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CANADIAN
ELECTRICAL NEWS
AND
STEAM ENGINEERING JOURNAL

OLD SERIES, VOL. XV.—No. 6.
NEW SERIES, VOL. V.—No. 10.

OCTOBER, 1895

PRICE 10 CENTS
$1.00 PER YEAR.

CANADIAN

ELECTRICAL NEWS

AND

STEAM ENGINEERING JOURNAL.

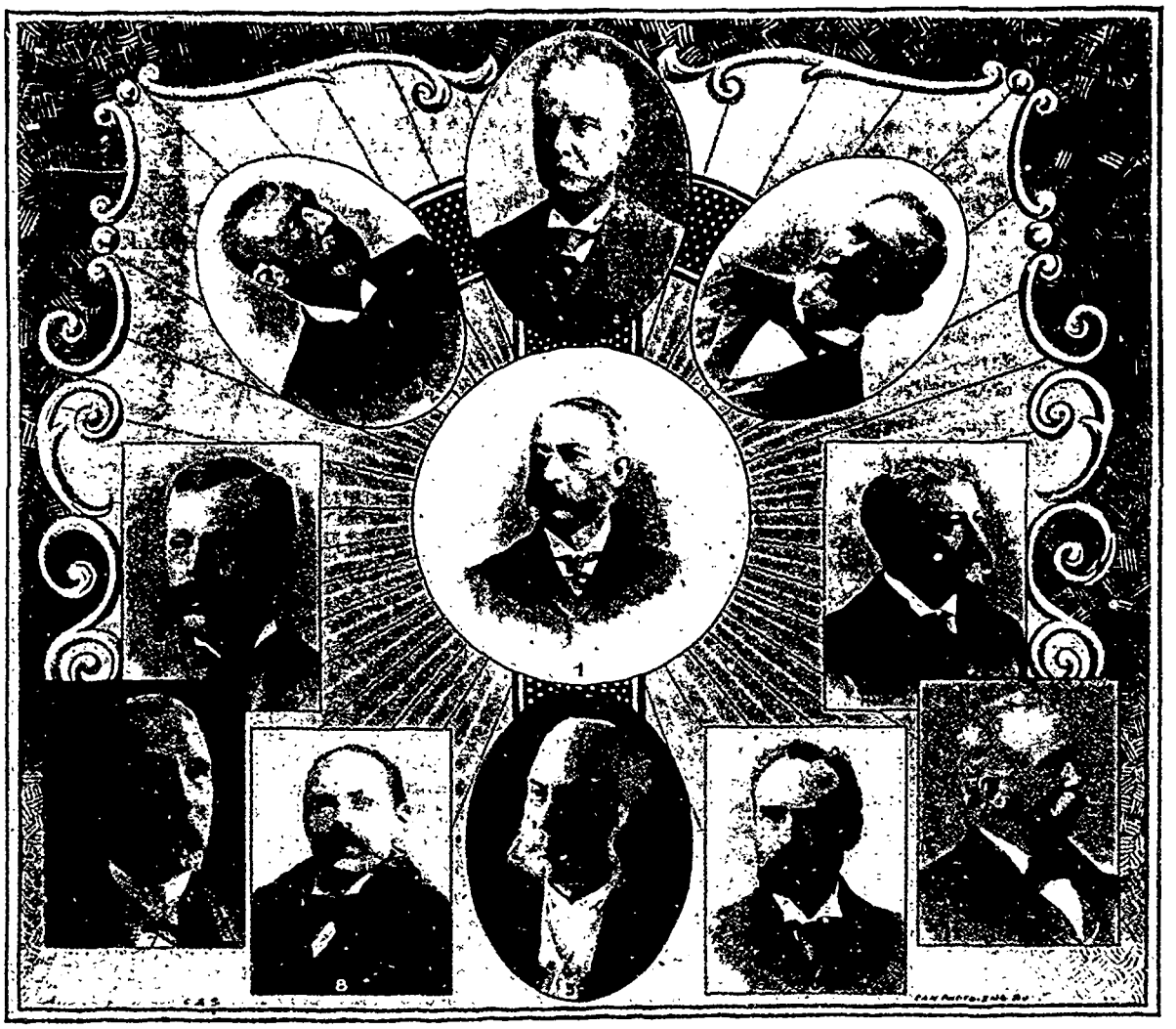
VOL. V. OCTOBER, 1895 No. 10.

ELECTRIC LIGHT INSPECTION STAFF.

THE accompanying group comprises the electric light inspection staff, with the chief electrician, appointed under the authority of the Electric Light Inspection Act, the scope and aims of which have already been given to the readers of THE NEWS.

The majority of those comprising the group have been engaged since the inception of the Gas Inspection Act in 1875 in the duty of testing gas and gas meters; and anyone at all acquainted with the delicate nature of these tests, especially the chemical analysis for impurities in the gas, must admit that their training has peculiarly well fitted them for the new work under the Electric Light Inspection Act.

Being warned some years ago that the work of testing electric light meters would be imposed upon them, the gas inspectors throughout the country took up the study of electricity, and have made considerable progress in acquiring an elementary knowledge of that science. We are informed by the chief electrician that the work of instructing these gentlemen in the use of the various electrical apparatus with which their offices are equipped was of a very pleasing nature. Their well-trained analytical minds fitted them in no small degree for the new work, and the readiness with which they acquired a knowledge of the instruments and the manner of using them, confirmed Mr. Higman in the opinion he had formed from the beginning that the gas inspectors would do the work satisfactorily and well.



ELECTRIC LIGHT INSPECTION STAFF.

1. O. HIGMAN, M.Inst.E.E., A.M.Can.Soc.C.E., Chief Electrician, Ottawa, Ont.
2. A. AUBIN, Montreal, Que.
3. D. MCPHIE, Hamilton, Ont.
4. A. MILLAR, Halifax, N. S.
5. A. ROWAN, St. John, N. B.
6. J. K. JOHNSTON, Toronto, Ont.
7. JOHN WILLIAMS, London, Ont.
8. N. LE VASSEUR, Quebec, Que.
9. A. F. SIMPSON, Sherbrooke, Que.
10. WM. JOHNSON, Belleville, Ont.
11. H. G. ROCHE, Ottawa, Ont.

Of Mr. Ormond Higman, the chief electrician, upon whom the work of inauguration has mainly devolved, very little need be said, as his experience in electrical work covers a period of over thirty years. He is a native of Cornwall, England, and entered the service of the Electric & International Telegraph Company at Liskeard in September, 1864. Coming to Canada in 1869, he entered the service of the Montreal Telegraph

Company in October of that year. In 1873 he was made chief of the operating staff at Ottawa and manager of the company's sessional staff in the House of Commons. For nearly twenty years Mr Higman continued in this capacity, also acting as Inspector of the Ottawa Division. For five or six years prior to 1892, in addition to his other duties, Mr. Higman filled the position of Electric Light Inspector of the Ottawa district for the Canadian Underwriters' Association. In September, 1892, he was invited by the Hon. John Costigan, then Minister of Inland Revenue, to draft a bill having for its object the inspection of electric lighting ; the measure to be along the lines of the Gas Inspection Act. This duty, we are informed, Mr. Higman performed to the entire satisfaction of the Minister and the chief officers of the department. In August, 1893, the Hon. Mr. Wood, Comptroller of Inland Revenue, sent Mr. Higman to Chicago to represent the Department at the meeting of the International Congress of Electricians at the World's Fair. On presenting his credentials to the committee, Mr. Higman was chosen to represent British North America in the Chamber of Delegates—a body composed only of official delegates from the different governments of Europe and America—to consider and adopt a system of units of electrical measure. He was also made a vice-president of the General Congress.

During the session of 1894 Parliament passed two electric bills, one for the purpose of legalizing the international units adopted at Chicago, the other dealing with the work of inspection Mr Higman's appointment in connection with the inauguration of the latter followed as a matter of course. We believe Mr. Higman is possessed of sound judgment and understands thoroughly well the nature and standing of the electric lighting industry in this country ; and in the administration of the new law we are satisfied that he will not only protect the rights of the consumer, but will conserve, so far as he is able to do, the best interests of the supply companies.

Mr. Higman is a member of the Institute of Electrical Engineers, London, England, and an associate member of the Canadian Society of Civil Engineers.

KIND WORDS CAN NEVER DIE.

THE CANADIAN ELECTRICAL NEWS has issued a special convention number, containing among its special features an illustrated article on the electrical features of the Dominion capital, the programme of the Canadian Electrical Association convention and the convention of Stationary Engineers. The NEWS is always a valuable publication for those interested in electrical and engineering matters, and this special number is of unusual interest and very creditable.—Peterborough Review.

We extend our congratulations to our contemporary upon the very creditable production which it has just issued in the form of a special convention number of the CANADIAN ELECTRICAL NEWS, containing an article descriptive of the electrical features of Ottawa, the programmes of the Canadian Electrical Association convention and the convention of the Stationary Engineers. The illustrations are good and everything about the journal indicates prosperity and advancement. C. H. Mortimer, the publisher of the NEWS, is one of the best known men in Canadian electrical circles and his popularity is deserved.—Western Electrician, Chicago.

ANNUAL REPORT OF THE ROYAL ELECTRIC COMPANY.

THE eleventh annual report of the Royal Electric Company, of Montreal, recently published, shows that the net gain on the fifteen month's operations was $106,209.14, out of which five quarterly dividends of 2 per cent. each, amounting to $99,900.10 have been declared, the remainder going to swell the balance of $308,758.98. The lights on the direct current arc system have been increased from 1617 to 1666 ; the lights on the alternating current incandescent system from 40,013 to 53,977, and the motors from 347 to 688.

Reference is made in the report to the faithful service of Mr. Charles W. Hagar, who recently retired from the position of secretary and manager, and a tribute paid to the experience and business ability of his successor, Mr. Wm H. Browne.

SPARKS.

The Ottawa electric railway has been extended to the village of Hintonburg.

An electric road is proposed between Trout Lake and the landing, in the Kootenay country, B. C.

The street intersection of the electric railway at the corner of Richmond and Dundas streets, London, consists of 171 pieces, and the iron weighs from 45 to 50 tons.

A company, called the Co-operative Telephone Co., of the counties of Lake St. John and Chicoutimi, Que., with headquarters at Herbertville, has been formed to build and operate a telephone line. Capital stock, $10,000.

There are forty men working in the McLaren and Buckingham mica mine at present, and the work is being carried on night and day. A large vein of very fine amber colored mica has been struck. A shaft 200 feet deep has been sunk.

William Kyle, charged with attempting to bribe a Niagara Falls, Ont., councillor in connection with an electric railway franchise, and Robert F. Segsworth, of Toronto, an alleged associate in the matter, have been committed for trial on the charge. They were released on bail.

The Halifax street railway has been sold by the Sheriff to the new Electric Railway Co. for $25,000. The sum of $50,000 has been paid into the Bank of Nova Scotia, the amount named by the Legislature to be paid the bond holders of the old company before work on the new road can be commenced.

While Mr. W. McIntosh, Woodstock, and Mr. Geo. Leacock, Sutton, were stringing wire for the Guelph electric railway from an elevated truck, the wire broke and both men fell to the ground. Mr. McIntosh fell on a dray and had his left leg broken. Mr. Leacock fell behind the horse's heels and received a severe shaking up, but had no bones broken.

Steam jets in furnaces produce destructive effects on the metal if there is sulphur in the coal.

Heat applied to a solid first expands it, then melts, and finally converts it into a vapor, if the temperature is sufficiently high.

Sand has been recommended to catch the drippings of oil tanks or barrels. The use of sawdust for the purpose is objectionable in that it may cause spontaneous combustion.

After cleaning boilers, do not screw up the nuts on the manhole and hand-hole covers any tighter than is necessary, for you may break the guards or dogs that hold the covers in place and cause yourself much trouble.

Prof. Blondel, of Paris, in measuring the total spherical intensity of arc lamps, found that it was nearly trebled by diminishing the carbons from 21 and 13 mm to 14 and 8 mm diameter, the 13 and 8 presumably referring to the negative carbon.

The state telephone system of Sweden is soon to be connected with the state telegraph system. Instead of addresses, the telephone numbers will be used, the telegraph clerks looking up the address. Messages may be telephoned to the telegraph office and telephoned back, thus dispensing with the greater number of messenger boys, as in Sweden nearly everyone uses the telephone.

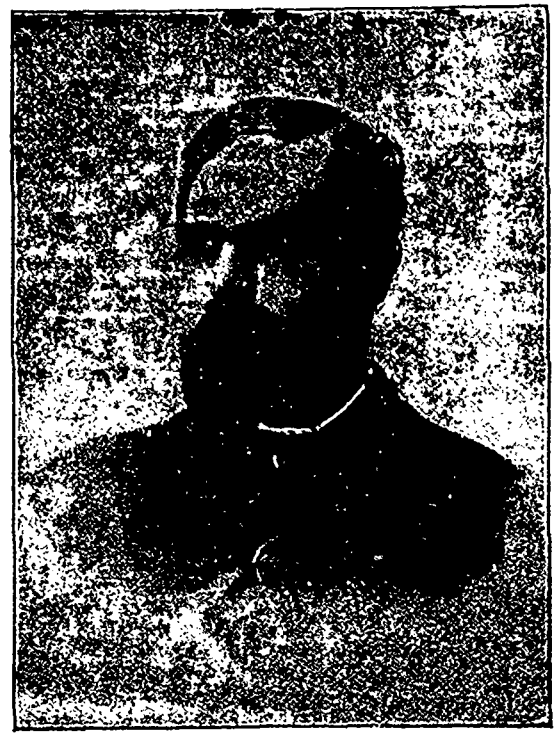
Within the next year the Illinois Central and the Chicago and Northern Pacific railroads, both of which are now operated by steam, will be run by electricity. It is possible that the latter will use electricity on its entire system. The Illinois Central will begin with its suburban service only. Bids have already been secured from builders of electrical appliances for the complete equipment of the latter. It is estimated that the entire cost will be from $3,000,000 to $4,000,000. This will include the substitution of electricity for steam as the motive power in the company's car shops at Burnside.

Prince Henry of Prussia displayed the courage of the scientific enthusiast when he stood the other day with tongues of flame more than a yard long shooting forth from his hands in quivering zigzags, accompanied by incessant cracklings. It was in the lecture room of the scientific society Urania, at Berlin. He had offered himself as a subject to Professor Spies to demonstrate the fact that alternating electric currents of high frequency passed through a human body, far from causing death, produce no ill effects. The Prince declared that he felt no inconvenience whilst Professor Spies was passing through his body a discharge of 100,000 alternations a second with a tension of 10,000 volts.

MR. A. B. SMITH.

WE present herewith to the readers of the ELECTRICAL NEWS a portrait of Mr. A. B. Smith, the newly-elected President of the Canadian Electrical Association. It was fitting that in an Association which aims to represent the various branches of electrical industry in Canada, the first presiding officer, who was representative of the electric lighting interest, should have been succeeded by one identified with the telephone department, and that he in turn is now superseded by a gentleman connected with the telegraphic service. The honors have in every case been well bestowed.

Mr. Smith, the present incumbent of the office, is a native of Montreal, has had a long and varied experience as a practical electrician, and in his capacity as electrical inspector for the Underwriters' Association, has rendered valuable service to the electrical fraternity at large by his common sense dealings with such matters as come under his control. As a youth in 1862 he entered the service of the Montreal Telegraph Company at Montreal. In August, 1869, he was appointed chief operator at Hamilton. In 1872 he was promoted to the position of general inspector, in which capacity he displayed noticeable ability, and in 1879 was further advanced to the position of superintendent of construction for the entire system, the duties of which he has since discharged in a most satisfactory manner. He was one of the original promoters of the Canadian Electrical Associatian, and since its organization has been one of the most efficient workers in behalf of its welfare. The honor which has been conferred upon him has therefore been fairly earned. Knowing as we do his adaptability for the position he occupies, we cannot but consider the interests of the Association to be safe in his hands.



MR. A. B. SMITH, President Canadian Electrical Association.

A NEW FUEL SAVING INVENTION.

A TEST has recently been made in this city of an invention, new in Canada, though in use for some time in Philadelphia and some other cities of the United States, by which it is claimed a large saving is effected in fuel for steam boilers, by producing more perfect combustion. The principle on which it is based is that in order to bring about the combustion of the smoke and gases given off by the fuel, a greater degree of heat must be created than was required to set free the smoke and gases. This is accomplished by means of gas, produced from oil by means of steam, in a retort attached to the furnace, this gas being forced into the fuel and causing a degree of heat sufficient to ensure perfect combustion. The principle seems to be a reasonable one, and the tests would indicate that the invention will prove a very valuable one.

The test was made with a boiler which supplies power to a number of industries at 109½ Adelaide Street West, Toronto. Prof. Welton, of McMaster University, was present, and as an independent witness watched the experiments. The boiler was first worked for a day of eight hours in the ordinary way, and then for a similar period with the apparatus, the amount of fuel consumed and water evaporated being carefully noted in both cases. The result showed that under the ordinary system the average evaporation per pound of coal was six and six-tenths pounds of water, while with the new apparatus the average was nine pounds evaporated, a gain of 36 per cent. The quantity of oil consumed in producing the gas was only one and a quarter gallons.

The inventor guarantees a saving of at least 15 per cent. in fuel in boilers with the most improved settings. In ordinary boilers the saving will run all the way to fifty per cent., and Prof. Welton informs us that for half the day when the test was made the saving was even greater. Another test is to be made, and if the results are as satisfactory, a number of users of steam power will adopt the apparatus. The cost is not large, being about $300 for boilers up to 100 horse power, a trifle compared to the saving effected in fuel.

Mr. Teter, the inventor, has great faith in the merits of his system, in which he appears to be justified by the results. Prof. Welton, who is an impartial spectator, is satisfied that it is all that is claimed for it.

SPARKS.

Mr. E. Rutherford has opened an electrical supply store in Peterboro.

In its mileage of electric railways, Germany stands first, France second, England third.

The Milton Electric Light and Power Co., Milton, Ont., has been incorporated. Capital stock $15,000.

During the week of the operation of the trolley in London, numerous accidents are reported to have occurred.

Sir Henry Tyler, ex-president of the Grand Trunk, is on his way to Peru to experiment with an electric locomotive on a mountainous railway.

The Olympic Mill Company, Olympia, Wash., is operating a small saw mill by electricity, said to be the first of the kind on the Pacific coast. The new mill contains a resaw, a planer, sticker and turning lathe, and is run by a 16 horse power dynamo.

St. Thomas has accepted the tender of the Street Railway Company to light the city, conditional upon its operating the electric street railway.

The Kingston Electric Railway Co. has closed a contract with the Canadian General Electric Company, of Toronto, for six new open cars, to be delivered May first.

The Dominion statistician's figures show that last year the three hundred odd miles of electric railways in Canada carried fifty-seven million passengers.

Mr. Jas. Milne has been appointed lecturer on electricity in the Toronto Technical School. He is general superintendent of the Incandescent Light Company.

The test of the new double cylinder engine on the G. T. R. is declared to be satisfactory, but stronger coupling pins and drawbars will be necessary for such heavy trains.

Arrangements had been made to light Acton, Ont., by electricity, and part of the plant arrived, when a hitch arose, and Mr. Eblage, who had the matter in hand, declined to proceed. It is likely it will be taken up by someone else.

Brockville will have an electric railway next year. Wm. Henry Comstock, Charles Snow Cossitt, David Spencer Booth, Oliver Kelly Fraser, George Ira Mallory, Wm. Andrew Gilmour and Matthew Munsell Brown will form the company to build it. They are all local men. The capital of the company is $200,000.

Application will be made at the next session of the Dominion parliament for an act to incorporate a company of prominent Canadians, with a capital of $100,000, to introduce into Canada a new process for manufacturing gas for illuminating and fuel purposes. The process is a most interesting one and produces gas for fuel, lighting and power from crude petroleum, water and peat, dispensing with the use of coal in any form.

It is evident that the business of the Peterboro' Carbon and Porcelain Co. has not been profitable, and mis-management is assigned as the cause. A meeting of the shareholders has been held for the purpose of considering the question of liquidating the concern, but it was adjourned without a decision. They owe their banker over $20,000, and without fresh capital, an entire suspension must take place. The paid-up capital appears to have been $40,000.

The Pittsburg Reduction Company has closed a contract with the Niagara Falls Hydraulic Power Manufacturing Company for 3,000 horse power, delivered on the shaft of the turbine, to be placed under the high bank by the Hydraulic Power Company. They will install upon these turbines direct current generators, the current from which will be used for the manufacture of aluminum. The Reduction Co. has now practically got control of all the available cheap power, thus shutting off competition and will use about 25,000 horse power. Their furnaces will be placed under the high bank.

CANADIAN ELECTRICAL ASSOCIATION

REPORT OF PROCEEDINGS OF THE RECENT CONVENTION AT OTTAWA.

THE Fifth Convention of the Canadian Electrical Association was opened in the Railway Committee Room of the House of Commons, Ottawa, at 11 o'clock a.m. on Tuesday, September 17th, 1895. Mr. K. J Dunstan, the President of the Association, occupied the chair.

The following persons were in attendance:—

J. J. Wright, A. M. Wickens, F. C. Armstrong, Jas. A. Bayhs, Wm. B. Jackson, T. F. Dryden, J. F. H. Wyse, John C. Gardner, F. C. Maw, A. B. Smith, K. J. Dunstan, J. A. Kammerer, C. H. Mortimer, H. P. Dwight, Chas. P. Dwight, Joseph Wright, E. B. Biggar, Toronto. Wm. T. Bonnet, L. B. McFarlane, D. A. Starr, H. O. Edwards, James A. Burnett, D. W. McLaren, P. W. Atkinson, John Carroll, Montreal, John Murphy, J. W. Thompson, H. G. Roche, A. A. Dion, Mayor Borthwick, O. Higman, G. F. Macdonald, C. Routh, H. Bott, D. C. Dewar, J. W. Taylor, Warren Y. Soper, C. Berkeley Powell, D. R. Street, Ottawa; F. W. Harrington, John H. Dale, W. R. McLaughlin, New York, U.S.A.; H. O. Fisk, J. Knapman, Peterboro'; W. A. Mackay, C. H. Wright, A. A. Wright, Renfrew; George Black, Hamilton, J. A. McCrossan, Rat Portage; V. B. Coleman, Port Hope, J. E. Brown, Aylmer, W. J. Gilmour, Brockville; E. Carl Breithaupt, Berlin; R. G. Moles, Arnprior; F. H. Badger, jr., Quebec; A. F. Simpson, Sherbrooke.

The President announced that the present meeting was in the character of a formal opening, and that the first business session would be held in the afternoon in the Board of Trade rooms at 2:30 p.m.

ADDRESS OF WELCOME.

Mayor Borthwick made a speech welcoming the Association to Ottawa, in which he said:

It affords me a great deal of pleasure in having the opportunity of welcoming a body of gentlemen interested in such an important industry, to the city of Ottawa.

We claim to be living in a progressive age, and when we contemplate the rapid strides that have been made in every department that affects the human race, I think there are few who will dispute our claim; and while you, gentlemen, who are occupied in the study and development of electricity, are prepared to give all credit and honor to those who are occupied in the development of other branches of knowledge, yet I feel that you will be justified in claiming that you have outstripped all the others in the marvellous achievements that have been made in your own branch during the last few years.

It is in the memory of most of us when the use of electricity was practically unknown, and when first discoveries began to be made the world wondered, but the new discoveries have been so rapid and so great that we have almost ceased to wonder, and content ourselves by asking in a placid manner, "What next?"

If we had been told a few years ago that we would have the lightning chained down so that we would use it as the motive power to transport us from one part of the city to another, or from one part of the country to another, or if we had been told that we would be able to sit in our own home and hear the voice of absent ones in distant cities, or many of the other things that can be accomplished by the use of electricity, we might have expressed ourselves by saying, "Eye hath not seen, neither hath it entered into the heart of man, the marvellous things that are in store for those who live twenty years hence." Now there is a feeling here that some of the citizens of Ottawa have contributed something in the way of assisting in the development of this great science, and we claim as a city to be keeping fairly abreast of the times. Whether such is the case or not it is for you to judge, but if we are not up to the mark in electrical appliances, I know that you will find the gentlemen who are associated in this line large hearted and generous, and our citizens know how to entertain strangers, and if we cannot teach you anything in electricity, we are progressive enough to learn; and I sincerely hope that you will be so electrified by your visit that you will all be pleased to pay us another at an early date. I therefore in behalf of the citizens extend to you a very cordial welcome.

The President, Mr. Dunstan, replied as follows:

On behalf of the Canadian Electrical Association, I wish to thank you very heartily, Mr Mayor, and through you the members of the Ottawa City Council, for the kindly spirit which has prompted you to present an address the tone of which is so complimentary, the welcome which it extends so hearty, that we would have indeed a high opinion of the merits of our Association and the work which it is performing were we not highly flattered and were we not greatly pleased with the reception which we have met with at your hands.

You have laid stress upon the great progress made in applied electricity within the past ten or fifteen years, and remembering as I do that I am speaking in the city of Ottawa, in the city which is fast earning for itself the reputation of being the electrical centre of Canada, remembering as I do that I have the honor of addressing the first magistrate of that city, I feel that words of mine are unnecessary to add emphasis to your statements in that direction.

You, sir, have no doubt been an eye witness of the great strides made by Ottawa in industrial progress during the past fifteen years, and you cannot but realize the great part played by electricity in such development.

The same thing, sir, holds good, perhaps not to the same extent, but yet holds good in every city, town or village throughout the broad Dominion—villages rescued from Egyptian darkness by electric light, isolation broken down by inter-communication, made possible by the electric railway and telephone, the very world itself made small by reason of the telegraph girdle which encircles it.

You have truly said that the work accomplished in the past is but an earnest of what may be expected in the future, and if this be so and if the future industrial progress of Canada is to a great extent dependent upon the widespread application of electricity in its various branches, then, sir, I think we may fairly claim that an association such as this, in endeavoring to encourage the science of electricity and promote the interests of those engaged in electrical industries, has a mission to fulfil worthy of every encouragement. That great changes, great advancements, will take place I think there can be no doubt, and if in the year of grace 1905 it should so happen that this Association should hold its convention in Ottawa, I can look forward in imagination and fancy I hear the then mayor in his address of welcome contrast the small beginnings of to-day with the vast accomplishments of his time and generation.

You have, Mr. Mayor, kindly expressed the hope that this will not be the last occasion of an annual gathering in your city; without assuming too much authority, I can safely answer you on that point, in fact I have a suspicion that before voting time to-morrow not a few members will be ready to vote Ottawa as the permanent headquarters of the Association, with annual meetings always here. However this may be, there can be no doubt that all members will leave your hospitable city with the warm desire to return as soon as possible consistent with the aims and objects of the Association. I will not trespass longer upon your time further than to again personally and on behalf of the Association thank you for the kind address which you have read and to say how gratified we will be if you can spare time to attend our sessions, which will be held at the Board of Trade rooms during the next three days. (Applause.)

Mayor Borthwick then stated that should the Association find the Board of Trade rooms not suitable for their meetings, the city would be pleased to place the City Hall at their disposal.

The President then thanked His Worship and stated that they might be glad to avail themselves of his kind offer.

After having examined, under the guidance of Capt. Bowie and Senator Clemow, the objects of interest in and around the Houses of Parliament, a visit was made to the Patent Department, where numerous models of electrical appliances were viewed with much interest.

AFTERNOON SESSION.

The President took the chair at 2.30 p.m. and opened the convention with the following remarks.

PRESIDENT'S ADDRESS.

Gentlemen,—I have to congratulate you on the good attendance at this the open sitting of the fifth annual meeting of the Canadian Electrical Association. I believe I am within bounds in stating it to be the largest attendance on an opening day in the history of the Association. This is a matter for congratulation, viewed not only from the standpoint of this particular meeting, but more especially from the broader ground of the strong evidence which it affords of life and vitality in the Association itself. It is generally accepted as a fact that the third and fourth years in the history of a body such as this are most trying and critical. Early enthusiasm for a new organization will influence many persons to join a society and remain members for the first year or two; fees are paid willingly and with promptness, but if there be no good reason for the organization and continued existence of such a society, or if the seed has

been sown on shallow ground, the third and fourth years will show a withering away of the membership roll and the attendance at the annual meetings will gradually grow beautifully less; fees come in slowly and you may know the end is near.

Those who were the original promoters of this Association, and who believed firmly in the wisdom of founding it on a basis broad and wide enough to embrace all persons in the Dominion interested in electrical industry, have watched therefore with no little anxiety its progress during the past two years, half fearing to find a reduced membership roll, diminished attendance and half-hearted interest at the annual gatherings. It is therefore a matter of much satisfaction that the meeting in Montreal last year was such an unqualified success and that indications all point to a Convention of even greater interest and pleasure this year.

The Secretary-Treasurer's report will show the Association to be in a sound financial condition.

The Committee on the Revision of the Constitution will report at an early opportunity, and I would ask the members to give this report most careful consideration. You will all agree that changes should not be made in the Constitution lightly or without good reason, but our present set of rules falls far short of composing a complete and comprehensive Constitution for the proper government of an organization such as this. We have reached now a stage when, assisted by four years' experience, we can draw up and adopt a Constitution not too complex in character yet broad enough to meet all requirements. The rules should afford members the opportunity of accomplishing every legitimate object of the Association and at the same time should provide ample safeguards against hasty, ill considered action.

