cylinders. They have also a model steam pump with cylinders cut in half, showing working of valves.

Many of the merchants of the city contributed to the prize list for the picnic games, and a goodly number turned out to the Exhibition grounds to enjoy them.

In the drawing for a forty gallon barrel of oil, a little maid of eight summers picked out the lucky ticket. In the lacrosse match the team captained by Mr. Hunt won victory over the team led by Mr. Murphy. The Executive have reason to congratulate themselves on the complete success of the picnic.

BROCKVILLE ASSOCIATION NO. 15.

AT the last meeting of the above association, the election of officers for the ensuing year resulted as follows:

Pres., W. F. Chapman; Vice-Pres., Archie Franklin; Rec. Sec., Wm. Robinson; Fin. Sec., John McCaw; Treas., John Grundy; Conductor, W. S. Baverstock; Trustees, Ernest Carr, Fred. Andrews and Edward Devine; Delegate, W. F. Chapman.

The Secretary reports that good work is expected during the next term, the newly-elected officers being all energetic men.

WINNIPEG ASSOCIATION NO. 11.

AT a meeting of the above association at their hall on the 11th ult., the following officers were appointed:

President, G. Hazlett; Vice-President, Thos. Gray; Rec. Sec., J. Sutherland; Fin. Sec., A. B. Jones; Treas., R. Sutherland; Conductor, E. Simpson; Door-Keeper, J. Harrison; Trustees, G. Hazlett, C. E. Robertson, Thos. Gray.

The District Deputy, Mr. C. E. Robertson, installed the officers, and in a short address asked them to pay great attention to their work in this association, as it was one of the most important in the world.

All the officers are working engineers, and prospects seem to point to another year's successful work.

CHAS. E. ROBERTSON, Dist. Deputy.

CARLETON PLACE ASSOCIATION NO. 16.

Editor ELECTRICAL NEWS.

SIR,—The following officers of Branch No. 16, C.A.S.E., were elected for the present term, July 6th:

Past President, Geo. H. Routh; Pres., Jos. McKay; Vice-Pres., Henry Derrer; Rec. Sec., A. M. Schofield; Fin. Sec., John Hamilton; Treas., John McFarlane; Conductor, Thos. Meehan; Door-Keeper, W. M. Taylor; Trustees, A. Nichol, J. D. Armstrong, J. M. Hamilton.

Branch No. 16 is making good progress. The membership does not grow very fast, owing to the limited number of engineers in the town. We have met once a week so far, but are thinking of changing our rooms, and meeting only twice a month, doing away with our reading-room for a time. The weather being so warm has interfered with our meetings of late, although in spite of that we are in good shape financially and every other way.

Branch No. 16 wishes the other sister branches every success.

A. M. SCHOFIELD, Rec. Sec.

ONTARIO ASSOCIATION STATIONARY ENGINEERS.

Editor ELECTRICAL NEWS.

SIR,—I wish to call the attention of certificate holders of the O.A.S.E. who have not renewed their certificates to Sec. 2, Art. 7, of the By-Laws and Constitution, which is incorporated by the Ontario Legislature, and reads as follows:

"The certificates shall be good for one year, and shall remain the property of the Board, and must be returned to the Registrar within 30 days after the holder thereof has been notified so to do."

A notice was sent to every member in January last, yet there are quite a number who have not sent in their renewal fees.

A further notice will be sent out (to all who have failed to renew) in a few days, and after thirty days from date of said notice, all certificates not then renewed will be cancelled and means taken to collect old certificates.

This will entail a good deal of work and expense, but the Board are determined to carry out the act as laid down.

I would also request all certificate-holders who may change their place of residence, to communicate same to me by post card. I remain,

Yours very truly,
A. E. EDKINS, Registrar.

P. S.—Renewal fees are $1.25, $1.00, and 75c. for 1st, 2nd and 3rd class respectively. A. E. E.

SPARKS.

A liquidator has been appointed for the Victoria Electric Light Co., Lindsay, Ont.

The Burk's Falls (Ont.) electric light plant has arrived in that town and is being placed in position.

The local electric light company's plant at Port Arthur, Ont., has been purchased by the town for $7,000.

The Bell Telephone Co. has served a writ on the Dundas Telephone Co., claiming damages to the amount of $10,000 for alleged injuries to the former's service.

The Stratford Gas Co. has accepted the electric light agreement proposed by the Council. Lights will be supplied on the moonlight schedule at the rate of $57 per lamp.

An order-in-council has been passed under the Electric Light Inspection Act, making the following additional regulations:—All electric light supply meters in use at the time of the passing of the Electric Light Inspection Act shall be presented for verifications as follows:—One-third before 1st December, 1895, one-third before 1st March, 1896, one-third before 1st July, 1896. For every unverified meter found in use after the first day of July, 1896, the owner thereof shall incur a penalty of twenty-five dollars. For every failure or neglect to comply with the provisions of section 22 of the Act in relation to affording the department testing facilities, the contractors shall incur a penalty of fifty dollars. For every failure to procure a certificate of registration as required by section 35 and the payment of the fee established thereof, within thirty days after the first day of July, in each year, the contractor shall incur a penalty not exceeding one hundred dollars and not less than fifty dollars.

CANADIAN ELECTRICAL ASSOCIATION.

ARRANGEMENTS for the Annual Convention of the Canadian Electrical Association are being pushed forward as rapidly as possible, and are making satisfactory progress. A strong local committee has been appointed at Ottawa, to arrange for the proper reception and entertainment of the members of the Association who may attend the convention. This committee is composed of the members of the Executive resident in Ottawa, with whom are associated Messrs. T. Y. Soper, J. W. McRae, and Thomas Ahearn. The committee is manifesting an enthusiastic interest in the work which has been assigned to it to perform, and the members of the Association can confidently look forward to a convention which will be in every respect the equal if not superior to any which has previously been held. A number of interesting papers on various phases of electrical work have been promised for this convention by persons who are well qualified to write interestingly and instructively upon the subjects which have been assigned to them, or which they have voluntarily chosen.

It is a well-known fact that Ottawa is one of the most interesting cities in the Dominion, and this is particularly true from an electrical standpoint. It possesses one of the greatest water powers in Canada, from which sufficient current is generated for the operation of the city railway and lighting systems. The street railway system has become known far and wide as a model of what such a system should be, and will consequently well repay careful inspection of all its details both of management and equipment.

The dates for the convention have been fixed for the 17th, 18th and 19th of September. The local committee are arranging with the railway companies for reduced rates, and hope to be able to secure a single fare rate. The very satisfactory attendance at the Montreal convention last year gives ground for the expectation that at Ottawa a considerably larger attendance will be witnessed, as the convention will be located mid-way between Ontario and Quebec.

DEVELOPMENTS IN THE TELEPHONE BUSINESS.

IT is astonishing to observe to what an extent the telephone business has become a part of the World's commercial equipment and to notice what strides have been taken by the telephone system in Canada since Professor Alexander Graham Bell made his first experiments in telephony at Tuttello Heights, on the outskirts of Brantford, in the year 1875.

The business which has now become consolidated under the control of the Bell Telephone Co. of Canada, having a paid up capital of over $3,000,000, consists of upwards of 500 offices and toll stations, with an enormous mileage of wire connections, and notwithstanding all that has been done a large amount of money is still being expended in erecting and otherwise perfecting the system so far as it relates to the successful operation of local exchanges; while in recent years also Long Distance lines have been constructed covering the greater part of the Provinces of Quebec and Ontario.

In all the large cities the Company has shown willingness to adopt the more expensive underground system for its wires, dispensing to a great extent with the over-head pole work on the principal streets in business sections. Toronto, Hamilton, Ottawa, London and Montreal all have systems of underground work more or less extensive. The subways in the latter city are used principally for trunking between exchanges. As has previously been mentioned in this journal a large amount of this work has been done within the past five years in Toronto, where subscribers now enjoy telephone communication over metallic circuits free from all noise and disturbance.

At present there are nearly five thousand subscribers in Toronto divided among four exchanges, consisting of the new Main office on Temperance St., having about three thousand subscribers, and the balance being divided between Yorkville, Parkdale and Toronto Junction Branches.

The underground cables which run to the New Main Exchange enter that building from two directions, passing over and round a roller curve built of iron and steel rods, on which are small cast iron rollers over which the cables pass. The cables are then bent up through holes in the ceiling of the cellar to the floor above and are there attached to iron cable terminals. The cables are protected from abnormal currents by the usual combination, heat coil and carbon arresters. From the terminals the lines are carried in switchboard cables under a false flooring to one side of the Hibbard distributing rack, from the other side of which similar cables are taken through a shaft up stairs to the large operating room, which is located on the top floor of the building. Here they are connected to an intermediate board fastened on the wall close to the first section of the large switchboard.

The switch itself is of the branch terminal type, with the usual jacks and self-restoring drops. It has an ultimate capacity of 4,200 lines, and is at present wired for 3,6[illegible]. Ten positions are arranged for incoming trunks from branch offices, and especially designed sections are used for Long Distance work. In front of every operator is a small 10 volt incandescent lamp which lights when an annunciator falls, attracting the attention of the operator and also facilitating supervision by the Chief operator. Small incandescent lamps are also used for dis-connect signals on the inter-office trunk lines. Outgoing trunk lines are equipped with mechanical visual busy test signals. Instead of the usual cam and ringing keys, a combination key is used, consisting of two buttons. Depressing one button cuts in the operator's telephone, while a depression of the other button cuts its out, and enables the operator to ring a subscriber.

The frame work of the switch is of iron veneered with polished cherry. The brass work is of dull finish, and the whole presents a very handsome effect. The board in all its parts, except the cables and wires, was made in the Bell Telephone Co.'s factory in Montreal, being put together and set up here by local employees.

The power plant consists of a two horse power motor-generator for charging the storage batteries, and two-half horse power motor generators for ringing bells—one being kept as a spare—twenty storage cells, 300 amp. hour and fourteen 30 amp. hour cells. The cells are arranged in sets, one set being in use while the other is being charged; suitable switches throw them in and out of circuit. A Weston Standard voltmeter and ammeter are in the charging circuit, while four Weston current indicators are in the discharging circuits.

Attention was called in a former article in this journal to the magnificent fire proof head office building which the Company is now erecting in Montreal. The building will front on Notre Dame, St. John and Hospital Sts. In Ottawa also the Local Exchange has been thoroughly remodeled and now occupies a handsome new building, adapted in every particular to its requirements. A description has already been given in the ELECTRICAL NEWS of the new Exchange lately erected in Quebec.

All along the line the same energetic policy is being pursued. New Exchanges are being opened in small places, and additional Long Distance lines are being erected in different sections of the country.

A FEW STEAM PUMP CALCULATIONS.

WANTED- A steam pump to deliver 1,000 gallons per minute. Strokes per minute, 40; length of stroke, two feet; steam pressure, 80 pounds: head to pump against, 100 feet; allowance for loss, 20 per cent. A loss of 20 per cent. necessitates calculations for 1,000 gallons + 20 per cent., or 1,200 gallons per minute. This divided by 7.48 gives 160.4 cubic feet of water per minute. Dividing 160.4 by 40 we have 4.01 cubic feet per stroke, and call it 4, omitting the decimal. Dividing again by the length of the stroke (in feet) we get 4 + 2 = 2 square feet as the area of the pump cylinder, or about 19½ inches for diameter; a pretty large diameter for the stroke, but necessary to meet the requirements, although it would be better to lengthen the stroke to three feet. The head of 100 feet (.434 pounds per foot, but calling it .5, makes an allowance for friction) gives us fifty pounds pressure per sq. inch of piston, and the piston area equals 2 + 144 = 288 square inches, 288 + 50 = 14.400 pounds total pressure on the piston to be overcome by steam pressure on the steam piston. Dividing the total load by the steam pressure we have 14,400 + 80 = 180 square inches for the steam piston plus 20 per cent. loss in the steam cylinder, etc. 15.25 + 3.05 = 18.3 inches as steam cylinder diameter. The conditions here given are a little unusual, the hand being low for the pressure used, and the stroke short for the diameter; also the small number of strokes per minnte, but the method of calculating is clearly shown and can be done for any selected case.

THE ONLOOKER.

THE college-bred mechanic is a good deal in evidence in these days of technical colleges and schools for manual training. He is, in some respects, a much discussed individual, for it has not been settled in all minds that schools and colleges can turn out capable mechanics. They may make scholars and professional men, but, as Rudyard Kipling has said, that is another story. Opinion differs whether the course actively pursued of recent years of producing electrical engineers through our colleges and universities is going to give to the electrical industry the strong and efficient men, that this science, with its great development, must require. True, the schooling, if we may use the term, obtained by the electrical student, is usually supplemented by a measure of practical training in some one or other of the large electrical manufacturing companies, but is this sufficient to make a capable electrical engineer? In this particular, important advances have been made within a very few years, for Mr. James B. Cahoon, the electrician in charge of the Expert Department of the Thomson-Houston Co., has said, that a few years ago no special requirements for entrance were required or exacted and the result was that the student class was composed mainly of young boys from sixteen to twenty years of age, who could not overcome their boyish proclivities, and were in for fun more than serious work. To-day, in most of the colleges and universities furnishing an electrical engineering course, the age limit has been raised, and no student is admitted unless he is an engineering graduate of some technical college.

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But the question is a broader one than that of method and efficiency, as reflected through college and university. Experienced men divide on the question, whether the mechanical engineer or the college-bred electrician is likely to make the most capable electrical engineer. The former has a practical knowledge of mechanics, that is as necessary, in many respects, to the electrical, as to the mechanical, engineer. With this thorough knowledge as a foundation, the contention is that he can add to that an electrical knowledge, and thus equipped, no mere college taught electrician can expect to cope with him. This may seem like treating very slightingly the work that is being done in our colleges and universities, and which, by those whose views ought to count for something, is pronounced timely and capable. It does not seem unlikely, in this case, as in others, that the best results will be secured by striking a happy medium between the two methods. Though prejudice has condemned the educated man in many practical walks of life, opinion, based on experience, shows that education, whether with the mechanical or the professional man, is important ammunition in his possession. If the thoroughly trained mechanical engineer can add to that invaluable capital the electrical training that comes through the student course of the universities of the present day, he ought to develop a measure of strength that would at once place him at the top of the electrical engineering profession. Much of the criticism levelled against mechanical engineers, who undertake to call themselves electrical experts, is due to the fact that these men are not mechanical engineers any more than they are electricians. They are firemen and stokers too often, and doing their work in a bungling manner, the capables and incapables come in together for severe criticism.