The report of the Committee on Legislation will point out the good work done by the Association at the last session of the Ontario Legislature, when an assessment bill was introduced, no doubt with the best of motives, but which, if it had become law, would have laid a very unfair burden upon electrical industries already established, and would have hampered and to a great extent prevented the further extension of the telephone, telegraph and electric light, especially in the smaller towns and villages and throughout country districts. By bringing this measure promptly to their notice, those interested were able to point out to their various representatives in the House the true character and far-reaching effect of the legislation, and I am glad to say the bill was withdrawn.

During the progress of the Convention papers will be read on various subjects, and I cannot point out too strongly the advantage of full discussion, not only as a mark of intelligent appreciation of the labor bestowed on the preparation of the papers, but also because during such discussion new points and fresh ideas are brought out and there is that free interchange of opinion which is of such great value in an Association such as this, comprising as it does so many persons all trying to solve the same problems, all seeking the same results.

Throughout the commercial world of Canada, and to a still greater extent in the United States and other countries, severe depression of trade and great stringency in money has been experienced during the past few years. It could not be expected with reason that those engaged in electrical industries could entirely escape such a storm, but I believe it will be found to be a fact that they have suffered much less than have those engaged in other branches of trade and commerce. More than this could not have been expected—anything less would have been a great disappointment.

At the last session of the Ontario Legislature there were incorporated no less than twelve electric railway companies. This fact alone gives a fair indication of the great activity in that particular branch of applied electricity.

I am well aware that railway construction does not in every case immediately follow the acquisition of a charter. Too often charters are obtained for purely speculative purposes, and legitimate enterprises are blocked by unreasonable demands on the part of speculating incorporators, who do not hesitate to ask heavy compenstation for giving up charters never seriously intended to be used by themselves. One of the most important electric railways opened for traffic during the past year is that known as the Hamilton, Grimsby and Beamsville Railway, running from the city of Hamilton to Grimsby, a distance of about 18 miles. It is not only the longest road of the kind in Canada, but is exceptional on account of the large amount of freight it handles.

I am informed that during the three months of June, July and August just passed, it carried 94,164 passengers and handled 559 tons of freight, in addition to 2,917 cans of milk and a large quantity of fruit.

A large fruit market has been established in connection with this railway in the central part of Hamilton. It is needless to point out the many advantages afforded by such a road to the farmers and fruit growers living along its line, and in the villages and towns through which it passes, nor is it necessary to mention the great value to the city of Hamilton in having this market established there, and thus being made the headquarters of the great fruit trade of a large section of the Niagara Peninsula.

On every hand throughout the whole country we now find similar electric roads projected or under construction; towns and villages are being connected together, with the result that this cheap and convenient means of local transit, together with the intercommunication afforded by the telephone, will go far to break down that isolation which makes farm and country life so distasteful to the younger members of the community, and may have a far-reaching effect upon the great problem of how to attach the people to the soil.

In the telephone field the event of most moment has been the opening of the new main exchange belonging to the Bell Telephone Company in Toronto. The switchboard is of the most modern type, complete in every detail, and known technically as a branch terminal board. It has all the novel features, including self-restoring drops, incandescent pilot lamps, automatic disconnect signals, &c. This switch is not only a sample of the most modern type of the multiple switchboard, but is the largest installation of the kind in the world.

The great Niagara Falls power plant will soon provide an object lesson in the transmission of power over long distances, and we should very shortly be in possession of fairly reliable information upon which to estimate the economic distance within which electric energy may be transmitted in successful competition with local plants.

While it must be admitted that electric light plants have been established already in all the cities and larger towns throughout the country and it is therefore in the enlargement of existing plants rather than in the installation of new systems that increase in that branch of electrical industry must be expected so far as these larger towns and cities are concerned—there is yet the larger field presented by the many smaller towns and villages scattered over this broad Dominion, and perhaps a still larger field existing in connection with isolated plants. In a country also, such as Canada, where there are so many opportunities of obtaining water power from natural falls or by damming up the surplus water of rivers and streams, is it not a fact that there is still room for a large number of installations using water power, the energy developed being available for light and power within economic distances. It has been wisely said that the utilization of energy is a fair test of the progress and civilization of a country, and realizing as we must to what great extent the future industrial progress of Canada is bound up with and dependent upon the growth and development of electricity in all its various branches, we as an Association have a right to feel that in endeavoring to foster and encourage this industry we are working, not only in our own interests, but also for the general advancement of the country.

The question of municipal control of city lighting was fought to an issue in Toronto in a contest remarkable for warmth and energy. Every effort was made on both sides to educate the people in the way they should go to the polls, the result being that the by-law to provide funds to erect the civic plant was defeated by a vote of eight to one.

Last year the Welsbach burner formed a slight unsettling element in the lighting business, there being those who felt that the greater efficiency of this burner would, by cutting down the cost of gas, injuriously affect electric lighting interests. These fears have proved to a very great extent groundless, but we find this year a new disturbing feature, in the form of acetylene gas, but to what extent it will become a live issue yet remains to be seen, as it is too early to predict the commercial outcome of Mr. Willson's cheapened method of production. The gas has defects which may prevent it ever coming into general use, but on the other hand it is possible it may become an important factor. Whatever the outcome, electric light men must face the fact that prices, from competition or other causes, have a downward tendency, and this tendency must be met with improved methods of production. Electric light is of such superior intrinsic value as an illuminant that it is only necessary to maintain a high standard of efficiency, combined with a price not greatly in excess of that charged for gas, in order to control the best market as against competition in any form, but this high efficiency and close economy of production can be obtained only by most skilful business management, combined with technical knowledge and a thorough grasp of details.

We must prepare for every eventuality of our business, and these annual conventions, the communion of men working on parallel lines in various places throughout the country, the interchange of thought, opinion and experience, the rubbing of mind against mind, must tend towards the systematizing of methods and towards placing the conduct of business upon a higher, more scientific, more economical plane.

Indications point strongly to our being on the verge of a "horseless age;" an age when tricycles, carriages and a large proportion of vehicles in general will be self-propelled. Will the motive power be derived from electricity, petroleum, compressed air, or some other source of energy? Tests have resulted so far greatly in favor of petroleum, but electricity has so many advantages, due to freedom from dirt, smell and risk of explosion, that the discovery of a lighter, more economical form of storage battery would enable electricity to control a trade the magnitude of which it is difficult to even estimate. The person who makes this discovery will reap the greatest reward of the age.

In bringing these very inadequate remarks to a close, I wish to thank the members of the Association for the honor conferred upon me when I was elected your presiding officer for the past year, and while I claim a warm interest in the affairs of the Association

and a strong desire to build it up, as far as lies in my power, on the broad plan contemplated at its formation, I fully realize that the work actually accomplished has fallen far short of what you might have expected, with all fairness, at the hands of your presiding officer.

The minutes of the last meeting, read by Mr. Mortimer, the Secretary, were confirmed. The Secretary-Treasurer's report was then read, as follows:

SECRETARY-TREASURER'S REPORT.

I am pleased to be in a position to state that notwithstanding the business depression which we have recently experienced, this Association has made satisfactory progress during the period covered by this report. The success which attended the convention in Montreal last year appeared to give to the organization a new impetus, and I have no doubt that a like result will follow our present gathering.

At the date of my last report, Sept. 19th, 1894, there were enrolled on the books of the Association 99 active and 38 associate members. This number has increased to 169 active members and 41 associates, a total gain in membership during the year of 71. With this membership, and at the present reduced fees, the Association should have a yearly income of $589, while the annual expenses amount to only about $400. In making this statement it is presumed that every member can be depended on to pay his yearly fee when the same shall become due. This expectation has, unfortunately, not been realized in past years, as shown by the fact that the arrears of fees outstanding on the 31st of May last amounted to $321. Your Secretary-Treasurer, acting under the direction of the Executive Committee, has more than once issued accounts to members in arrears, accompanied by special requests for payment. It is therefore to be feared that much of the above stated amount in arrears will prove to be uncollectable. The Executive Committee still have under consideration the question of what action should be taken as regards members in arrears for fees who have failed to respond to repeated requests for payment. In view of the reduction in active membership fee decided upon at last convention, there would seem to be good ground for the hope that prompt payment of fees will be the rule for the future.

Following is a statement of receipts and disbursements for the year ending 31st May, 1895, showing also the condition of the finances of the Association brought up to the present date:—

Receipts.

Cash on hand June 1st, 1894		$ 21 30
Cash in bank " " "		250 18
14 active members' fees at old rate, $5.00		70 00
71 active members' fees at new rate, $3.00		213 00
14 associate members' fees at $2.00		28 00
Captain Carter		2 50
Increased amount paid by associate members to become active		2 00
Exchange on cheque		10
		$589 08

Disbursements.

Expenses of Convention at Montreal		$278 76
By cash as per local committee's statement	$106 50	
By cash, stenographer	27 00	
By cash, Canadian Electrical News, printing	92 15	
By cash, Canadian Photo Engraving Co	52 41	
By cash, express charges on books sent to and from convention	70	
	$278 76	
Refund to members on account of reduction of fee		$ 18 00
John Yule	$ 2 00	
A. A. Wright	2 00	
J. W. Taylor	2 00	
F. J. F Schwartz	2 00	
W. A. Mackay	2 00	
J. A. Kammerer	2 00	
O. Higman	2 00	
R. T. Dickenson	2 00	
E. Carl Breithaupt	2 00	
	$18 00	
Postage		$ 38 50
Stationary and printing, Electrical News		7 75
Grant to Secretary		25 00
Statistical Committee, expense account		25 00
Telegrams and messages		79
Exchange on cheques		1 15
Ribbon for badges		1 60
Envelopes		75
Macrae & Macrae, delivery of 21 copies convention report		11
Blackhall & Co., 50 certificate covers		4 00
Receipt forms		35
Express charges		55
	$402 31	
Cash in bank May 31st, 1895	186 77	
Cash on hand		
		$589 08

Receipts since May 31st, 1895.

Refund by Statistical Committee for fees		$ 23 62
Receipts for fees since May 31st, 1895		173 00
		$196 62

Expenditure since May 31st, 1895.

Postage		$ 8 10
Exchange		75
Blackhall & Co (covers)		4 00
	$ 12 85	
Cash in bank, Sept. 17, 1895	84 12	
Cash on hand, Sept. 17, 1895	99 65	
		$196 62

Total standing to credit of Association ... $370 54.

The Executive Committee have held six meetings during the year, viz.: On Oct. 16th and Nov. 19th, 1894, Feb. 7th, March 19th, June 21st, and Sept. 17th, 1895. At the first of these, accounts in connection with the Montreal convention were passed for payment; draft of a circular by the Secretary urging members to endeavor to increase the membership approved, the Secretary instructed to notify Messrs. McFarlane, Powell and Yule of their appointment as a Committee on Legislation, requesting them to communicate promptly to the President the introduction of Dominion or Provincial legislation affecting the electrical interests.

At the second meeting 25 persons were elected to active membership.

At the third meeting, seven active members were elected; the Secretary was instructed to invite from each member of the Executive suggestions for needed amendments to the constitution. To the suggestion made by Mr. George Whyte-Fraser, in a letter to the President, that the Association should co-operate with the Underwriters' Association in demanding a proper standard of efficiency on the part of persons engaged in electrical work, the Secretary was instructed to reply that the matter was one which could only be dealt with by the Association as a whole, and suggesting that Mr. Fraser should bring the matter up for discussion at this meeting.

At the fourth meeting the Secretary was instructed to draft a circular to be sent to all electric companies in Ontario re proposed assessment legislation referred to more fully in report of Committee on Legislation.

At the fifth meeting, correspondence was considered from members of the Executive resident in Ottawa relative to arrangements for the present convention. The dates of the convention were fixed, and the following persons were requested to act as a committee to make the necessary local arrangements: Messrs. C. Berkley Powell, O. Higman, J. W. Taylor, J. W. McRae, T. Ahearn and W. Y. Soper. A grant of $100 was voted for the use of this committee; the Toronto members of the Executive and the Secretary were appointed to arrange for papers, and complete and have printed the program for the convention. Three active and two associate members were elected.

At the sixth meeting of the Executive held immediately prior to the opening of this convention there were elected 17 active and 2 associate members.

C. H. MORTIMER,
Secretary-Treasurer.

Certified Correct, Sept. 17, 1895.

F. C. ARMSTRONG, CHAS. P. DWIGHT } Auditors.

Moved by Mr. J. A Kammerer and seconded by Mr. Taylor, that the report be received and adopted. Carried.

Mr. Smith enquired the total membership; the President replied, stating that there were 169 active members and 41 associate members, a gain during the past year of 71, a showing which he was sure would be very gratifying to everyone.

Mr. Kammerer presented the following report of the Committee on By-Laws and Constitution:

TORONTO, Sept. 16th, 1895.

To the Officers and Members of the Canadian Electrical Association:

GENTLEMEN: Your Committee on Constitution and By-Laws beg to report that after carefully perusing and digesting the Constitution and By-Laws of the Association as they now stand, they found quite a number of conflicting laws, and also a very large number of important points which were not covered by it. So many changes were considered necessary that your Committee deemed it advisable to undertake a complete and thorough revision, and not to proceed in the usual way of adding to or cutting out portions of the existing Constitution and By-Laws, but to submit to you an entirely new Constitution, in the construction of which they have utilized as much of the existing matter as was in their judgment thought suitable, and added new clauses to cover those points which were considered essential for the good government of the Association. This new Constitution, as formulated by your Committee, was published in the September issue of our official organ, the CANADIAN ELECTRICAL NEWS, in order that all members of our Association might become perfectly familiar with the proposed changes, give them careful thought and be prepared to discuss the points on which they may be at variance with what is proposed by your Committee. We beg to submit to you herewith the result of our labors, which we trust will be satisfactory to the members present and beneficial to the Association at large:

ARTICLE I.

NAME.—This organization shall be known as the Canadian Electrical Association.

ARTICLE II.

OBJECT.—The object of this Association shall be to foster and encourage the science of electricity and to promote the interests of those engaged in any electrical enterprise and for discussion and interchange of opinions among its members.

ARTICLE III.

MEMBERSHIP.—The Association shall consist of active, associate and honorary members. The term Active Members includes all members actually engaged in electrical business. The term Associate includes those interested or actively engaged in any electrical pursuit, and they shall be entitled to attend all meetings of the Association, except those of the Executive, and take part in all discussions, but shall not be entitled to vote or be eligible for office. Honorary members shall be elected by a two-thirds vote of the Association.

ARTICLE IV.

OFFICERS.—The officers shall consist of a President, 1st and 2nd Vice-Presidents, Secretary and Treasurer, and an Executive Committee, consisting of ten members, five of whom shall act on the Committee for two consecutive years. The President and Vice-Presidents shall be ex-officio members of the

Committee. Five shall form a quorum. The office of Secretary and Treasurer may be held by one person.

ARTICLE V.

FEES.—The annual fee shall be for active members $3.00, associate members $2.00, payable in advance.

ARTICLE VI.

ELECTION OF OFFICERS.—All officers shall be elected by ballot at a general meeting of the Association. The ballot shall be taken in the following manner:—The Secretary shall read the list of active members alphabetically, and each member shall deposit with the Secretary a slip of paper on which he has recorded his vote, the Secretary checking off his name on the list of voters. Two scrutineers named by the Chairman shall assist the Secretary in counting the votes, and the Chairman shall declare elected the person receiving the majority of the votes cast. In case no one candidate receives such majority on first ballot, another ballot is to be taken, and so on until a clear majority is given in favor of some one candidate. Officers shall hold office until the close of the session, at which their successors are elected, such successors to be elected on the second day of the first general session after the expiry of ten months from day of previous election.

ARTICLE VII.

ELECTION OF EXECUTIVE COMMITTEE.—Members of the Executive Committee shall be elected by ballot in the following manner, the vote being taken immediately after the election of officers:—Ballot papers containing the names of the ten members of the Executive Committee, five of whom must be re-elected, shall be given the members. The Secretary shall read a list of those entitled to vote, and members, having first marked a cross opposite the names of the five persons selected for re-election, shall deposit the ballots with the Secretary, who, assisted by the two scrutineers named by the Chairman, shall count the vote, and the Chairman shall declare elected the five persons receiving the greatest number of votes. Members shall then proceed to elect the five other members of the Executive, the election being by ballot and the Secretary reading the names as before. Each active member of the Association shall have the right to vote for an active member of the Association, including the retiring members of the Executive, and the vote being counted in the usual way, the Chairman shall declare elected the five persons receiving the greatest number of votes.

ARTICLE VIII.

PLACE OF MEETING.—Place of next meeting shall be decided by ballot, taken in same manner as laid down for election of officers.

ARTICLE IX.

VACANCIES IN OFFICE.—Vacancies in office, caused by death or resignation, shall be filled by the Executive Committee to cover the term until the next general meeting of the Association, at which the officers are elected.

ARTICLE X.

NOTICE OF MOTION.—Permission to introduce any notice of amendment or amendments to this constitution must be granted by a majority of two-thirds of the active members present. Permission being granted, notice may be given and the proposed amendment moved at any subsequent sitting. After discussion the amendment must be submitted to a Committee of five, named by the Chairman. The report of said Committee cannot be considered on the same day on which it is introduced. A two-thirds vote of all active members present shall be necessary for its adoption.

ARTICLE XI.

Notice of substantive motions is required, and no motion shall be discussed at the sitting at which the notice has been given, but this rule does not apply to merely formal motions, such as motions to adjourn. All reports of standing Committees are to be discussed at a sitting subsequent to the one at which such reports have been received. This rule may be suspended by a vote of two-thirds of the members present.

ARTICLE XII.

All motions must be duly proposed and seconded, and shall, except those of a purely routine character, be in writing.

ARTICLE XIII.

No member shall speak more than once, or at a greater length than five minutes, upon any question until all others have had an opportunity of doing so, nor more than twice on any one question without permission of the Chairman, or a majority of the members entitled to vote. The mover of a substantive motion has the additional right to reply.

ARTICLE XIV.

Questions may be re-considered upon a motion to re-consider being made by a person who voted with the majority, provided such motion is carried unanimously. No discussion of the said question is allowed until the motion for re-consideration has been carried.

ARTICLE XV.

VOTING.—Every active member present must vote, but any person entering the room after the question has been put by the Chairman may not vote. The Chairman shall not vote except in the case of a tie. Voting by proxy shall not be allowed.

ARTICLE XVI.

Except where vote is by ballot the chairman will take the sense of the meeting by voice, or by asking members to stand, but on call of five members the Secretary shall read the list of persons entitled to vote, and record the yeas and nays.

ARTICLE XVII.

An appeal may be taken without debate against the ruling of the chair, a vote of two-thirds being required to reverse the decision.

ARTICLE XVIII.

The President shall nominate a Committee of three to strike the Standing Committees for the following year and define their respective duties, the report of the Committee being considered at a subsequent sitting to its introduction. The number of Standing Committees must be decided by the Association.

ARTICLE XIX.

The first person named on any Committee shall act as Chairman until Committee is called together, when they will elect their own Chairman, but the President, in his absence the 1st or 2nd Vice-President, shall be Chairman of the Executive Committee. In the event of the absence of ex-officio members, the Executive Committee shall proceed to elect a Chairman pro tem.

The general order of business at all sessions shall be as follows:

Reading Minutes of last meeting.
Report of Secretary-Treasurer.
Report of Standing Committees.
Election of Standing Committees for following year.
Selection of place of next meeting.
Approximate date of next meeting.
Election of Officers and Executive Committee,

Time being allowed for general business and social affairs, at the discretion of Executive Committee or Chairman of meeting. Selection of next place of meeting and election of Officers and Executive Commitee must be on second day of meeting. Order of business may be altered only by unanimous vote of members present.

ARTICLE XX.

Ten active members of the Association shall be a quorum for business.

ARTICLE XXI.

Todd's Parliamentary Practice shall be the governing law of the Association in all cases not provided for in its own rules.

ARTICLE XXII.

DUTIES OF THE PRESIDENT.—It shall be the duty of the President to preside at all meetings of the Association and to call meetings of the Executive Committee, and when requested by the Executive Committee, to call a special meeting of the Association.

ARTICLE XXIII.

DUTIES OF THE VICE-PRESIDENTS.—The 1st, or in his absence, the 2nd Vice-President, shall act in the absence of the President.

ARTICLE XXIV.

DUTIES OF THE SECRETARY.—The duties of the Secretary shall be to attend all meetings, take record of all proceedings, and shall perform such other duties as the Executive Committee shall direct.

ARTICLE XXV.

DUTIES OF THE TREASURER.—The duties of the Treasurer shall be to keep a correct account of all receipts and disbursements in connection with the Association. All checks for disbursements shall be signed by the Treasurer and countersigned by the President, after being approved by the Executive Committee.

ARTICLE XXVI.

THE DUTIES OF THE EXECUTIVE COMMITTEE.—The Executive Committee shall be the governing body of the Association, shall manage its affairs, pass upon all applications for membership, eligibility of representatives, subject to the constitution, and such special rules or regulations as may be adopted by the Association from time to time.

ARTICLE XXVII.

DUES.—Dues shall be payable annually on the 1st June, in advance. Members in arrears for dues, other than those for current year, shall not exercise the privileges of membership.

ARTICLE XXVIII.

The permanent office of the Association shall be in Toronto.

Respectfully submitted.

J. A. KAMMERER, Chairman.

Moved by Mr. Kammerer, seconded by Mr. J. J. Wright, that the report be now received and that it be discussed tomorrow.

The President: I would like to say in connection with this that printed copies of the report have been distributed, but if any member wants one, copies are to be found on the table. This is a most important matter, and if you will go into it carefully before the sitting to-morrow, it will be a great advantage.

Mr. E. Carl Breithaupt presented the following report of the Committee on Statistics:

REPORT OF THE COMMITTEE ON STATISTICS.

Your committee beg to report as follows:—

The information which it was considered desirable to obtain was principally such relating to central stations for the supply of electric light and power and electric street railways. Detailed information from such stations regarding the original cost of installation, the cost of operation, the volume of the output, the prices realized, and any particular difficulties, or extraordinary circumstances encountered, would doubtless be of great value to every person interested in these branches of electrical work. The members of the electrical fraternity have everything to gain and nothing to lose by a free interchange of ideas and an open discussion of experiences met with, this object is indeed one of the principal motives for the formation of the Canadian Electrical Association. On the other hand, the data referred to, although they are not strictly business secrets, are not of such a nature as a company desires to publish openly. The previous Committee on Statistics had sent out blanks requesting data from central stations, on looking over their returns received, we found that only a small proportion of sheets sent out had come back, while on those which were returned the answers to questions were incomplete and therefore of little value. It was thus evident that the compilation of the desired statistics would involve a considerable expense, and since the funds of the Association did not warrant it, your committee did not proceed in this way.

During the past year, however, the Dominion Government has commenced to gather statistics relating to the electrical industries and it was suggested that the Committee should lend its assistance to this work. Mr. Higman was added to the Committee as advisory member, and separate forms were drawn up by the Committee, one to be sent to electric lighting and power companies, the other to electric railway companies. These returns being the property of the Government, are kept secret. The detailed information concerning each separate company can, therefore, not be presented, but the totals will be published and these will be of undoubted value because they will be complete. Mr Johnston, the Dominion Statistician, assures us that in another year he will be in a position to give the Association a large amount of information concerning these industries, all properly summarised and tabulated.

All of which is respectfully submitted.

E. CARL BREITHAUPT, Chairman.

Moved by Mr. Breithaupt, seconded by Mr. Armstrong, that the report be received and discussed at the next session.

Mr. L. B. McFarlane presented the following report of the Committee on Legislation:

REPORT OF COMMITTEES ON LEGISLATION.

Shortly after the last meeting of this Association your Committee on Legislation was called upon to act in conjunction with the Executive in an important crisis, which it was pointed out at its organization might arise, and in such case organized effort would prove one of the valuable functions of the Association. Legislation, which, though not intended to be hostile, might, through lack of thorough knowledge of its promoters, result most disastrously to electrical interests.

During the last session of the Ontario Legislature a bill was introduced which, if it had become law, would most assuredly have worked an injustice to many, and would have been burdensome to all who have invested their capital in electrical enterprises, by laying a tax as personalty upon all street equipment of electrical companies.

Immediately upon the introduction of the bill your President called a meeting of the Executive, when the following circular was drafted and sent by the Secretary to all the electric light companies in Ontario:—

TORONTO, March 19th, 1895.

DEAR SIR:—As you are interested in an electric light plant, I am instructed by the Executive Committee of the Canadian Electrical Association to call your attention to an amendment to the Assessment Act which has recently been introduced in the Legislative Assembly of Ontario by Mr German, and which is contained in Bill No. 91, the object of which is to make electric light poles and wires assessable.

Such an addition to the expense of the electric light business would prove to be a serious burden, more especially in the smaller places where lighting plants scarcely self-sustaining under present conditions. In such places the electric light has in most instances been established by public-spirited citizens for the public convenience and the welfare of the place rather than with a view to any profit from the invested capital. The business, as you are aware, is at present sustained only by the exercise of the closest economy, and is consequently not in a position to stand any additional burden.

There is no public demand for the proposed legislation, and it is felt that the measure is one that should be opposed by those whose interests are at stake. I would therefore request you and the stockholders of your company to communicate immediately with the representative of your riding in the Legislature, and any others with whom you are acquainted, and ask them to oppose the bill as being detrimental to the prosperity and development of the electric lighting industry, and as certain to work serious injury and injustice to capital which was invested in the belief that it would continue to remain exempt from taxation. It should likewise be pointed out that even though it may not be possible to defeat the Bill entirely, no increase in taxation should in any event be made until existing contracts with municipalities shall have expired.

As the Bill may come before the Committee of the House within a few days, immediate action in the direction indicated above is necessary.

Very truly yours,

C. H. MORTIMER, Secretary.

As a result of this circular we have reason to believe that a large number of the representatives who compose the House had information placed before them in the most effective way that the proposed legislation would work an injustice, inasmuch as it would enable municipal councils to make a breach of the understanding on which nearly all the electrical companies of the Province were organized; that in many cases where the business is barely self-sustaining under present conditions such taxation would prove so burdensome that it would mean the practical confiscation of the plant; that instead of proving a benefit to the public, the result would be exactly the reverse, as many companies which were organized, not with a view to profit, but as a public convenience, would be compelled to suspend, thus not only causing a loss of the investment, but depriving the country of its advantage. But more important than all, it was clearly shown that the first result of such hostile legislation at the present experimental stage of the practical application of electricity to modern requirements would prevent the investment in the business of capital, which is so important to the development of this great interest, and thus prove of incalculable injury to the commercial interests of the country.

So forcibly were the conditions presented to the legislators that a large majority were convinced of the injustice and inexpediency of the measure, and the mover of the bill himself voluntarily withdrew it at its first appearance in Committee.

The matter of municipal assessment in many of its phases presents a difficult problem, but in no feature is this more apparent than in its application to electrical interests. Your committee would therefore urge, not only upon members of this Association, but upon all who are interested in any way in electrical enterprises, a thorough consideration of the practical application of this question, and especially to see that their representatives in the legislature, who may be called upon at any time to legislate on this subject, have some knowledge of the interests involved, so that they may know the effect of ill-considered changes which may possibly be proposed.

JNO. YULE,
Chairman of Committee.

It was moved by Mr. McFarlane, seconded by Mr. McDonald, that the report be received and considered at the next session.

The President: It would now be in order to consider any general business in connection with the interests of the Association.

Mr. Kammerer: A great many members of the Association, and those connected with electric stations generally, seem to be very much at sea respecting the inspection fee charged by the Inland Revenue Department, that is, the charges for inspecting meters. As Mr. Higman is here we would like to have him explain what the inspection fee is for.

It was understood that Mr. Higman would explain the matter at the next session.

Mr. Kammerer: There is also the matter of the taxation of poles and wires on public highways.

The President: That matter really was covered by the report of the Committee on Legislation. It will be found, as stated in that report, that the bill was withdrawn.

Mr. A. A. Dion then read the following paper:

SOME NOTES ON THE CONSOLIDATION OF TWO SYSTEMS OF ELECTRIC SUPPLY.

BY A. A. DION, M.A.I.E.E.

1. The march of electrical progress has been so rapid within the last few years, such marked advances have been made in the methods of supply and distribution of electrical energy for light and power, that central stations, which six or seven years ago were looked upon as the embodiment of the best and latest practice, are already handicapped in the race for wealth, in view of the many improvements which have been made since that time.

2. The constant and rapid increase in the use of electricity in cities has correspondingly increased the difficulties of distribution at constant potential, and new systems have had to be devised to meet the new conditions. Electric supply companies, whose stations were equipped when distribution at one thousand volts seemed like tempting providence, and small generator units were the rule rather than the exception, now find it impossible to adopt more economical systems of distribution without undue sacrifice of apparatus, and must confine their efforts towards the improvement of their services to changes within the limits of existing pressures.

3. The amalgamation of rival electrical interests, which is not infrequent in these times, brings up another and more difficult problem, that of consolidating various and oftentimes conflicting elements to form a single and uniform system. To do this without throwing any apparatus out of service was the task that the writer was lately called upon to undertake.

4. He does not claim originality for any of the features of the plan adopted, but simply states how it was done, in a particular case, believing that in furnishing each other information regarding work done in our respective fields of action, we best carry out the objects of this Association, and he trusts that some of the members may be benefitted by the discussion which this paper may bring out, if not by the paper itself.

5. The amalgamation above referred to comprised three electric light companies, namely, "The Ottawa Electric Light Company," "The Chaudiere Electric Light and Power Company," and "The Standard Electric Company of Ottawa."

THE OTTAWA ELECTRIC LIGHT COMPANY.