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A conversation the Onlooker had a day or two since with Mr. D. C. McLean, Chief Engineer for the Toronto Street Railway, brought out in bold relief the contrast between the capable and incapable engineer. Mr. McLean is a mechanical engineer, having received a training and experience that is common to few men. He is one of the seventy-four, and only seventy-four, the world over, who have passed an honorary examination in engineering, that in Great Britain holds a parallel position with the degree of B. A. from Cambridge or Oxford. There it is necessary, in order to become an engineer, to be apprenticed, under articled indentures, for a period of seven years, where the training the young man is to receive, rather than the immediate emoluments, is the main consideration. Having put in this length of time in apprenticeship, then in order to obtain a third class certificate he must put in one year's actual experience at sea. To obtain a second-class certificate another twelve months at sea is necessary, and the same length of time is called for when trying for a first-class certificate. In the latter case the engine of the vessel must be at least 3,000 h. p. and whilst the student-engineer is not actually in charge of the vessel, he has charge of an important watch, so that the responsibility, and the experience that comes from that responsibility, is thrown upon him. Mr. McLean has obtained this experience, besides having had thirteen years' actual experience as a marine engineer. The Onlooker enquired of him why so great emphasis was laid on the training of a marine engineer, and the reply was that only by this means could one become thoroughly equipped in his work. The ordinary experience will make a man what will be termed an engineer, but not as the term is understood in its highest sense. Queried as to his view of the training necessary to become an electrical engineer, Mr. McLean replied that the best authorities were of one view that the perfectly equipped electrical engineer must be nine-tenths a mechanical engineer. "How absurd," said he, "to suppose that because a young man can handle a coil of wire and perform a few mechanical acts connected with an electrical plant, that this makes him a master of electrical engineering. And yet I have seen this kind of thing. I have known those calling themselves electrical engineers to be unable to give an intelligent answer to what was an armature, while it was altogether beyond their comprehension to work out the simplest equation." The study of mechanics in Mr. McLean's opinion embraces so much, that it is impossible for one to become a master of his work except by years of toil. Going over the long list of text books that an Old Country examination calls for it was clearly shown that these could not be mastered except after many years of study. Then, on top of the study there had to be the real experience. It may be that Mr. McLean's ideal of a mechanical and electrical engineer is a difficult one to reach. The very fact that it has been placed high ought to be an incentive for those who would aspire to complete success to endeavor to reach it. One thing seemed very clear to the Onlooker that with a man of Mr. McLean's education and experience at the helm the mechanical and electrical affairs of the Toronto Railway Co. were in strong hands.

MOONLIGHT SCHEDULE FOR AUGUST.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1.....	P.M. 11.40	.....	4.20
2.....	.....	A.M. 4.00	
3.....	A.M. 12.40	" 4.00	3.20
4.....	" 1.40	" 4.00	2.20
5.....	No light.	No light.	....
6.....	No light.	No light.	....
7.....	No light.	No light.	....
8	P. M. 7.30	P. M. 9.30	2.00
9.....	" 7.30	" 9.50	2.20
10.....	" 7.30	" 10.10	2.40
11.....	" 7.30	" 10.30	3.00
12.....	" 7.30	" 11.00	3.30
13.....	" 7.30	" 11.30	4.00
14.....	" 7.30	A. M. 12.20	4.50
15.....	" 7.30	" 1.00	5.30
16.....	" 7.30	" 1.10	5.40
17.....	" 7.30	" 2.10	6.40
18.....	" 7.30	" 3.30	8.00
19.....	" 7.20	" 4.30	9.10
20	" 7.20	" 4.30	9.10
21.....	" 7.20	" 4.30	9.10
22.....	" 7.20	" 4.30	9.10
23.....	" 7.00	" 4.30	9.30
24.....	" 7.00	" 4.30	9.30
25.....	" 8.00	" 4.30	8.30
26.	" 9.00	" 4.30	7.30
27.....	" 9.40	" 4.30	6.50
28.....	" 10.40	" 4.30	5.50
29.....	" 11.00	" 4.30	5.30
30.....	" 11 30	"	5.00
31.....	"	" 4.30	
		Total,	153.00

Kamloops, B. C., is about putting in an electric plant of the capacity of 1,000 sixteen candle-power lamps.

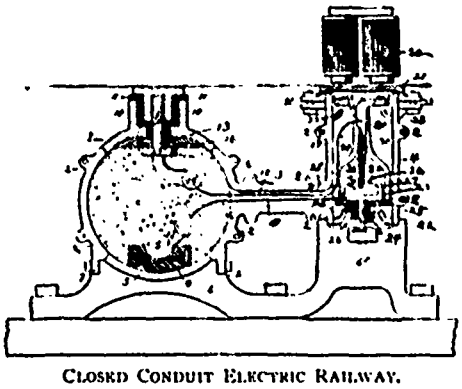
It is reported that the Weston Union Telegraph Co., is about constructing a telegraph line to Alaska, via British Columbia.

The following board of directors have been elected by the North-West Electric Co., of Winnipeg: G. H. Streyel, president; J. M. Graham, G. A. Simpson, J. A. McArthur and H. Cameron, manager and secretary.

RECENT CANADIAN PATENTS.

CANADIAN patents have recently been granted for the following electrical devices:—

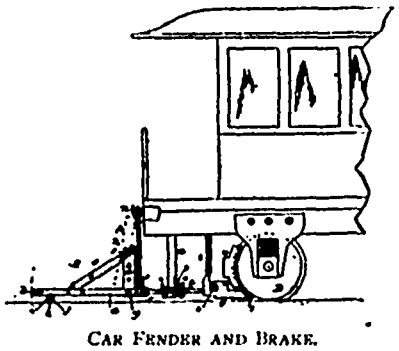
No. 48,819, for a closed conduit electric railway, to James Francis McLaughlin, Philadelphia, Pennsylvania, U.S.A., and May, 1895; 6 years.



CLOSED CONDUIT ELECTRIC RAILWAY.

In an electric railway, the combination with a closed conduit provided with main and supply conductors, of switch boxes arranged alternately on opposite sides of the conduit and provided with switching mechanism for coupling the main conductor with sections of the working conductor, and two series of electro magnets, on opposite sides of the motor car, in line with the switch boxes, for operating the switches therein by magnetic attraction.

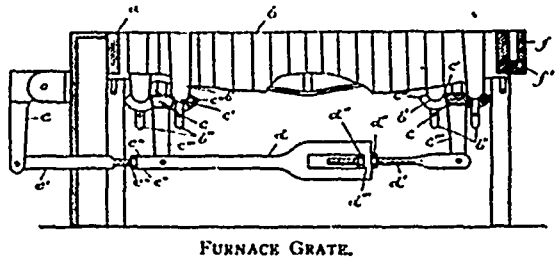
No. 48,838, for a car fender and brake, to William McBeth, Hamilton, and Harriet Belle Lewis, Winona, both in Ontario, Canada, 3rd May, 1895; 6 years.



CAR FENDER AND BRAKE.

The combination with an electric or other railway car, of a frame a, b, c, standards d, d, horizontal bar e, e, vertical bangers l, l, provided with openings m, m, adjustable diagonal braces, f, f, with covering a, shaft j, rollers k, rubber tubing b, and cushion p, all constructed substantially as and for the purpose specified. In an electric or other railway car, the combination with a fender of brake shoes, and brake shoe rods, the same constructed to be operated by the fender being pushed against the brake shoe roads, when meeting an obstruction on the track, to apply the brakes on the wheels automatically, substantially as set forth. In an electric or other railway car the combination with a fender A, of brake shoes g, connected by a shaft r, supported by springs s, brake rods, t, t, attached to the brake shoes, brackets u, provided with lugs 4, and spiral spring v, v, to push the brake shoes off the car wheels, and brake rods operated by the rear contact movement of the fender A, against the said brake rod, substantially as and for the purpose specified. In an electric or other railway car, the combination of the fender and brake mechanism, substantially as and for the purpose specified.

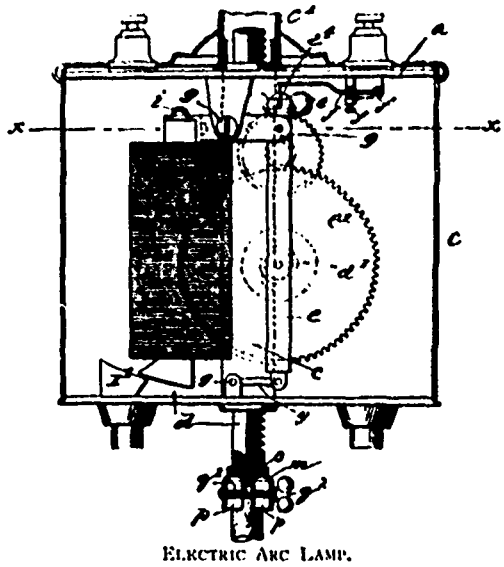
No. 48,870, for a furnace grate, to Edward Gurney, Toronto, Ontario, assignee of Henry Truesdell, Hawarden, Iowa, U.S.A., 7th May, 1895; 6 years.



FURNACE GRATE.

The combination of a grate frame, rock shafts provided with alternating lateral arms and also operating arms as at C^a, a rod d, pivotally connecting arms C^a, one of its ends being connected to one of said arms C^a by a screw connection, an operating lever, an adjustable connection between rod d, and the operating lever, and grate bars supported on the lateral arms. The combination of a frame, two sets of bars adapted to move alternately in vertical planes, a stationary coupling bar having journal bearings and rigidly attached at its ends to the frame and interposed between the two sets of grate bars rock shafts mounted in the journal bearings of the coupling bar, and having means for alternately moving the grate bars vertically, and means for operating the rock shafts, as described.

No. 48,935, for an electric arc lamp, to Peter Kirkegaard, Brooklyn, N Y., U.S.A., 13th May, 1895; 6 years



ELECTRIC ARC LAMP.

In an arc lamp, a frame carrying a gear train controlled by an escapement, said frame being pivotally mounted on parallel arms, said arms being pivoted to fixed supports, whereby the frame will always be parallel to a given plane, in combination with an electro magnet located in the shunt circuit of the lamp and attached to the frame, and an armature permanently fixed with respect to the magnet, a carbon holder consisting of a U shaped yoke pivotally connected with the end of the carbon rod, in combination with two jaws pivoted respectively to the arms of said yoke, and means for closing and opening said jaws.

ELECTRIC WINNIPEG.

A very odd thing, and one that not only astonishes, but startles, the stranger, says a writer in Toronto Saturday Night, is the peculiar electrical condition of everything in Winnipeg during the winter. If you reach out to touch an electric bell, before your finger is within three inches of the enunciator there is a flash of lightning that goes up through your arm and will probably make you jump six feet. If you touch any metallic substance there is a flash of lightning; when you get into bed the clothing crackles, and one would think that the landlord had provided you with a blanket adorned with fire-flies.

After a while one gets so nervous one is afraid to touch anything. I have stumbled around my room and bruised my shins rather than take chances lighting the gas or turning on the electric current. If you reach for the gas jet, "crack" it goes. If you shuffle your feet along the carpet you can light the gas with your finger. It is really one of the most startling phenomena in the whole northwest. Imagine turning over in one's bed and having the quilts emit sparks, or reaching for a bell and being immediately answered by a flash that is apt to make one howl. I saw my traveling companion, who had grown somewhat careful, wrap his finger up in a piece of paper to touch the bell. He jumped back with a shriek, and the whole paper seemed on fire. The people of the effete east who want to become electrified and have their systems filled with electricity should go up north; they will get in proper shape and will learn to avoid radiators and every other metallic substance.

The fact remains, however, that in that climate one feels wonderfully hopeful and able to work, and no task seems too hard to be undertaken, and I am firmly convinced that the great men of Canada will be developed there. It is a remarkable fact that Ontario, the most blessed of all the sections of Canada, has developed, proportionately to its population, fewer brainy and energetic politicians and business men than the provinces by the sea or the great western stretch of land with the wonderful electricity in the air and the greatest difficulties of money making in the climate.

Messrs. E. Carl. Breithaupt, Berlin, A. A. Dion, Ottawa, Chas. B. Hunt, London, and E. P Merrill, Toronto, were representatives of Canada at the annual convention of the American Institute of Electrical Engineers held last month at Niagara Falls.

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STEAM ENGINEERING JOURNAL

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THE Chicago City Railway Co. has recently established a school in which their motormen are given instruction which is calculated to fit them to discharge their duties in an intelligent and efficient manner. This is only possible when men have acquired a knowledge of the method of construction and operation of the apparatus placed in their charge. The experiment is one which seems to be in the direction.

IN the present number of the ELECTRICAL NEWS is printed the decision of Mr. Chief Justice Meredith of the Common Pleas Divisional Court, Toronto, upholding the judgment of Mr. Justice Rose, in dismissing the action brought by Mrs. Agnes Hartford against the Bell Telephone Co., the Toronto Electric Light Co., the Holmes Protection Co., and Silas Wheeler, to recover damages for injuries sustained by contact with an electric wire on the streets of Toronto. The learned judge took the ground that the direct cause of the injury did not orginate with the defendant companies, but was due to the act of a boy who chopped a branch off a tree which stood near the wires of the Holmes Company and the Bell Telephone Company, and the falling of the branch, which caused the Holmes Company's wires to come in contact with the wires of the Electric Light Company. While the complainant in this case is deserving of the greatest amount of sympathy, there can be no question that the decision given is a just one, and that had the plaintiff been well advised legal action would not have been brought, at least as a first resort. Had a more conciliatory course been adopted it is by no means improbable that some of the thousands of dollars which are being expended in law costs might have found their way into the pocket of the unfortunate victim of this accident.

So sanguine is the *Street Railway Gazette* of the success of the conduit electric street railways now under construction on Lenox avenue, New York, and in the city of Washington, that it advises persons desirous of obtaining franchises for the operation of electric railways by the overhead system to lose no time in securing them. The view is that after the conduit road shall have been shown to be workable, the public will be found much more reluctant to grant permission for the construction of roads on the overhead method.

THE turbine water wheels are about as unique and interesting as any other feature of the great power plant which is about to be set in operation by the Cataract Construction Co., on the American side of Niagara Falls. These wheels, which were designed in Geneva, have six times greater capacity than any turbine wheel previously constructed, being capable of giving 5000 H. P. while running at 250 revolutions per minute, under a head of 136 feet. No higher praise could be bestowed upon the skill of the designers of these wheels than to state that during a recent test their speed varied only 7 per cent. as a result of 3,000 H. P. being suddenly dropped from the load.

THE extent to which electricity will ultimately supersede steam as a motive power on railroads is the subject of much speculation and interest. The ELECTRICAL NEWS has been slow to place confidence in the assertion so fully made, that in a few years the steam locomotive would be superseded by the electric locomotive. On the contrary, there is little room to doubt that under certain conditions and for certain purposes, the electric locomotive will find a place on steam railroads. This subject has received its latest consideration in a paper entitled "The Substitution of Electricity for Steam in Railway Practice," by Dr. Louis Duncan, presented at the recent convention at Niagara Falls of the American Institute of Electrical Engineers The questions considered by Dr. Duncan in his paper were: (1) Given a railway system at present operated by steam, will it pay to change entirely to electricity, or to make a partial substitution, and how should the change be made? (2) If entirely new lines are to be built, will it pay to equip them electrically? How should they be equipped? The ultimate conclusions arrived at by the author on these points, are as follows: 1st. The tendency of passenger transporation on the steam lines has been in the direction of the greatest electrical economy, while the tendency of the freight transportation has been in the direction of the least electrical economy. 2d. It will not pay any through line with considerable traffic, having two tracks, to equip their main tracks electrically. 3d. With four track roads it will pay to equip all of the tracks electrically unless a considerable portion is through passenger traffic. 4th. It will pay all the larger roads either to equip a number of their branch lines electrically, or to control competing electric lines. 5th. In order to remain on a dividend paying basis it is imperative that most of the two track lines either build additional tracks or control the electric roads that parallel them 6th. Believing that ultimately all of the traffic will be done by electricity, it is imperative that the managers of steam roads keep constantly in touch with electrical progress.

THE question of the rating of arc lamps seems to require a considerable amount of adjustment. Should an arc lamp be rated according to candle power, or current, or voltage, or how? The rating usually adpoted is according to nominal candle power, that is, a specification says that the lamp shall give a full candle power of nominal 2,000 or 1,500, etc., with a certain amperage. Now, as a matter of fact, this is no specification at all, and refers to no standard whatever. First of all, what is the full candle power of a nominal 2,000 c. p. arc lamp? Next, at what angle is this full c. p. to be measured. It is well known that the intensity of the light from an arc varies according as the eye is above, on a level with or below the arc, and that it is maximum at an angle of 45° below the horizontal. It is well known to those who make any study of electrical matters, that the arc lamp does not give the light, but that its givenly apiece of mechanism for regulating the distance a part of the carbons, and that it is the carbons that give the light; that carbons vary among themselves so much that those of different makes may give 50 per cent. difference in light for the same expenditure of energy. So how can the lamp be rated at so many candle power without distinctly specifying the kind of carbon, its size, and the angle of measurement? Candle power depends directly on the temperature of the crater, and this temperature is nearly inversely proportional to the size of the carbon, the amperage remaining constant, so that any lamp may be adapted to give any candle power (within reasonable limits) by merely varying the diameter of the carbon. However, as the carbon decreases in diameter, it takes a greater pressure to produce the same amperage than with a larger carbon, so that candle power and amperes remaining constant, pressure and diameter must vary inversely according to some proportion. All these general conclusions have been very carefully examined by Professor Ayrton, and experimental results prepared, which show the proportion rather closely that exists between amperes, volts, diameter of carbon, and candle power, and the effect on an actual case of varying one or more of these factors. Starting with the assumption that a certain candle power (at a certain angle of course), is required, and keeping that intensity invariable, he shows that with a certain definite diameter of carbon a certain quantity of energy is required, which, within limits, remains constant, no matter whether the volts be high and the amperes low, or vice versa. Now this gives us a very satisfactory basis where to rate our arc lamps. Instead of specifying them to be of so many "candle power" a standard which no one can verify, and which depends on so many uncertain factors let them be rated at so many volts with a certain amperage, and a carbon of such and such clearly defined diameter. These data can be easily verified by experiments, and purchasers of arch lighting plants will have something to go by, instead of nothing as they have now.

A COUNTRY like Canada, when water powers abound, and where manufacturing industries afford outlets for large amounts of capital, is peculiarly well adapted for the development of the electrical methods of power transmission by the use of polyphasal currents. The demand for power is increasing every day; the supply is practically unlimited in the numerous streams that waste their potential energy in innocous desuetude, and the means for the conversion of this potential energy of water into kinetic energy of rotation are open to all. The Canadian manufacturing interest should be particularly wide-awake in adopting any means for cheapening the cost of their power, and it is somewhat remarkable that the electric motor has not had a greater success in ousting from the factories and other places where power is scattered about in small units, such a very inefficient prime mover as the small steam engine. Central station plants would do well to work up this kind of business. A great source of expense and loss, in such plants, is the fact that for a great part of the time the machinery is being idle, and so earning no money, while if work could be found for it during a longer period a deficit might be converted into a profit. In other words, a higher "load factor" would be an advantage. Now a few motors would go a long way towards helping out returns, and there are very few towns where power is not required to a smaller or larger extent. There are always some people who use a little power, and the fact of it being obtainable would of itself create a demand. A principal reason why electric motors are not more used in factories, saw mills, &c., seems to be the regrettable ignorance on the part of the owners and operators of electric lighting plant of the possibilities of electric transmission, and this ignorance is largely taken advantage of by steam engine manufacturers, who sell small inefficient engines under the very noses of electric light owners. Why do superintendents of central stations not keep themselves up to date in the matter of electrical developments? It might perhaps be too much to expect of an average "electrician" that he should study the more scientific elements that govern the design of new apparatus, but at least he should know that improvement is taking place along certain lines, or that certain novel types of apparatus are being brought out, or that electricity is being used for such and such new purposes. And yet it is very unusual to find a man in charge of a small power house with any general information at all on electrical subjects. Owners are just as bad. The unfortunate results of this carelessness and indolence are observable wherever one goes, and can be seen in almost every detail of the managment. Machinery is purchased because it is cheap, without any reference

whatever to its efficiency. Wires are put up by guess work as to size, and the instruments used are frequently curiosities. These matters, we can understand, are passed over by inexperienced persons, but why the use of motors for all kinds of industrial purposes is not more pushed by those having power to sell, is a question that can only be answered by reference to the backwardness of electrical knowledge throughout the Dominion. There are many towns in which are situated factories of all kinds that use steam power in small scattered units. These small inefficient steam engines might very well and successfully be replaced by electric motors, that would do the work equally well, and economize much in the saving of condensation in pipes, radiation, &c., to say nothing of the higher efficiency possessed by the electric motor over the small steam engine. Here is a promising field to work in for central station men, who are sufficiently enterprising to study what may tend to their own pecuniary advantage.

SINCE the article appearing elsewhere in this number relating to the approaching convention of the Canadian Electrical Association was put in type, some additional particulars have come to hand from Ottawa concerning the arrangements for the convention. The local committee have secured from the railway companies a rate of a fare and a third for delegates attending the convention from any part of Canada. Any member with or without his wife desiring to attend the convention should buy a first-class single fare ticket to Ottawa from the ticket agent where he lives, and at the same time procure from the agent a standard certificate. This standard certificate is in the possession of every ticket agent, and is absolutely necessary in order to buy a return ticket from Ottawa back home at one-third the regular fare. The Ottawa hotels have quoted very low rates for the accommodation of delegates and their wives; in no case will the rate exceed $2.00 per day. We are advised that the local committee are not only making most complete arrangements for the entertainment of the members of the Association, but are likewise making provision for the ladies. A banquet to members and their wives has been arranged for at the Russell House, at the close of the Convention. This banquet will be of an electrical nature in its appointments and quite unique in all respects. We strongly recommend all members of the Association to visit Ottawa on the occasion of this Convention, and take their wives with them.

OUR readers will be interested in noting by another column, that the Canadian General Electric Co. have commenced the manufacture of carbide of calcium under the Willson patents. So much has been written and prophesied regarding this new product of the electric furnace and of acetylene gas, the result of its decomposition in water, that the opportunity of obtaining it will be welcomed, if only for experimental purposes. We are not, however, able to share the roseate views of its promoters to the extent of seeing in it an invincible or even a formidable rival of the electric light. It would indeed be the irony of scientific evolution should the electric arc in the end have produced of itself a rival from which should come a successful challenge of its supremacy as the most brilliant and economical of artificial illuminants. This, however, is far from likely. Already certain limits, undescernible, naturally, in the first glow of an inventors enthusiasm, have been indicated by more recent developments. The earlier representations as to the cost of production of the carbide, have been found unreasonably low, even under the most favorable conditions, and difficulties in the actual use of the gas for illumination, while possibly not insurmountable, have led to the belief that it is more likely to prove of service as an enricher of existing bases, than as an actual illuminating medium. Looking at the matter from an electrical point of view, there seems to be no reason to fear, but rather many to welcome, the new discovery of Mr. Willson. Carbide of calcium and its most important resultant, acetyline gas, will take their proper rank amongst the contributions of electrical science to the industrial art, not as revolutionary or destructive intruders, but as valuable and now indispensible auxiliaries.

Sherbrooke, Que. capitalists are applying for letters patent to constitute a company to run electric and horse cars in that city, with power to extend their railway to any place in the district of St. Francis.

THE TELEPHONE AND ITS TROUBLES.

WHEN a telephone was first used on a telegraph circuit, says A. Dolbear, in the Cosmopolitan, it was noticed that hissing and frying sounds could be heard, as well as telegraphic signals of all sorts, all of which had their origin in other electric circuits. Sometimes the extraneous noises were so much stronger than the telephonic speech that they quite overpowered it. The din destroyed the articulation. This was the case when the automatic Wheatstone transmitter was employed on a telegraph circuit parallel to a telephone circuit on the same poles. This was at first interpreted as being due wholly to induction, and for business purposes telephone lines were removed as far as practicable from telegraph lines. The trouble did not cease. In some cases it was nearly as bad as before; and then it was apparent that the source of the disturbance was the earth itself. Both circuits made use of it as a part of their systems, and their ground connections were adjacent, oftentimes practically the same. When the telephone ground, as it was technically called, was moved away, there was some relief, but it was found possible to detect telegraph signals from lines separated by miles of earth.

When compared with telegraphic instruments, the telephone is found to be exceedingly sensitive. A sounder requires about the tenth of an ampere to work it properly, a relay, about the hundreth of an ampere; but a telephone will render speech audible with less than the millionth of an ampere, and is, therefore, more than ten thousand times more sensitive than a telegraphic relay. When the earth is made to form a part of an electric circuit, the current does not go in a narrow strip from one ground terminal to the other, but spreads out in a wide sheet, much broader than perhaps most have imagined. Thus, if the grounds be no more than three or four miles apart, the spreading earth current can be traced in a sheet as much as two miles wide. If the grounds be still further apart, the sheet will be correspondingly wider. This earth current in its course may meet with streams of water, gas and water-pipes, and other conductors better than the earth itself, and these will conduct some of it, but not all. The stronger the current the more it is spread, and a telephone ground connection anywhere in its path will receive its share unavoidably.

In cities and towns employing the trolley railway systems, the rails form part of the circuit. As they lie upon the earth, the earth necessarily conducts away a notable part of the current, no matter how large the rails and good the connection. For instance, in Boston, where great pains has been taken to provide ample metallic conductors in rails and return wires, a thousand amperes have been found to return through the earth to the power house, and this is something like ten per cent. of the whole output. How widely such a current may spread may be imagined, and one may compare such a current with the minute one needed for telephonic work. One must remember that a steady current does not effect the telephone at all. It is only when the current varies in strength above a certain rate, thirty or forty times a second, that it begins to be troublesome. The variations in strength come from the Morse key or its substitutes in telegraphy, from some types of arc lighting dynamos, from alternating dynamos for incandescent lighting, and from the motors in railway work. Though there be thousand amperes in the earth, if the variation be but one ampere, the nine hundred and ninty-nine which are constant are not offensive, hence it does not so much matter how much current is in the earth as how rapidly it varies. There are other currents in the earth due to natural causes, such as lightning, auroras, etc., which have sometimes been destructive to the telephone and its connections. To protect both service and the telephone itself there is one remedy, namely, to cease using the ground as a part of the needful circuit, and to provide each instrument with a complete wire circuit. Telephone companies are adopting this method everywhere as fast as practicable. It is more costly to establish and maintain, but it has been made necessary by the nature of electrical action and by the great increase in industrial enterprises within the past ten years.

Iron ore is now smelted by electricity in some parts of Nova Scotia. The new method will likely supplant the old blast furnace process.

The half-yearly dividend of 1¾ per cent. declared by the Toronto Railway Company recently, is equivalent to a dividend of 35 per cent. on $600,000, the amount of the company's original investment.

SOMETHING ABOUT INJECTORS.

Hints About Them for Engineers and Firemen.

In some instances it may be found impossible to adjust the injector for the work required, as it may have been especially for a far different pressure than that at which you wish to work it, for the higher the steam pressure used the smaller in proportion must the steam tube opening be, and no injector can be made which will fit all conditions equally well, regardless of advertisements to that effect.

Suppose our injector acts as we have stated before, we immediately know that it is not the fault of the injector, for if it was it would not start at all, unless in rare cases there may be a tube loose, and after the injector has started this may move and alter the relation between the water and the steam supply.

If our injector does not receive steam from the same pipe, the engine does, and the boiler is not forced to such an extent that it lifts the water badly, we may neglect the wet steam cause and look for others. First of all, we will make sure that our water supply is not interrupted by some unknown cause, for this would cause a deficiency of water and the steam would show at the overflow, making the injector break. This water deficiency may be caused by the water valve having a loose disk, which may move on the steam enough to alter the opening for water, and this is a fruitful cause of trouble many times both in steam and water pipes.

Or it may be that a pump in the neigborhood is taking the water at intervals, and at times the lessening of water may be enough to cause a "break" in the injector's working. Other causes which give trouble may be given briefly:

In many instances the pipes leading to the injector are long and small, and often filled with rust and other deposits, and while the injector will start all right it breaks just as soon as it has used the amount of water that is in the pipe, for this acts as a reservoir, supplying water enough for a start, but being soon exhausted.

In a case of this kind it will not do to blame the injector after being sure that there is nothing loose about it, for if it will start it will run until worn out, unless stopped by some outside cause, and this cause must be looked for.

In cases where small injectors are used on large pipes, confusion often arises as follows: The injector will start all right, and after a very short period of operation, will suddenly break and we wonder why. In cases that have come under my notice this has been caused by there not being an opening into the boiler, the check being either stuck or the stop valve shut. The injector starts well enough, but after it gets the large pipes filled and the pressure rises to the limit of the injector, then it breaks. A long pipe between injector and boiler, even if not so large, will have the same effect.