6. This was the oldest company, it having commenced business in 1881, and its operations were confined to arc lighting. It owned a substantial stone power house. The motive power was water, and was transmitted through four vertical turbines operating under a head of sixteen feet. The electrical equipment consisted of eighteen T. H. ten Ampere generators manufactured by the Royal Co. of Montreal, supplying 325 lights for lighting the streets of the city and 95 lamps for private lighting. This company also owned a small workshop for armature and arc lamp repairs.

THE CHAUDIERE ELECTRIC LIGHT AND POWER COMPANY.

7. This company was the next in point of age, it having commenced business in 1887. Its business was confined to incandescent lighting and supplying power for motors. Its first plant was a multiple series system, using the well known U. S. double magnet generators of 25 amperes and 550 volts. The lighting was limited to stores and other public places; five lights were run in series. Each light pendent consisted of two lamps, one above the other. The lower lamp alone usually burned. When, however, it burned out, an electro-magnetic device, con-

tained in the socket, instantly brought the upper lamp in circuit, thereby preserving the continuity thereof.

8. These machines were replaced in 1889 by the Alternating Current Converter system, but were used later for other purposes. The first installation of the latter system consisted of two Westinghouse smooth core alternators of 750 lights capacity each, that were separately excited by small machines of the U.S. type. At the time of amalgamation this company had installed 27,000 incandescent lights and 42-500 volt motors ranging from one and one-half to 20 h. p. and aggregating 320 h. p.

9. This company occupied three power houses, which, for the purpose of this paper we will designate as "a," "b" and "c."

10. "a" was the original power house, and was operated by water. It contained eight 750 light Westinghouse alternators separately excited. From this station eleven pairs of lighting feeders ran to various parts of the city. The switchboard was equipped with indicating instruments of the Westinghouse pendulum type,—one ampere meter for each pair of feeders and one voltmeter for each alternator—Westinghouse compensators, Wurtz non-arcing lightning arresters and a large number of double-throw switches by means of which the feeders and generators were made interchangeable. Some of the longer circuits were supplied with regulators or "boosters."

11. "b" was the next power house to be occupied. It was also a water power station and was built when the daily loads outgrew the capacity of "a." The electrical equipment of "b" consisted of a 1,500 light Westinghouse alternator with smooth core armature and a 120 K. W. alternator with toothed core armature, both separately excited, and a 75 K. W. 500 volt U.S. direct current generator of the upright type. The alternators were separately connected by wires to the switchboard in station "a," some four hundred feet away, and the D. C. generator supplied the motor circuits, two in number, which ran from this station.

12. "c" was a steam power station which had been built in 1893 as an auxiliary, made necessary, on account of periodical diminution of the water power through anchor ice and other causes. No place could be found for the steam plant on the premises of the other stations, therefore it had to be erected some distance away on a water course where an abundant supply of water was available for condensing purposes. Additional electrical equipment had therefore to be provided for this station. The building was a one story brick structure with stone foundation 85 ft. by 130 ft. It contained six return tube boilers 14 ft. by 60 inches and a pair of tandem compound condensing engines, rated at six hundred horse power each. These engines were belted through clutch pulleys to a six inch shaft running through the building. Two Westinghouse alternators of 240 K. W. capacity each with toothed armatures were belted to the shaft also through clutch pulleys. They were separately connected by wires to the switchboard in station "a," some two thousand feet distant. In this case pressure wires were run back from the switchboard to the voltmeters in the steam station. Floor and shaft space and stone piers were provided for additional generators.

13. The alternators of this company were run at about 1,100 volts, except those in the steam station, which, owing to their distance from the switchboard, etc., were run at nearly 1,200 volts, when fully loaded, that being their rated capacity. The frequency in every case was about 133 cycles per second. Westinghouse converters—1,000/50 volt—were used, mostly small ones, 1,000 to 2,000 watts and a few of 4,000 watts and 5,000 watts. Over three-quarters of the current output was supplied through meters, the Schallenberger being used exclusively. This company also had a small workshop for re-winding armatures and field coils.

THE STANDARD ELECTRIC COMPANY OF OTTAWA.

14. This was the junior company, it having commenced business in 1891. It could thus profit by the experience of others, and it had made provision for considerable extensions of the original plant. It occupied a substantial two storey building with a hydraulic plant consisting of four 66 inch turbines operating under a head of twenty-two feet with shafting, clutch pulleys, etc., which made each turbine capable of running the whole station or any part of it. This station contained six separately excited alternators of The Royal Company's manufacture, i. e., one of 5,000 lights capacity, one of 2,000 lights capacity, and four of 1,500 lights each, and four sixty horsepower direct current compound wound generators, also manufactured by The Royal Company. The direct current machines were used for the supply of power for motors; two of them were run in series operating a one hundred horsepower 500 volt motor running an entire flour mill day and night. Another was used to supply 33 250 volt motors ranging from ¼ h. p. to 20 h. p., and aggregating 105 h. p. The other was held in reserve.

The alternators were run at a frequency of about 133 cycles per second. The lighting switchboard was equipped with T. H. measuring instruments and plug panels which made the ten lighting circuits and the six alternators interchangeable. The voltmeters were connected with the centres of distribution by pressure wires, the distribution being made through T. H. and "Royal" transformers.—1040/52 volts—52 volt lamps and T. H. wattmeters were used throughout the system.

15. There were 18,000 incandescent lights installed.

CONSOLIDATION.

16. The plans adopted for consolidating these several systems have not all been carried out at this time. The work is being done in a gradual manner in order to cause no commotion among subscribers, but for the purpose of this paper we will assume that this work has been completed and speak of things as they will be. As a first step towards carrying out the proposed changes, the small work shops above mentioned were merged into a single one in larger and more commodious premises known as the old arc light station, owned by the company and unoccupied at that time. Some additional tools were provided and a foreman competent to superintend any electrical and mechanical work that might be required, was put in charge.

17. For several reasons it was deemed advisable to maintain the arc light service as a department entirely separate from the other branches of the business; for instance, the hours of lighting are limited, and the men connected with this service in most cases have no connection with the other departments. No changes were made in this station beyond the addition of a 60 light Westinghouse arc light machine, in order to increase the reserve and decrease the liability of impaired service from burn-outs, etc.

18. Each circuit is usually run independently from two generators, of a capacity of thirty-five and twenty-five lights respectively, in series.

19. Three patrolmen drive through the streets of the city during the lighting hours starting up lamps that have gone out and reporting every morning all lamps out, or requiring the attention of the repairer, as well as cases of improper carboning, etc.

20. These patrolmen also answer all fire alarms during lighting hours, and remain on hand at fires in order to cut wires, if necessary, and perform any other duties which may suggest themselves in the interests of the company. The daily reports of these patrolmen are posted in a book kept for that purpose in which the history of any particular lamp in the service can be read at a glance.

21. In the attempt to consolidate the two systems of incandescent lighting it soon became evident that all the feeders must be concentrated at one power house, in order that one station only need be kept running during daylight, and water power being cheaper than coal, that station which had the largest water wheel equipment was the most suitable for a central station. The Standard Electric Company's large and commodious power house best answered the requirements and was selected as the central or distributing station, and the alternators in the other stations were connected, each by a pair of wires, to a central switchboard in this station.

22. In the steam station a 500 volt, direct current, compound wound generator of 250 h. p. was installed as a part of the power system, to take the place of the 500 volt U. S. machine above referred to.

23. The stations a, b and c, of the Chaudiere Company, having become sub-stations, a switchboard panel for each generator was provided in every station. This panel is made of marble set into an iron frame. Each panel contains a T. H. voltmeter connected by pressure wires with the switchboard in the central station, a T. H. ampere meter, alternator field rehostat, main combined switch and cutout, and exciter combined switch and cutout. As these cutouts or fuse blocks, that serve at the same time the purposes of a switch, are also used in the central switchboard, they may be described here.

24. They consist of a block of lignum-vitae hollowed in the centre so as to form a chamber, air tight but for a small aperture in one side. This chamber contains a fuse of aluminum alloy. The terminals are outside this chamber and fully protected. When a fuse blows the sudden expansion of the air contained in the chamber causes a sudden air blast through the aperture effectually breaking the arc. The terminals extend outward in the form of metallic plugs, which may be inserted in or withdrawn from spring receptacles set in the switchboard. There are no metal parts exposed on the face of these panels from which there is danger of receiving a shock or getting burned.

25. Each generator in the steam station is excited by a separate machine, but each of the exciters is of sufficient capacity to excite any two of the generators.

26. Even the most approved water wheel governors are not sufficiently sensitive or rapid in their action to maintain constant wheel speed under large or sudden changes of load and the speed of water wheels on power service varies to a considerable extent. To prevent wheels racing when a heavy circuit is opened, hand levers were arranged to throw the governor into faster gear with the gate, so as to close it in a few seconds. While this was an excellent feature as a preventive of accidents, a remedy for the more or less continuous variations of voltage in the circuits had to be found, and for this purpose a separate turbine was set up to run dynamos capable of exciting the fields of not only all the direct current generators, but also those of the alternators in this station. The fields will now remain constant, no matter how the speed may vary and the fluctuations of E. M. F. will be materially reduced.

27. The machines used as exciters are one of the 250 volt D. C. generators (run at 125 volts) for the alternators, and two of the 550 volt U. S. machines before referred to (run on a three wire system), for the 250 and 500 volt generators.

28. These exciters are also used to directly supply the motor

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

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THE citizens of Ottawa and of Rat Portage are boasting of their enlightenment—there being, it is said, in each of these places, one incandescent lamp in operation for every unit of population.

THE question as to the legality of Sunday street cars is to receive an authoritative decision in the courts of Ontario. The Lord's Day alliance secured in May last, a fiat from the Attorney General, to allow the question to be tested, and a few days ago, their solicitor, A. E. O'Meara, acting for John Henderson, of Hamilton, who appears as plaintiff, applied for an injunction to restrain the Hamilton Street Railroad Co., and their employees from operating their road on Sunday. The case will be tried at the Hamilton assizes in November, but whatever the decision then, it will without doubt be carried to a higher court.

IT is understood that the Department of Inland Revenue has ordered from James White, of Glasgow, a complete set of Lord Kelvin's standard ampere balances for the Standards Branch at Ottawa. These instruments will be of the one-ampere type shown on page 24 of James White's catalogue and will be in all respects similar to the set made for the Board of Trade Standardizing Laboratory in London. They are being made with the view of obtaining great permanency and accuracy, so as to put them beyond any question of dispute. The set of four instruments will range (a) from 0 to 1 ampere; (b) from 1 to 5 amperes; (c) from 5 to 25 amperes; (d) from 25 to 125 amperes. We understand that when these instruments are placed in position, the Department will be prepared to standardize instruments for the electric lighting industry free of charge, giving a certificate of the comparison.

IT has been hinted quite recently that possibly the Montreal Electric Club would not resume its regular meetings during the coming winter season. Some of the leading spirits in the Club appear to have become in a measure discouraged on account of the apathy of many of the members, and the failure of the local electric manufacturing companies to extend to the Club the recognition and support to which they believe it is entitled. We should indeed regret to witness the winding up of an organization which has shown so much activity and has done so much to awaken and maintain interest in electrical matters in Montreal. Perhaps if those who have so successfully managed the affairs of the Club in the past would stand by the ship a little longer, more favorable conditions would ensue, resulting in a prolonged life of usefulness for the Society.

ONE of the most profitable adjuncts to an electric street railway is a conveniently located park. A number of Canadian roads have invested in property of this character, and so far as we can learn the investment has in every instance turned out satisfactorily. Rockliffe Park, owned by the Ottawa Electric Railway Company, is an extremely popular resort, and has been rendered increasingly so by the erection of a merry-go-round and other means of amusement. It may surprise the managers of other roads, who have not yet gone into this feature of the business, to learn that the merry-go-round at Rockliffe Park, which cost the railway company about $2,500, has produced a revenue of $5,000 during the past season, in addition to increasing very largely the passenger receipts of the road. It is learned that Mohawk Park has been the means of doubling the receipts of the Brantford Electric Railway Company, and that the new park opened recently in connection with the Winnipeg Electric Railway nets the company as much in receipts as the balance of the entire system.

Prof. Alex. Graham Bell, inventor of the telephone, has just returned from Europe, and has apparently got some new ideas in his head, which may materialize into as famous and useful inventions as the telephone. He is interested in flying machines, and believes the day is not far distant when men and women will go flying through the air like birds. What a relief that will be to our congested streets. Balloons and butterfly wings must, however, he says, be discarded. He believes a machine of greater specific gravity than the air to embody the true principle, and says that there are several French designs, one especially called the kilikoptes, which meets his idea. He thinks the introduction of the bicycle will not displace the horse to the extent some people predict, but that a means will be discovered by which that animal can be taken off the ground, and still used as a motive power. When not only men but horses take to flying, what may we not expect. Then as to his radiaphone, he says it is as perfect as the telephone, but impracticable for long distances on account of the rotation of the earth. Prof. Bell has also invented a condenser for providing the Newfoundland fishermen with fresh water at sea. He is a wonderful man.

THE fifth convention of the Canadian Electrical Association, the proceedings of which are fully reported in this number of the ELECTRICAL NEWS, viewed either from the standpoint of instruction or pleasure, was eminently successful. The subject of the papers presented were sufficiently varied to attract the interest of members in every department of electrical effort. It is a matter of much regret that three of the authors, Messrs. Hartman, Keeley and Milne, were unavoidably detained from the meeting, necessitating the reading of their interesting productions by proxy. The absence of these gentlemen had also the effect of lessening discussion. In this connection it might not be out of place to remark, that while the papers presented at the conventions of the Association have usually been of an interesting and instructive character, the discussions upon them have not been as spontaneous and thorough as could be desired. The discussions should be taken part in by every member who holds an opinion on the subject under consideration, and if this were the case, they would prove to be one of the most valuable features of every convention. We look for an improvement in this particular at future meetings. It will be seen that the Association has revised and greatly improved its constitution, thus placing itself on a sound working basis. The increase in membership during the year is most gratifying, and is due in no small measure to the enthusiastic efforts of Mr. Dunstan, the retiring President. The newly elected President and Executive officers are well qualified to maintain the progress and usefulness of the organization. It would be impossible to speak in too high praise of the efforts of the Local Committee in making such complete arrangements for the entertainment of the visitors. For the successful carrying out of these arrangements, the Committee spared neither time, labor or expense. It is to be hoped that they will feel in some measure rewarded by the success achieved and the expressed appreciation of their work on the part of every member and guest. The opinion is freely expressed that the Ottawa convention has in many respects strengthened the Association and brightened its outlook for a prosperous future. The fact that this youthful organization has already taken first rank with older societies of similar character in other countries, should be a source of pride to Canadians interested in the science of electricity, and should ensure to it their hearty support. The next convention is to be held in Toronto in June, the most beautiful month of the year, and should prove to be worthy of its predecessors and surroundings.

MOONLIGHT SCHEDULE FOR OCTOBER.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1.....	A.M. 1.40	A. M. 5.10	3.30
2.....	" 2.40	" 5.10	2.30
3.....	No light.	No light.	....
4.....	No light.	No light.	....
5.....	No light.	No light.	....
6.....	P. M. 5.50	P. M. 7.30	1.40
7.....	" 5.50	" 8.10	2.20
8	" 5.50	" 8.50	3.00
9.....	" 5.50	" 9.50	4.00
10.....	" 5.50	" 10.50	5.00
11.....	" 5.50	" 12.00	6.10
12.....	" 5.50	A. M. 1.00	7.10
13.....	" 5.50	" 1.10	7.20
14.....	" 5.40	" 2.30	8.50
15.....	" 5.40	" 3.50	10.10
16.....	" 5.40	" 5.40	12.00
17.....	" 5.40	" 5.40	12.00
18.....	" 5.40	" 5.40	12.00
19.....	" 5.40	" 5.40	12.00
20	" 5.40	" 5.40	12.00
21.....	" 6.00	" 5.40	11.40
22.....	" 7.00	" 5.40	10.40
23.....	" 8.00	" 5.40	9.40
24.....	" 9.20	" 5.40	8.20
25	" 10.20	" 5.40	7.20
26.	" 11.00	" 5.40	6.40
27.....	" 11.30	" 5.40	6.10
28.....	.....	" 5.40	5.10
29.....	A.M. 12.30	.....	
30.....	" 1.30	" 5.40	4.10
31.....	" 2.30	" 5.40	3.10
		Total,	194.40

SPARKS.

Electricity has been applied to the aging and tempering of wine in Italy with great success.

The Oshawa railway has given the contract for the erection of a power house of 250 horse power.

Mr. A. M. Schofield, for the past three years with the Carlton Place Electric Co., is going to Detroit.

Joseph Lamonge, a French-Canadian carpenter, was killed by a trolley car in Montreal on the 23rd. He drove in front of a moving car.

David and Elizabeth Boyd are sueing the Hamilton Street Railway Co., for $2,000 damages sustained by being run into by a car on Barton street.

It is said four new mica mines will be opened up in Wakefield this fall. Mr. T. J. Watters is operating a new amber mica mine in Portland. He also contemplates working the Lake Girard mines. The demand for mica for electrical purposes is rapidly increasing.

It is proposed to convert the disused railway belt lines back of Toronto, controlled by the Grand Trunk, into electric lines. No decisive action has yet been determined on, but should it be decided to make the change work will probably be commenced early in the spring.

Work will be commenced on the Quebec city electric railway at once, but little will be done in tracklaying till next spring. A delay has arisen because of the refusal of the present street railroad company, which has exclusive right of way for nine years, to allow the electric company to cross its tracks.

(Continued from page 177.)

circuits on Sundays when the load is very light, and the motor wheel which has run day and night during the week is shut down.

29. Each D. C. generator is supplied with a double-throw switch by means of which its fields may be connected either with the separate exciter or with its own armature. Alternators may also be excited by the common exciter or independently, the change being made through the switchboard.

30. Each of the three companies had pole lines in the same districts, in many cases both sides of a street were occupied by them. The number of poles to be maintained was reduced by placing all the wires running on a street on the best pole line and discarding the other. The lighting districts that were occupied by two different systems were divided in two, so that, while the number of feeders was actually reduced by three pairs the number of distribution centres was doubled and the line loss between them and the converters was correspondingly decreased.

31. The mains running through contiguous districts are made to overlap, so that all public buildings such as churches, theatres, halls and hotels have their lights divided between at least two separate circuits and converters. This makes it almost impossible, in case of accident, for all the lights to be out at one time.

32. The size of feeder units had been kept down within the capacity of the smallest generator, but it was found advisable to increase the units for the present to 1,000 and 1,500 lights, which seemed to best fit our generator units.

33. Eight circuit feeders were calculated for an ultimate load of 1,500 lights, and ten for 2,000 lights; this left some margin for extensions.

34. This change made it necessary to run the 750 light machines in pairs as a 1,500 light unit.

35. First parallel running was tried but it was found that the idle currents were considerable at times and this method of running was abandoned. Two of the generators were then mounted on iron girders set very accurately so as to approximate a solid iron base, and flanged pulleys were put on the shafts and bolted together These generators could thus be driven as a single machine. The armatures were connected in multiple. If this arrangement proves satisfactory, from a mechanical point of view, the other generators in this station will be similarly coupled.

36 It is necessary to the proper working of a lighting and power service, that the losses in the different parts of each circuit should be predetermined and unchangeable. In order to better obtain this result a series of official wiring tables were issued by the company, covering interior wiring services, mains, feeders, etc., together with such printed directions as would secure uniformity in the manner of using the tables, a thing much to be desired but not always obtained. The losses to be 10% in feeders, 2% in mains, 1% in services and 2% inside buildings calculated.

37. It was also necessary for the convenient working of the lighting system that a uniform voltage should be maintained on all mains, and 1040 volts was decided upon; it was also decided, however, that 50 volt lamps would be used, experience having taught us that lamps of medium efficiency when run by water power gave the best results for customers and company, when burned somewhat above their normal voltage.

38. The public has come to expect a great deal of light from a 16 candle power lamp. If the lamp is good and the efficiency 3½ watts per candle or lower, it will maintain its candle power for a considerable time when overrun by four per cent.

39. Converters of 100 light capacity have been introduced wherever the business was sufficiently bunched up, displacing the smaller ones which are used in the districts of more scattered lighting. No doubt still larger ones will be used in time.

40. The compensator system of regulation was adopted in preference to the feeder and pressure wire system. We still have the feeders, and the compensators take care of all the losses between the dynamo and the lamp, while the pressure wires lose their usefulness at the distribution point, although the losses between that point and the lamps may be considerable in some cases.

41. Each circuit is provided with at least three non-arcing lightning arresters, one at the station, one at the point of distribution and one or more at the distant ends of the mains. These are carefully grounded, the ground wires being riveted to street railway rails whenever possible.

42. A Bristol recording voltmeter, set up in a case convenient for carrying about, is used to adjust the compensators. The voltmeter is left at some point of the circuit to be adjusted, for twenty-four hours This is repeated at different points of the same circuit The adjustments should be checked once a month.

43. The main switchboard situated in the central station consists of thirty-four marble panels set side by side in a framework of angle steel fastened to the stonework of the building. This frame stands at least six feet from the wall and is supported by soft rubber discs set into iron rings fastened to the floor. These discs have the effect of taking up the vibrations of the floor, and prevent their being communicated to the instruments above. The switchboard is 57 feet long and nine feet in height.

44. There are eight dynamo panels similar to those in the other stations and already described, six for the alternators in this building, and two spare ones.

45. Five motor panels that contain Weston illuminated dial voltmeters, Weston edgewise ampere meters, Westinghouse circuit breakers, ground detector, and jaw switches, through which all the motor circuits and D. C. generators are interchangeable.

46. The twenty feeder panels contain Westinghouse pendulum voltmeters, ampere meters and compensators, throw-over switches and panels for plug and cable connections with twelve pairs of bus bars and combination switches and fuse blocks, as already described.

47. These twenty panels are divided into two sections of ten between which a special panel is set up, containing a clock, a ground detector and switch, and other special devices.

48. Directly in front of each section of feeder panels and four feet away from them stands a table made up of an iron frame work with sides of wire netting and plate glass top set in a polished brass frame. Each of these tables contain ten regulators or "boosters" with a range of 20% up or down. Each circuit can thus be regulated independently.

49. The attendant at this switchboard controls the whole system. He is also in communication with the attendants at sub-stations and the station superintendent's residence by a private telephone line.

50. For economy in line construction it was decided not to extend the 250 volt motor system except for units of one h. p. or less, and to merge it and the 500 volt service into one single three wire distribution. The 100 h. p. motor in the flour mill is, however, on a separate circuit and may, if desired, be run independently of the others. The three wire system is supplied by two of the 250 volt 60 h. p. generators in series, and the 500 volt 250 h. p. generator connected to the + and − wires. The brushes of the 250 volt machines on the + side and the + brush of the 500 volt machine, may be connected together for equalizing purposes. All the D. C. generators are interchangeable through the switchboard.

51. It was found necessary to almost completely reconstruct the motor circuits. Four pairs of No. 0000 feeders were strung up. As the joints in wire of that size are extremely unsightly a portable welder was constructed for welding the lengths of wire together. A large regulator core was fitted with a primary coil of 388 turns and a secondary coil of a single turn made up of 12 No. 0000 wires upon the ends of which massive metal jaws were shrunk. These jaws normally stand about four inches apart, but may be pressed closer together by an insulating clamp and screw, the elasticity of the secondary coil causing the jaws to resume their normal position when released. The current is regulated by a T. H. reactive coil. This apparatus may be attached to any converter on the line as required.

52. Several of the U. S. dynamos in use for lighting up to 1889 have been put in service as motors, two of them running elevators very successfully.

53. The company has lately made what is believed to be an innovation in providing in its office, which is open day and night, a locker with a glass front in which are displayed rubber coats, gloves and shoes. This in addition to the rubber gloves regularly supplied to all linemen. The key of this locker hangs within a little box behind a glass which is to be broken, in case of accident, by anyone requiring the clothing.

Mr. Breithaupt: I think we are much indebted to Mr. Dion for his paper on the consolidation of three different plants. The arrangements with regard to the dynamos would cause some difficulty, and as Mr. Dion has explained, the consolidation also of these three lines on one switchboard; for instance, the day work had of course to be concentrated in one station, as it would not do to operate some lamps from one station and some from another. An interesting part to my mind is the way in which the lines have been treated, particularly the street mains, how the mains of the three different companies were consolidated into one and still kept to a certain extent separate. Large buildings being on duplicate mains, if the machinery should be disabled in one station the lights would not all be interfered with; this I think is deserving of commendation. The paper throughout is so very clear and precise that I have very little criticism to offer. It is certainly a very extensive work. I was told some time ago that it was not completed yet.

Mr. J. J. Wright: I notice one point that Mr. Dion speaks about, that is, the durability of lamps when being overrun by four per cent. I presume he speaks from experience. I would like to know what the durability of the lamps would be when overrun four per cent. A few minutes ago I was looking over an article in the ELECTRICAL NEWS in which it was stated that every one per cent. overrun reduces the life of a lamp fifteen per cent. According to this Mr. Dion's four per cent. would reduce the life sixty per cent.

Mr. Dion: Replying to Mr. Wright I do not claim that overrunning a lamp would not shorten its life. It certainly does shorten it very materially, but we have come to the conclusion that we can seldom run lamps to their death. There comes a time in their existence when it is a charity to put an end to them. We think, everything considered, that it pays the company and gives better satisfaction to the consumer to give a very bright

light. We lose on the life of the lamp but do not lose very much on the use of the light.

Mr. Kammerer: There is one matter I would like to speak about in connection with the regulation of the speed of dynamos driven by a water wheel. Mr. Dion might tell us what efficiency of government he gets by the means adopted, for the purpose of maintaining a steady flow of current in the fields. While perhaps to the man who is running water-wheels and applying power by water-wheels all the time, it may seem a simple matter, still to my mind it is not very clear what efficiency he can get. For instance, the holding up of electro-motive force under a sudden load, or getting the gate to open and close fast enough to prevent acceleration upon the removal of a load. Some of us would like to get a little further information on this point.

Mr. Dion: I am sorry I have no figures as to water regulation with me which I can present. We realize that a considerable portion of the variation of the electro-motive force is due to the variation in the fields, and if we can keep that portion of it steady it would better the regulation of the electro-motive force to that extent. That system of exciting the fields had been tried last winter by the electric railway and its effect was very favorable. The result of the change was very noticeable, so much so that the difference after the operation was remarked upon by people riding in the cars. We hope it will be very useful in our case.

Mr. Fisk: We are running a street railway in Peterboro by water power, and also an incandescent light plant. We have every advantage as far as water is concerned, and the incandescent is giving good satisfaction. Of course an attendant, when the load is coming on, remains close to the wicket and increases the power. We do not find our incandescent load comes on suddenly, that is, not enough to affect it. The load appears to come on gradually and to go off in the same way. Of course on railway work it goes up and down considerably. So far we have not been able to control that as close as we would like; the attendant throws the water on and off as necessary. We have not been able to run the railway and our incandescent lamps together, and even with an engine and a very good regulator it seems impossible to run incandescent lighting and railway work at the same time.

Mr. L. B. McFarlane: There is one line here in paragraph 12 that I would like to call your attention to. We would like to know about the anchor ice. We understand that it is a detriment in running, and that steam power had to be put in and used on account of it. I believe it is intended to have a company in Montreal to use the Lachine Rapids as a source of power, and we would like to have the experience of Ottawa as to whether that difficulty can be overcome or not.

Mr. Soper. I would like to ask Mr. McFarlane whether it is the anchor ice that causes the buzzing in the telephone. (Laughter.)

The President: If Mr. Soper will answer Mr. McFarlane, no doubt Mr. McFarlane will then be glad to reply to his question.

Mr. Soper: I think Mr. Dion, or his assistant, Mr. Murphy, more competent to answer than I. He is very familiar—I may say distressingly familiar—with the subject during certain seasons of the year.

Mr. Dion: The anchor ice question is a very difficult one to deal with. People who have lived all their lives in this place and have been connected with water power, and who are supposed to know all about the question, disagree very much about the particular nature of this trouble and how it comes about. Under these conditions it would be presumptuous for me to say anything about it. However, where the trouble arises in the fall with the anchor ice, which is more properly called frazil, being more like half melted snow than anything else, is that it comes down, preventing the flow of water in the water-wheel. This occurs in the fall after a very sharp frost, but it is of short duration and lasts a few days only. When the weather is settled and the river freezes over, this stops the stuff from coming down. Another trouble which occurs later in the winter is of a different nature. As far as I can make out it comes by anchor ice adhering to the solid ice underneath and forming a solid bank of ice, which extends nearly to the bottom. This is a serious difficulty, and as the banks are of large extent it is impossible to remove them. It was after experiencing this difficulty the steam station was determined upon.

Mr. C. B. Powell: As an extension to what Mr. Dion has said, and in order to give Mr. McFarlane a little more light on the subject, I would say that I never heard of the existence of a water power without this anchor ice; some have more and some less. The St. Lawrence Rapids I think have more than almost any other in Canada. We have indulged in much speculation as to the occasion of it and as to the nature of the trouble. The cause is water running over shallow ground, and freezing with great rapidity it assumes the character of snow—of melted snow that is—and banks up against the water-wheels. In Montreal every water-power is troubled with it, and I never heard of anything that would prevent it. During the time of the anchor ice trouble it is impossible to do anything with it. Various remedies have been proposed; people have even talked of putting steam pipes in the rapids, but no amount of heat would have any effect on it. We have the best means of coping with it from the fact of having an auxiliary station.