Great difficulty will sometimes be experienced in starting an injector, and one of the most common causes for this is a leaky check valve, allowing hot water from the boiler to come back into the injector and boil the water, or prevent it from condensing the required amount of steam. This can be readily found by care, carefully noticing whether any hot water shows at the overflow when the steam supply is shut off; this will indicate a leaky check valve unless the steam valve leaks, and a little care will soon determine which is the leaky valve.

The checks that give the most trouble are what are termed straight way or swinging checks, which, while very good for some work, are not as good for injector work as the old-fashioned plain check. The reason is this: The passage of water through them wears the side of the seat farthest from the hinge, and in a very short time the check is not tight, and this little leakage back from the boiler makes it hard to start the injector. And if a very slight obstruction becomes lodged near the hinge, the opening at the outer end of the swinging valve is much greater and the leakage is considerable. This is not said to injure any maker of swinging checks, but merely to give my own experience in this class of work.

When you have your doubts as to the quantity of water that can be supplied to the injector, just measure the flow by letting it run into a measure of known quantity, and note the time taken to fill the measure. If we have a two-gallon pail, and the water from the supply pipe of the injector will fill it in five seconds, we know that as there are sixty seconds to the minute the pail will be filled twelve times per minute, which is twenty-four gallons a minute, or 24×60 equals 1,440 gallons per hour.

Then, if the capacity of the injector is only 1,000 gallons per hour at the steam we are carrying, we know we have an ample margin for working. This, of course, is a very large injector, and will supply a large boiler or boilers.

In many cases the injector is made useless by the manner in which the piping is put up, and the writer has found cases where the injector refused to work, in which the supply of water had been cut down to less than half by the man who did the piping screwing all the pipes so far into the valves and elbows as to almost close the openings. This is particularly apt to be the case in the valves and checks, as the brass of which they are made gives so much more than iron fittings that the men do not stop until the pipe refuses to turn with the same force that they apply to iron pipe fittings. A little judgment helps wonderfully in a case of this kind. It is sometimes necessary or convenient to pipe the injector to the same supply and delivery pipes as used by the pump, although it should never be done where both are to be used at the same time, as the pulsating action of pump is very apt to take the water from the injector momentarily and cause it to break.

Where this is done there should be valves so that the pump connections can be shut tightly from the injector and vice versa, particularly in the case of a lifting injector. One instance of this kind was brought to my notice aboard of a little yacht which was being hurriedly fitted for a southern winter cruise, and in which the injector would start nicely and work for a minute perhaps, and then break or fly off, as some call it. The first thought was that there was a piece of wood or waste floating in the water tank in the bow of the boat, and that the action of the water drew it over the pipe and shut off the water supply, as often happens in cases of open tanks. This was not correct, however, as investigation showed that the men who had piped the injector had connected the water supply to the same pipe that supplied the wash basins in the cabins, and whenever the faucets in the cabins were open or leaked the air was drawn into the pipe and into the injector, and caused the break. By piping the two water supplies separately the trouble was remedied, and the boat was ready for her trip in tropical climates.—The Tradesman.

CALCIUM CARBIDE AND ACETYLENE GAS.

The Canadian General Electric Co. have commenced to manufacture calcuim carbide under the Canadian patents of Mr. T. L. Willson. An electric furnace has been erected at the Peterboro works, under the supervision of Mr. Willson's representative, and a number of orders for the carbide have been filled. A considerable demand for small quantities, principally for experimental purposes, has already arisen. Should the sanguine expectations of the inventor be realized, the use of this product in the manufacture of acetylene gas will in the near future assume immense proportions. For the carbide as a potential source of energy are claimed, as especial advantages, its extremely low first cost of production, as well as its portability and convenient form for transportation. Besides its use in the production of acetylene, it seems likely to be of great commercial value in the production of cyanides and in various other processes of metallurgy.

Acetylene itself is a colorless gas with a penetrating odor. Its specific gravity is 0.91 and it is soluble in water, which, at 64° F. will absorb its own volume of the gas. It can be condensed into a liquid and in that form is readily portable. As an illuminant, properties are claimed for it which should, if justified by the facts, establish it as unmeasurably superior to coal or water gas, and make it easily, the most formidable rival which electric lighting has yet had to encounter. When burned at the rate of five cubic feet per hour, it has produced a light eqnal to 250 candles, as against an average equivalent of 16 to 20 candles with ordinary illuminating gas. If, however, the results actually attained in practice should fall far short of the possibilities thus indicated, there will remain for acetylene a field of great value as an enricher of ordinary illuminating and fuel gases.

The Willson process for the manufacture of the carbide is a most interesting one, and we hope shortly to present to our readers an account of it as now in operation at Peterboro.

THE NEW CANAL AT SAULT STE. MARIE.

APPLICATION OF ELECTRICAL MACHINERY FOR OPERATING THE LOCK GATES AND VALVES OF CANAL LOCK.

THE remark merits reflection that at a time when railroads are cutting seriously into the carrying trade by water, there has, perhaps, seldom been greater activity in canal building, and more thought given to projects pointing to the development and expansion of existing waterways, and the opening of new channels of commerce along these lines.

It matters little what part of the world is studied, unusual effort in canal building is discovered. One of the great projects of the past year has been the completion of the Manchester ship canal, providing a direct route between Liverpool and Manchester. Italy has important maritime canal schemes under consideration, and there has lately been completed a notable maritime canal across the high and rocky Isthmus of Corinth. Certain difficulties have hindered the progress of the Nicaragua canal, a scheme in which, at least, one province of the Dominion, British Columbia, is largely interested, as it will be the means of shortening the route between the Pacific Coast and Great Britain by just one-half; but of its ultimate consummation there can be no doubt.

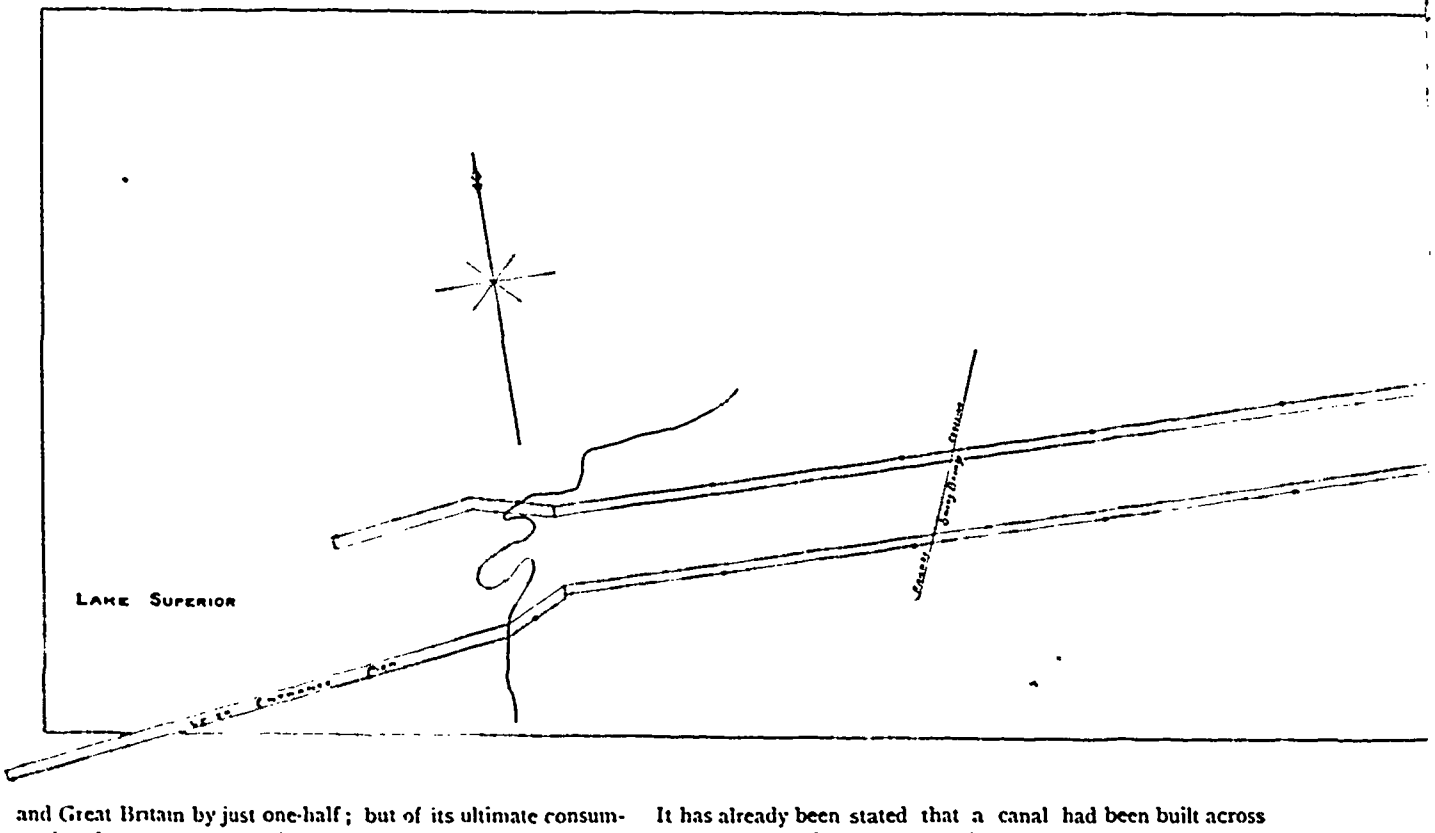
The development of the Canadian canal system furnishes one of the most interesting chapters in Canadian history. The first practical step towards the construction of these artificial waterways was taken in 1815 and 1816, although they had been talked of long before, and indeed the rapids of the St. Mary's river and some of the rapids of the St. Lawrence had been passed by primitive canals and locks as early as 1798. In 1815 the legislature of Lower Canada voted a grant of money to build a Lachine Canal, and in 1818 a joint commission from Upper and Lower Canada reported in favor of a canal system on the St. Lawrence river, the canals to have a minimum depth of water of 4 feet. Work was begun on the first Lachine canal in 1821, and it was completed in 1825, at a cost of $440,000. The canal was 28 feet wide at the bottom, 48 feet wide at the top and 4½ feet deep, and the locks were of masonry 100 feet long and 20 feet wide. Hardly had the Lachine canal been finished when the Royal Engineer in the charge of the Rideau canal, then being built to connect the Ottawa river at Ottawa with the St. Lawrence at Kingston, urged the government to construct the remaining St. Lawrence canals with longer and wider locks, and with depth of water of 9 feet. This the government decided to do in an act passed in 1832, and the system was finally completed with the enlargement of the Lachine canal, to the new dimensions in 1848.

Meanwhile, during the construction of the St. Lawrence canals, the Welland canal, between Lake Erie and Lake Ontario, had been completed and enlarged once. This canal was begun by a private stock company in 1824, after several years investigations by government commissions, and was completed in 1829. It was 27 miles long in 40 locks constructed of wood 110 feet long and 22 feet wide and with 8 feet depth of water on the sills.

After the union of the several Canadian provinces in 1867, further steps began to be taken towards developing the canal system. In 1870 a canal commission was appointed, which reported in 1871, advising an uniform and enlarged waterway with locks 270 feet long, 45 feet wide and 12 feet depth of water on the sills. This depth of water was afterwards increased to 14 feet. In other directions the energy of the government and private parties in canal development has been shown.

BUILDING THE SAULT STE. MARIE CANAL.

In not a few respects, the Sault Ste. Marie canal, in which we are particularly interested at the present time, and which has a special interest to readers of the ELECTRICAL NEWS, marks in several ways new developments and progress in canal building.



It has already been stated that a canal had been built across St. Mary's Island as early as 1798. This canal was built by one of the Northwest fur companies, and, according to such records as can be obtained, was 300 feet long and 45 feet wide, with a lock that raised the water 9 feet, or one-half the total fall at the rapids, so that the remaining height must have been overcome against the current—no great task for the light bateaux of the fur hunters. Between the building of this primitive Sault Ste. Marie canal and the construction of the great work of the same name, which is here illustrated and described, 96 years have elapsed.

The total length of the new canal across St. Mary's Island is 3,500 feet, and the dredged approaches under water at the two ends are about 18,000 feet long, with a depth of water of 21 feet. The essential feature of the work is, of course, the lock by which the 18 feet fall of the Sault Ste. Marie is overcome. This lock is built of masonry, and is 900 feet long between quoin posts, and 60 feet wide, with a depth of water of 20¾ feet on sills on low water. The height of the top of the walls above the floor of the lock chambers is 43¾ feet.