Mr. Fisk: Regarding anchor ice, I had some little experience with it. There is another condition that bothers me more than anything. Before the river freezes over in the fall, when the temperature of the air drops below the temperature of the water, the water seems to remain free of ice, but if you put an iron bar into the water it immediately becomes covered with ice; even a piece of wood will become coated in the same way. It gathers on the buckets of the wheel until the wheel seems to be a solid cylinder. I once got a number of men to empty the wheel of ice by means of hot water, and then let the water in again. It was just as bad again in half an hour. This condition of affairs generally occurs in November, and sometimes in March before the river is open. With regard to anchor ice proper, we are well situated in Peterborough, unless the river be neglected. Otherwise we suffer very little from it, but this frost condition there seems to be no remedy for.

Mr. Soper asked what was the condition of the surface of the water where it entered the flume.

Mr. Fisk: Comparatively smooth.

Mr. Soper: Were there any ripples on it?

Mr. Fisk: No.

Mr. Badger moved that a vote of thanks be tendered Mr. Dion for his very interesting paper; seconded by Mr. Breithaupt. Carried.

Mr. Dwight then read the following paper:

THE TELEGRAPH IN CANADA.

By Charles P. Dwight.

The telegraph in Canada has so often been made a subject of history and retrospect that one can hardly hope in a paper of this nature to do more than briefly outline much of what has already been written concerning its rise and development. The various stages in its practical operation, from the simplicity of the old paper register to the present day, are too well known to require any elaboration at my hands, and I have, therefore, simply put together something which may be considered as a record for this Association concerning the more important telegraph organizations which have existed in Canada from the start.

The first commercial telegraph line erected in this country was in the year 1847, between Toronto, Hamilton, St. Catharines and Niagara Falls; connecting at the latter point with a line through to Buffalo, owned by one David Kissock. The organization under which this line was built was known as the Toronto, Hamilton, Niagara Falls & St. Catharines Electro-Magnetic Telegraph Company,—a somewhat lengthy title for a concern of this nature, but one which was thoroughly expressive in regard to the scope and nature of its business. As a matter of curiosity there is laid on the table for your inspection one of the original stock scripts of this Company, which an antiquarian friend has loaned me for the occasion, and which you will note bears the signature of Thos. D. Harris, President, and P. B. Marling, Secretary. The capital stock of this Company was $10,000, and the line was built under contract by Samuel Porter, a man long known afterwards in connection with various telegraph enterprises in the United States, and of whom it was said that "he built for this first Canadian Telegraph Company an honest and well appointed line."

In the same year, 1847, was organized the Montreal Telegraph Company, with a capital of $60,000. This Company immediately proceeded to construct a line from Quebec to Toronto, and soon afterwards purchased the line erected by the Toronto, Hamilton, St. Catharines & Niagara Falls Company. The line from Quebec, when finished, was looked upon at the time as the best piece of telegraph construction on the continent. The poles were of cedar, thoroughly tamped and well set. Wooden brackets of white oak were used, with glass insulators. The wire was a No. 9 gauge, English galvanized, and was the first of this kind employed for such a purpose on the continent.

At the close of the year 1847 the Montreal Company had in operation 540 miles of wire, with 9 offices, 35 employees, and had sent in all 33,000 messages.

An organization known as the British North American Electrical Association was also formed in 1847, with F. N. Gisborne as the moving spirit. This Company, or Association, proposed connecting Quebec with the Lower Provinces, and finally with the Atlantic Coast, but for some years the line was extended no further than Riviere du Loup. It was finally extended to Woodstock, N. B., however, where connection was formed with the American Telegraph Company, an organization which had already connected a few of the principal points in New Brunswick at that time, and which had a capital of $25,000. A second organization, known as the American Telegraph Company, constructed a line about this time from Quebec to Montreal, but was afterwards absorbed by the Eastern Company. All of these lines east of Quebec, however, proved a dismal failure from a financial point of view, and were soon turned over to the Montreal Company without charge, and the line between Quebec and Montreal was also taken over by them at a nominal charge.

In the Eastern Provinces there is on record a project set on foot by Mr. Lawson R. Darrow in 1847, for the purpose of connecting the lines then in Nova Scotia with those of Maine, and an act of incorporation was granted for this purpose in 1848. In the same year a line was built from Calais, Maine, to St. John, N. B., under the organization just mentioned, and which had now been incorporated into a Company known as the New Brunswick Electric Telegraph Company, with a capital of $40,000. A line to St. John via St. Stephens, St. George and St. Andrews, was completed Jan. 1st, 1849, and during the ensuing summer the line was completed from St. John to Hampton, Sussex, Salisbury, Dorchester and Sackville to Amherst, where connection was made with the Government line then in Nova Scotia, which was built from Amherst to Halifax in Nov., 1849, and which for the first time gave Halifax connection with New York.

In 1856 the lines of the New Brunswick Telegraph Company were leased to the American Union Telegraph Company, and some ten or twelve years later came under the direction of the Western Union Telegraph Company.

The Government line between Halifax and Amherst was built by F. N. Gisborne, for the purpose of forming a connection with the American and New Brunswick lines at the former place, in order to meet the demand for communication with New York, consequent upon the arrival of steamers at Halifax with European news. In 1851 this line was sold to the Nova Scotia Electric Telegraph Company, an organization chartered in March of that year, and which afterwards extended the line from Pictou to Sydney, C. B., and from Halifax to Yarmouth. Upon completion of arrangements for the landing of Atlantic cables in Newfoundland, the lines of the Nova Scotia Company were leased to the American Union Tel. Co. in 1860. In 1866 this lease was taken over by the Western Union Company, who purchased the lines outright in 1872.

Returning to the Province of Quebec again, we find that in 1849 there was organized what was known as the Montreal & Troy Telegraph Company, which built a line the same year from Montreal to the frontier, and thence via Whitehall to Troy. This Company was organized by Ezra and Alonzo Cornell, who also constructed the line, and which worked for several years afterwards in connection with the Montreal Company A B. Cornell, whom it will be remembered was afterwards Governor of New York State, acted as manager of the Company at Montreal for two years after the construction of the line. Some few years afterwards the section of the line from Whitehall north became the property of the Montreal Telegraph Company, under a compact with the American lines, known as the Six Party Contract, whereby certain divisions of territory were made and allotted each Company.

In 1850 there was projected and built a line between Montreal and Bytown (probably the first telegraphic connection enjoyed by Ottawa) by the Montreal and Bytown Telegraph Co., of which Edward McGillivray was President, and which a few years afterwards was purchased by the Montreal Telegraph Company.

In the year 1852 the Grand Trunk Telegraph Company was organized, and built a line between Buffalo and Quebec, and seem to have given the Montreal Company a pretty lively opposition between these points. After a few years, however, it went the way of so many of its predecessors, and was purchased by the Montreal Company for the sum of $11,000. Then sprang up another organization, known as the Provincial Telegraph Co. which built a line over the same route, but it too was soon absorbed by the Montreal Company.

In 1868 was organized the Dominion Telegraph Company, which had soon built lines embracing all the important points between Buffalo, Detroit and Quebec, and whose opposition became more lively as time went on. Rates were reduced, and the outcome promised disaster for all concerned. When in 1881, therefore, a proposition was made for the consolidation of these conflicting interests, under lease, by the Great North Western Telegraph Company, considerable satisfaction at the prospect was expressed by all concerned, and a deal on these lines was accordingly put through, and is in operation to-day. The combined mileage of the two Companies at the present time, as operated by the Great North Western Tel. Co. at the present time, is 18,000 miles of poles, and 40 000 miles of wire, with some 1 800 offices throughout Ontario, Quebec, New Brunswick, Manitoba and Northern New York State.

By means of this amalgamation the telegraph business of the country was for a time almost entirely in the hands of the Great North Western Telegraph Company. In every city and town where two offices had previously been maintained the wires were all taken into one, and sweeping reductions in expenses consequent upon such a move were at once inaugurated. The monopoly thus brought about was not destined to last long, however, and almost immediately afterwards the Canada Mutual Telegraph Co. was organized, and constructed lines between Niagara Falls and Toronto, Montreal and the boundary line, and Montreal, Coteau and Ottawa. Some three or four years after the amalgamation had been effected, the Canadian Pacific Railway Co. had also commenced the construction of telegraph lines along the route of their road, and between many of the principal cities and towns of the Dominion, and in September, 1886, had opened 366 commercial telegraph offices throughout Ontario, Quebec, Manitoba and the North West Territories. Since that time they have been constantly adding to their plant, and at the present time have somewhere in the neighborhood of 25,000 miles of wire in operation, and 800 offices.

In certain remote localities along the St. Lawrence and in the North West territories, where private companies would hardly be justified in extending their lines, the Dominion Government have in operation at the present time somewhere in the neighborhood of 3,000 miles of wire.

The total amount of capital invested in Canadian Telegraphs may be roughly fixed at between six and seven million dollars, and the total wire mileage at somewhere in the neighborhood of 75,000.

In respect to population it can truthfully be said that no country in the world enjoys a more extensive system of telegraphs than Canada. Scarcely a town or hamlet in the whole country but has connection by this means with the outside world. Hundreds of offices are maintained throughout the country in small out-of-the-way places, where the actual business is but trifling, and where the lines in reality prove much more a matter of convenience to the public than profit to the telegraph companies.

The following comparative table, showing the number of inhabitants per each telegraph office, will indicate more clearly the position of Canada in this respect.

Country.	No. of Inhabitants to each Telegraph Office.
Great Britain	6,417
Switzerland	2,556
Holland	10,254
France	7,719
Germany	4,510
United States	5,625
Canada	2,320

In respect to rates, too, no country enjoys a cheaper schedule than Canada; distances and other conditions fairly taken into account. The maximum charge between offices in Ontario, Quebec and New Brunswick is 25 cents, and for this sum a message can be transmitted over twelve hundred miles of wire.

In Canada the telegraph companies have always kept well abreast of the times in promptly adopting the various improvements in apparatus which have from time to time been placed upon the market, and two well-known repeaters, the Toye and the Neilson, attest our own ingenuity in this respect. Both the duplex and the quadruplex systems are in daily use over some of the most important routes, and direct and rapid communication is maintained between all the larger centres, as well as with New York, Chicago and other important American points.

So essential a feature in every day business life as the telegraph has now become is very apt to be regarded in its simplicity as something from which little more may be expected in the way of improvements. Great things may yet be looked for, however, in the practical operation of the telegraph From the days of the old Phelps register, when messages were laboriously spelt off the slowly winding tape, the brightest minds in the profession have ever been directed towards achieving that rapidity and perfection of transmission towards which so much has already been done. Numerous contrivances have within recent years been placed upon the market in the shape of printing machines, and the latest achievement in this direction—known as the Buckingham Automatic Printer—gives promise of being an unqualified success. This machine has recently been put to a thorough test over a line one thousand miles in length, and a sample of the work done by this means is laid on the table for your inspection. It is a quadruplex printer, capable of transmitting and printing 150 words per minute.

Predictions are of course a little premature as yet, but if thoroughly successful and universally adopted it will readily be seen how much nearer every man's door the telegraph will come.

Within the past two or three years dynamo plants have been installed in the offices of the Great North Western Tel. Co, in Toronto and Montreal, displacing several thousand cells of gravity battery in each place, and for adaptability and general efficiency there are few superior plants to be found anywhere.

In Canada telegraph lines are maintained under adverse conditions, which exist in few other countries similarly equipped. Long stretches of lines are maintained through rough and sparsely settled districts, and the sleet storms of winter often mean total abolition of long stretches of poles and wires over the most important routes, and involve an amount of labor and expense in their restoration little understood by the average outsider, who has merely a grumble to offer if his business cannot be got through in all kinds of weather.

Aside from the position which the telegraph occupies in our midst as a simple means of sending and receiving messages, it might not be out of place to enumerate a few of its more important outside functions. I need not say in this connection that there is no more vital adjunct in the operation of our great railways to-day than the telegraph. Railway telegraphy is in fact an art in itself, without which many of our more important railway systems might be likened to ships without rudders.

The collection and distribution of market reports is a service performed by the telegraph companies in Canada which is worthy of special mention. By means of tickers and special delivery are daily distributed amongst our brokers and others continuous quotations from the markets of Liverpool, London, Beerbohm, Chicago, Milwaukee, St. Louis, Duluth, Detroit, Toledo, New York and Paris, in both stocks and grain; a service which serves to keep those interested in continual touch with all the great markets of the world.

The gathering and distribution of reports in connection with the Meterological Department is another service, which is of inestimable value to many of the most important interests in the country.

The press service of the telegraph companies is also an important feature in connection with their business. I need not remind you that it is by means of the telegraph, broadly speaking, you are enabled to discuss so readily the affairs of the world, and look so wise and weighty. In Canada a regular system is in operation, whereby every telegraph agent is also an agent indirectly of the press; forwarding to headquarters such items of public interest happening in his town or neighborhood as he is required to send, and which is afterwards sifted and made use of by papers here and elsewhere. That the politics, and political opinions of the country, are largely moulded by the press, there is little question. In fact many papers are primarily in existence for no other purpose than to serve political ends. Latter day enterprise in journalism is a source of constant wonder. In the dissemination of both political and legitimate news there is no one factor more important than the telegraph.

These are of course facts almost too well known to require repetition at my hands, but mere mention of the part played by the telegraph in connection therewith is sufficient to indicate the magnitude of its mission. As an instrument in the higher civilization of man it has no peer, and that we in Canada have shown ourselves so thoroughly alive to this fact is certainly a matter for congratulation.

The President: I may say that this contribution to our set of historical papers is a very valuable one. We are endeavoring to get a complete set of historical papers, which will be placed on record and which will become more and more valuable as time goes on. We already have the history of the telephone and of the electric railway, and this adds the telegraph to the list.

Mr. Black: I have listened with a great deal of pleasure to the paper read by Mr. Dwight, and it has taken me back in memory a great many years. I am probably the oldest telegraph man in the room at the present time and have had some little experience with a good many of these companies that Mr. Dwight refers to. I think he has probably put more history in a small space than most people would have been able to do. Of course he has left out a great deal that might have been said, but still the ground is well covered. In the matter of the Grand Trunk Telegraph Company I mentioned to Mr. Dwight to-day that the Grand Trunk Railway compelled them to change their name, but I could not remember what name they took. I think it was the International. The Montreal Telegraph Company had to compete with what was, I think, the most miserable line ever put up in Canada. It was built of No. 10 wire, and from the appearance of the line it must have been strung on poles picked up on the roadside. They had not digged proper holes for the poles; merely made a hole with an augur and put them in.

Mr. Higman: In regard to Mr. Bethune, who is not present, he is perhaps, with the exception of Mr. Dwight, senior, and another man in the service, the senior telegraph man of this country. He could no doubt add very interestingly and materially to the discussion. I listened with a great deal of pleasure to one of the passages in the paper, which brings to my recollection some very curious things in the world of telegraphy One of these is in connection with the old Montreal and Troy Telegraph Company. The story is one that Mr. Bethune told me on one occasion, and which I believe is true, but will hardly be credited by people of this age, who are in the habit of using the latest appliances for testing telegraph lines. This was about the year 1847. There had been a bad storm and Mr. Bethune with some workmen were engaged in making repairs. Their wire had run out and they scoured the country for wire, but could find none. In their search they visited a farm house, and not being successful in getting any wire they racked their brains to discover a substitute. Finding a piece of rusty weather-beaten stove-pipe, they determined to use it, and puncturing a hole at each end, they strung it up, and Mr. Bethune stated to me that that pipe swung there for three weeks, during which time the line worked uninterruptedly. Now if they had had a galvanometer and other appliances for testing lines, they would not have used that stove-pipe at all, as their instruments would have shown that it would not work. Where ignorance is bliss it is folly to be wise. This is an actual fact. Those engaged in telegraph work a quarter of a century ago will bear me out. When I left England we were not allowed to take by sound at

all; we were obliged to let the paper run through the register, and if we did take by sound a fine was imposed. The last fine I paid was in King George pennies, and it cost me fifteen cents express charges on the fine. In the matter of cut-outs, we had one bound with string on both sides of it. There was nothing to prevent it reaching the re-lay and was often found next morning.

Mr. Soper: I would like to say a word in praise of the paper just read. As an old telegrapher it was very valuable to me. Its historical value was very great. It must have been at the cost of considerable trouble that the author has been able to give it to us. We old telegraphers are not like those who find themselves in the electric work to-day without going through the early stages of telegraphy, and we look back almost with joy upon those days with their hardships. We had a freemasonry among us which does not exist to-day, and the paper read by Mr. Dwight brings back those days vividly to my mind. I wish to propose a hearty vote of thanks to Mr. Dwight.

Mr. Smith: Mr. Higman has told us about working through a stove-pipe. I can remember a case where we put on an extra battery and jumped the break. Mr. Dwight has gone to a great deal of trouble in going through a mass of details and dishing them up to us in condensed form, so they can be placed with the Association records for all time to come. I do not think that the general public give the telegraph companies credit for the enterprise they display, when you come to consider the way in which they push their lines out into hundreds of places where they do not pay, and maintain a service in Canada such as is not found anywhere else in the universe. And people seem to take it as a matter of fact; they merely send their messages and pay their quarters. There is a disposition on the part of some to think that the telegraph service has reached its limit. This is a great mistake. This specimen of work done by printing telegraph is an evidence of what may be done. Any system that will transmit 150 to 200 words a minute in characters as legible as that, is worth more consideration, and we expect to be able to quadruplex the line at that. It is a question of how far this is going to interfere with the mails in the near future.

Mr. Black: I have had brought to my notice a novel piece of line repairing. I remember linemen coming in on one occasion seemingly having some question to ask me. One nudged the other, telling him to ask the question. I asked them what it was they wanted to know, and one spoke up and asked if a piece of clothes line would do to mend a break in a telegraph line. I told them no. The foreman then said that they had taken a piece of clothes line about a yard long out of the telegraph line and they had inquired at the nearest office if the line had been interrupted, and they were told that there had been no interruptions for three weeks. (Laughter).

The President: I have the pleasure of announcing that, by courtesy of the Electric Railway Company, members wearing the Association badges will be carried free on the electric cars. The Telephone Company also have placed a telephone at the disposal of the members. The Mayor this morning with great courtesy offered us the use of the City Hall. I mention this in case you wish to take action in the matter. We were fortunate in having the Railway Committee Room for our opening meeting, and both the Board of Trade Rooms and the City Hall at our disposal for future meetings.

Mr. Soper: It may not have occurred to you that the ventilation of this room is not very good. When I came in half an hour ago it was very noticeable; the air seemed laden with noxious gases. I think the City Hall much better in this particular, and just as convenient.

It was moved by Mr. Taylor, seconded by Mr. Badger, that future meetings be held in the City Hall, which has been placed at the disposal of the Association by the courtesy of the Mayor. Carried.

Moved by Mr. Smith, seconded by Mr. Roch, that a hearty vote of thanks be tendered the Board of Trade for the use of their room. Carried.

At 8 o'clock p.m. the members, accompanied by a number of their lady friends, entered special cars provided by the Ottawa Electric Railway Co., and made an interesting visit of inspection to the power stations and Mr. J. R. Booth's lumber mills at the Chaudiere.

SECOND DAY.

MORNING SESSION.

At 10:30 a.m. the convention resumed, and the President announced the order of business.

Mr. McFarlane moved the adoption of the report of the Committee on Legislation, seconded by Mr. Gilmour. Carried.

The President: The next order of business is the consideration of the report of the Committee on Constitution. I would suggest that this should be taken up article by article, as it is a very important report and should receive careful consideration.

Mr. Kammerer: I beg to move that the constitution be taken up clause by clause. I notice it is called an amendment, but I think we should call it a revision of the constitution. It really is a revised constitution.

Mr. Wright: I beg to second the motion that the report be now taken up clause by clause. Carried.

The President read clause 1. Carried.

The President read clause 2.

Mr. Black: In reading this article over I think it would be advisable to make some change in the first part of it. In claiming to foster and encourage the science of electricity I think we are assuming too much. Of course it is easy to find fault, but not so easy to suggest a remedy. I do not like the words "foster and encourage."

It was decided, after some discussion, to make the clause read "advance the science of electricity and to promote the interests of those engaged," etc.

The President read Article III. Carried.

The President read Article IV.

Mr. Breithaupt: With regard to the Executive Committee the clause reads "Five of whom shall act on the Committee for two consecutive years." What about the other five? Is it the idea that every member of the Executive Committee should act for two years?

The President: You will remember two or three years ago it was thought advisable that there should be continuity in the Committee, that is, that there should be a certain number of members who should act for more than one year. The plan adopted was to elect ten members to the Executive Committee on the understanding that five out of the ten must be re-elected for a second term; and in Montreal last year a ballot was prepared with ten names, and members were asked to choose five out of the ten to act for the second year. It is presumed, of course, that the five who best deserved re-election would be chosen. The remaining five would also be eligible for re-election along with all other active members of the Association.

Mr. Breithaupt: Then we are really electing ten members each year. I beg to move that the clause be adopted.

Mr. Wickens seconded the motion. Carried.

Article V was then read by the President and carried.

Article VI was read. After discussion the clause was amended by substituting the word "annual" for the word "general" in the fifteenth line of the clause.

Articles VII to XXIII inclusive were then read by the President and adopted.

Clauses 25 to 28 inclusive were then read and carried.

Mr. Armstrong: Under what heading does the matter of the change of date have to be considered.

The President: There is no definite date fixed in the constitution. You will find it in the order of business, Article XIX.

Mr. Dewar: I would like a little light on Article III. There does not seem to be much distinction between active and associate members.

The President: The difference is that associate members are not allowed to vote. The term includes those interested in and actively engaged in electrical business, but an active member must be actually engaged in some electrical industry. I do not think myself that the difference is very clearly expressed but it is a difficult thing to define.

Mr. : It is not the idea that anyone can be an active member; for instance, I could become an associate member even if not actively engaged in electrical pursuits.

The President: The word "interested" is the defining term: it would include a student for instance at a college studying electricity. He would be interested in that sense, but not being actively engaged in electrical pursuits he could not be an active member, but would be eligible for associate membership. The clause is intended to be broad enough to take in any person who takes enough interest in electrical science to wish to join the Association.

Mr. Atkinson: The clause reads "Honorary members shall be elected by a two-thirds vote of the Association." Should not this be a two-thirds vote of the members present at the meeting? In clause 10 it speaks of a majority of two-thirds of the active members present, and I think the other clauses should read the same.

Mr. Kammerer: We being the active members present, represent the Association when we are here. There is not likely to be a full session, and if members do not come to exercise their franchise we cannot help it.

Mr. Atkinson: Further down in clause 10 regarding the report of a committee on an amendment it says: "A two third vote of all active members present shall be necessary for its adoption." I think Article III should read the same way.

The President: Is there any objection to making that clause perfectly clear, by making it the two-thirds vote of members present.

Moved by Mr. Atkinson, seconded by Mr. Badger, that the last line of Article III be altered by striking out the word "Association" and replacing same by the words "Active members present." Carried.

The report as a whole was then adopted.

The President: The next order of business is the consideration of the report of the Committee on Statistics.

Moved by Breithaupt, seconded by Mr. Wickens, that the report be adopted. Carried.

Moved by Mr. Black, seconded by Mr. Knapman, that there be two committees, one on statistics and one on legislation. Carried.

The President then nominated as a committee to strike the standing committees, Messrs. J. W. Taylor, L. B. McFarlane and A. B. Smith.

Mr. Kammerer: I think it is a pity to limit the number of

members on these committees. It might be possible to get ten good men who would act harmoniously together and it would be an advantage of course to have a larger number.

It was moved by A. B. Smith, seconded by Mr. McKay, that the next convention of this Association be held in the City of Toronto.

Mr. Roch: How long is it since a meeting was held in Toronto.

The President: Two years ago. Last year the convention was held in Montreal and the year before last in Toronto.

Mr. Armstrong: With the exception of Mr. McCrossan, of Rat Portage, I do not see any members here who comes from west of Toronto, and as the next meeting should be held in the west anyhow, I think Toronto is the most central place and the convention should be held there.

The motion was put and carried.

The President: With regard to the date of the next convention it has always been the custom in the past to fix upon the month, leaving the exact date to the Executive Committee as they are sometimes able to make favourable railway rates and other arrangements.

Mr. Taylor: I would like to hear some reason why it is considered better to change the date of the meeting to June.

Mr. Armstrong. I think the first meeting was held in June and the reason why September was chosen was because it was thought that reduced railway rates might be obtained in that month on account of the fall exhibitions and it was also intended to have some sort of an electrical exhibition in connection with the Industrial Fair in Toronto. However, the idea of anything of that kind has passed away and I think the best plan is to hold it in June. After the summer is over and we have all had our holidays it is difficult to get away again, and I think that for that reason we will find the attendance larger if held in the summer instead of in September.

Mr. Taylor. My object in asking was to have an expression of opinion from the others, there are many members from points far away and I would like to get a full expression of opinion.

The President. It is a radical change and should be well considered. As far as Toronto is concerned we would not get as favourable railway rates in June as we would during the exhibition.

Mr. A. A. Wright. I think myself and the majority of the members here must acknowledge that the great majority of central station men outside the cities would find the summer the better time, in the fall they are very busy, but during the month of June they have a little leisure and it would be more convenient for them to attend in June than in September. It is true you sometimes get lower railway rates in September, but not always, even now you do not get any lower rate than at any other season of the year.

Mr. Bonner. The Mining Engineers have fixed on June for their meeting, and the American Association, I think, are also to have their meeting next June, so that altogether, I think there will be a great number of meetings of other associations during that month. How would that affect members of this society. I do not know if any of them are members of the other associations, you might consider that point before the time is settled.

Moved by Mr. Fisk, seconded by Mr. Armstrong, that the next meeting of this Association be held in the month of June, the exact date to be fixed by the Executive Committee. Carried.

ELECTION OF OFFICERS.

The election of officers being the next business, the President appointed Messrs. Wickens and Gilmour to act as scrutineers and to assist the Secretary in recording the vote.

Moved by Mr. W. A. McKay, that Mr. A. B. Smith be President for the ensuing year. Mr. R. G. Moles seconded.

Mr. D. A. Starr moved, seconded by Mr. Kammerer, that one ballot be cast by the Secretary for Mr. Smith. Carried.

The President then declared Mr. Smith elected.

Mr. Smith: I wish I had sufficient words of eloquence to give expression to the feeling of appreciation I have for the great honor you have laid upon me, and to assure you that the Asso-tion shall have my best attention and most earnest efforts in the year that is to come.

Moved by Mr. J. F. H. Wyse, seconded by Mr. W. E. Jackson, that Mr. J. A. Kammerer be first Vice-President.

Moved by Mr. Smith, seconded by Mr. Dewar, that Mr. C. B. Powell be nominated for 1st Vice-President.

Moved by Mr. J. Carroll, seconded by Mr. L. B. McFarlane, that Mr. W. Y. Soper be nominated for 1st Vice-President.

The President. The point has been raised and it is for you to decide whether you prefer that the names be written on the ballot papers and that you should mark a cross opposite the name of the candidate you wish to elect, or that you should yourselves write in the name.

Mr. J. J. Wright: Since the constitution says that the votes shall be by ballot, if the members should write the names of the candidates it would not be a vote by ballot, as the writing might be recognized by the scrutineers; therefore it will be necessary to adopt the other course.

The President I am asked to announce on behalf of the local committee that a cordial invitation is extended to all members of the Association to attend the banquet to be held this evening. Formal cards of invitation have been sent to all old members of the Association, but within the last few days a number of new members have been elected who may not have received cards. It is necessary, however, that all who desire to accept the invitation should notify either Mr. Soper or Mr. Powell this morning.

Mr. Black: The constitution as amended provides that the Secretary shall read a list of those entitled to vote, and members shall deposit their ballots as their names are called. I would suggest that members vote without their names being called, as the Secretary is not prepared with an alphabetical list. I think it would save time.

The President: If it is the unanimous wish of the meeting that the ballots be taken up by the scrutineers, trusting that only those who are active members in good standing will vote, I think we may do it in that way. If there is any opposition on the part of any person we will adhere to the method prescribed in the constitution.

The ballots were then collected by the scrutineers.

The President: While the ballots are being counted we might take nominations for the office of 2nd Vice-President, not closing them, however, until after the ballots are counted.

Mr. A. B. Smith, seconded by Mr. John Carroll, nominated Mr. L. B. McFarlane.

Mr. Kammerer, seconded by Mr. J. J. Wright, nominated Mr. George Black.

Mr. D. A. Starr, seconded by Mr. J. W. Taylor, nominated Mr. J. A. Kammerer.

The President announced that the balloting for 1st Vice-President resulted in the election of Mr. C. B. Powell.

Mr. A. B. Smith, seconded by Mr. Armstrong, nominated Mr. C. H. Mortimer for Secretary-Treasurer for the ensuing year.

Mr. Mortimer: I wish to thank the meeting for their expression of opinion.

Mr. Dion: I beg to move that the President cast a ballot in favor of Mr. Mortimer. Carried. Ballot deposited.

The President then announced the result of the ballot for 2nd Vice-President, saying that Mr. McFarlane had headed the list, but had not a clear majority of the votes cast, necessitating a fresh ballot.

The President announced that a photographer was prepared to take a group picture of the members that afternoon in front of *the City Hall, and it was decided to have the group taken.*

The President. Mr. Black wishes me to say that he desires to have his name dropped, so that the election will be a straight one between Messrs. McFarlane and Kammerer.

The ballots being taken, the President announced the election of Mr. McFarlane as Second Vice-President.

Mr. D. A. Starr. As I may have some friends who might wish to vote for me on the Executive Committee, I wish to announce that I desire to retire from the Committee. I have been a member of this Committee from the beginning, and I am afraid a very unworthy one, in fact, I did not attend a meeting during the past year. I beg to resign.