The gates are of wood, composed of white oak and iron truss rods. They are built on what may be called the truss bowstring type. Each leaf of these consists of a quoin (or heel) post formed of three pieces, a mitre (or toe) post formed of two

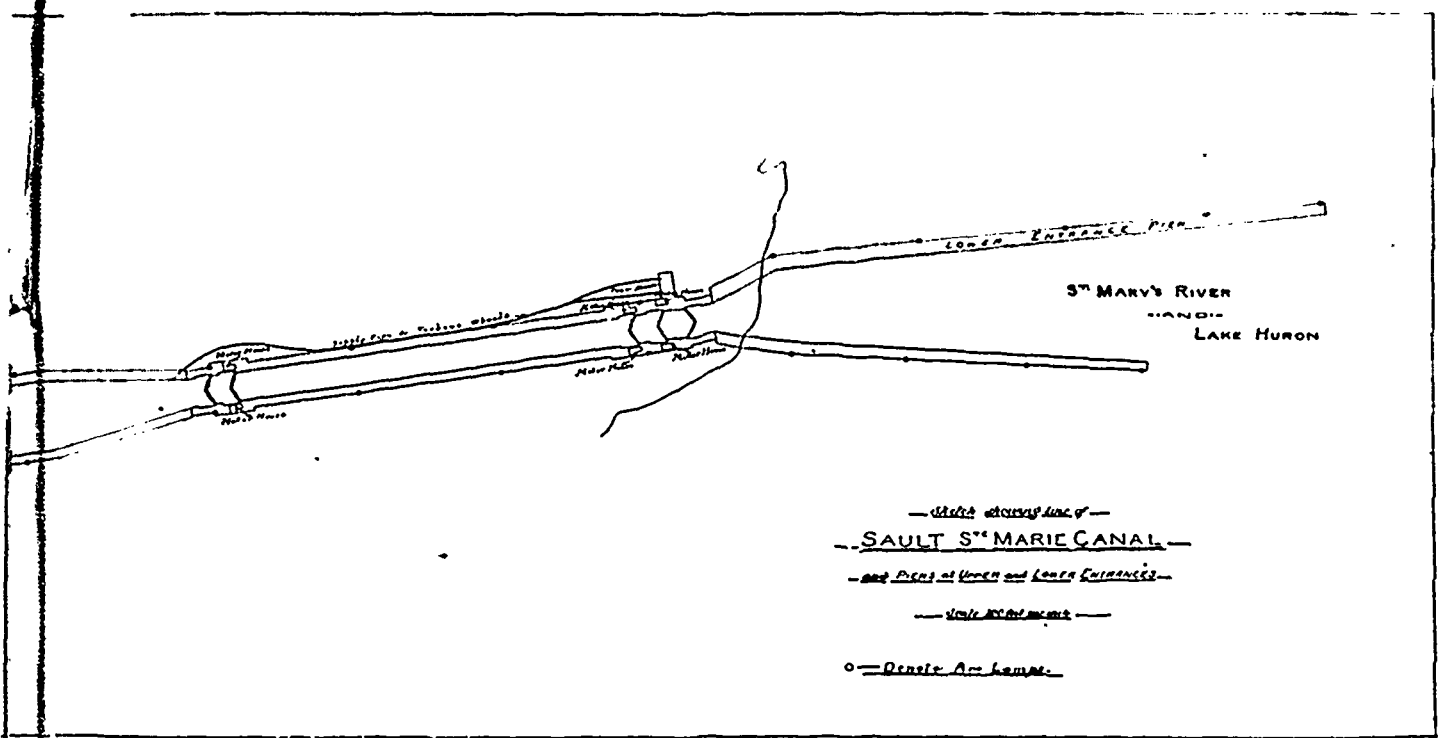
pieces, 3 intermediate vertical frames and the requisite number of horizontal frame trusses spaced and proportioned nearly in accordance with the pressure due to depth sheeted with 3 inch pine plank, spiked to the horizontals. Each horizontal frame consists of an upper or upstream chord, bent into a circular arc, a straight chord bar and iron truss rods. The latter are secured in the quoin and mitre posts in the intervals between the horizontals, but form part of the latter in reality.

There are five sets of gates, 2 at the upper or west end, and 3 at the lower end, i.e., a lock and guard gate at each end and an extra or auxiliary lock gate at the lower end for immediate use in case the lower main gate should get injured. Two sets of those gates (the lower main and auxiliary) are 44½ feet in height × 37 feet in width, weighing about 87 tons per leaf. The guard gates are of course to be used only when the lock chamber is being pumped out for examination or repairs.

Water is admitted to the lock chamber by four 8 × 8 ft. culverts, extending under the breast wall and underneath the floor and having openings at their tops. The inlets and outlets to these culverts are closed by butterfly valves 10½ × 8 ft. area, constructed of steel. Both the valves and gates are operated by electric power.

running transversely across the canal. The shafts are used for each set of four valves, one running from the right side-wall chamber to the centre, and carrying two valves, and the other from the left side-wall chamber, also carrying two valves. At the ends of each shaft in the wall chamber is a crank arm of forged steel, its least leverage being 4 ft., to which a vertical draw rod 55 ft. long is attached, and steadied in line by 2 sets of guide rollers. This draw rod is placed in a well in the lock wall, and when moved vertically up or down by the operating mechanism opens and closes the two valves on the shafts to which it is attached, i.e., the valves are operated in pairs.

The operating wire rope cables connect with the gate leaf on hooks secured to the gate near the mitre post, the front or closing cables run to and around a horizontal pulley secured on the mitre sill platform and from thence to a horizontal pulley at the bottom of the well, then under a vertical, then up the including well to another pair of vertical pulleys which gives the diverging angle to the cable which passes to and around one of the sheaves of the travelling pulleys operated by the gate machine, and back to and around the deflecting pulley stationed in the end of the frame, thence again to and around the second sheave of the travelling pulley and thence back to a standard to



The culverts are constructed entirely of wood, those for filling the lock are 8 × 8 ft. inside, and those for emptying 8 × 10½ ft. inside. In constructing the culverts 12 × 15 inch longitudinal sills were first bolted to the rock foundation, with 1¼ in. round bolts 6 ft. long or over, spaced 6 ft. apart. On the above 12 × 12 in., transverse timbers were laid 6 in. apart, and the interstices filled with Portland cement, concrete and grout, flush with their tops. On the top of this was laid a flooring of two thicknesses of plank, 3 in. and 2 in. thick respectively. The walls between the culverts 2 ft. thick, composed of two thicknesses of 12 × 12 in. timbers, were then built and capped with 12 × 22 in. transverse timbers laid close, having planed joints. This range of cap timbers was then bolted to the longitudinal sills, first laid by bolts 2 ft. apart, extending down through the culvert walls and the transverse timbers; to give the bolts a good surface for holding down the cap timbers, continuous iron straps were placed crossing the timbers and acting as washers and the nut screwed firmly down on these. Of course these bolts had to be put in while laying the longitudinal sills, and the culvert walls built around them. The cap timbers were then covered with a double flooring of 3 inch and 2 inch plank respectively.

VALVES AND VALVE MACHINERY.—The admission of water into the culverts is controlled by valves. These valves are of steel, and are mounted on horizontal steel shafts, 10 in. in diameter, which it is secured in a shackle bolt having an adjusting screw.

The back or opening cable, when hooked on the back of the gate, passes direct to the horizontal pulley in the bottom of the well and from thence as already described for the closing cable passing round its pulleys and being attached to the opposite end of the gate machine. The four turns of the rope around the travelling pulley, which travels 8 ft. 9 inches, causes a travel of 35 ft. to the end attached to the gate leaf, and opens or closes the leaf by a single stroke of the cross head.

In all there are six gate machines, one for each leaf of the upper lock gate, lower lock gate and auxiliary gate. A one storey wooden motor house covers each of the gate machines and its connecting motor. Four of those houses are L shaped, this additional portion being to enclose in the same building the valve machine and its motor.

With this machinery the time required to pass a vessel through the lock going up stream is, after the vessel has taken her place in the chamber, 50 seconds for closing the lower gates, plus 50 seconds for opening the valves, plus 9 minutes for filling the lock, plus 50 seconds for opening the upper gates, or 11½ minutes altogether. As the lock can be emptied in 7½ minutes a vessel can be locked down in 10 minutes.

It may be noted, that both the gate and valve machines are

governed by automatic switches, operated by what may be called cut-off, or adjustable tripping bolts, which push the switch handles over and thereby cut off the current, so that the cross heads will not go beyond the intended point.

The tripping bolts (which push the handles) are adjustable in a slot by a nut and washer on the back of the plate, so as to make them cut sooner or later, or to the point required. These tripping bolts are isolated by 3-16ths of an inch hard rubber sockets, and washers, so as to prevent the current from passing on to the metal of the machinery. Chords run from the switch handles to pulleys on the ceilings, and by these are conducted to the controllers, and the switches are closed by the motor-man pulling the chords without having to leave his position. By this arrangement the danger of damage to the machinery (from the cross head running ablock at the ends of the screws) will be prevented

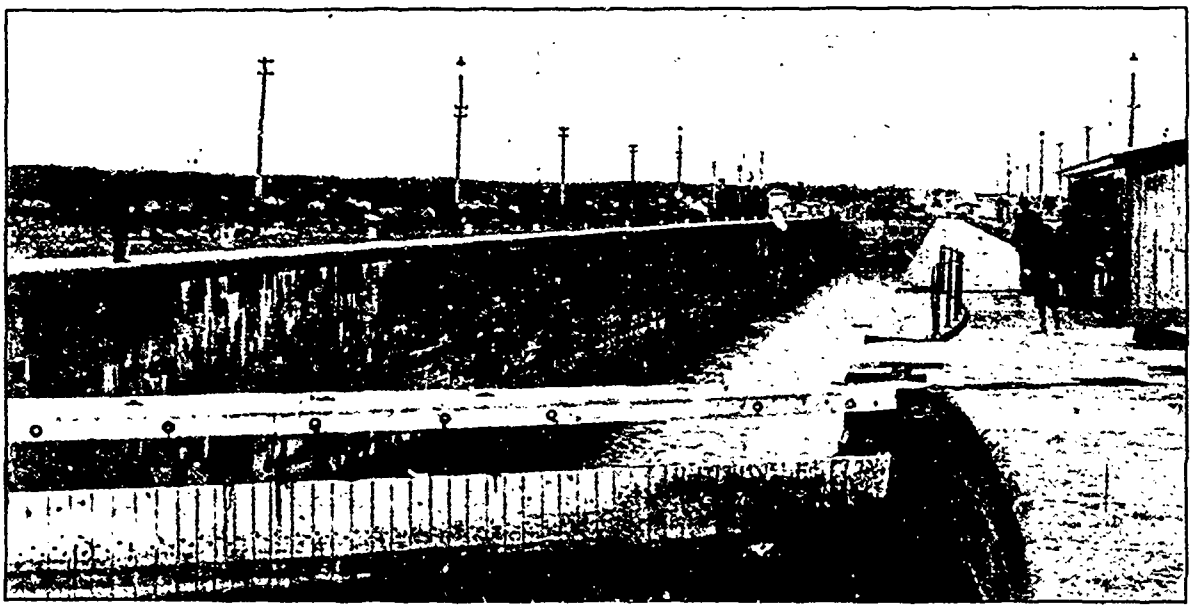
FIRST APPLICATION OF ELECTRICAL MACHINERY.

The machinery which has been described is, as far as we can learn, the first electrical power machinery ever used for operating the gates and valves of canal locks, and that it should for the first time be applied to a lock of this size and importance, indicates the confidence with which this form of power, which was hardly considered manageable a decade ago, is now regarded. For both the old 1881 lock and the new 1800 feet

One turbine will be used for running the generators, the other for running the arc light dynamo and general shop work, but when it is required to pump out the lock, the two wheels can be coupled and used to operate the centrifugal pumps. There are two of these pumps, and they have a combined capacity of 32,000 gallons per minute. The two pumps will lay the lock chamber dry in between 6 and 7 hours.

It should be noted also that near the upper end of the supply pipe there is a 6' 8" valve operated horizontally by two Tobin bronze screws, also two 5 ft. valves placed in the supply pipe (and operated vertically by screws of the above named bronze) immediately above the power house, permitting of either the whole of the pipes or of either or both turbines being laid dry when necessary

It should be further noted that there is a 13 inch turbine water wheel set horizontally at the rear of one of the large turbine cases. This wheel has its water supply from a T shaped pipe placed between and supplied from the 5 ft. supply pipes, and having a valve on each arm of the T, so that in the event of the large turbines having to be stopped, or in the event of one or either having to be laid dry, by the arrangement of these valves on the T's a supply of water can always be obtained for the small turbine wheel, which, by belt to and from a small counter-shaft on the second floor, drives the incandescent light dynamo,



THE LOCK FROM THE WESTERN END.

lock on the American side of the St. Mary's river, hydraulic machinery is used.

The reasons which led to the adoption of electric power on the Canadian lock are stated by Mr. J. B. Spence, Chief Draftsman Department of Railways and Canals, as follows.

As regards economy, I think the difference between electric and hydraulic power will be very trifling, and here the point of economy was not taken into consideration. One of the main objects of using electricity was to overcome the great trouble caused by frost when hydraulic machinery is used. During the closing weeks of navigation the cold is so great that oil has to be used in the hydraulic engines placed on the lock walls, and even then the cold causes the oil to thicken and makes the action of the engines slow and tedious. Of course, frost would not have interfered with hydraulic valve engines placed at the bottom of the lock, but in this case eight engines would have been required, while only four screw power machines are needed with the machinery as designed. These considerations seemed to make it advisable to use electric power throughout, and I have every reason to think that everything will operate successfully when we open for navigation.

Two 45 in 155 H P. turbines, equalling a combined power of 310 H. P., supply the power for operating the generators and pumps. These turbines are set horizontally and are supplied with water from the upper level by a 6 ft. 8 in diameter steel pipe, placed at the back of the lock wall, just before entering the power house, this supply pipe divides into two 5 ft. pipes - one for each turbine The discharge pipes from the turbines are also 5 ft. in diameter The turbines are placed on the first floor of the power house, and operate by belt a horizontal counter shaft on the second floor From this counter-shaft are operated the dynamos and generator on the second floor and the centrifugal pump shafts on the first floor.

so that a full supply of incandescent lights can be obtained throughout the buildings, pump well, etc., supposing that the large turbines are still.

The electrical plant for operating the gates and valves and for lighting the canal and approaches, was supplied by the Canadian General Electric Co., Ltd., of Toronto and Peterboro, under detailed specifications and designs drawn up by the government electrician, Mr. D. Bryce Scott.

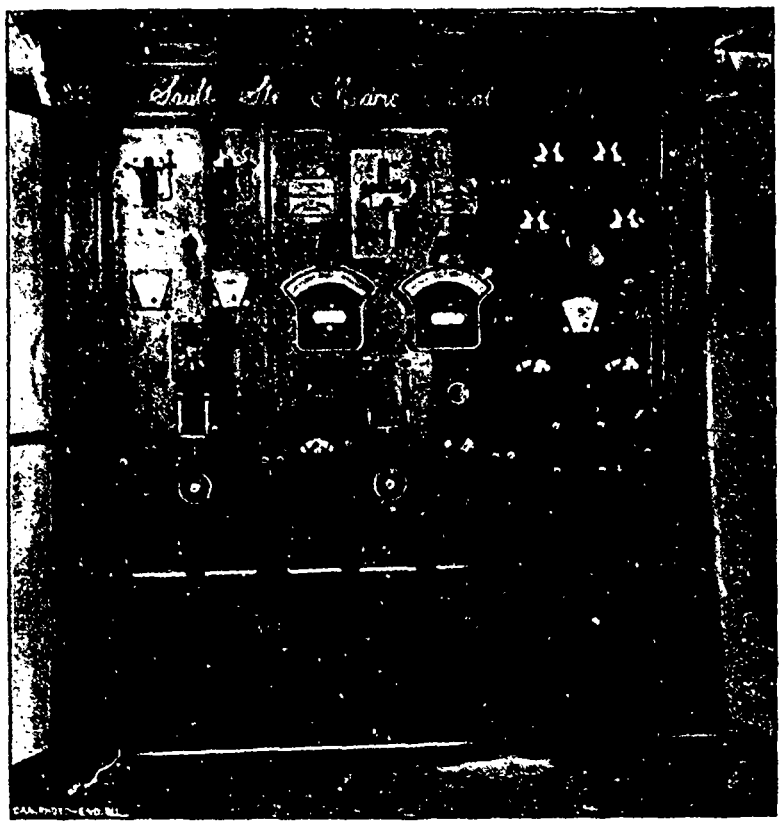
The current for power purposes is supplied by two 45 K.W. 500 volt Edison standard bi-polar dynamos, either of which is of sufficient capacity for operating under normal conditions.

The lighting plant consists of a No. 7 Wood arc dynamo, having a capacity of 40 2000 C. P. lamps, and a 3 K. W. Edison bi-polar incandescent machine for lighting power house and repair shops.

The switchboard (illustrated) is a beautiful piece of work, and is a great credit to the manufacturers. It consists of three polished black slate panels 7 ft. long by 5 ft. wide and 2" thick. These are supported by a heavy oak frame of ornamental design. The centre panel carries the instruments and controlling apparatus for the power generators, while on the right is the arc machine panel and on the left that for the incandescent machine.

The mechanical arrangement of the gate and valve mechanism has already been described, and it therefore only remains to give the electrical arrangement. The motors are of the Canadian General Electric Co.'s standard W. P. 50 railway type, and

are operated in pairs by means of series parallel controllers classified by the manufacturers as type "K," that is to say, the two motors situated opposite each other on the canal walls and operating one pair of gates, are electrically connected in exactly the same manner as the motors on a street car, the connections across the canal being made by heavily armoured submarine cables, each having 14 conductors and being about 2½" in diameter. The valve motors are also connected in pairs in exactly the same manner as described above.



SWITCHBOARD IN POWER HOUSE.

The lighting of the canal and approaches is accomplished by means of a row of arc lamps down each side of the canal, situated at about 300 feet apart. These lamps are double carbon of the standard "Wood" type and are supported by means of iron poles and hoods placed on the top of 40 ft. poles.

In connection with the electric plant a somewhat unprecedented and novel system of an electric regulator is now almost completed and ready to be placed. Recognizing the well-known fact that by using the ordinary electric regulator the generator has to be worked at its full capacity, therefore wearing out the machine unnecessarily, to avoid this Mr. Spence saw, that by giving the large water wheel sufficient work, equal to about three-fourths of its power when running the generator, the amount of current when taken off was but a fraction and almost imperceptible. Therefore he decided to try a system to meet these requirements, and as the end of the water wheel shaft projects over the large wheel in which two large centrifugal pumps are placed, he arranged by placing a mitre wheel on the projecting shaft supported by bridge, and driving a horizontal mitre wheel placed on an upright shaft which extends deep in the well and firmly secured in step. Then on this shaft is placed the propeller wheels of a size to meet the power required, one facing up and the other down, which it is expected will cause no undue strain either up or downwards, and by a tip coupling at the horizontal mitre wheel, and when the regulator is not required, such as when running the large centrifugal pumps, the horizontal mitre wheels can be uncoupled. By this arrangement it is considered that the object will be accomplished.

The contractors for the lock and canal (being section 2), also the lower entrance under water, including the crib work, which form the wharf piers (being section 1), were Hugh Ryan & Co., Toronto, Ont. Mr. M. J. Haney, one of the members of the firm, was the superintendent in charge of the work, and Mr. William Birmingham was the engineer for the above contractors. The contractors for the upper entrance submarine work (being section 3) were Messrs. Allan & Fleming, of Ottawa, Ont. The lock gates were built and placed by the noted gate builder, Roger Miller, Ingersoll, Ont. The contractors for the turbines were William Kennedy & Sons, Owen Sound, Ont. The contract for the gate and valve machines and all pulleys was executed according to departmental detail drawings by the Canadian Locomotive & Engine Co., of Kingston, Ont., and the contractors for the electric plant were the Canadian General Electric Company, of Toronto, Ont.

MR. JAMES BRUCE SPENCE.

For considerable of the data on which this article is based we have to thank Mr. J. B. Spence, Chief Draftsman of the Department of Railways and Canals for the Dominion. These particulars were also in part furnished to the Engineering News, of New York, though revised to date by Mr. Spence when given to the ELECTRICAL NEWS. We cheerfully credit our New York contemporary with the information that we have found it convenient to borrow from its pages.

Mr. Spence is a son of the land of the brown heather and shaggy wood, a native of Kingedward, Aberdeenshire, Scotland. Shortly before reaching manhood's years he came to Canada, choosing the city of Hamilton as his place of abode. After a brief period in that city, in April, 1861, he received an appointment on the civil engineering staff of the old Great Western Railway of Canada, serving under George Lowe Reid, then Chief Engineer of the railway. He remained on the staff of this railway for a consecutive period of sixteen years and left the service in 1876, to accept the position of assistant to the late John Page, then Chief Engineer of Public Works and Canals, for the Dominion. He served under him and his two successors for a period of nearly 19 years. During recent years he has held the post of designing engineer and chief of the draughting staff of railways and canals. It is thus seen that Mr. Spence's experience in Canada covers a period of over 34 years. As James Bruce Spence he is registered a member of the Canadian Society of Civil Engineers. To him is due much of the credit for the success that has attended the completion of the Sault Ste. Marie canal. We are pleased to furnish among our illustrations a portrait of Mr. Spence.

MR J. B. SPENCE.

A retired farmer of Cote des Neiges, was recently crushed to death under an electric car in Montreal.

NOTES ON THE RECONSTRUCTION OF A SMALL CENTRAL STATION PLANT.*

By Franklin L. Pope.

The financial condition of the smaller central station electric lighting plants throughout the country is at the present time by no means satisfactory, and in too many instances cannot even be truthfully said to be encouraging. A survey of the field shows that very few such plants located in towns having less than 10,000 inhabitants are earning more money than is necessary to meet their operating expenses and to provide for indispensable current repairs. In the State of Massachusetts, in which the operations of all electric lighting companies are by law made a matter of public record, it appears from the latest reports that the aggregate liabilities of the 57 companies operating in that State, including stocks, bonds, and floating indebtedness, amounted on June 30, 1894, in round numbers to $14,000,000, nearly all of which stands charged to construction account. The net earnings for the preceding year were $1,000,000, or about 7.1 per cent. on the total investment; a sum obviously quite insufficient to provide for depreciation and at the same time pay a fair dividend on the capital which has gone into the business. But if half a dozen of the larger plants, in cities like Boston, Lowell, Worcester, Springfield, Lynn and Fall River were excluded from the list, the showing for the smaller plants would be even far worse than it now appears.

Many of these small plants were started at an earlier day than could have been justified by any reasonable estimate of the business then in sight, and now find themselves hampered by inconvenient buildings, and with unsuitable machinery, bought at high prices, and encumbered with defective business methods which experience has shown to be wholly inconsistent with the dictates of good judgment.

With the owners of many of these plants, it has become a very serious question whether the easiest way out of the dilemma which confronts them may not be to relegate the entire plant to the junk shop and the scrap pile, and commence over again with new buildings, modern machinery and improved methods of administration. When the necessary capital is readily forthcoming, there can be no doubt that this would often be the wisest course of procedure, but for obvious reasons, it is one which is not always, nor even usually practicable. The alternative is to remodel the existing plant, bringing it as nearly as may be into accordance with the best modern practice, and utilizing so far as possible the old material; a course which at least has the merit of avoiding an undue expansion of the construction account, in most cases already sufficiently burdensome.

Having been called upon during the past year to advise the owners of a plant of the character above referred to, in reference to certain changes which had been suggested as desirable, and having afterward been employed in a professional capacity to design the work and superintend its execution, I have thought that some account of what we undertook to do and how we did it, might not be without interest to the members of the Institute.

The Great Barrington (Mass.) Electric Light Company was organized and commenced business in 1888. The population of the district intended to be served was about 3,000, and most of the expected consumers were located within 2,000 feet of the point decided upon for the station. This was built of wood, in the most inexpensive manner possible, and was placed alongside the railway for convenience in receiving coal, although at the same time the danger from fire was materially increased. The original outfit was an Edison 3-wire, equipped with a pair of 250-light 110-volt dynamos, and the company commenced business with 281 lights on contract of $10 per year each; wiring free. The centre of distribution was 1,800 feet from the station, necessitating over a ton of copper in the feeders alone. Generally speaking, the plant was well laid out, and well built as things went in those days. The two dynamos were belted to a single 80 H.P. Armington & Sims engine. The original cost of the plant was about $[illegible],000. The following year a Schuyler arc plant for street lighting was added, carrying 35 arcs, nominally of 1,500 c.p., which was run from the same engine and boiler. In 1890, the plant was considerably enlarged by the addition of a second arc machine, a Westinghouse 500-light alternator, and a second engine and boiler of the same capacity as the first. An 80-kw Westinghouse dynamo of more modern type was afterward substituted for the original one.

Upon examining the plant last year, I found the Edison machines carrying on Saturday evenings a maximum load of some 450 lights, while three evenings in the week (with the stores closed) it fell to perhaps half that amount. The two Schuyler machines, with an aggregate capacity of 55 to 60 lights, were carrying about 38 to 40, or an equivalent of that amount, while the Westinghouse machines were seldom as much as half-loaded, carrying a maximum of possibly 500 lights during three or four months of the summer season, and not much more than one fourth that amount the remainder of the year. Necessarily, with so many dynamos of different types, and with such a variable, yet small average output, the consumption of coal was excessive as compared with the light delivered and paid for.

The street lines, according to the usual practice, were of No. 6 B. & S. weather-proof wire; the poles were of cedar, of good size and fitted with pine or spruce cross-arms, with common green glass insulators set upon wooden pins. In consequence of a silly prejudice, which had been fomented among the citizens by interested parties against permitting poles to be set in the streets, the wires, in a very great number of instances, had been attached, by cross-arms or brackets, to the trunks of the immense elm trees with which the streets of the town were shaded; a practice which occasioned an enormous loss of current every wet night, as well as much irregularity in the performance of the lights. The effect on the trees was by no means salutary, while the appearance was as much worse than that of poles in the streets as could possibly be imagined.

The village of Great Barrington extends for the most part along a single broad thoroughfare for a distance of nearly three miles, and the street lighting circuits are consequently very straggling. The 1,500 cp lamps, which were suspended at intervals of 800 to 1,000 feet, were actually of very little service in illuminating the densely shaded streets.

After a careful consideration of the situation, keeping in view the greatest possible reduction of present and future operating expenses, it was determined the wisest course to pursue would be to consolidate the whole service so that it could be supplied by one dynamo, in place of five underloaded ones. In pursuance of this plan it was decided to adopt the two-phase alternating system, at a maximum pressure of 2,100 volts in the primaries, and 105 volts in the secondaries, with a frequency sufficiently low to permit the advantageous use of induction motors if required. It was furthermore decided to abandon the steam plant, and to make arrangements to utilize some one of the excellent water-powers which were available within practicable distances. Under ordinary circumstances, I should have hesitated to recommend the substitution of water-power for steam as the sole source of power for the operation of an electric-lighting plant. Water power is an invaluable auxiliary, and when conveniently available for use in conjunction with steam, may often be made to save a very large coal bill in the course of a year. On the other hand, the excessive fluctations to which it is subject—which are scarcely realized by those but casually acquainted with the subject—render it in most cases a very uncertain reliance for a business which is compelled to go on, perforce, every night in the year, and which cannot suspend operations, as an ordinary manufactory does, if worst comes to worst, for a week or two at a time. Even a water privilege which, during ten months of the year, furnishes twice as much power as is needed, and even more, may be expected to fall off, during one of the extraordinarily dry seasons which occur at intervals of from five to ten years, to one-third its usual amount. In such a case, an electric plant solely dependent upon water-power would find itself in a most undesirable predicament.

In the present instance, the choice of a water privilege finally reduced itself to two sites, one in the town itself, within half a mile of the centre of consumption, and the other at Glendale village, seven miles distant, both situated on the Housatonic river. The privilege first mentioned being already occupied by a woolen factory, only the surplus water was available, but this was known to be quite sufficient for the requirements of the electric company at least nine months in each year, leaving three months to be run by steam. It had the advantage of being close at hand, and was capable of being fitted up at a moderate cost. As to the Glendale privilege, it was necessary to be very sure

* A paper, slightly condensed, presented at the Twelfth General Meeting of the American Institute of Electrical Engineers, Niagara [illegible]ls, N. Y., June 2[illegible], 1895.

that the lowest water of a dry summer would give all the power required to run the plant without the aid of steam. Having invariably found the value of a water-power to be greatly exaggerated, not only in popular estimation, but in the opinion of its owners, the matter was investigated with much care.

While negotiations were still pending with the owners of the Glendale privilege and also the one in the village already referred to, overtures were received from a manufacturing company owning a third exceptionally desirable privilege, on the same stream, at an intermediate point considerably nearer than Glendale. This company had only recently completed a new dam, headgates, race-ways, etc., at a very considerable expense, and was willing to lease the complete establishment, including a new McCormick turbine of 325 H.P. and a two-phase Stanley generator of corresponding capacity, at a monthly rental based upon the actual output as measured in kilowatt hours at the dynamo terminals, provided that a certain minimum monthly consumption was guaranteed. With the same volume of water as at Glendale, the fall at this point was 20 feet, assuring at least 417 H.P. at lowest water, during lighting hours. All the hydraulic apparatus and appointments were of the best possible construction, and well calculated to insure absolute permanency of operation.

The minimum rental exacted was somewhat less than the amount of the coal bill of the Great Barrington company for the preceding fiscal year, but while the immediate saving in operating expenses was not large, the acceptance of the proposition would place the company in a position to reduce its rates to consumers, for the reason that its output might be very largely increased without materially augmenting its operating expenses. A lease for a term of years was accordingly closed.