Mr. Taylor: Last year I was put on the Committee to represent Peterborough and this year to represent Ottawa. As you already have Mr. Powell and Mr. Higman, either of whom I am sure will make a better member than I, I beg you to drop my name from the list.

The election of second term members of the Executive was then proceeded with, and resulted in the election of Messrs. Black, Breithaupt, Higman, J. J. Wright and Kammerer. New members of the Committee were then nominated as follows:

Mr. K. J. Dunstan nominated Mr. A. B. Smith.
Mr. F. H. Badger nominated Mr. J. J. Wright.
Mr. Rosebrugh nominated Mr. H. O. Fisk.
Mr. H. O. Fisk nominated Mr. J. J. Wright.
Mr. J. Carroll nominated Mr. D. A. Starr.
Mr. W. Y. Soper nominated Mr. J. Carroll.
Mr. Wickens nominated Mr. Kammerer.
Mr. Armstrong nominated Mr. Kammerer.
Mr. A. A. Wright nominated Mr. J. S. Knapman.
Mr. Yule nominated Mr. George Black.

The meeting then adjourned for lunch.

AFTERNOON SESSION.

The meeting resumed at 2.30 p. m.

The result of the ballot for new members of the Committee was announced by the President as follows. Messrs. Badger, Soper, Wickens, Carroll and Dunstan.

The President announced that he was requested by Mr. Higman to state that the Governor General's electric launch would be waiting them at the first lock, under the Dufferin Bridge, at 4 in the afternoon and at 10.30 the next morning and 2.30 Friday afternoon.

The President: We all appreciate the courtesy of His Excellency, and I have no doubt a large number of the members will be very glad to avail themselves of the privilege.

Mr. McFarlane. Under the head of general business I would like to bring up a matter which I think should be attended to. We have reappointed Mr. Mortimer Secretary-Treasurer, and heretofore we have given him an allowance of twenty-five dollars. Now the Association has increased largely in membership, and the work devolving on him has also been largely increased, therefore I think his renumeration should be greater. Certainly

it does not anything like represent the amount of work that has been done. I beg to move that we make the rumuneration fifty dollars instead of twenty-five. Seconded by Mr. D. C. Dewar.

The President: The amount is intended not as a grant for services but more as a compensation to Mr. Mortimer for the expenditure that he is actually put to by reason of the work involved, that is for the time of his typewriters, etc., and the grants have been in recognition of that fact.

Mr. Higman: I would suggest that the amount should be seventy-five dollars instead of fifty dollars.

Mr. Mortimer: With all due deference to Mr. Higman and thanking him for his proposition I do not think the funds of the Association will warrant such a grant. I only want it to cover any actual outlay on my part.

A vote of thanks was passed to the Secretary-Treasurer for his services during the past year.

Mr. Higman: The Association gives one hundred dollars towards a banquet to-night. I think the city in which the meeting is held should meet all the expenses of the meeting, so that the Association would have money to meet its expenditure.

The President then read a letter from Mr. Keeley, enclosing some remarks on Mr. Dion's paper, which the President asked Mr. J. J. Wright to read, as follows:

The writer, regretting the circumstance of his being called away from Ottawa at the time of the present Convention, desires to be heard from in regard to the valuable paper with which Mr. Dion has favored the Association. It is just such papers as this that are calculated to beget amongst any body of workers in a new field that fraternal spirit of mutual advancement and excellence. No one can gainsay that the Canadian Electrical Association has so far made a fine record for itself in this respect. Its main object, as defined in its constitution, has been adhered to in a signal manner; and with its members working hand in hand and comparing notes of their practical experience, there is no reason why we should fall short of seeing, since they contain such records, the Transactions of this society taking rank with the text book.

Mr. Dion has, it would appear, even in treating his large and interesting subject so thoroughly yet briefly, been obliged to take it for granted that those of the members especially concerned in the matter are fully conversant with the difficulties inseparable from the achievement of what he so successfully undertook. Well, of course they should be, and such of us as happen to be in position to appreciate these difficulties, can afford to smile, a little way off, at those others of us who might perhaps easily persuade ourselves that, with the pointers he has given us, we know the whole of it and could go and do likewise. That's encouragement. The first unlooked for difficulty is an incentive for investigation, that's the way to knowledge. Knowledge smooths out our wrinkles and we become blessed smilers with the rest. Now, in this regard Mr. Dion's paper speaks for itself; there is a world of incentive and a world of information contained in it for those who would "mark, learn, and inwardly digest" as we are at other times and in other places exhorted to do for our well-being.

Reverting now to the text of the paper, it would be interesting to discuss amongst other points the electrical considerations involvent in the described plan of supplying E. M. F. to the fields of a number of direct current generators and alternating current machines from the operation of a special or separate turbine, common to them all. Supposing the operation of the turbine is kept within the limits of the lowest water supply, so that the power is constant and invariable for a given demand; if the demand be increased or diminished by the introduction or withdrawal of one of the dynamos, or a sudden change in the load on any one of them, the effect of this would be felt in all of the fields until the turbine was adjusted to the new requirement. But allowing this, if the turbine is so governed that it will maintain a given speed, irrespective of the demand made upon it, within predetermined limits, the changes could, perhaps, take place so rapidly as to be almost imperceptible. This feature, taken in conjunction with the supplementary regulators or "boosters" whereby the drop in leads under increased amperage may be made up, seems to simplify the matter of current supply when contrasted with the method in use elsewhere of meeting changes in load on any one dynamo by altering its speed or the speed of its special field exciter. But it brings out prominently what is the great desideratum of the hour; the thing needful to the attainment of perfection; but a thing that with well directed energy and inventive genius shall never be described as a "long felt want"—that is an automatic "booster" pure and simple.

Another but minor point in the paper might perhaps be touched on. Mr. Dion describes the converters of one of these systems consolidated as Westinghouse 1000: 50 volts, and of another Royal 1040: 52 volts. Presumably this is merely a distinction without a difference, as the ratio of conversion is the same, and in the latter part of the paper it is shown that the 1040 voltage had been applied to the whole.

The writer very much regrets this lost opportunity to listen to what must prove a very interesting and profitable discussion on such a lively paper, and begs to join his thanks with those of the members present, to Mr. Dion for this account of his able work and valuable contribution to the transactions of the Association.

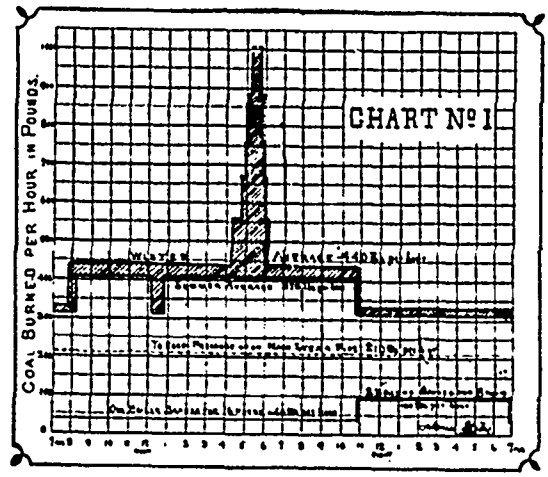
The President: If there is no discussion arising out of Mr. Keeley's memorandum, and as Mr. Street, I think, is not in the room, I will ask Mr. Wickens to read the paper written by Mr James Milne of Toronto, who is unfortunately unable to be present having been detained at the last moment.

The paper was then read as follows:

FROM THE COAL PILE TO THE METER.

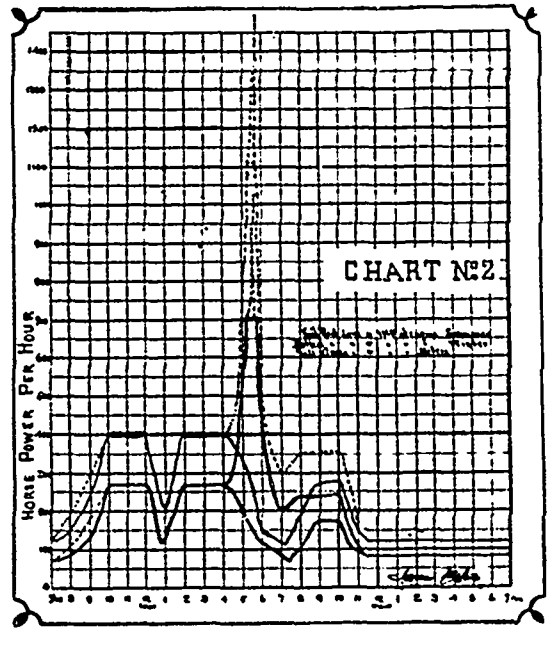
By James Milne.

We see so many curves these days showing the high efficiency of this and the very high efficiency of that, and so on, that we are apt to think there is little room for improvement. My intention is therefore to trace from the coal pile to the meter on the consumer's premises, and endeavor to show by means of diagrams,



calculated from different sources, the condition of affairs in light and power plants and to see if there is not something that could be improved on.

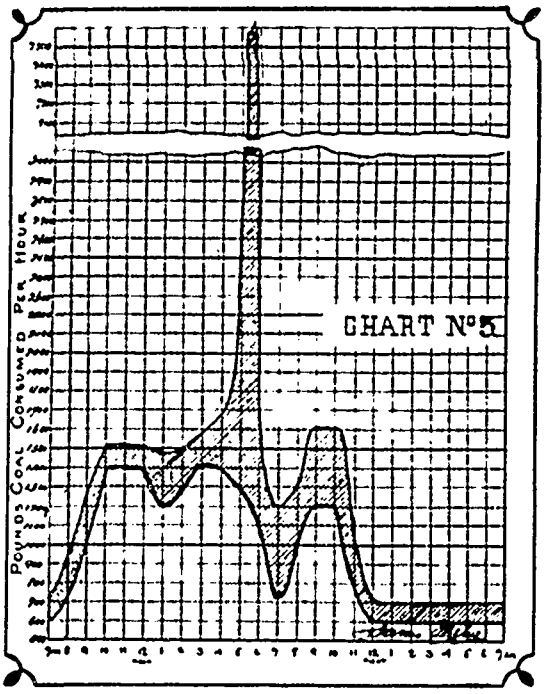
Chart 1 illustrates at a glance the following. first, the amount of coal required to keep up the pressure at the boilers without delivering any to the main steam pipe. It will be seen that for 16 hours about 40 lbs. are consumed and for 8 hours it takes 100 lbs. per hour. Second, the amount of coal required to keep the pressure up when steam is turned on the main pipe, which is equal to 210 lbs. hourly. Third, the amount of coal required to keep the steam pressure up for running the average friction load in summer. In this load I have included the power required to run the generators and charge the fields, but not supplying any current to the external circuit. Beginning at 11 p.m. we find the average friction load takes 310 lbs. per hour up to 8.15 a.m. after that it rises to 420 lbs. and continues at this until noon. It then decreases until 12.30, and again rises, and at 1.15 it is 420 lbs. and remains at this until 11 p.m. Fourth, the amount of



coal used for the average friction load in the winter time. It will be observed that for the same load there is a slight increase in the coal consumption owing to increased radiation, condensation, etc.

We are now ready to supply current to the external circuit, and chart 2 illustrates the power as indicated at the engine for 24 hours run, summer and winter. The full red line shows the *1 h. p. at the engine in the summer, the dotted red line the 1 h. p.*

in the winter, and the full and dotted green lines the 1 h. p. available at the service or when the wires enter the consumer's premises. You will observe as the h. p. increases the distance between the red and green lines also increases. This is accounted for by the decrease in the efficiency of the external circuit and also the increase of the friction load, and you will readily understand that when the load is at its lowest the distance between these lines will be a minimum and the only time they would coincide would be when the plant is shut down. The peak in the winter time is always an interesting figure to those in the business and no doubt deserves a word or two, for it is generally about this time that a few words are said in the power house, but whether they be good or bad I will leave that for yourselves to conjecture. I thought of plotting this peak 50% higher, but the data I have was not very reliable so I concluded



it was better to leave off at the point where it might be misleading. According to our diagram it is plotted for 1200 h. p. at the engines and we find by looking at the green line 700 h. p. are being registered at the meters, which means by deducting the correct amount for friction, losses in generators, etc., we find a loss of 25 in the line, or in other words we get at this time an efficiency of 75 between switchboard and meters. It may seem to you or some of you at least that this is an enormous loss and steps should be taken to reduce it. When everything is taken into account I think we will find it cheaper to put up with this loss than try to overcome it. It (the loss) is only for say 60 days a year, etc., for 1 hour per day, making a total of 60 hours per annum. Now if copper were put in to reduce it we know that interest, depreciation, etc., runs on continually, and would in some cases more than offset the amount spent for the extra coal consumed during this loss. It would be an easy matter to calculate the amount spent on coal to make up this loss and see how much copper it would be equivalent to, even taking the whole amount as interest on the investment.

On diagram 1 we showed the coal consumption per hour necessary to keep up the steam pressure to run the engines and generate current up to the switchboard. We now come to chart 3, which shows the amount consumed when running as indicated on chart 2. The part in section shows the increase for the winter load, and in this we have again an interesting diagram which, when calculated out, shows very clearly the effects of forcing boilers. By comparing the run made between 10 a. m. and 12 noon, and that made between 5 and 6 p. m. in the winter time, we find there is an increase of 75 in the amount of coal burned per horse power per hour, which certainly shows that forcing boilers is far from being economical. Diagram 4 shows the amount of coal consumed per square foot of grate surface. Beginning at 11 p. m. we have 22 lbs. This continues up to 7 a. m. when a change over is made which reduces the amount to 9 lbs. for a short time. It then gradually increases until 10 a. m. when we get a fraction over 17 lbs. At 12 noon it diminishes to 15, and we again find at 3 p. m. it is the same as from 10 to 12, viz. 17 lbs. From 3 to 5 it averages 16 lbs., and at 6 it has reached 9 lbs. From 7 to 9 it increases from 9 to 15 lbs. and continues at 15 lbs. for 1½ hours. The part in sections, as in the other diagrams, shows the difference between the summer and winter loads. The two peaks show the amount burned per foot of grate surface on two different sets of boilers. On one it will be seen that 43 lbs. per foot are consumed and 32 lbs. on the other, and to my mind shows that they are going for all they are worth.

In calculating the amount of coal consumed per foot of heating surface I find at the most econonical load .322 lbs. are burned, and the most uneconomical load, between 5 and 6 p. m. in the winter, it is as high as .9 lbs. per square foot.

Let us now see what economy we are getting from the boilers.

Summer:

Total water evaporated for 24 hours = 201,600 lbs.

$\frac{201,600}{25,000}$ = 8.07 lbs. water evaporated from temperature of feed or 210 which is equivalent to 8.32 lbs. from and at 212° per lb. coal. Allowing 10% ash which is not excessive and compares favorably with the average of the data I have received from different plants, we get 8.97 from temperature of feed or 9.24 lbs. from and at 212° per lb. combustible.

Winter:

Total water evaporated per 24 hours = 276,343 lbs.

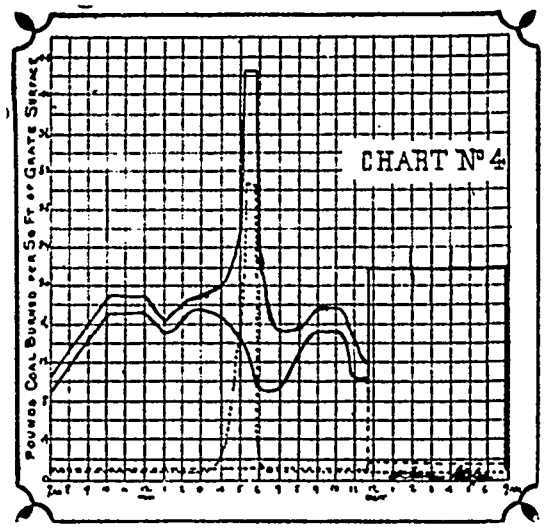
$\frac{276,343}{36,000}$ = 7.5 lbs. from temperature of feed or 200° which is equivalent to 7.9 from and at 212° and allowing the same percentage of ash we get 8.34 lbs. from 200° and 8.78 lbs. from and at 212° per lb. combustible.

In the summer time we have stated that an evaporation of 8.32 lbs. per lb. of coal is obtained and taking the coal at 12875 B. T. U. we get a theoretical evaporation of 13.32 lbs. water per lb. of coal from and at 212°. This agrees fairly well with any of the tables giving the thermal units of heat of the grade of coal burned.

Theoretical evaporation = 13.32 lbs. actual evaporation = 8.32.
Efficiency therefore is = 62.47 %, or say 62.50.

We are all more or less acquainted with the first law in Thermodynamics, which may be stated thus: Heat and mechanical energy are mutually convertible, a unit of heat corresponding to a certain fixed amount of work called the mechanical equivalent of heat. We can can calculate the mechanical equivalent of the coal pile thus: $\frac{12,875 \times 772 \times 25,000}{24 \times 60 \times 3300}$ = 5229 h. p.

∴ 5229 × .6247 = 3266.5 h. p. available at the stop valves of the boilers, which, if all were utilized, would give us 3.1 h. p. per lb. of coal per hour, or a little over .31 lb. coal per h. p. per hour,



a result which with the greatest refinement in engineering has not yet been attained in practice, and I think I am safe in saying never will.

We will now calculate the efficiency of the steam:

Average steam pressure, 125 lbs. absolute.
Average exhaust pressure, 20 lbs. "
Water per h. p. per hour, 28 lbs.
Temperature of feed, 210° Fah. (Summer).
Temperature of water before entering heater, 40°.

125 lbs. abs. = 1187 units. Feed water raised from 40° to 210° = 170 by heater.

∴ 1187 − 170 = 1017 Thermal units of heat expected per pound of steam.

Thermal units per 1 h.p. per minute = $\frac{1017 \times 28}{60}$ = 474.

∴ $\frac{42.75}{474}$ = .09 or 9 % efficiency.

Taking the temperature of the feed at 210 and that of the steam at 344°, we get

$\frac{344 - 210}{805}$ = .168, or an efficiency of 16.8 %

if same were a perfect engine working between the limits of the

temperature 344° and 210°. Therefore the relative efficiency between the perfect engine and the above is

$$\frac{.09}{.168} = 53\%$$

By the above reasoning we get an efficiency of 9% of the total power available at stop valves of boilers :

3266.5 × .09 = 293.98 h.p.
our actual h.p. is 230 or 78.23 % of 293.98
∴ .9 × .7823 = .070407 or a fraction over 7 %

represents the efficiency of engine to boiler, and calculating to coal pile, we get an efficiency of .625 × .09 × .7823 = .625 × .070407 = .044, or a net efficiency of 4.4%.

We also find from actual results that a mechanical efficiency of 82.3% is obtained from the engines ; that is to say, it takes 17.7% to overcome friction and run generators up to speed.

Therefore the power available for running the generators is

230 × .823 = 189.29 h.p.

Efficiency of generators not less than 92%,
∴ 189.29 × .92 = 174 14 h.p. available for sending out to the line, and from boiler to switchboard we have

.09 × .7823 × .823 × .92 = .0533

or briefly, $\frac{174.14}{3266} = .0533$, or 5⅓% efficiency,

and going back to coal pile we get .0533 × .1247 = .0333 or 3⅓% efficiency.

We have got one more item to take into consideration to complete our calculations, and that is the efficiency of the external circuit, which is in the summer time 85%. Therefore the total h.p. available at the meter on the premises of the consumer is 174.14 × .85 = 147 h.p. fully, or more accurately 3266 × .09 × .7823 × .823 × .92 × .85 = 148 h.p.

The net efficiency from boiler to meter is

$$\frac{148}{3266} = .0453 \text{ or } 4.53\%$$

and from coal pile to meter we get .0453 × .6247 = .0283 or 2.83%.

From the above we get the following results :

Power for running generators.....	100
Power available at switchboard.....	92
Power available at meter.....	78.20

Efficiency of the electrical apparatus, including outside circuit = 78 1-5 %.

Engine.....	100
Available for generating current.....	83.3
Available at switchboard.....	75.72
Available at meter.....	64.35

The commercial efficiency from engine to meter is 64.35%.

Boiler equivalent.....	100
Indicated h.p. at engines.....	7.04
Available for generating current.....	5.79
Available at switchboard.....	5.33
Available at meters.....	4.53

The efficiency therefor from the boilers to the meter is 4.53%.

Coal pile equivalent.....	100
Available at stop valves of boiler . . .	62.47
Indicated h.p. at engine.	4.4
Available for generating current	3.62
Available at switchboard.....	3.33
Available at meter...	2.83

The above extended results apply, as has already been stated, to the summer load, but as the results from the winter load are practically the same, I need not take up your time going over them.

We see, therefore, that the electrical end shows up exceedingly well. For every 100 h.p. at the engine, 82.3 are utilized for generating current, and 75.77 of these are sent out to the line, which, although it could be improved on, leaves very little to be gained by any new invention or alteration that may hereafter be made.

Regarding the steam end, there can be no doubt that considerable attention has been paid to it, and it is still receiving more. Yet it does not alter the fact that it is here where we get the worst showing. When some of the great scientists arrive at the method of abstracting electricity direct from the coal pit or even the boiler without the intervention of the steam engine, better results may be obtained.

I see in some of the engineering papers that evaporation condensers are coming into use and are being applied to plants that have heretofore been running non-condensing. This is a step in the right direction and as no more water is used than that required for steam purposes, parties at present having to pay for their water might find this a profitable investment, inasmuch as a vacuum of from 22" to 26" is readily obtained, in fact, guaranteed by the builders.

Mr. Breithaupt: I have listened with much pleasure to the reading of this paper ; no doubt it is of very great interest to those engaged in running electric plants. As to criticism of this paper I am really not in a position to critise it. The facts seem to have been derived from actual experiment. The total efficiency from the coal pile to the meter of 82.3 is extremely small. Of course we all know it is small, but it is a matter of some congratulation, we think that the electric end is the economical part of the transformation of the energy. This is a good showing and it is a matter which engineers, especially those engaged in this kind of work should be pleased with. The efficiency of the electrical apparatus we have cannot be very much improved and there is no doubt that high efficiencies, that will be enough higher to make a difference at all worth while, will be difficult to get. I do not see that we can expect a better showing than we have here. I would like to ask whether the experiments which led to this paper were from non-condensing engines.

Mr. Wickens. All high speed non-condensing engines—no economies, simply a feed water heater, working with the exhaust steam.

Mr. Breithaupt. I think it would be a matter of some interest to make a comparison between the results derived from these and from condensing engines, and the difference might be ascertained by simply introducing the relative units for the engines. In that way we could arrive pretty fairly at what result we could expect when running condensing engines. I see Mr. Milne speaks in the last part of his paper of evaporation condensers coming into use. I would like to hear from anybody who has had experience with them. I know a little about them but have had no practical experience. I think the Association is very much indebted to Mr. Milne for his paper, and, as Mr. Keeley says, it is certainly papers of this kind which are of the greatest value to the Association. The scientific papers are undoubtedly also of very great value, but papers of this kind, where you get the actual experience of different men in electric light, railways, &c., by comparison, is where the Association can be of incalculable benefit to its members. I therefore move that a hearty vote of thanks be tendered to Mr. Milne for his paper ; seconded by Mr. Wright and carried.

The following paper was then read by Mr. Street :

SUGGESTED FORMS IN ELECTRIC LIGHT ACCOUNTING.

By D. R. Street.

There is no system of accounting that cannot in some particulars be improved, and there is no accountant who cannot increase his knowledge by comparing methods with his fellow accountant ; therefore, in placing this paper before the members of the Canadian Electrical Association, the writer does not claim for his system superiority over all others, but the various forms referred to herein, having been found to work most satisfactorily, and having been adopted by the Ottawa Electric Company, after long and varied experiments and careful comparisons with other systems, it occurred to the writer that many of these forms would prove of some value to others, as they undoubtedly have to the Ottawa Company in dealing with its employees and its 3,000 customers.

A paper of this kind is somewhat tedious, therefore full explanations must to a certain extent be sacrificed, to avoid too great length. For the same reason the writer must confine himself to some of the most important forms, leaving out a number of minor but decidedly labor-saving ones.

For the purpose of this paper the forms are classified under the following heads. The writer begs to draw special attention to the system of meter reading and of keeping meter customers' accounts, which is quite different from that used by other companies.

A. Applications and Contracts for the Supply of Light and Power.
B. Requisitions for and Ordering Supplies.
C. Orders for Construction and Repair Work.
D. Time Returns and Pay Sheets.
E. Lamp Records.
F. Collection of Revenue. Commercial Lighting, Arc and Incandescent, (weekly collections), Meter Lighting, Reading of Meters, Keeping and Rendering Accounts.
G. Cash Book, Accounts Payable Register, and Vouchers.

APPLICATIONS AND CONTRACTS FOR THE SUPPLY OF LIGHT, POWER, ETC.

Applications for light, power, etc. should be made in writing and on printed forms, therefore applicants are required to fill in one of the following blanks :—

Form 1. Incandescent Lighting, Commercial System.
Figure 2. Incandescent Lighting, Meter System.
Form 3. Arc Lighting.
Form 4. Supply of Current for Power and Heating,

which forms require no explanation, except that they are intended to take the place of more formidable documents, which customers are often afraid to sign.

Upon the acceptance by the company of any such application, it assumes the form of a contract, and immediately separate work orders are made out for service connections, supply of lamps and meters (if necessary), the number of such orders being recorded on the face of the contract, which is then entered in the proper register and filed away. By a strict adherence to the rule of obtaining an application on the proper form from every customer, and of not issuing orders for services, etc., until it is received, it will be impossible for any one to obtain light without a record appearing in the books of the company, and a glance at a contract will show what has been done, as well as what remains to be done in the particular case.

REQUISITIONS FOR AND ORDERING SUPPLIES.

REQUISITIONS FOR SUPPLIES. (FORM 5.)

1st. This form is used by the storekeeper and the heads of departments, to notify the General Superintendent that supplies are needed.

2nd. The General Superintendent then orders goods, (as hereafter described) entering on the face of the requisition the date of such order, and returns the requisition to the sender.

3rd. The sender holds the requisition until the goods arrive and are checked, when he returns it to the Superintendent with a report upon it of proper goods having been received in good condition.

4th. The Superintendent then stamps upon the face of the order in copy (impression) book, the date of receipt, together with a note of the particular

branch of work or the department to which goods are chargeable, and files the requisition away.

ORDERS FOR SUPPLIES. (FORM 6).

These order blanks are printed in copying ink, and an impression is kept in the copy book, the number of the page upon which it is copied being entered on the order as the order number.

When the requisition is returned to the Superintendent with certificate of goods received, the copy of order in the book is stamped, "Goods Received, date ..... ."

When a bill for supplies is received it is checked by turning up the copy of the order, and if this copy is stamped "Goods Received," and the prices are right, the account is certified and the copy of the order is then stamped "Certified, date ....." thus avoiding any possibility of certifying twice to an account for the same goods. The series of forms used under this head have the effect of making any errors extremely improbable.

ORDER ON STOREKEEPER. (FORM 7).

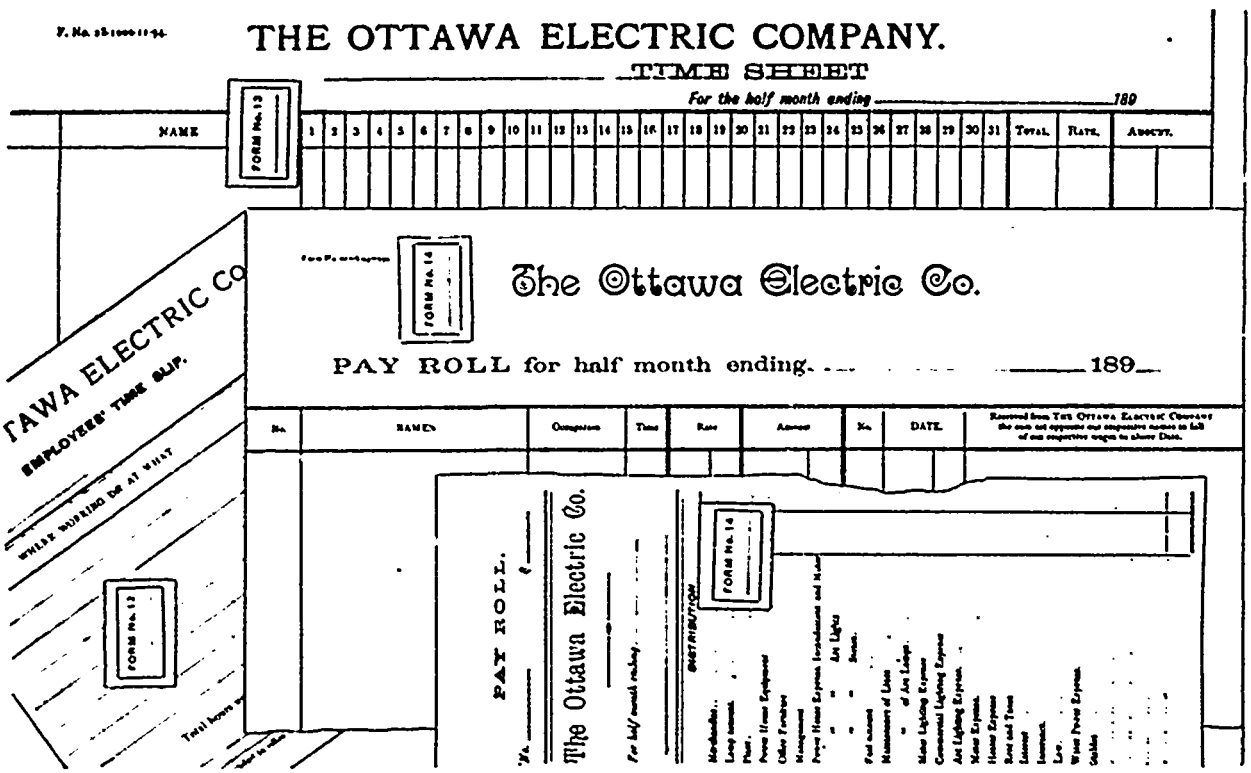
This blank is used by linemen and wiremen in obtaining from the storekeeper materials required for their work. It is usually filled in by the workman and signed by the foreman. Upon delivery of goods the store-keeper stamps this order, "Goods Delivered," (with date), initials same, and then places it upon a file which goes to the entry clerk for charging purposes.