In laying out the plant it was determined to bring the main feeders directly to a distributing station in the village, to be used principally as a convenient headquarters for testing the circuits and controlling the street-lighting service. In laying out the transmission line, a surveyor was employed, and a preliminary line was run directly from the power house to the distributing station. The air line distance was found to be 5.15 miles. With the assistance of the surveyor, the actual line was then staked out, going directly across country, and keeping as near as circumstances permitted to the transit line. About half the distance, the transit line was found to so nearly coincide with existing highways, that the consent of the local authorities was obtained to set the poles along the highway location; the remainder of the route lay principally through uncultivated land of little value, so that a comparatively small expenditure was sufficient to secure a release from all claims for land damages. This enabled the line to be located with long stretches absolutely straight, avoiding all sharp angles; a very important consideration when heavy wires are used. The poles were of selected chesnut with natural butts, usually set five feet in the ground at maximum intervals of 125 feet. The poles were ordinarily 25 feet long and eight inches thick at the small end. Shorter poles were sometimes used on elevations and longer ones in depressions, in order to equalize the strain as much as possible. The insulators used were of the large double-bell white porcelain type (German government standard), and were imported by us from Hagen. The insulator of the top wire is set upon a malleable iron stem 14 inches long, screwed into the top of the pole, which is tapered to five inches in diameter and protected from splitting by driving on a wrought-iron ring. The tapered part of the pole, as well as the top, was given a coating of mineral paint mixed as thick as it could be spread with a brush. The insulator of the second wire is carried on a malleable iron goose-neck, screwed in a five-eighths inch hole bored in the side of the pole, in such position as to bring the wires about 16 inches apart. Another hole was bored on the opposite side of the pole, intended to take the goose-neck of the third wire at some future time, leaving the same interval between the second and third wires. The porcelain insulators are fixed to their iron supports by a packing of oakum placed between the screw threads, which serves to prevent any danger of fracture by expansion or contraction. The line wire is laid in a groove formed in the top of the insulator, except upon the curves and angles, in which case it is tied at the side in a circumferential groove, as is usual in this country. The German method of tying is quite complex, and unnecessarily strong; in case of undue strain if anything gives way it had best be the tie wire. We therefore devised a simple tie which was easily and quickly applied, and which has so far served an admirable purpose. We were obliged to string the wires during very cold weather; sometimes as cold as eight or ten degrees below zero, and hence it was necessary to strain them very tight. A block and fall and a well-trained horse were used in pulling up, usually six or seven spans of one wire at a time. The hook of the block was always attached to the copper wire, whether bare or insulated, with a chain-knot made of three-quarter inch rope. The feeder wires were of No. 3 B & S soft copper, covered with weather-proof "insulation" along the highway (as a concession to enlightened public opinion), but elsewhere bare. The lengths of wire were joined with McIntyre twisted couplings; the unusual strain we had to put upon them occasionally pulled one apart, and this led us, out of abundant caution, to solder them, although this was done for mechanical rather than for electrical reasons. Only two feeder wires have as yet been strung, providing for a single-phase current from one side of the two-phase generator, but it is the intention to run a third feeder at an early day, which will enable two-phase induction motors to be connected to the same distributing system.

A pair of telephone wires of No. 12 steel were strung below the feeder wires, and these were supported upon small German porcelain insulators on iron goose-necks on opposite sides of the poles. These wires were transposed at intervals of about a mile, in order to eliminate the inductive effects of the alternating current in the feeders. The feeder lines were carried under the railway at an undergrade crossing by placing the insulators upon iron brackets leaded into the stone abutments. The plan of construction above described makes a strong, handsome and durable line, while the insulation of the circuit, even in the worst of weather, is simply faultless.

The system has been planned to deliver the current at the distributing station at a uniform pressure of 2,100 volts. Two distributing centres were fixed upon in the old Edison three-wire network, and at each of these points a pair of large transformers, having a ratio of 20 : 1 were fixed upon a pole, with their respective primaries in series between a pair of branch feeders from the distributing system, and their secondaries were coupled in series in like manner, with the neutral wire between them. None of the consumers on the old Edison system knew when the change had been made to the new service from anything they were able to notice in the behavior of the lights.

The next thing done was to reconstruct the street-lighting system. In place of the 36 arcs of 1,500 nominal c. p. formerly in use we substituted 126 incandescent lamps of 50 volts and 32 c. p. placed in Iona fixtures projecting horizontally from the poles 14 feet above the ground. The lights, as a rule, were fixed upon every alternate pole, but in the business centre, the street being broad, they were placed on each side at intervals of about 250 feet, and staggered, so as not to come opposite each other. A Shallenberger shunt cut out was applied to each lamp. The usual number of lamps in each circuit was 42, although we have since placed, in some cases, as many as 47 in one series without reducing the brilliancy of illumination sufficiently to be noticeable by any one but an expert. One end of each street-lighting circuit is joined to a special feeder leading to the sub-station, where it is connected with the main feeder through a knife-switch. The other end of each lamp-circuit is connected to any conveniently located branch feeder of the regular commercial lighting service. Each lamp-circuit has, or will have, a fuse-block and cut-out inclosed in a weather-proof box at each end, where it joins the opposite feeders. These 32 c.p. lamps, when run at full candle power, furnish a most satisfactory illumination, and give the streets a very attractive appearance. So far as possible, each lamp was located with the aid of a transit and level, so as to get them in absolutely straight lines both vertically and horizontally, a precaution which adds materially to the decorative effect. It is admitted by all that the streets of the town are much more satisfactorily lighted by the incandescents than they formerly were by the arc lamps, while the actual cost to the company is considerably less. The new lamps were cut in, one at a time, on the old arc wires, jumpers being temporarily placed across the terminals until everything was in readiness to discontinue the use of the arc-light machines.

One of the most marked advantages of the series street-lighting system, especially when shunt cut-outs are used, is its great

flexibility and convenience. For example, instead of placing from 40 to 45 fifty-volt lamps in one series, we may use 20 to 23 one hundred-volt lamps, or if an odd number be required, less than is necessary to make up a circuit, the deficit may be supplied by adding extra shunt-boxes in series at any convenient point in the circuit, until the pressure has been reduced to the required point. From time to time, as new lights are added, these spare shunt-boxes are one after another brought into use in connection with them. Sometimes, also, we temporarily install extra street lights by connecting them in parallel to the secondary mains of the regular commercial service, ultimately transferring them to new series circuits.

It has been found to be desirable to use a lamp of rather low efficiency for the street-lighting service, as there is always danger of leakage and short circuits from wet boughs of trees and other objects getting into contact with the wires, and thus diverting an abnormal current through some portion of a lamp circuit. In such case, a lamp of high efficiency is pretty certain to be burned out, or at least to have its career of usefulness materially abridged. In this plant, the average consumption of energy in the street-lights, including lamps, lines, shunts and leakage, is found to be about 140 watts per lamp of 32 c.p.

Perhaps the most ticklish part of the whole undertaking was the changing over of the Westinghouse system, which was a 1,050-volt primary and a 52-volt secondary, running at 16,500 alternations. In accordance with the new plan, it was of course necessary to double the pressure both in the primary and secondary circuits, and to substitute 104-volt for 52-volt lamps throughout. A preliminary test of one of the transformers demonstrated, that which perhaps might have been foreseen from theoretical considerations, viz., that a dangerous quantity of heat was developed within a few hours when it was used to convert from 2,000 volts down to 100. In order to utilize, as far as possible, the old transformers, and at the same time avoid the above difficulty, various expedients were resorted to. Wherever a group of consumers was located in one neighborhood, a pair of large transformers were installed, with secondary mains extending from 500 to 600 feet in various directions, these transformers being of course placed in series with each other. Scattering consumers as far as practicable were united in pairs or small groups, and supplied by a pair of small transformers coupled in the same way. The Westinghouse meters, having been originally constructed for a frequency of 16,500 alternations, ran slow when the frequency was reduced to 8,000. The necessary coefficient for correction of the readings was easily ascertained by experiment, and as fast as possible the meters were fitted with new discs, supplied, by the Westinghouse Company at a trifling expense, adapted to the lesser frequency.

Of course it will be understood that the reason for resorting to these various shifts and expedients, was merely that we might utilize the old apparatus as far as it could possibly be done, and also that we might carry on the work of reconstruction, for the most part, with the ordinary force of the establishment.

The selection of the best among the many available types of turbines for electric work is a matter which merits far more consideration from a scientific standpoint than it generally receives. Water-wheels, like dynamos and motors, are sometimes sold on commission by agents, and it not infrequently happens that the salesman who makes the largest "claims," especially if he sells his goods the cheapest, carries away the contract. It needs to be said, however, that there is a far greater difference than is often suspected, in the work that different types of wheels will do with a given, and especially a limited amount of water. There are, furthermore, a great many types of wheels in the market, which although as efficient as could be asked for with a full head of water, are very far from being so when the volume of water is reduced, even by a comparatively small percentage. It is but just to say that it is seldom that a turbine makes so favorable a showing, not only in this but in other respects, as the one provided by the company from which we lease our power.

The results of tests made in the testing flume of the Holyoke Water Power Company are worthy of particular note, for the reason that they show a very high percentage of efficiency maintained through a wide range of variation in the quantity of water passing through the wheel; a most valuable characteristic for electric work. When the quantity of water used was diminished from 81.75 to 42.55 cubic feet per second, the percentage of efficiency fell only from 80.99 to 63.9, and what is even more remarkable, it was found that the efficiency remained well above 80 per cent. over a range of variation of discharge from 83.22 to 70 cubic feet per second, or 15.9 per cent. More than one type of turbine which enjoys a high reputation and extensive sale among power-users, will not reach 65 or even 60 per cent. efficiency at "three-quarters gate," while the 33-inch wheel above referred to has been found to give by actual test no less than 78 per cent. under similar conditions.

The turbine carries upon its shaft a driving-pulley 100 inches in diameter, weighing 1,000 pounds, which serves as a balance-wheel. It is also provided with a Replogle electric governor, operated by three cells of gravity battery, which has never failed to do its work quickly and certainly, even under trying conditions.

In carrying out this work, some things have been learned by experience which may be of use to others called upon to advise or to undertake the construction of similar works, and I will therefore venture to summarize some of my conclusions as follows:

1. In considering the advisability of operating an electric plant by water-power, do not on any account neglect to ascertain from authentic sources of information, just how much water can be depended upon during the low stage in an extra dry year, for this is the measure of its value for electric work, except when used as an auxiliary to steam. The ordinary estimates of the commercial value of a water-power are only too apt to prove preposterous exaggerations.

2. If rights-of-way or releases of damages can be obtained without too much trouble and expense, it is better to build the feeder line as directly across country as may be, than to follow a highway. The saving in cost of construction will usually be more than enough to pay for the right-of-way, and on such a route there need be no interference from trees, while many inconvenient angles and much trouble in guying and bracing are avoided. Shorter and stouter poles may also be used; in itself a very important consideration.

3. In electric line construction it is preferable to dispense with cross-arms unless there are more than six wires. The best arrangement is to place one wire on a top-pin and the others alternately on the front and back of the pole, at a vertical distance apart of 12 inches. This construction not only costs less than properly braced cross-arms, but is much less conspicuous and therefore much less objectionable in a public street, is less interfered with by trees, and is far more durable. Much trouble is caused by the decay of cross-arms after they have been exposed a few years to the weather; they split at the ends so that the pin comes out, and not infrequently break in two in the middle, thus fouling the wires.

4. In medium-sized towns and cities, especially in shaded streets, the incandescent lamp may be made to give a better distribution of light for the same money than is possible with the "half-arc" so extensively used, and is much less troublesome to maintain in good working order. My own experience leads me to think that the lamps ought not to be of less than 24 or more than 32 candle-power. Use lamps of low rather than high efficiency, but run them at full candle-power, or even a trifle above. Good street lights, well arranged, and renewed sufficiently often, are the best possible advertisement for any electric company.

5. Use large transformers as far as practicable, placing the consumers within 500 or 600 feet radius upon secondary mains. We have used both two-wire and three-wire mains. The latter plan is certainly to be recommended when the distance approximates or exceeds 500 feet, but for short distances, as for example when distributing within a single block at a pressure of 100 volts or more, it is a question whether the gain in cost of copper over the two-wire plan is of sufficient importance to offset the additional complexity.

6. It was found that raising the voltage in the residence district from 1,000 . 50 to 2,000 : 100 greatly improved the uniformity of distribution, by lessening the potential drop without entailing any corresponding disadvantages. It would seem to be preferable, on every account, to use the higher pressure.

7. One of the most important minor points in the management of a plant is apt to be too much neglected; the maintenance of the insulation of the wires by promptly replacing all cracked

and broken insulators, and by keeping the wires absolutely free from contact with uninsulated objects. The covered wires which lead into the hoods of the street-lamps need to be carefully looked after.

8. Number all the poles with yellow paint applied with a stencil on a black ground; and keep a record book of the position of each one and its distance by the line from the test-station.

9. In selecting a turbine-wheel, consult competent authorities as to the available fall and minimum quantity of water, and when making the purchase do not expect to get a $1,000 wheel for $100. Pay a fair price and insist, not only that the wheel shall be well made in every way, but that it shall be tested by an expert before acceptance. If it does not give an average efficiency of 76 per cent. between half-gate and full-gate, it is not advisable to accept it, inasmuch as you can easily do better, as our own experience proves.

10. I think our experience shows that it is possible to largely increase the net earnings of an old plant without necessarily renewing it throughout, but plenty of time should be taken for considering as well as for execution, in order to secure satisfactory results with a moderate expenditure.

SCIENTIFICALLY CUT LAMP GLOBES.

AN invention that undoubtedly will be developed into great utility, and that among many other applications, would seem to hasten the adoption of small arc lamps for interior or even desk use, is described in the London Journal in an article on "Holophane Globes," which is the name applied to glass globes that are cut on scientific principles for the proper dissemination of light. It is stated that holophane globes, when enclosing any light of high candle power, such as the Welsbach incandescent gas, or the electric lamp, give the appearance of a vase filled with light, brilliant, yet soft while the actual burner or filament cannot be discerned.

The principle of the holophane globe is readily explained. The interior surface of the globe is formed into vertical grooves, which are so shaped as to spread out horizontally the rays proceeding from every part of the light source. The mouldings on the outer surface of the globe are horizontal, and have the effect of distributing the emergent rays in the vertical sense; and inasmuch as the light may be required in some instances to be cast downward and in others to be equally dispersed, the angles of the outside grooves are modified accordingly. This is a very different thing from the uncientific cutting seen in ornamental cut glass globes which do nothing for the diffusion of the light.

As for the loss entailed by the reflection and refraction of Holophane globes, it is certified by M. de Nashville to amount in the case of an arc light to from nine to thirteen per cent., and as this observer remarks, there is no other kind of globe in existence capable of realizing such diffusion of light and presenting such uniformity of effect. As the loss of light by transmission through clear glass is from eight to ten per cent., the claim that holophone globes do their special work for about four per cent. of loss, is well established.

THE ONLY TEST OF MERIT.

THAT the people are quick to appreciate a good thing when they see it, is abundantly shown by the phenomenal record of the Toronto Industrial Exhibition. The Fair which begins on the 2nd of September next, is the seventeenth of the series. It has grown steadily in popularity and yearly attracts increasing numbers which is the best possible proof of its superior excellence. This season the display will be more complete and varied than ever. The number of enteries is unusually large in all departments. Already every foot of space in the building is taken up, though additions and re-arrangements have been made to accommodate the increased number of exhibitors. Great improvements have been made in the accommodations provided, and all arrangements for public convenience are as nearly perfect as possible. An attractive and diversified programme of entertainments is offered. All railways will give low rates and special excursions will be run from many points, presenting an opportunity of which all should avail themselves.

The Brantford Electric Street Railway Co. is inclined to charity. Its gross receipts on August 6th will be given to the public hospital.

PERSONAL.

Mr F. J. Proutt, Superintendent of the Malden Electric Co., of Boston, and formerly of Bowmanville, Ont., was recently married to Miss Laura J. Yarnold, of Whitby.

We are pleased to notice that Mr. D. H. Keely, of Ottawa, has recently received the appointment of General Superintendent of the Government Telegraph Service of Canada. Mr. Keely was for some years assistant to the late F. N. Gisborne, who was for many years at the head of the Government Telegraph Service of this country. In this capacity Mr. Keely had the most favorable opportunity of becoming acquainted with the requirements of the service, and the means of meeting those requirements in the most satisfactory manner. Since the death of Mr. Gisborne, Mr. Keely has been discharging the duties of General Superintendent in a manner so satisfactory to the public and the Government, as to warrant his permanent appointment, and we have no doubt that he will justify the wisdom of the Government's choice.

TRADE NOTES.

Rhodes, Curry & Co., Amherst, N. S., have received a contract from the Halifax Electric Railway for fourteen street cars and a $20,000 car house.

The Bell Telephone Company have contracted with the Babcock & Wilcox Company for two of their latest wrought steel type of boilers for their new building now being erected at the corner of Notre Dame and St. John streets, Montreal. While it is not intended to instal the electric light plant at present, the boilers will be abundantly large to furnish steam for the electric light engine whenever wanted, and they will also be built to carry 200 lbs working pressure if desired. The Babcock & Wilcox Company report that their business is very good indeed, their shops at Belleville being well filled with orders for boilers to be delivered during the summer and fall.

The Gooderham & Worts Company, Limited, are just now installing at their new distillery at Toronto, a complete independent water works pumping plant, for the purpose of giving them additional fire protection. This new plant is not intended to furnish all needed fire protection, but rather to supplement the resources of the regular City Water Works. Gooderham & Worts' plant, however, will be very complete and perfect, and the equipment will be first class in every particular. Two large compound condensing pumps of 1,500,000 gallons capacity each will be used. These pumps to receive their steam from two Babcock & Wilcox wrought steel boilers. The boilers will be of the well-known Babcock & Wilcox Co.'s latest improved type, all pressure parts being constructed of wrought steel; boilers when completed to be capable of carrying a working pressure of 200 lbs. per square inch. As many of our readers already know, the Babcock & Wilcox Company are now building their boilers in Canada, having equipped large shops at Belleville, Ont., with special tools, patterns, etc., so that they are now prepared to turn out large orders promptly. The Gooderham & Worts Company are locating their new pumping plant in a handsome new brick building with brick stack, entirely independent from their other works, and the arrangement of the boilers and pumps will be such that the apparatus will always be in readiness for use at a moment's notice.

SPARKS.

The gross earnings of the tramway companies of Montreal and Toronto average about $4,000 a day.

Charlottetown, N. B., has received a number of tenders for electric light supply, but the contract has not yet been awarded.

The Hubbell Primary Battery Co. have commenced manufacturing their batteries. They are already introduced in the C. P. R. and C. A. R.

The Ottawa Carbon and Porcelain works have commenced grinding coke and carbon. It is expected these works will soon give employment to 100 men.

Dr. Corbett, of Port Hope, proposes to put in a three phase system and new apparatus in his electric light plant. He also proposes supplying power to some local manufacturers.

The town of St. Marys, Ont., having declared incandescent lighting both expensive and inefficient, the Council has decided to advertise for tenders for thirty-two arc lights of 1,000 candle power each.

The Co-operative Telephone Co. of the counties of Lake St. John and Chicoutimi Que., with a capital stock of $10,000, with headquarters at Herbertsville, has been formed to build and operate a telephone line

The last annual report of the Ottawa Electric Co. shows 2,192 meter customers, 677 ordinary commercial and 138 monthly accounts, making a total of 3,007 different customers being at the present time supplied with electric light.

Halifax, N. S., is probably the last city of importance to adopt an electric street railway, but it is at last an assured fact. The company has purchased from the Johnston Steel Co., of Louraine, Ohio, 1,000 tons of rail. The same company has also a contract to furnish the special work necessary for the curves, sidetracks, turnouts, etc., the aggregate cost of which is $30,000.

The Canadian Electric Forging and Smelting Co., of Toronto, seeks incorporation for the purpose of smelting, heating, cooking, and the manufacture of chemicals, by products, gases and electricity, the manufacture and sale of machinery and construction of necessary plants for all electrical circuits, etc. The capital stock of the company is to be $500,000, divided into 5,000 shares of $100 each. The principal stock holders are from the States of Massachusetts and New York and the Province of Ontario.

ELECTRIC RAILWAY DEPARTMENT.

AMERICAN STREET RAILWAY ASSOCIATION CONVENTION.

THE executive committee of the American Street Railway Association has made an arrangement with M. Davjs, customs broker of Montreal, for a reduction in custom house charges as follows on exhibits for the Montreal Convention: Warehouse and bond entry $1; export bond entry, $1; making and procuring consular certificates, $1. When goods to be returned are valued at $50 or more a consular certificate which costs $2.50 must be procured, but this is unnecessary in the case of goods which are valued at less than $50. The fees therefore to be paid for goods under the value of $50 would be $2; and $3.50 would be added to that when a consular certificate is required.

Shippers should mark goods with their own name, and "Care of M. Davis, Montreal, for exhibition purposes," prepaying the freight, and sending invoices marked "certified correct," and signed. On arrival, Mr. Davis will make warehouse bond entry, and have goods delivered at the Victoria Rink.

When the exhibition is over, the owners of the goods will have to repack them, using preferably the same cases that the goods came in, and they will be returned under the export bond. They must be careful not to make more packages of the goods in sending them out than they had in bringing them in, and it is a distinct advantage to have them in the same cases, so that the marks on these cases may be identified. Consignors must pay all freight and cartage.

The following regulations have been adopted:

Space will be allotted on Aug. 1 to all exhibitors whose applications have been filed with the secretary and accepted on or before that date. Applications for space received and accepted after Aug. 1 will be allotted remaining space, if any, in the order of their acceptance.

The space will be charged for at the rate of 15 cents a square foot, and no space less than 50 square feet will be rented, nor more than 1,000 square feet unless by special arrangement with the secretary.

Space allotted cannot be transferred without permission and must be taken possession of on or before Oct. 9.

Articles placed on exhibition cannot be removed without the written permission of the secretary.

All goods shipped to the exhibition should be plainly marked "Street Railway Exposition, Montreal, Canada." It is advisable to secure a time-limit delivery. Be sure to allow plenty of time for transportation.

On and after Oct. 8 exhibitors and their agents and workmen will be admitted to the building for the purpose of preparing necessary structures. The general reception of articles for exhibition will commence on Oct. 9.

Exhibitors of machinery in operation must have everything in running order, in readiness to start their machinery on the morning of the opening day.

All goods intended for exhibition must be on the premises and properly displayed on or before Monday evening, Oct. 14.

Exhibitors must provide all counter shafts, pulleys, belting, switches, switchboards, etc., necessary for the operation of their machinery.

No platform or other structure must be nailed to the floor or walls.

Exhibitors must not place any sign or circulate advertisements, except such as pertain to their own business (and those only in their own space), without written permission from the secretary.

Electric power will be furnished to those who use power. The charge therefore during the entire time of the exposition will be 45 cents per rated kilowatt of machine actually using current. The minimum charge for power will be $15.

All machinery will, if possible, be exhibited in motion, and should be kept in motion at regular work during the hours 9 to 12 a. m., 2 to 6, and 7 to closing p. m.

Parties desiring to sell and deliver in the building any article whatever, must first obtain a written permit from the secretary for such consideration as may be determined upon.

Any permit to sell may be revoked at any time, at the pleasure of the association.

Every possible precaution will be taken to guard against fire, and a full corps of watchmen will be on duty day and night; but the association will not be responsible for loss or damage to articles on exhibition, by theft, fire or otherwise.

The association reserves the right to charge an admission fee to the citizens of Montreal should it so determine, but the admission of exhibitors and their agents will be free.

THE WESTINGHOUSE CONDUIT RAILWAY SYSTEM.

THERE is now on exhibition at the New York offices of the Westinghouse Electric and Manufacturing Company, says the Electrical Review, a model of an underground electric railway system which is attracting considerable interest. It embodies the inventions of Mr. Malone Wheless and Mr. Geo. Westinghouse, jr. The patents taken out by Mr. Wheless were controlled by the Electro-Magnetic Traction Company, of West Virginia, but have recently been acquired by the Westinghouse company. Mr. Wheless' system has been practically tested in Washington, D. C., where a line three-quarters of a mile long was laid last fall on North Capitol street and successfull operated all of last winter. Another line is in operation at the new plant of the Westinghouse company in East Pittsburgh, and it was this line that Manhattan Railway officials recently inspected with a view to its possible adoption on the elevated railways of New York city. The system was originally designed for street surface traffic, but a few modifications will permit its adoption on elevated roads.

The principle of operation is very simple and the construction of the road involves a minimum amount of digging, as it is placed near the surface. The feeding conductors are laid underground at the side of a single track or between double tracks. The feeders are connected at suitable intervals with automatic switches. At corresponding intervals, in the centre of each track, are triple-point contact plates. Under each car are three collector bars which make a sliding contact with the triple-point plates. As the car passes over these plates a storage battery carried on the car automatically operates the switches, and thus the current is thrown from the feeders through the switch to the contact points and on through the collector bars to the car motor. When the car has passed a contact plate the switch automatically breaks the connection with the feeder and the plate remains dead until the passage of the next car. The collector bars are sufficiently long to prevent sparking. It is said that the system is so arranged that overhead trolley lines can be used in suburban districts and the same car run on this underground method in city streets.

Should the Manhattan Railway Company decide to use the Westinghouse conduit system, the triple contact plates will be replaced by a succession of metal bars separated by distances varying from 10 to 20 feet.

SPARKS.

During the month of June the Galt and Preston electric railway carried 13,000 passengers.

The largest telegraph office in the world is the general post office building, London. There are upwards of 3,000 operators, 1,000 of whom are women. The batteries are supplied by 30,000 cells.

Mr. C. J. Morris, of Montreal, has entered an action against the street railway company of that city for $2,500 damages on account of the death of his child, which was killed by one of the cars which was being backed into the shed.

The Privy Council has granted the Toronto Street Railway special leave to appeal from the decision of the Supreme Court of Canada dismissing the appellant's action to recover the amount paid for custom dues levied on steel rails.

The route is now definitely decided for the Halifax, N. S., electric tramway. The main line of four and ahalf miles, and branches of four miles additional, will be in running order by November 1st. The road, building and rolling stock will cost in the neighborhood of $340,000.

Mr. S. R. Break, superintendent of the Detroit street railway lines, is a resident of London, Ont. He has resigned his position, to which a salary of $2,500 was attached, owing to religious scruples, the duties of his office having made it necessary to transact a certain amount of business on Sunday, to which he objected.

The heavy blasting on the side of the stone cliffs for the Gorge electric railway at Niagara Falls has been causing havoc in the neighborhood. A recent blast was sent off which tore out several thousand tons of rock, sending it up in the air some 300 feet over on the Canadian side about a quarter of a mile from where the blasting took place. Hundreds of pieces of rock, weighing from ten to thirty-five pounds, dropped like grape shot from their great height on the laurus and roofs of residences on the street facing the river bank. The Niagara Falls Park and River railway have closed their incline railway and promenade, being afraid of accidents to tourists.

The new electric light building at Dunnville, Ont., is nearly completed.

The telephone line between Moncton, N. B., and Hopewell Cape has been completed.

SITUATION WANTED

ADVERTISER HAS HAD SIX YEARS' EXperience in management of rail and tramway traffic (passenger and commodity) and would take charge of this department, or sole charge of new or other electric line; energetic and capable; age 32; understands how to work up business; best of references both as to ability and character. Address Box 24, ELECTRICAL NEWS.

Please mention the CANADIAN ELECTRICAL NEWS when corresponding with advertisers . . .

SPARKS.

Cornwall expects to have an electric railway shortly

A radial electric railway between Sarnia and Florence to run through Petrolia Ont., is being discussed.

The Nanaimo Electric Light Power & Heating Co. have purchased the Nanaimo Electric Light Works The price paid is said to be $55,000.

The extension of the electric railway between West Toronto Junction and the village of Weston is practically a settled fact It is understood that the Canadian Electric Co. will carry out the work

The Niagara Falls and Lewiston N Y Electric Railway, running along the river bed was formally opened July 19th. On the initial trip one of the cars jumped the track and several persons were injured

Hintonburgh council has decided to give the Ottawa electric railway the right of way over the Richmond road through the village for twenty years provided the company pay $200 per year for five years and macadamize the road

At the annual meeting of the Kingston Street Railway Co., recently held, it was decided to increase the capital stock by issuing stock and bonds to the extent of $100,000, to be expended in extending the system to Cataraqui and other points.

The contract between the City of Quebec and Mr H. J Beemer, representing the Quebec Montmorency and Charlevoix railway, for the construction of the city electric railway, has been signed Work will be proceeded with at once

The total passenger receipts of the Ottawa Electric Railway Co., for the year ending May 31st 1895 were $183 394 68 and from mails, rents and other sources $10 596 68, making a gross revenue of $193,991 36 The total expenses were $122 335 09.

One of the latest undertakings in electrical science is the construction of an electric line for the transportation of passengers, mail and express from Chicago to Buffalo and New York The run to Buffalo is to be made in four hours and to New York in from eight to ten hours.

At the 26th annual general meeting of the Dominion Telegraph Co., held in Toronto on July 17th, the directors submitted a very favorable report of the year's business The following gentlemen were elected directors for the ensuing year Thos Swinyard Sir Frank Smith, K. C M. G., Gen Thos. T Eskert, Chas A Imker A G Ramsay, Henry Pellatt, Hector Mackenzie Thos I Clark and Thos R Wood. At a subsequent meeting of the newly elected Board, Mr Thos. Swinyard was re-appointed president, Sir Frank Smith, vice-president, and Wm Fred. Roper secretary and treasurer.