The object of the particular form used is, of course, to save writing for the workmen, who, as a general rule, do not take to writing very kindly.

ORDERS FOR CONSTRUCTION AND REPAIR WORK.

In order that work requiring material and labor should be promptly and carefully attended to, and that accurate returns should be received at the office for charging purposes, the following forms are used:—

No. 8. Notice to Superintendent of Construction for Work Required.



No. 9. Order from the Superintendent of Construction to his foreman.

No. 10. General Order for Inside Work (for file in office).

No. 11. General Order for Inside Work (duplicate of above) for foreman.

Nos. 8 and 9 are for line and outside work exclusively, the former being issued from the office to the Superintendent of Construction, upon receipt of which he issues the latter to his foreman, and keeps No. 8 on file until the work is executed, when he reports labor and materials used, signs it and hands it to the entry clerk for charging.

Nos. 10 and 11 are for inside work, repairs, delivery of lamps, etc., No. 11 being simply a duplicate of No. 10. It is written at the same time, being put together alternately in pads, and transfer paper being used between them. No. 10 (the original) is kept on file in the office, and No. 11 is handed to the foreman of wiremen, both bear the same number. When the work is done, a full report of labor and materials is made on the back, when it is returned to the office and checked with the original (No. 10) and handed to the entry clerk for charging.

Keeping the original order on file in the office until the work is completed enables any officer to see for himself if an order has been given, should doubt arise, and by promptly checking off when the returns come in, any unnecessary delay in the execution of work, as well as failure to report labor and materials to be charged, are easily detected.

TIME RETURNS AND PAY ROLLS.

FORM 12—EMPLOYES' TIME SLIP.

The employees time slips for the use of wiremen and linemen to report daily their own time and where and at what they were working. These forms must be filled in and handed into the office by each man, at the close of each day, which gives the office time returns independent of those furnished by the foremen or chiefs of departments, besides, these slips are used for the distribution of charges in the general pay roll.

FORM 13—TIME SHEET.

The sheets are used by the foremen or chiefs of departments to make time returns, every half month, of all men under them. These sheets, after being checked with time slips, (Form 12) are handed to the General Superintendent for his certificate as to correctness in rates of wages, etc.

FORM 14—PAY ROLLS.

The pay roll is made up from the different time sheets. One feature of this roll is that a number is given each name, and this number appears before the name and again before the place of signature, which lessens the chances of signatures being put in the wrong line, or wrong amounts being paid, and again, keeps the roll clean, a man not having to run his finger along the line to find the proper place to receipt. The expenditure distribution, covering the amount of pay roll and obtained from time slips (Form 12) is endorsed on the back, ready for journal entry.

LAMP RECORDS.

FORM 15—BOOK—LAMPS RECEIVED.

In this book entries are made of all lamps received, with date, showing from where received as well as the different candle power.

FORM 16—BOOK—LAMPS GIVEN OUT.

In this book is entered each day from lamp slips, all lamps given out, showing to whom given, candle-power, etc., and, together with Form 15, is balanced every month, which balance must agree with the inventory of lamps taken at the same time.

FORM 17—LAMP MEMO SLIP.

This slip is used as a requisition on the storekeeper for lamps given out, and also to show to what departments such lamps are chargeable. At the end of each day entries are made in the lamp book from these slips.

FORM 18—DAILY LAMP REPORT.

This report is for the use of the office and is made up every morning from the lamp book, and checked from the slips of the day before. It is particularly useful in showing at all times the number of lamps on hand, and also in distributing the lamps given out among the different accounts to which they are properly chargeable.

The accurate keeping of lamp records is a matter of considerable importance, and the system exemplified by the series of forms above described has been found entirely satisfactory.

COLLECTION OF REVENUE—COMMERCIAL LIGHTING, INCANDESCENT AND ARC.

FORM 19—REGISTER OF WEEKLY COLLECTIONS.

This register contains the names of all customers who pay weekly, together with the addresses and particulars of charges. Each customer is given a number, and the book is so arranged that names need only be written every 26 weeks, extra pages being bound in that fold over to the customer's number (see specimen herewith). At the beginning of each week the amount due is brought forward in the first column, and receipt tickets are made out (see form 20) for each customer and given to the collector. At the end of each week the second column, "Amount Paid," and third column, "Delinquents," are entered up from collector's statement, (Form 21) and the total of the last two columns must agree with the first column, and so on from week to week, the total in delinquent's column being brought forward each time, which shows at a glance the amount owing by any customer.

FORM 20—COLLECTOR'S RECEIPT TICKET, WITH STUB.

These tickets are made out at the beginning of each week from collection register, and handed to the collector, who, upon payment, hands the receipt part to the customer and retains the stub.

FORM 21—STATEMENT OF WEEKLY COLLECTIONS.

The collector each day enters up this sheet from stubs of receipts, and at the end of each week returns statement to the office. The total collections should agree with the cash given in, and the total collections plus the total of delinquents should agree with the total of tickets given in.

FORM 22—ARC LIGHT REPORT (PRIVATE LIGHTS).

This blank is for the use of arc light patrolmen and is entered up each

day and handed into the office at the end of each week, and contains the report of the number of private lights burning each night, with any remarks necessary. The charging into register of arc weekly collections is made from this report.

FORM 23—ARC LIGHT RECEIPT TICKET.

This form is for the same purpose as No. 20, but it is used exclusively for arc lighting customers, an exact copy of the patrolman's report being placed on the stub, for reference, in case of dispute with any customer as to correctness of charge against him.

COLLECTION OF REVENUE—READING OF METERS, KEEPING AND RENDERING METER ACCOUNTS.

FORMS 24-25—METER READINGS.

From experience it has been found that where the actual putting down in figures of meter readings was done outside of the office, a number of mistakes occurred, particularly when obliged to send out inexperienced men, and then it is impossible to enquire into any suspected error, without sending out to re-read the meter, but the form herewith overcomes this trouble. It is a copy of the dial of the meter, requiring simply the copying of the position of the hands, which any man of fair intelligence can readily do. The reading is then reduced to figures in the office. Should any doubt arise as to the correctness of any account, the copy of the meter dials can, in a moment, be turned up for checking.

Form 24 is a fac-simile of the Schallenberger (Westinghouse) dial, and is for the use of this style of meter only, while Form 25 can be used for either Schallenberger, Slattery or T. H. meters.

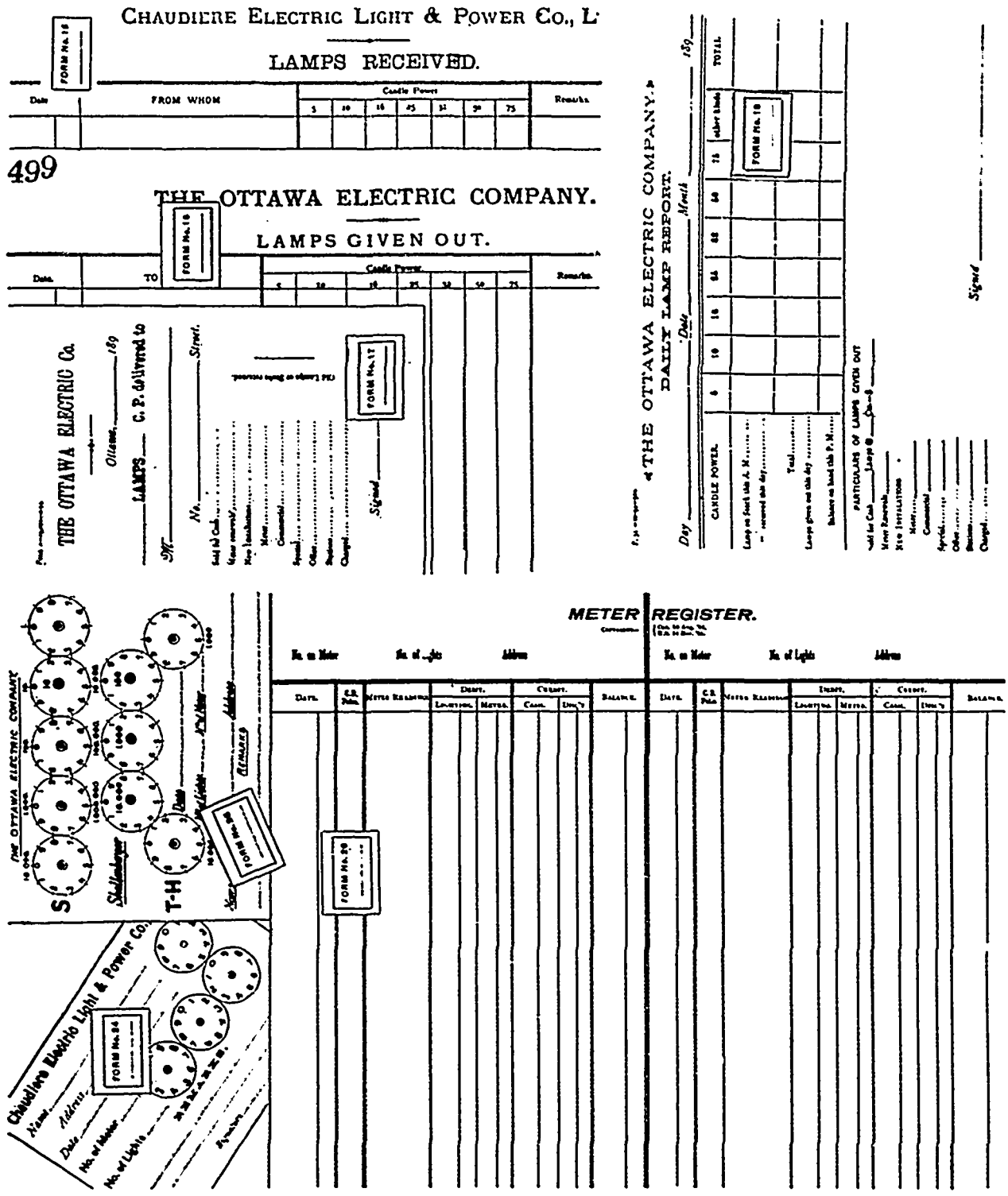
If the system of numbering each meter is adopted (as hereafter described) much time can be saved, as it is then only necessary to report this number, together with the surname of customer, with copy of dial, when returning meter readings to the office, the Christian name or initials and address being unnecessary.

FORM 26—METER CUSTOMER REGISTER, (COPYRIGHTED 94 AND 95).

This book requires very little explanation, being a ledger with a column each, for meter date, meter reading, lighting, meter rent, cash paid and balance, and for which book the writer claims a number of advantages.

1stly. The saving of space, two lines only being used each quarter. A half page of this ledger will last six years with quarterly readings.

2ndly. All readings, payments and balance due can be seen at a glance, which means a great saving of time, and makes quite easy a comparison of the cost of one year's lighting with another when asked for by a customer, a thing of frequent occurrence. Anyone who has seen the old style of oblong book, with rulings for quarterly entries, which necessitated the carrying forward of readings and balances every quarter, will, I think, grant the superiority of this book. A regular index must be kept for the register, but in posting meter readings this index need not be used, if the meter in the house of each customer is numbered with the ledger folio of the customer and the number reported with each meter reading. This plan will be found to save much time, both in reading meters and posting; in fact, by experience it has been found that with this numbering plan, posting can be done in exactly one-half the time as when having to look up an index for names.



FORMS 27-28—METER ACCOUNTS

Form 27, which is patented, will be found to be a particularly good one, and much appreciated by customers. It has an exact copy of the meter for present and previous readings, which permits customers checking the readings themselves.

Form 28 is applicable to either watt or ampere readings, and when there are a very large number of customers, its use may be found to save much time.

A colored envelope is used when sending out meter accounts, and is found useful by customers in enabling them to easily pick out their light account from among other papers.

GENERAL BOOKS.

FORM 29—CASH BOOK.

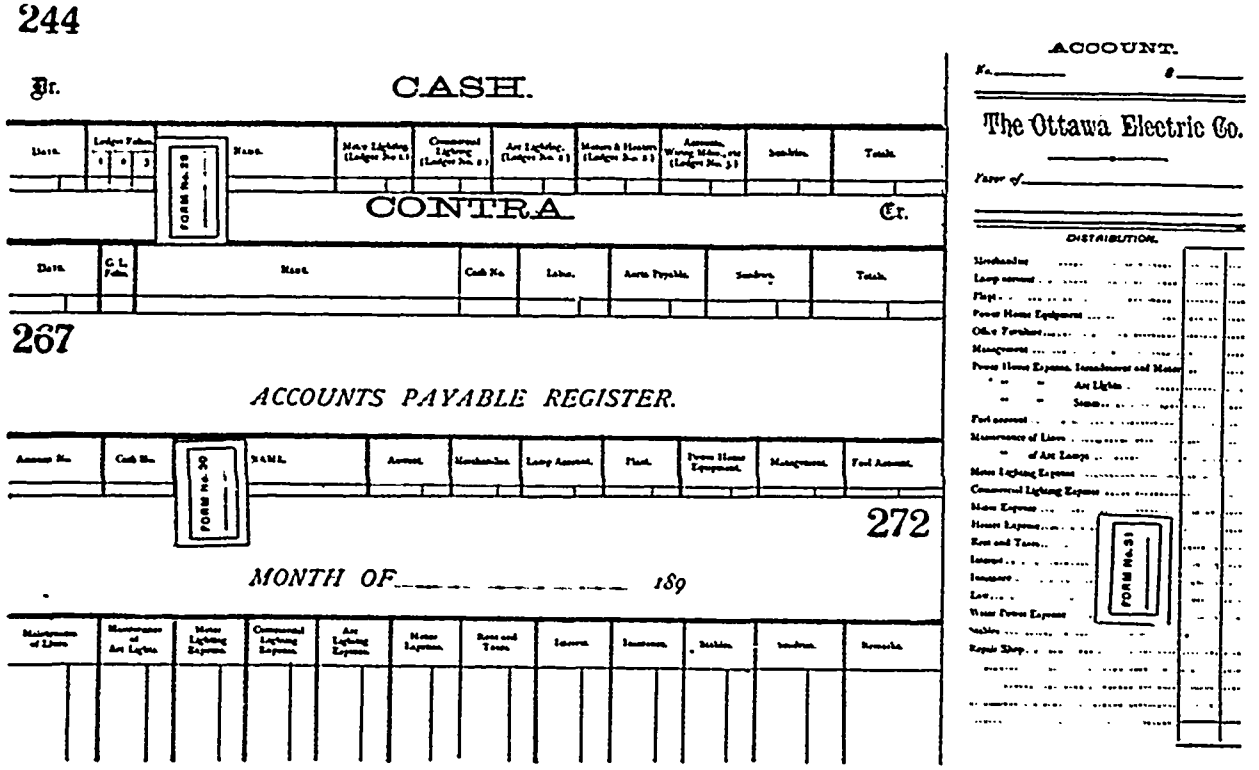
This book is nothing out of the ordinary, being on the principle of a journal cash book, with separate columns. On the debit side the cash at time of receipt is distributed among the different revenue accounts, and a similar distribution of disbursements is made on the credit side, the totals of different columns being posted in the general ledger under their respective headings at the end of each month.

FORM 30—ACCOUNTS PAYABLE REGISTER.

This book is for the sub-division of all bills to be paid and their distribution to the different expense or other accounts to which they are properly chargeable. The principal advantage of this system is that amounts owing appear properly distributed in the expenditure of the month, during which they have been incurred, regardless of the time when they are paid, the amount at the credit of "Accounts Payable" account representing at all times the total of accounts outstanding.

FORM 31—VOUCHER.

This blank is an ordinary account form with endorsements on back for distribution of amount. All the accounts paid are entered under this cover, the original invoices being usually attached inside. When the account is entered in accounts payable register, the amount is distributed in accordance with the endorsement on the back. When paid it is filed away as a voucher. An index is kept for accounts payable register, that enables one to find any account, paid or unpaid, at a moment's notice.



In conclusion, the writer sincerely trusts that the forms and descriptions herewith may prove of interest, and possibly of use to some, and that their discussion may bring out new suggestions which may be of general benefit.

Mr Armstrong: I think, gentlemen, we will all agree that this is a very valuable paper, and of peculiar interest to managers and accountants of large stations, however, there is a class of stations to which this system would scarcely apply, on account of the cost of carrying it out. I have several times been asked by managers of small companies, who are just starting in business, to furnish them with a system of books, forms, &c. I am not an accountant myself, and I would be very glad to know if any member of the Association could furnish us with a simple system, suitable for small plants where there is no great multiplicity of accounts.

Mr. A. A. Wright (Renfrew). As Mr. Armstrong points out, this system of Mr. Street's is more applicable to large than to smaller plants throughout the country. Perhaps some member of the Association would make some suggestion with regard to a system applicable to small companies. With regard to Mr. Street's system, we have not really had time to go through the forms, but they seem to be very applicable to large plants such as the Ottawa Electric Company, but they do not seem to apply to small stations. Still I have no doubt if one could go through them a great many of them would be found very useful. In my own place we do not collect every week as they do here. We collect every first of the month. Our man has a book printed by ourselves, with dials the same as here. One man goes round and takes all the readings, and then they are reckoned up at our own office and regular accounts made up. Another collector goes round to collect the accounts, if there is anything left unpaid it is carried forward. We endeavor to collect every month. With regard to the statement for the works, we do not have to take charging and delivery accounts in that way. With reference to the giving out of material for wiring, we do not use such an elaborate system, because it is not necessary. All we do is when a wire man goes out, we weigh the wire that he takes with him and weigh it again when he comes back, and the difference of course is charged up. We also have an account of the number of rosettes, lamps, sockets, &c., which are charged up to the individual. We have an account for every customer and we can turn up every man's account and see what he has had, the amount of wire, &c., and the amount received for wiring, and we know how we stand at any time. Also, if any additional lamps have been put in, the date, &c. We can see the number of lights originally installed and the amount received. In addition to that I make up a diagram for every man's house, showing the mains in the house where the lights are placed, and thus keep a full record of the work done, so that it can be turned up at any time. Of course at our central station we charge up the amount of fuel, &c., every month, and an account is kept of everything that is used—oil, matches and everything—for of course we always keep a coal oil lamp in case of accident. A column is devoted to each article, we do not of course expect an accident, but it is as well to prepare for it. If you want a correct account you must have everything or nothing. We also have a monthly account carried forward every month and at the close of the year by adding it up, we have a statement for the year which will show the amount of profit or loss, as the case may be. We owe a vote of thanks to Mr. Street for his able paper, and I am only sorry that I have had no time to go over it so as to be able to discuss it intelligently.

Mr. Breithaupt. I beg to second the vote of thanks. I have had an opportunity of going over the papers in detail, and Mr. Street has also kindly shown me his books. I think his system of book-keeping throughout is a very good one. As to applying the system to smaller plants, I think those engaged in running a smaller or any sized plant almost, can learn very much from Mr. Street's paper. There are some forms that might be eliminated. The Meter Reading Form is a very good thing because it takes the record of the meter dial just as it is and thus avoid mistakes just where they usually occur. The Consumer's Ledger which Mr. Street keeps is an exceedingly valuable book, the meter readings and everything being shown so that the state of the consumer's account can be seen at a glance. I think it is a book that all companies whether they have meter accounts or not should keep. In my own case I keep it as an adjunct simply for checking accounts. We render accounts monthly, and if any discounts are given they are shown in a separate column, so by looking at the Consumers Ledger at any time we can see the state of that man's account. Another book I keep is the Consumer's Register, and in this I keep an abstract of the accounts. I have the first column for arrears another for the amount used, another for gross amount due, the fourth for discounts, and the fifth, total amount owing by that consumer at that time, columns six and seven, amounts paid and date when paid. In keeping accounts in that way, which is something on the same

principle as Mr. Street has outlined, but not quite so elaborate, you have the accounts so that you can refer to them and tell at a glance the state of any account. I think we are all much indebted to Mr. Street, and I beg to second the vote of thanks.

Mr. A. A. Wright: Is the number of the meter put down on the account that is sent out?

Mr. Street: The meter accounts are sent out every two months. We have two systems of accounts—one the meter system and the other the commercial or weekly collection system. In fact, here we find it impossible to read every month on the larger meters. We disregard to a certain extent, the number of the meter, that is the factory number; of course there is a record of that in the Consumer's Ledger. The ledger folio is put on each meter, that is, when a meter is placed the ledger number of that man's account is put upon that meter. When the man that reads the meter brings his report, he brings that number which enables us to turn up the account without looking at the index. We simply put up a label on the meter with the ledger number.

The vote of thanks was then carried.

The President. We will now adjourn in order to take advantage of the courtesy of the Governor General in placing his electric launch at the disposal of the members of the Association.

The meeting then adjourned till the next morning.

THIRD DAY.

MORNING SESSION.

The President. The first order of business this morning is the reading of the remaining papers. I will ask Mr. J. J. Wright, of Toronto, to read the two papers composing the group prepared by Mr. D. H. Keeley, of Ottawa, who is, unfortunately, absent from the city, and therefore unable to read the papers himself.

Mr. Wright then read the following papers:

A NON-INTERFERENCE DIPLEX RELAY.

By D. H. Keeley.

Any who have given attention to the subject of quadruplex telegraphy will be more or less familiar with the difficulty that has been encountered in obviating interference between the sides when both are actuated, at the moment of current reversal in the polar system, or at the moment of transition from extremes of current strength in the straight system; and it will perhaps be interesting to examine what is herein presented as an absolutely reliable bit of non-interfering mechanism in that particular.

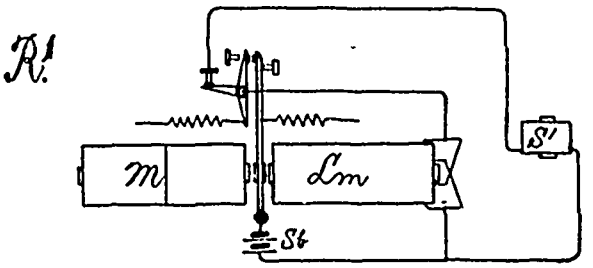
To cover the ground comprehensively yet briefly, in order to establish the essential dissimilarity of the polar and straight-current systems, and at the same time to make the adaptability of this new instrument to either plan clearly obvious, let it be stated that a quadruplex system is a duplexed diplex. The duplex is simply an arrangement of the signalling instruments at each end of the line in such a way as to render them unaffected by currents outgoing while free to respond to currents incoming, thus affording a means for simultaneous transmission in opposite directions, while the diplex is an arrangement of apparatus for simultaneous transmission in the same direction. If two keys can be arranged to transmit distinctive currents in a circuit common to both, and if two receivers can be arranged to respectively respond to these currents without confusion, we have a diplex; and any such system suitably duplexed affords a quadruplex.

It was first of all ascertained that two keys could be arranged in many different ways to satisfactorily transmit distinctive currents for diplex transmission. For instance, one would transmit a current of low strength; the other a current of high strength; while both together would produce an intermediate current. Hence it could be known at the receiving end whether one or other, or both, of the keys were being manipulated. By another plan one key operated to reverse the polarity of a current that was always presented to the line, and the other key acted to increase or decrease the strength of that current; so that in this case also it could be told at the distant end which, or if both, of the keys were in action. The designing of suitable receivers to respond to these key motions was, however, another matter. In the first described method one of the receivers responded all right to the intermediate or the high strength of current, and so followed the motions of the proper key; but the receiver that was intended to respond to the currents of low and intermediate strength was of course subjected to the current of high strength, and there the difficulty came in. The roblem was how to render it irresponsive to strong currents while it was responsive to weak ones, and a step towards the solution of it was the employment of an auxiliary lever hung in such a way as to hold the armature lever in an intermediate position between its limiting stops when attracted by the weaker currents; the strong current when applied would carry it beyond the intermediate position, so that with no current, or with maximum current, the lever would be in one or other of its extreme positions. The local circuit being completed only when the lever was in the intermediate position, the sounder should only, according to this arrangement, respond to the low and intermediate currents, but it was found inadequate because of a brief contact, completing the sounder circuit, that obtained in the passage of the armature lever between its extreme limiting stops every time the strong current was applied or withdrawn.

According to the second plan, for diplex transmission, one of the receivers was polarized and it responded all right to the reversals effected by the proper key irrespective of the current strength, while the other receiver was a neutral relay adjusted to respond to the currents of high strength transmitted by its corresponding key. In this operation, however, almost as great a difficulty as in the other case presented itself; because the action of reversal of the transmitted current momentarily cancelled the magnetism in the core of the neutral relay, and in the act of recording a signal the armature lever of the latter was liable to fall away and thus produce false effects and mutilation.

Seeing now what and where the difficulty was, it is easy to conceive there was greater promise of finding means for bridging over the brief interval of non-magnetism in the neutral relay, than for rendering a receiver of low adjustment irresponsive to strong currents as required in the first described case; so it came about that greater attention was paid to the solution of that problem, and the outcome of it all is the standard polar quadruplex now everywhere in use. The other problem, however, was not left to neglect, for it was conceived that if the straight or three current plan could be successfully operated, it would be feasible to construct a sextuplex system with it, by simply adding the polarized relay and reversing key of the other method.

Whether this conception is to be realized should not now long remain an open question—for the problem of the straight current diplex is solved, as will be seen by what here follows, having reference to the accompanying figure, which represents an instrument that originated with the writer, and was, some little while back, put to a practical and highly satisfactory test on one of our regularly quadruplexed lines:



In the receiver R¹ an auxiliary electro magnet Lm, wound to produce a considerable counter e. m. f., is placed directly behind the relay armature so as to act thereupon in opposition to the main circuit coils *m*. In the normal condition, with no current traversing *m*, the armature lever is held against its back stop by a light retractile spring in the usual way. When a weak current, say the minimum, traverses *m*, the armature lever is attracted to the intermediate position, this closes the circuits of both Lm and S¹; the retractile power (that is, what the magnetic attraction in this case becomes) of Lm is delayed by its own counter e. m. f. until the attraction of *m* has grown sufficient to retain the armature in the position to which it was drawn, so the closed circuit of S¹ remains undisturbed. The same action attends the intermediate current, so S¹ responds to the minimum and intermediate currents. When the maximum current traverses *m*, the armature lever is carried from its intermediate position, and S¹ opens, but the circuit through Lm remains uninterrupted. If the current again decreases, the lever returns to its intermediate position, and S¹ closes; but if the maximum current is entirely withdrawn, the armature lever will, in consequence of the steady pull exerted on it by Lm, be drawn sharply back to its rear limiting stop. And if, when the armature is resting in the latter position, the maximum current is applied to *m*, the armature lever will pass directly over to the front limiting stop, in consequence of the counter e. m. f. of Lm robbing it of any retractile power during its passage across the contacts in the intermediate position. There is, therefore, no hindrance to the forward movement of the armature, and there is an acceleration of its movement rearward; hence the maximum current can be applied and withdrawn at pleasure, without in any way affecting the local circuit by which the sounder S¹ is operated.

Assuming the action of this instrument to be understood in the light of the foregoing, it will be perceived that if it were employed as the neutral relay in the polar diplex, the local connections might be so modified that the sounder S¹ would not be affected by the current reversals, while it would be responsive to the increment key.

A PERCENTAGE METHOD FOR CIRCUIT MEASUREMENTS.

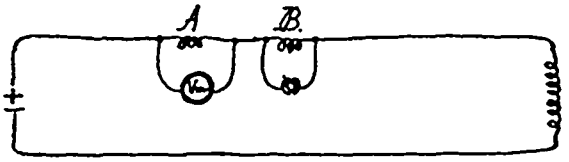
By D. H. Keeley.

As in the operation of Ohm's law the dimension of any one of the three quantities, E.M.F., resistance and current, is readily determinable when the other two are known ($E=R\times C$; $R=\frac{E}{C}$, $C=\frac{E}{R}$); and as, from the relationship thus established between these quantities, an applied E.M.F. is seen to be expended or absorbed in direct proportion to the resistance in its path, the current in any single circuit must needs be uniform in all parts, and therefore varies inversely as the resistance of the entire circuit.

It is clear, of course, that the resistance of any portion of a single circuit necessarily comprises a certain percentage of the whole; and it ought therefore to follow, in view of the foregoing, that the mere observation of the effect (the variation of current) produced in any circuit by the introduction and withdrawal of a known resistance, should afford an indication of the measurements of that circuit.

The elemental feature thus developed is interesting, as enabling one to make measurements of any circuit by means of either a volt-meter of low range, or an ampere-meter, adapted both for direct and alternating currents; and such a method might prove useful where both of these instruments and regular resistance measuring apparatus are not readily at command.

The adaptation of a volt-meter to this end is set forth hereunder; an obvious modification would produce the same results from ampere-meter readings:



Apparatus. A, B, two known resistances included in the circuit to be tested, Vm, volt-meter shunted around it.

Readings {Potential difference between terminals of A}.—

Volts with B cut out = say 20

Volts with B cut in = say 16

Difference 4

Interpretation: The current, or the proportion of the applied E.M.F. expended in it, and therefore in all other parts of the circuit, has in this case fallen $\left(\frac{4\times100}{20}\right)$ = 20 per cent., in consequence of the introduction of B, and because the current is inversely proportional to the resistance in any circuit, the current goes down in this case exactly as the resistance goes up; so the resistance B evidently comprises 20 per cent. of the total resistance of the circuit.

From the data thus obtained the following deductions may be made:

MEASUREMENTS OF THE CIRCUIT.
(A=say 5 ohms; B=say 5 ohms.)

With A and B included:	Whence.	With A and B eliminated.
Resistance B÷·20; or 5÷·20=25 ohms	25 - (A+B) or 25 - 10 =	15 ohms
E.M.F. and Current Volts in A; A. or 16÷5=3·2 amperes.	ohms amperes 25 × 3·2 =	80 volts $\frac{80}{15}=5\cdot33$ amp.

Mr. A. B Smith: If there is to be no discussion on these papers I would like to move a vote of thanks to Mr. Keeley. It is a matter of regret that the Executive were not able to get these papers distributed earlier. If we had been able to do so we would have had some discussion on them. I have much pleasure in moving a vote of thanks.

Mr Kammerer: As an old telegrapher, having been out of it five years, I may say this is beyond what I was used to handling. In 1888, when the Canadian Pacific Railway line was completed to Vancouver, we had through the use of the instruments described conversations between Montreal and Vancouver, which at that time was considered a great achievement.

The vote of thanks was carried.

The President: The next order of business is the presentation of a paper by Mr. Hartman, of Peterboro', who is also unable to attend in person. I will therefore ask Mr. Armstrong to read it.

Mr. Armstrong: I wish to say before starting to read this paper that it is a matter of particular regret to Mr. Hartman that he is unable to be present. Unfavorable circumstances have made it simply impossible for him to do so.

Mr. Armstrong then read the paper:

SOME MODERN ALTERNATING CURRENT APPARATUS.

By H. T. Hartman.

It is only about eight years since the advent of alternating apparatus into the field of practical incandescent lighting Up to that time the only methods in practical use were the series system, the two wire constant potential system, and the Edison three wire system and its variations, all using direct current

The series system, under which name may be included the various series multiple devices, was crude and objectionable on account of the high potentials introduced into the consumer's premises, and the impossibility of cutting out lamps except in groups. The dynamo attendant had no very accurate means of knowing when a lamp broke, and if no additional resistance was interposed, the rest of the lamps on that circuit were subjected to an undue strain, which shortened their lives materially. Moreover, when such a resistance was put in circuit to compensate for the breakage of a lamp, it represented a constant waste of energy. For these and other obvious reasons, the series systems were never very extensively used.

The multiple systems, two and three-wire, are excellent in every respect, but are of only limited application in the present state of the art of incandescent lamp making. Where the territory to be covered is not too great and the consumers too scattered, the three-wire system is still, to my mind, not only the most economical and satisfactory in operation for lighting purposes, but it is also the cheapest to install.

However, the alternating current system sprang almost at a bound into favor with central station men, because the use of high potentials in the street lines so lowered the copper losses per lamp that it became perfectly practical to locate the stations at a considerable distance from the centre of distribution, where land was cheap, fuel convenient, or water power available. It also became possible to supply customers on the outskirts of the town who could not have been reached by either of the direct current multiple systems, except by an expenditure for copper which could afford no adequate return.

But the alternating system had some faults which gradually became painfully evident.

First, the loss from the centre of distribution to the lamp on the consumer's premises was from three to five per cent. greater than in the direct current systems, on account of the drop in the transformer. This gave bad regulation at the lamps, and as the alternating system was generally installed with an eye to lowest first cost rather than economy of operation, there were no pressure lines from the centre of distribution, when there was such a centre at all, so that the dynamo man regulated the pressure by the light of nature, all of which had a very bad effect on the life of the light of art

Second—A transformer had to be installed for practically every consumer, and as the capacities in lights of the various transformers did not always agree with the capacity of the consumer, the central station was compelled to have considerably greater capacity in transformers than in lights actually installed As the transformer was of low efficiency when under-loaded, and caused a constant wasteful drain on the station when not loaded at all, it began to be evident that the stations were in the peculiar position of making money on the efficient load between five and ten o'clock p.m., and losing it on the inefficient load the rest of the night.

These evils have been remedied by the use of modern transformers, giving low loss from no load to full load, by putting more copper in the street lines and distributing it to better advantage, by the use of alternators properly compounded so as to exactly compensate for the loss in the mains and feeders, and by the use of the three wire system of secondary distribution. This latter has the very great advantages of lessening the number of transformers, permitting the use of large units, which are more efficient at all loads, and have a much smaller leakage current on open circuit in proportion to the number of lights capacity than the smaller sizes. Moreover, the use of the three-wire system insures a much greater average load on the transformers than the old method, and reduces the total transformer capacity required.

Third Inductional troubles began to be experienced on long lines. This subject has been enveloped in such an air of mystery and so disguised with sine curves and their variations, harmonic functions and technical names, that the average central station man is apt to think that there is no use in attempting to understand it.

The fundamental facts are quite simple. In the first place, a flash of current in one of two parallel wires tends to induce an answering flash in the other wire, opposite in direction and tending to stop the current in the first wire. If the current in the first wire becomes uniform, that in the second ceases, but if it simply rises and then falls again, the flash induced in the second wire will first tend to prevent the starting of a current and then to prevent its stoppage. If both wires are carrying alternating currents from one dynamo, they act in the same way upon each other, each tending to slightly raise or lower the pressure of the other.

If the two circuits belong to two different dynamos, which are not exactly in phase, the effect of one upon the other will be to first increase and then diminish the pressure, according as the currents are in the same or in opposite directions. This effect is called mutual induction and gives rise to very objectionable flickering of the lights.

It may be reduced (a) by reducing the number of alternations per minute; (b) by placing the two lines of each circuit as close together as possible and as far from any other circuit as possible, (c) by crossing the lines of one circuit at the middle of the line, the effect on one half being counteracted by the effect on the other half.

If a direct current be passed through a coil of wire, the difference of potential across the terminals of that coil will be equal to the current multiplied by the resistance.

If an alternating current is applied to the terminals of the said coil, a considerably greater difference of potential will be required. This effect is caused by the fact that the passage of a current through the coil induces a magnetic flux in it, and when this flux is increased or diminished, an electromotive force is induced in the wire in such a direction as to tend to prevent the change by opposing the current causing it. This is called self induction, and is, of course, present in any ordinary two-wire circuit, which is only a coil of one turn. In other words, it vastly increases the loss in the line and consequently interferes seriously with regulation if present in a lighting circuit. It increases with the frequency, the length of circuit, the current and the distance between wires.

In order to lessen these two sources of trouble, the tendency has been to decrease the frequency in alternators, and in most of the later machines the standard is only about one-half of what it used to be. The speeds have been greatly reduced and the use of laminated magnet cores have materially lessened the heating and consequent loss of power due to eddy currents. The character and quality of insulation has been greatly improved. For example, the use of oil in transformers not only aids in the radiation of heat, thereby increasing the capacity, but also acts as an efficient insulator itself, especially in resisting puncture by an induction or lightning spark, and in immediately closing any gap which might be made by this or other causes.

In armatures the core used to be elaborately insulated, while the coils had only their cotton wrapping. Now the insulation is applied to the coil where it is needed, and the core is only insulated where it is necessary to protect the coil from mechanical injury and in certain places where additional electrical protection is required.

The use of slotted armatures and machine-wound armature coils, which are readily removed and duplicated if necessary, has resulted in compactness, solidity of construction and durability far exceeding the older types.

Much has been said of the two and three-phase systems, and they have come into great prominence on account of the magnitude of recent transmission schemes. Both are, however, subject to the serious disadvantage that the circuits must be kept balanced. Otherwise one armature circuit is liable to be overloaded, and as any adjustment of the field to give proper voltage on that circuit will give very different results on the others, the regulation is bad. The question of balancing circuits is far worse than in the case of an Edison three-wire plant, for in that case three wires are run to every installation of over six lights, but in the case of the polyphase circuit you are practically limited to balancing one transformer against another, and the shutting down of a few transformers on one side of the system would make a serious difference of potential. This objection, of course, does not hold where the load consists principally of motors.

The monocyclic system, however, has all the advantages of the polyphase system, combined with the simplicity of single phase. There is no trouble about balancing circuits, the lights being taken from the main circuit only. Only two wires need to be run for lighting, the third being required only where power is used. The three-wire system may be used for secondary distribution, an additional small transformer being required if power is needed. The motors are better than the best direct current shunt wound machines, both in efficiency and speed regulation, while the construction is such that it is almost impossible to injure them either mechanically or by overload.

The field consists of iron laminations built up like an armature core, only the teeth project from the inner instead of the outer periphery. The coils are machine wound and overlap in such a manner as to support each other at the ends outside of the core in a very rigid and substantial manner. They are held in place by wooden wedges driven into grooves in the teeth. The lines from transformers are led to these field coils direct, and have no connection whatever with the armature. The latter is wound in three closed circuits, consisting of massive bars, in which currents are induced by flow of current in the fields. The poles in latter shift progressively forward with each phase, thus exerting a powerful and uniform torque on the armature.

Each of the armature circuits has a German silver resistance in series with it at the moment of starting, in order to give large starting torque without excessive current. As soon as the machine has reached its normal speed these resistances are short circuited by means of a sliding collar keyed to the shaft and moved by a small handle at the side of the motors. There are no brushes, no commutators, no moving contacts of any kind, and the only moving wires carry only very low potentials, in no way connected with the circuit, and are so imbedded in the core as to be practically indestructible except by means of an axe.

The sub-division of the field, winding into many sections, has two great advantages. It affords great radiating surface and excellent ventilation, thus enabling it to carry heavy overloads temporarily without damage, and it also lessens the difference of potential between adjacent coils, thus reducing the chances of a burn-out to a minimum. Moreover, there is no cumbersome, troublesome starting rheostat to take up valuable space and serve as a fire trap.

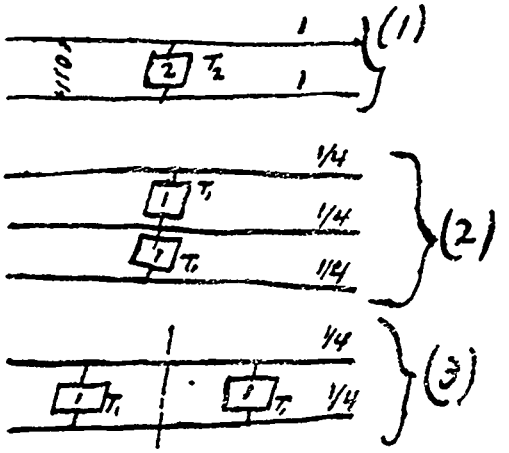
In short, this is the ideal motor in simplicity, compactness, efficiency and durability, and it does not require the gift of prophecy to foretell the doom of the direct current motor, with its many faults and frailties, and the succession of its new rival.

"Le Roi est mort, vive le Roi."

Mr. Medbury: I am glad the writer has referred to the use of the three-wire system for secondary mains. I have been under the impression for some time that the advantages to be derived from the application of the three wire system to secondary mains have been somewhat exaggerated. There seems to be a widespread and deep conviction that there are some advantages especially peculiar to the use of the three wire system for secondary mains which are not possessed by the two wire system for secondary mains. After carefully considering the matter, I am under the impression that in almost every installation that I have seen where the three wire system of secondary mains is used, that with the same number of transformers installed on the two wire system there would have been at least the same results obtained as to regulation of drop of tension as in the three wire system and no greater expenditure for copper, if as much. I have thought that possibly some of my premises, in reaching the conclusion which I have, may be erroneous; for that reason there would naturally exist a doubt as to the correctness of the conclusion. It seemed proper, therefore, to lay before this Association both the premises and the conclusion in order that if there was an error it might be discussed and the right conclusion reached. If in error I should certainly wish to be corrected, and most frankly desire to learn my mistake. I think the three wire system, direct current, only applicable to large private plants like large factories. I think in such cases from direct current, it is advisable to install a three wire plant. Take the Parliament Buildings here for instance. For them to install their own plant the three wire system is the best, although the Government have at Moncton, on the Intercolonial Railway, an alternating current plant supplying lights throughout the yard. In fact, if you get over half a mile, the alternating current simply distances your direct current plant and the direct current plant for price is not in it. Turning to the next page—I notice he says, "the loss from the centre of distribution to the lamp on the consumer's premises was from 3 to 5 per cent. greater than in the direct current systems on account of the drop in the transformer," evidently "drop in potential" is meant. He could not have meant the loss—you make the loss whatever you desire. It is entirely conventional. It seems to me there is something to be guarded against there. The idea that that would be the loss is erroneous. We can make the loss in the alternating system as little as in the direct current systems. I will notice a matter with regard to carrying different pressure lines on the circuit. Pressure lines are not very expensive. I have visited stations running different compound machines, and we run them ourselves. I have stood in several stations and as the load came on I noticed the station attendant going to the rheostat in order to cut down the potential, thereby annulling all the advantage he got from his compound winding. It is entirely useless to install a compound machine unless pressure wires are installed for a guide to the attendant or a compensating volt meter is used with a compensator.

Mr. Jackson: There are several points touched upon in the last paper of considerable interest to us all, each of which might with profit be discussed more fully. A few words in regard to the reason for the tendency among so many manufacturers to reduce the standard number of alternations per minute to so abnormally low a figure may not be amiss, in the light of the misleading statements we have just heard. This is not on account of the induction effects in the transmission lines, for with circuits up to five or six miles in length these effects are not seriously noticeable. The reduction of the number of alternations increases the cost and weight of the transformers, also the weight and cost of the generator, besides impairing its performance. The true cause for this tendency is the inability to run self-starting induction motors on most systems, including the monocyclic, at the high alternations now in use. You all understand the reason for this—that these motors operating on the monocyclic system and at the high frequency of 16 000 alternations per minute, create such a tremendous lag in the current that the generator is unduly loaded and the armature reaction increased to a prohibitory extent. There are two ways of overcoming this difficulty. One is by reducing the number of alternations and thus impairing the performance of your entire plant, with the exception of motors, and in many cases making it necessary to discard much valuable apparatus. The other is by the use of condensers in parallel with each inductive resistance of such capacity as to furnish all the magnetizing and lagging currents, the generator only having to furnish current for actual energy consumed by the motors, this current being in phase with its E. M. F., thus securing the advantages of high frequencies for all transformers and lights and all the advantages of low frequency for motors, even better than 4,000 alternations would do, and without any of the attendant disadvantages. The use of condensers in connection with motors has a beneficial effect whatever the number of alternations used may be, though the gain is more marked at high frequencies, such as from 8,000 to 16,000 alternations per minute. We are informed that circuits must always be kept balanced in the two and three phase systems. This is indeed true in the three phase system on account of the inductive interactions between circuits, but is not the case in the two phase system, for here we have no such interactions. That one of the troubles in the two phase system—as we are informed—should be that one phase can be overloaded, is indeed terrible, and that this overload can be remedied by regulation is remarkable in the extreme. In the light of such a statement it might be worth while to give a summary of what a two phase generator is, if this was anything but an electrical convention. In a two phase generator the phases have no electrical connection, consequently unless more transformers are put on one phase or more power required of it than half the capacity of the generator, it cannot be overloaded. Suppose for some reason one phase should have more than its normal output required, this overload cannot be remedied by regulation any more than in a single phase generator, nor would it hurt or injuriously affect the other phase. Why should any comparison be made between the two phase system and the Edison three wire system? There is no necessity to balance light against light in the two phase system as in the Edison three wire. In every case in the former the wires are of sufficient capacity to carry their entire load whether one phase is loaded and the other empty or both full loaded. You doubtless know that when coils are so set in a generator that they generate E. M. F.'s at 90° difference of phase, there is no inductive action between these coils, so it will be readily seen that throwing on or off of transformers on one phase cannot affect the other. Two circuits having the same maximum capacity and having the same character of load have at the most but a small difference in load at any time during service. With a two phase generator having an inherent regulation from no load to full load of not more than 6 per cent., the difference of voltage between phases at any time will be so slight as to be negligible. We might as truly say that two circuits cannot be run from one single phase generator satisfactorily as that a two phase circuit cannot be operated with good results if it has a closely regulating generator behind it.

Mr. Medbury. Let us in any installation where the secondary wiring is on the three-wire system, take any section served by two transformers. As laid out, these two transformers serve a certain district on either side, and are supposed to be in the centre of their work or located as near the centre as it is possible to figure, the adjoining banks of transformers each being in the centre of their service and feeding up to the end of the service. We have now taken an example. Under these conditions we have taken any set of transformers regardless—take it and the system it is laid out to serve. Let us now draw two parallel



lines of an arbitrary length, and at the centre corresponding to the centre of distribution of the work, place a transformer, which we will call T2. Let this transformer have a secondary pressure of 110 volts, and its capacity be represented, as indicated, by 2. Then the size of the wires running from the secondaries to this transformer may be represented by 1. This would represent the two-wire system of 110 volts. Now draw three parallel lines of the same length as before, and, bisecting these lines, place two transformers as arranged in the three wire system, the size of each transformer being one half of that in the first case, or represented by 1. Call each of these T1. Now as the potential between the two outside lines is 220 volts, the cross section of the wire required to do the same work with the same drop of potential will be one quarter of that in the first case. It has been customary to make the middle wire in the ordinary installation of the same cross section as the two outside wires. Again, draw two lines of the same length as in the other two cases, bisect them, and half way between the point of bisection and each end of the wire, on each side of the point of bisection, suppose a transformer to be placed of the same size as imagined in the three wire system, that is, having a capacity of 1, which is half that in the first case. It is evident then that the cross section of the wire required for the two mains is the same as that of the two outside wires of the three wire system, that the middle wire, of whatever cross section, is entirely dispensed with, furthermore, the same sizes and the same number of transformers are used. It will hardly be denied that the two-wire system is less expensive to instal, leaving out of consideration the cost of wire, that it is simpler, there being no necessity of maintaining a balance. Even the writer of the interesting paper just read, although an old-three-wire man, acknowledges that there is a compensation in the three-wire system in endeavoring to keep a balance; further, that the two-wire system is neater,

in respect to not only the mains but also to the house service, the ideal method of course being to do away with all visible wires to the house services, and the nearer the approach to this, whether it be two or one wire, the better from an aesthetic point of view. Again—a matter perhaps of less importance, but well worthy of some consideration by those central station owners who operate their plant on the meter system—there are, I believe, a very limited number of meters applicable to the three-wire system, while the same meters are also of equal service to the two-wire system. There are, however, quite a number of very satisfactory meters for the two-wire system, so that in installing a three-wire system a central station owner is confined to a very limited choice of meters, being forced to take from a limited number, whereas, on the two wire system, he has a choice of half a dozen or more satisfactory meters. It would be therefore seen that using the same number of transformers, and the same, if not less, amount of wire, the same satisfactory service could be given on the two-wire system as on the three-wire system, doing away with all the disadvantages that essentially pertain to the three-wire system, and gaining all the simplicity that there is in the two-wire system. This is a matter which has been of considerable interest to the speaker, as coming in contact with central station managers from Halifax to Winnipeg. He has felt that there is an entirely exaggerated estimate of the merits of the three-wire system as compared with the two wire system. I hope this matter will be thoroughly discussed here in order that if I am wrong I may be corrected and know the truth.

Mr. Starr. You had reference to secondary distribution only?

Mr. Medbury: Yes.

Mr. Armstrong: I had an intimation that two or three gentlemen present were likely to make something of an onset on this paper, and must again express my regret at Mr. Hartman's unavoidable absence. The point which seems to be causing the most trouble, at least to Mr. Medbury, seems to be the advocacy of the use of the three wire system for secondary distribution. I must, however, refuse to accept the alternative which he offers that the use of this system is due either to bad engineering or to an undue desire to sell copper wire. On the contrary it has been found in most cases the cause, not of waste, but of great economy. I will grant that, in the ideal case presented of a single circuit running along a single street the two wire mains may be all right under some circumstances and that there may be no gain in copper in using the third wire. But unfortunately this ideal case does not occur in actual practice or in a general distribution. In our work we find there has been a great saving in copper in using the three wire system, from the fact that it enables us to cover from a single set of mains with large transformers, an area of from 1,500 to 2,000 feet in width. In his calculation Mr. Medbury also neglects the distribution of the secondary losses entirely. According to Mr. Dion's excellent paper, the practise of the Ottawa Electric Co., in this respect, is to allow one per cent. loss on the services and 2 per cent. on the interior wiring, or a total drop of 3% from the transformer to the lamp. It must be conceded that, granting the same amount of total drop in both cases, the three wire system with 200 volts on the service and interior wiring will, with the same size of wire as on 100 volts, give us just half the drop on the services and interior wiring. This allows us, while employing the same total drop from the transformer to the lamp to double the drop on the mains themselves in the case given. This would, of course, give an area of just one-half on the three wire mains of that which would be required in the case as stated by Mr. Medbury. Further, in the use of the three wire system for secondary distribution an advantage will be found in the fact that in case of a break-down of one transformer of a pair, the additional load is not thrown on the one remaining, as would be the case on the two wire system, thus blowing out its fuses and shutting down all the lights fed from that main. With the three wire system the remaining transformer continues to carry its own load and maintains at least a half service throughout the buildings depending on that section. However, I think the principle trouble with the three wire system as applied to secondary distribution in the eyes of the gentleman who has spoken so feelingly regarding it, is that it renders difficult the sale of two wire meters to plants which use it. Mr. Medbury, I think it was, who referred to a statement of Mr. Hartman in paragraph 2 on the top of page 8, in which he states that the loss from the centre of distribution to the lamp was from 3 to 5 per cent. greater than in the direct current system on account of the loss in the transformer. It will be noticed that Mr. Hartman is here referring to conditions formerly existing in the early days of alternating work, not to the improved conditions which obtain at present. Regarding the remarks of the other speaker I have noted one or two statements regarding which I might say a few words. First, as to the question of the number of alternations used in the two systems spoken of, I cannot see why, for the reason stated, the assumed greater cost of transformers, it should be considered advisable to use 16,000 instead of 8,000 alternations per minute, since the use of the higher frequency admittedly necessitates a greater line drop from mutual and self-induction, and this drop, while not to be taken as an energy loss, is a most disturbing factor in regulation. Added to this is the necessity imposed by use of the higher frequency of introducing such a device as the condenser with the motors, for the purpose of raising the power factor. The only reason of importance seems to me to be in the fact that a great many plants are in operation in which the old-style transformers used are suited only for the higher frequency. In these days of polyphase apparatus, however, many changes are being made and a change in this particular can scarcely be objected to which is desirable in any case upon the score of economy and better regulation. Since, as Mr. Jackson admits, a well-designed transformer can be used for either frequency, this objection largely falls to the ground. There is a point regarding regulation on which I should like to get further information. In the first place, I have not had it made altogether clear to me as yet just how the inherent regulation of any particular machine can compensate for line loss, and also how the independent regulation of the two legs of the two phase is effected under varying loads and at considerable line loss. I have in my mind the case of a town making an increase to an existing single-phase plant in which a two phase system was being figured on as against single phase, in which the station was located at such a distance from the centre of distribution as to render advisable for commercial reasons a drop of 10 per cent. on the feeder. In this case it was proposed by the advocates of the two-phase system to make the present circuit, consisting altogether of shop-lighting, one leg of the two-phase, and the new lighting, which would be in residences and come on at a different time, the other leg. It was a matter of some difficulty for me to see how, under these circumstances, the independent regulation of the two legs was to be effected. I think a little information on this point would be of interest.

Mr. Medbury: The last speaker seems to have misunderstood me. Let your engineer simply take any two transformers; you do not get any more loss doing half the work. You fix the loss at 5 per cent.; I do not care what you make your loss. Of course you are obliged to put your two dynamos in separate phases; you are not obliged to put two transformers on each pole; they do not look nice—not very aesthetic. If I am mistaken I would be glad to know it. If there is one point in my reasoning that is fallacious I would like to hear it pointed out.

Mr. Armstrong: I am not talking of any particular case at all; the question is one of general secondary distribution. We have found in putting in a great number of these plants that a considerable saving in transformer and copper cost has been secured by using the three-wire system, as well as greater reliability of service. Mr. Medbury seems to have missed the point in regard to what I said as to line losses in secondary distribution. Taking an allowable drop of say 3 per cent. between the transformer and the lamp, it may be so re-distributed as to secure a considerable saving in copper by using the three-wire system.

Mr. Jackson: In answer to Mr. Armstrong's question, the difference in load is seldom so great as to make the running of a well regulating two-phase generator unsatisfactory, but to cover just such possible cases, the Stanley Electric Manfg. Co., of the United States, and the Royal Electric Co., of Canada, in connection with their S.K.C. system, will soon bring out a device by which the E.M.F. of either phase may be raised or lowered at will without affecting the other phase. This device being entirely within the generators makes it much more convenient than an ordinary regulator. Its construction will shortly be made known to the public. Such a regulator cannot be used satisfactorily upon a three-phase generator on account of the inductive action between the phases.

Mr. Wright: There may be good and sufficient reasons to prevent Mr. Jackson giving us full information. We of course can't press him. I would certainly like to have heard from him as to what is intended to be done.

Mr. Armstrong: It would be a pity to have anything like this turn out incorrect. I would like to hear some details.

Mr Jackson: I simply state it as a fact. The fact remains, but I cannot give any particulars as to the way in which it is done that is, as to the regulation of each phase separately.

Mr. D A. Starr: I have listened with great pleasure to the paper, and especially to the discussion which it has brought out. Some of you may remember the old adage, "When certain parties fall out, certain other parties get what is due them." (Laughter) I beg to move a vote of thanks to Mr. Hartman for his paper.

The vote was seconded by Mr. Breithaupt and carried.

The President: This ends the list of papers, and any general business will now be in order. I would like to have the report from the Striking Committee.

The report was then read, the Committees being as follows: Committee on Statistics: Messrs. Breithaupt, Yule and Higman. Committee on Legislation: Messrs. J. J. Wright, Dunstan, Powell, McFarlane and Badger.

Mr A B. Smith moved the adoption of the report, seconded by Mr. J. W. Taylor. Carried.

Moved by Mr. B. Jackson, seconded by D. A. Starr, that the thanks of the Association be tendered the Bell Telephone Co., for having placed an instrument in the convention room at the disposal of members.

Moved by L. B. McFarlane, seconded by A. B. Smith, that the thanks of this Association are due and are hereby tendered to the Local Committee, consisting of Messrs. C. Berkeley Powell, W. Y. Soper, J. W. McRae, T. Ahearn, O. Higman, and

J. W. Taylor, for their untiring efforts in making such successful provision for the entertainment of members and guests of this Association while in convention at Ottawa. Carried.

Mr. Armstrong moved, seconded by Mr. McKay, that the hearty thanks of this Association are hereby extended to His Worship Mayor Borthwick and the City Council, representing the citizens of Ottawa, for the use of the Council Chamber for the purposes of this convention, as well as for other courtesies received at their hands. Carried

Moved by Geo. Black, seconded by A. M. Wickens, that this Association desires to recognize the kindness of Capt. Bowie, the deputy sergeant-at-arms, and to thank him for courtesies received at his hands. Carried.

Moved by E. Carl Breithaupt, seconded by J. J. Wright, that the Secretary be instructed to convey to His Excellency the Governor-General the hearty appreciation and thanks of the members of this Association for the courtesy extended in placing at the disposal of the committee his electric launch for the use of the members during the meeting of the Association in Ottawa. Carried.

Moved by Mr. Wickens, seconded by Mr. B. Jackson, that a vote of thanks be tendered to the press for the very full and accurate reports published of the proceedings of this Convention. Carried.

Moved by J. A. Kammerer, seconded by R. G. Moles, that the thanks of this Association are hereby extended to the Ottawa Electric Railway Co., for granting free transportation and other courtesies to members in attendance at this Convention. Carried.

notice. It is not right that our President should retire without our being able to say something to him as to our appreciation of the dignity and efficiency with which he has presided at our meetings, and which has added so much to the results we have attained.

The President: I thank Mr. Smith very much for the kind words he has just spoken, and you, gentlemen, for the cordial manner in which they have been received. Anything that I have done has been a labor of love, and anything I can do for the Association in the future will be performed with much pleasure. We will now adjourn to meet, I hope, in Toronto in June of next year.

The convention then adjourned.

Immediately after the adjournment the members were conveyed by special electric cars to Rockliffe Park, a beautiful summer resort, the property of the Ottawa Street Railway Company, overlooking the junction of the Ottawa and Gatineau rivers.

By the courtesy of His Excellency Lord Aberdeen, several enjoyable trips were made on the Rideau canal in the Governor-General's electric launch, captained by Mr. O. Higman.

THE BANQUET.

It would require descriptive powers of a high order to convey to the minds of our readers an adequate conception of the beauty of the scene which greeted the eyes of those who were so fortunate as to be present at the banquet at the Russell House on the evening of Sept. 17th. It may safely be affirmed that nothing so unique and beautiful in the way of decorative

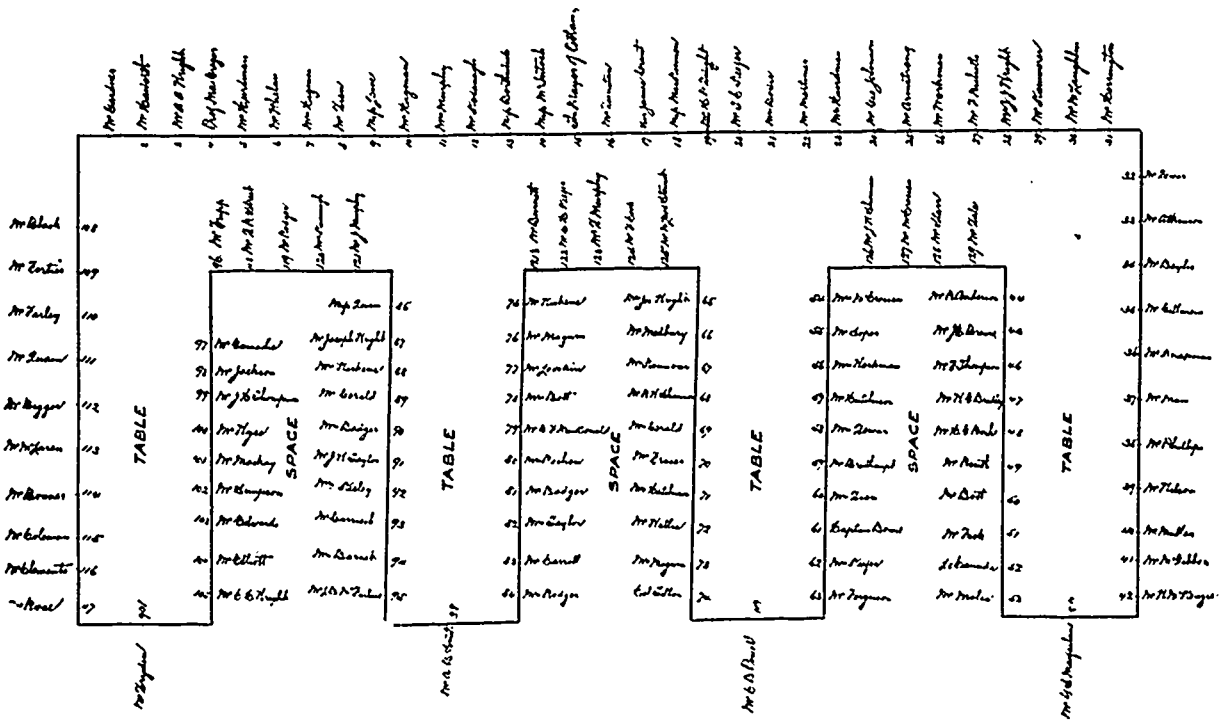


DIAGRAM OF BANQUET, CANADIAN ELECTRICAL ASSOCIATION, OTTAWA, SEPT. 18TH, 1895.

The President: Before closing this the final sitting of the fifth convention, I wish to thank the members for the honor conferred upon me when elected President, and for continued kindness and courtesy throughout my term of office. I wish to gratefully acknowlege the valuable services of the Executive Committee, the members of which have always shown a willingness to work heartily in the best interests of the Association. The services of the Secretary-Treasurer have been almost invaluable, and my association with him in conection with the work of the society during the past year has been a source of much pleasure to myself. I could not use words sufficiently strong to convey my personal appreciation of the splendid efforts made by the Ottawa local committee, but, gentlemen, I think the banquet spoke for itself last night in language more eloquent than I can possibly command. In leaving this chair I make way for an able and energetic successor, and I predict with confidence a brilliant future for the Association in which we are all so much interested. Before closing I wish to announce that Mr. Higman has informed me that the Governor-General's launch will be at the same place as yesterday at 3 o'clock this afternoon, and also by the courtesy of Mr. Soper that special street cars will be at the Russell at 2.30 to take members to the Chaudiere.

Mr. C. B. Powell: Before adjourning I would like to move that the President leave the chair and that the new President occupy it for a moment or two.

Mr. Smith on taking the chair said. I am very glad of this opportunity of being able to bring a little matter before your

effects has ever been witnessed in Canada before. As befitted the occasion, electricity was made to play the principal part in the decorative scheme. On the front of the music gallery and facing the guests on their entrance was emblasoned the word "Ottawa," the letters being formed of red and white incandescent lamps on a cream background. At the opposite end of the room shone forth in the same manner the figures, "1895." Immediately behind the chair of the presiding officer was a Union Jack, composed of a bank of 264 skilfully arranged incandescent lamps, intersected by the crosses of St. Andrew and St. George. On the opposite wall was a horse-shoe design, with the Association monogram, "C.E.A," in the centre, the colors being pale green, cardinal, white, lilac, red and blue. In the centre of the room was a revolving pagoda, carrying varied colored lights, the base being surrounded by flowering and foliage plants. At the apex of every lady's chair gleamed a small red incandescent lamp, which one of the speakers of the evening facetiously referred to as a danger signal. The ingenuity and skill of the caterer had been drawn upon for the successful imitations of dynamos, telephone poles and wires, street cars, and other electrical devices which adorned the tables. The general effect, as stated, was most pleasing, and reflected the utmost credit on the local commitee, the caterer, and all who had a part in its conception and arrangement.

The accompanying plan shows the arrangement of the tables, together with the names and location of the guests. The President, Mr. K. J. Dunstan, discharged in a highly creditable manner the duties of chairman and toast master, the vice-chairs

being ably filled by Messrs. A. B. Smith and C. Berkeley Powell. The menu card, which was an artistic production, contained the following:

"We may live without poetry music and art;
We may live without conscience and live without heart,
We may live without friends, we may live without books,
But civilized man cannot live without cooks.
He may live without books—what is knowledge but grieving?
He may live without hope—what is hope but deceiving?
He may live without love—what is passion but pining?
But where is the man who can live without dining?"

"O hour of all hours the most blessed upon earth,
Blessed hour of dinners."

MENU

Clear Dynamo Soup with Dumpling Units.

Broiled Whitefish with Ampere Sauce
Sliced Cucumber and Grounded Potatoes

Lamb Cutlets and Green Peas.
Chicken Soufflee, Dunsten Style.
Filets of Beef, Street Railway Sauce.

Roast Ribs of Beef, Ottawa Style.
Boiled Turkey, Polyphase Sauce.

Anchor Ice Sherbet.

"The game is up, every man to his taste.

Black Head Duck with Direct Current Jelly
Lettuce Salad, Telephone Dressing.

English Plum Pudding with (low potential) Brandy Sauce.
Greengage Tart. Wine Jelly.
Electric Ice Cream.
Cream Meringue. Fancy Cakes.

FRUITS.

Cheese and Crackers Coffee
Sherry (Wattage of '95). Ale. Ginger Beer.
Ginger Ale.
Electrocution.

"Let me speak, sir,
For heaven now bids me, and the words I utter
Let none think flattery"

"We part,—no matter how we part,
There are some thoughts we utter not;
Deep treasured in our inmost heart
Never revealed and ne'er forgot"

The formal toast list was a very brief one, being as follows: "The Queen"—God Bless Her; "The City of Ottawa;" "Our Guests;" "The Press;" "The Ladies."

After honor had been done to Her Majesty, the chairman proposed the toast to the "City of Ottawa," coupling therewith the name of Mayor Borthwick, who in fitting terms responded. By request of the chairman, Mr. C. Berkeley Powell proposed "Our Guests," connecting therewith the name of Mr. George Johnston, Dominion Statistician, who in reply quoted some figures to show the rapid development of the electrical industry. The chairman proposed the health of Mr. H. P. Dwight, President of the G.N.W. Telegraph Co. In responding Mr. Dwight related a few reminiscences connected with the early days of the telegraph in Canada. "The Press," proposed by Mr. L. B. McFarlane, 2nd Vice-President, brought able responses from Messrs. R. W. Shannon and Fred. Cook. The chairman asked Mr. A. B. Smith, President elect, to propose the health of "The Ladies," which he did, coupling with the toast the name of Mr. Soper, in whom the fair sex found an eloquent and witty champion. Sir James Grant proposed a toast to The Canadian Electrical Association, connecting with it the names of Messrs. K. J. Dunstan, President, and C. H. Mortimer, Secretary, who responded briefly.

At intervals during the evening excellent songs were sung by Messrs. W. J. Gilmour, Brockville; C. D. Fripp and Prof. McGregor, Ottawa; D. A. Starr, Montreal, and Mr. Dale, of New York.

CONVENTION NOTES.

Don't forget the T-r-g-e-r.

Mr. J. B. McCrossan, of Rat Portage, was the representative of the extreme west, while Mr W. H Clements, of Yarmouth, Nova Scotia, represented the provinces by the sea.

Some of the members of the Association went to Ottawa fully prepared to annihilate Professor Wiggins if his prediction regarding the weather should materialize; as it did not, he still lives.

Mr. George Macdonald, Superintendent of the Ottawa Fire Alarm System, placed himself at the disposal of outside members of the Association, and in every way exerted himself to make their visit an interesting one.

Mr. E. Carl Breithaupt divided his attention between the proceedings of the convention and the companionship of several fair lady friends, and in consequence was a subject of envy to many of his friends in the Association.

The grounds surrounding Mr. Soper's summer residence at Rockcliffe Park are illuminated at night by a large number of incandescent lamps, the trees taking the place of ordinary poles. One of the visitors was heard to remark that he doubted whether the wiring would pass inspection by the Underwriters.

If the Ottawa Electric Railway Co. doesn't set a slower pace for its merry-go-round at Rockcliffe Park than that which obtained during convention week, they can safely count on having on hand in the near future a multitude of suits for damages. Some of the members of the C.E.A. who made the trip were in constant expectation of being landed in the waters of the Ottawa or the Gatineau, if not in Hull, and have scarcely yet regained their equilibrium.

Some of those who made the trip on the Governor-General's electric launch, under the able pilotage of Mr. Higman, seemed fearful of getting too far from the city, lest the batteries would give out and they would be compelled to walk home. These fears were however soon dissipated when they observed the distance covered, and the manner in which the speed was maintained. As to the amount of current consumed, and the cost of producing the same, the records are silent.

TRADE NOTES.

The Canadian General Electric Co. are installing two 200 kilowatt generators of their multipolar type for the St. John Railway Co.

The Kingston, Portsmouth and Cataraqui Railway Co. have purchased additional cars and equipment from the Canadian General Electric Co.

The Oshawa Electric Railway Co. has ordered two 150 horse power tandem compound condensing engines from the Robb Engineering Co., of Amherst, N. S.

The Parry Sound Electric Light and Power Co., Ltd., have purchased a 75 kilowatt monocyclic generator from the Canadian General Electric Co.

The Kemp Manufacturing Co., of Toronto, are installing an isolated plant for lighting and power transmission. The Canadian General Electric Co. are doing the work.

A general meeting of agents of the Canadian General Electric Co., from all parts of the Dominion, was held at the head offices of the Company in Toronto last month.

The Packard Electric Co., of St. Catharines, Ont., have recently appointed Messrs. Ahearn & Soper as their representatives for Ottawa and Hull, and Messrs. John Starr, Son & Co., of Halifax, for the Maritime Provinces.

C. W. Ketcheson has opened up an electrical contracting business at 483 Yonge street, Toronto, and reports having met with very satisfactory results.

Messrs. Garrioch, Godard & Co., electrical contractors, of Ottawa, have placed an electric elevator in the Scottish Ontario Chambers and numerous other buildings in the city. They report business good, and have had almost more work than they can do. They have moved into new quarters at 25 Sparks street, and have an attractive window. Each member of the firm is a practical electrician, and has had an extensive experience.

PUBLICATIONS.

The Arena for October is unusually attractive. A fine portrait of the talented young Tennessee authoress, Will Allen Dromgoole, forms the frontispiece, and a richly illustrated paper on "Chester-on-the-Dee" from the pen of the editor opens this issue.

ALTERNATING ELECTRIC CURRENTS. By Edwin J. Houston, Ph.D., and A. E. Kennelly, Sc. D., New York. The W. J. Johnston Company. 225 pages, 77 illustrations. Price, $1.00.

This is the first of ten volumes of an "Elementary Electro-Technical Series," designed to give concise and authoritative information concerning those branches of electro-technical science having a general interest. The subjects to be treated are alternating currents, electric heating, electro-magnetism, electricity in electro-therapeutics, arc lighting, incandescent lighting, electric motors, electric street railways, telephony and telegraphy. The authors state that though the several volumes *form a series, each is, nevertheless, so prepared as to be complete in* itself, and can be understood independently of the others.

PERSONAL.

Mr. C. F. Sise, President of the Bell Telephone Co., is at present on visit to San Francisco.

Mr. R. G. Black, of Hamilton, son of the manager of the G.N.W. Telegraph Co. in that city, has secured a position with the Westinghouse Electric Manufacturing Co., of Pittsburgh, Pa., and is reported to be well satisfied with his new location and prospects.

It is expected that next summer electricity will take the place of horses on the St. Thomas street railway.

The Vancouver Gas Co., alarmed by the electric light proposals, has made an offer to light the streets with gas for a period of ten years, also to sell the city an interest in the company's property by the transfer of part of its capital stock, or to dispose of the whole plant to the city.

The Bell Telephone Company has always appealed against the assessment of its plant in Clinton, and when the appeal came up for hearing before the late Judge Toms, he decided on each occasion against the Company. This year an appeal was again entered and Judge Doyle took the same view as Judge Toms, deciding in favor of the town.

The electric cars have been running three years in Montreal. They commenced with three motor cars, now they are running 161 motor cars and 60 trailers. Then the heaviest day's traffic was during the exhibition, when they carried 80,000 passengers, no transfers being given. This year on the heaviest days there were carried 134,800 passengers, while 38,000 were transferred. The heaviest day's earnings up to that time was $4,000, in fact, the largest in the history of the company and during exhibition week. The greatest day during the present year was also during the exhibition, the earnings being $5,778. The miles of track are now 74½ as compared with about 45 three years ago.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

Proceedings of Sixth Annual Convention.

The sixth annual convention of the Canadian Association of Stationary Engineers was held at Ottawa on the 24th, 25th and 26th of September, and is pronounced to have been the most successful in the history of the Association. White badges, bearing the letters C. A. S. E., were quite in evidence on the streets of the capital, and a hearty welcome was accorded to the visitors.

On assembling in the city hall Mayor Borthwick read an address of welcome. After a few words of hearty greeting he proceeded:—"I see by the preamble of your constitution that it expressly stipulates that the Association shall not be used for the encouragement of strikes or interference in any way between its members and their employers in regard to wages. This is a matter for congratulation. It proves that you have at heart the interests of your masters, as well as those of your own, and whatever good may be derived from your deliberations—and good there must be when men of experience meet and exchange ideas—will be shared by employer and employee alike." Again he said:—"And as to the other principles you are called upon to uphold as delegates to this Convention, there can be no higher, nor nobler, nor none better calculated to avert calamities that too frequently happen through the lack of reliability and intelligence."

Mr. J. J. York, of Montreal, president of the Association, replied to the welcome in fitting terms, referring specially to Ottawa's great industry, the lumber trade, and the importance of the position held by the saw mill engineer. He also stated that it was the purpose of some of them to return to Ottawa soon, for the purpose of seeking an act of incorporation giving them the right to hold property and establish schools of engineering throughout the Dominion.

Ald. Stewart and Ald. Campbell also extended the hand of welcome to the delegates.

Mr. Thos. Wensley, President of Ottawa Branch, No. 7, then read an address of welcome, in the course of which he said: "There are many engineers who think that theory is valueless; that may be true to a certain extent, but the engineer who possesses a good theoretical knowledge of his profession, and combines it with a good practical knowledge of the same, has a great advantage over his fellow craftsman who is satisfied to do everything by the rule of thumb, and he is the man that in time will get to the topmost round of the ladder in his chosen calling. In these days of high pressure steam, with our compound, triple and quadruple expansion engines, the engineer must be a well informed and progressive man, not merely a starter and stopper; he cannot exist on a reputation gained years ago, but must keep himself abreast of the age, by the acquiring of greater knowledge, although it may be acquired with difficulty, and principally through his own exertions. The object of the Canadian Association of Stationary Engineers, as I understand it, is to mutually assist each other in the acquirement of this knowledge by the interchange of thought on the different matters that come within their calling, and it is our wish that its efforts in this direction may be crowned with success, which it certainly will if its members are true to themselves, and true to the Association and its principles as laid down in our constitution."

SECRETARY'S REPORT.

The following report was submitted by the Executive Secretary, Mr. Jas. Devlin, of Kingston:

MR. EXECUTIVE PRESIDENT, FELLOW OFFICERS AND BRETHREN—

It affords me unusual and peculiar pleasure in presenting to you a review of the work done by me as your chief secretary during the year just closed, and before going into the matter further I wish to thank the secretaries of the different branches for the untiring assistance given by them to me throughout the year, and I assure you it has always been a pleasure to me to discharge my duties, owing largely to the cheerful and pleasant manner in which they have always co-operated with me. I wish also to thank Bro. York, as well as the other members of the executive council, for their kindness to me throughout my term.

I am more than pleased with the work we are doing, though it must be remembered that we are yet in our infancy. The Canadian Association of Stationary Engineers is an institution for educational training, and training in our particular branch is as essential as a training in any other profession. It is our college—and the college commencement is the finest flower of Canadian civilization. Diplomas wave like flags and graduation orations ring out like cathedral bells. The university is the rock of national liberty. The educational institutions should be the pride of our nation. It is a great blessing to be young now. Better to be alive now than to have been a king and be to-day a mummy in the museum. The world has changed. Not long ago our ancestors were slaves. Not long ago it was a crime to own books. Printing presses were crushed by acts of kings. To read made men think. To think made men free. Not many years ago bibles were more unlawful than murders, and to read the gospel was a crime for which men were tortured and put to death. Then public schools were as dangerous as dynamite, and the thought of educating the masses was worthy only of burial. How changed now. The great thoughts of liberty, brotherhood and God are the granite cliffs against which the old tyranny and superstition has been beaten into spray. How the student's pen has taken the place of the Indian's arrow. The schoolmaster's ruler is beating away the old fetters, and is pointing to the vaster liberties in life. We live in an age of far-reaching opportunity. When Socrates in his flight would journey, he went afoot. The Saviour never went faster than on a donkey or camel back. But now when we travel we ride in a coach as luxurious as a palace, and rush across the continent with our team of lightning and thunder. The Rothschilds made their fortune by galloping to London after the battle of Waterloo and buying bonds before the news of Wellington's victory reached the city. No more fortunes will be made that way. Is there a battle, the whole story is flashed to the city before the smoke leaves the cannon's mouth—it is printed in the afternoon paper—read by the continent, and the paper is used to kindle the fire the same day. Did it ever strike you what an important part has been played by engineers in all these advancements? Do you ever stop to consider the importance of your calling, and the unbounded opportunities before you? I predict great things for the future, and not very distant either. We are just entering, you might say, on the electric age. I would not be surprised if, in a few years, the present electrical appliances for all purposes will be looked upon as huge curiosities, as the first steam locomotive now is, etc. Late in the last century, (1787) a certain philosopher, Dr. Elliott, was being tried for murder in England. Certain writings of his on the inhabitation of the sun were put as evidence by his friends to prove his insanity. How changed now. The conceptions of the madman are in the present day generally adopted on this scientific question.

This is really a progressive age. We have a magnificent heritage of country, which also adds to our blessings. Look at our country—into it you might throw the inhabitants of Europe, and they could hardly find each other. Our country is great and good. In Quebec and Nova Scotia, where they do not raise beans, they raise brains. And after all, brains are our great products. In Canada we have room for all. The Swede may live here, and dream of Gustavus Adolphus. The Quaker may go round as broad in his mind as he is in his hat. Here the negro may live on his own farm and twine the flowers of freedom about his portal, and think not of auction block or slave pen. And yet while in Canada we have room for all people, yet in Canada we have air enough only to stir one flag. But, brethren, don't think that all the questions are solved. The great social struggle is on; whilst it has not been so noticeable in Canada as in the United States, yet beneath our great industries are heard rumblings and voices which filled France before the revolution. We are to feel thankful, however, that the atmosphere has so considerably cleared, and the financial crisis which threatened us passed. Times are brighter in the United States. We should feel thankful for this, for what is prosperity to them is sure to redound to our advantage. I say we have large interests in the commercial welfare of our friends to the south.

The affairs of our cherished association during the past year have been without event. Perhaps there has been laxity somewhere. But all the branches have been active and appear to recognize the objects for which they are in existence. Enthusiasm will have to be instilled into the members. They must be made to understand that our future success depends upon their individual support.

During the year there were organized and put into working order two branches, namely, No. 15, situate at Brockville, and No. 16 at Carleton Place. Both are very active and display great interest in the general welfare of the association.

There are a great many matters affecting our interests which must come up for consideration sooner or later. Amongst the most important, and one that occurs to me as being of vital significance to the members, is that of arranging some cheap but safe method of life insurance. I am not going to suggest any particular plan, but would strongly recommend the appointment of a committee to enquire into the matter and report at some future time. Besides the advantages to be derived from the insurance itself, it would have a tendency, I think, to bind together more closely the members, to realize more that they are the members of an important brotherhood, to feel that they have a personal interest in each other's welfare.

I will not speak of the financial affairs of the association further than to state that all moneys that have come into my hands have been duly handed over to the treasurer, who will report as to our standing. I have made it a practice to remit to the treasurer twice during the year, namely, after each payment of the per capita tax had been collected in full, and at the same time furnished him with a complete statement of receipts and expenditures, with items and all other data in my power. I think it quite uncalled for to report oftener than twice a year, viz., at the times mentioned, to the treasurer, as it would add much to the work connected with the secretary's duties, at any rate until such times as we grow to such an extent as to be able to attach some remuneration to the secretary for his trouble.

I have had during the year some correspondence with Bro. Charles E. Robertson and others, with the view to opening a branch in Port Arthur, but as yet no active steps have been taken. I am sanguine that if efforts were put forth, a great number of new branches could be organized.

I cannot let pass this opportunity without calling to your attention the very loose manner in which the books pertaining to the branches have been kept, and I would strongly urge the appointment of a committee to investigate the matter and to arrange some form or system and report. I think also that the system of the executive department could be much improved by having a regular set of books gotten up especially on a form arranged by the same committee. Under the present system it is almost impossible for me to present to you a complete statement of the affairs of the whole association; but, gentlemen, my books are all here, and also every letter, report or other thing connected with the office, and I earnestly invite your perusal of the same, and I shall do all in my power to give you what information I can.

The report of the Treasurer, Mr. Duncan Robertson, of Hamilton, is as follows:

TREASURER'S REPORT.

Your treasurer begs leave to submit the following report for the year ending June 30th, 1895.

Receipts.

Sept. 4th, 1894.—Balance		$282 14
June 28th, 1895.—Cash per secretary		236 40
Sept. 24th, 1895.— " " "		145 60
		$664 14

Expenditure.

Sept. 7th, 1894.—Mileage to delegates		$175 25
" " Expenses to Niagara		38 70
" " Bro. W. G. Blackgrove—postage		0 75
" " Rent of hall		20 00
" " Bro. A. E. Edkins—postage		3 75
" " Past president's jewel		25 00
June 28th, 1895.—Secretary's expenses		57 46
Sept. 24th, 1895 — " "		8 11
Balance on hand		335 12
		$664 14

Respectfully submitted,

DUNCAN ROBERTSON, Treasurer.

In the afternoon the delegates were taken to see the Central Canadian Exhibition. At the evening session two papers were

read, one on combustion by Bro. Thos. Wensley, President of Ottawa branch, the other on safety valves, by Bro. A. M. Wickens. The papers were of a technical character.

SECOND DAY.

The second day's proceedings opened with a business session. It was resolved to allow $2 a day to delegates for maintenance and 5 cents per mile one way for mileage.

A proposal was made to change the name so as to admit marine and locomotive engineers to membership, but after considerable discussion it was laid over till next year.

It was decided to issue certificates to the members of the Association, for which they will pay a fee of 50 cents. This is not issued as a certificate of competency, nor has an examination to be passed to receive one. It is merely issued so that those belonging to the Association will be known as members. The certificates will be good for a year only. The conventions hereafter will be held each year on the first Tuesday after the 15th of August.

The question of having a system of insurance in connection with the Association was discussed and was left to the incoming executive to deal with.

During the day a visit was paid to the E. B. Eddy works at Hull, and afterwards the delegates were taken to Rockliffe Park and entertained at lunch by the local branch.

In the evening a visit was paid to the electric power house and to the pumping house of the water works.

At to-day's session a paper the most important and interesting of the Convention—was read by Mr. A. E. Edkins, of Toronto, on steam boiler explosions. The following is a summary of the paper:—

Having been requested to prepare a paper for this Convention I decided after much difficulty to take as my subject Steam Boiler Explosions. Scientists have given the subject much attention in the past, but their theories have not been of much benefit. It is difficult to draw the line between what constitutes an explosion and what might be termed a burst, rupture or local explosion. As operative steam engineers we are more directly interested in the most probable cause and the most efficient means to be adopted for the prevention of explosions. It is quite a common thing in the event of an explosion to hear men attribute the cause to a lack of water in the boiler, and some go so far as to infer that the boiler must have been empty and red hot, and the explosion caused by turning on the feed pump and throwing cold water on the red hot sheets, which being evaporated into steam (instantaneously) of sufficient pressure to cause the destruction of the boiler.

This is a most absurd theory, as will be shown. A cubic foot of water at a temperature due to a pressure of 60 or 70 lbs. of steam to the square inch has been found to have as much explosive energy as one pound of gunpowder. Gunpowder produces sufficient force to raise its own weight to a height of 50 miles, while water, under the conditions existing in a steam boiler under pressure, has energy stored sufficient to raise its own weight nearly one mile. The causes to which the explosion of steam boilers have been attributed are legion, and may be classed as follows: 1st, the known; 2nd, the possible; 3rd, the improbable and nonsensical. Among the first causes may be classed bad workmanship, defects in design and weakening and wasting of the structure from old age.

Among the second or possible causes of explosion may be mentioned, low water and consequent overheating of the boiler.

Among the third or absurd causes for explosions may be mentioned the following: The decomposition of water within a steam boiler and the formation of a powerful gas which under some conditions has been held responsible for some explosions, but which has been proved absurd by many scientists.

Electricity within the steam boiler has also been given as a possible cause of explosion, owing, no doubt, to the fact that steam upon being discharged into the air under certain conditions has exhibited signs of electricity, but proof of this theory has not been forthcoming.

Taking an ordinary horizontal cylindrical tubular boiler which will have about 900 square feet of heating surface and would contain 8.225 pounds of nearly its own weight and 20.84 pounds of steam, and according to a table prepared by A. Thurston, the stored energy contained in the water would be 50,008,790 foot pounds, while that in the steam would be but 1,022,731 foot pounds, or only one-fifteth of that stored up in the water. It is very plain, therefore, that the bulk of destructive force in the event of an explosion emanates from the heat stored up in the water.

It follows, therefore, that the class of boiler containing the most water must in the event of an explosion cause the greater amount of damage. Many instances were given where cold water has been turned into red hot boilers without serious results following.

THIRD DAY.

On the third day the Convention met and received reports from the various committees, also transacting some routine business.

President York brought up the question of securing models of the machinery and appliances they were in the habit of using, which would be of much benefit to the members, and which could be passed around among the different branches. He thought the manufacturers of pumps and engines should be applied to for the purpose of getting them to supply models, which would be of much benefit to the members as well as to the manufacturers. A motion was carried to the effect that the executive take steps towards securing models.

The executive reported that $350 was required to pay expenses of delegates. A number of the members returned half their allowance to the Association's funds.

A motion was passed acknowledging the great hospitality of the people of Ottawa.

The Convention was brought to a close by a banquet at the Windsor Hotel. The chair was occupied by Mr. Thos. Wensley, president of the Ottawa branch, who had on his right Mayor Borthwick and Mr. Blackgrove, the new president, and on his left Mr. York, ex-president. Among the guests were a number of the aldermen of the city and others. A very pleasant evening was spent, song and story entering largely into the program.

The following are the officers elected for the ensuing year:—President, W. G. Blackgrove, Toronto; vice-president, J. Devlin, Kingston; secretary, E. J. Phillips, Toronto; treasurer, Duncan Robertson, Hamilton; conductor, W. F. Chapman, Brockville; doorkeeper, F. G. Johnston, Ottawa; Provincial Deputy for Ontario, F. G. Donaldson, Ottawa; District Deputies for Ontario, J. Hugget, Toronto; J. Floody, Wiarton; Pro-deputy for Province of Quebec, O. E. Granburg, Montreal.

Kingston, Brockville, Montreal and London extended invitations for the next convention, but on a vote being taken, Kingston was selected by a large majority.

At the conclusion of the proceedings the retiring president, Mr. J. J. York, of Montreal, was presented with a jewel.

SPARKS.

The Nanaimo Telephone Co.'s plant is to be reconstructed.

Mr. James Pape has been appointed assistant electric light inspector for Toronto.

An electrical street car postal service has been inaugurated on the third avenue line in New York.

The machinery in the electricity building at the Bordeaux exhibition was destroyed by fire last week.

The Guelph electric street railway was opened for traffic on Sept. 17th. There is about five miles of track.

The electric light power station at St. Stepen's N. B., has had to run short on account of low water caused by the drought.

The Canada Switch and Spring Co., Montreal, is about to engage in the manufacture of railway, electrical and contractors' supplies, etc.

Mr. W. Y. Soper, vice-president of the Ottawa Electric Railway Company, says Ottawa is not yet large enough to require Sunday street cars.

The earnings of the Montreal street railway for the year ending 30th September, were $1,096,724.80, an increase of $214,552.38 over the previous year.

The Hamilton Radial Electric Railway Co. has closed a contract with the Niagara Power Company which makes the construction of the road to the Falls a certainty.

An extension of the Toronto and Suburban electric railroad has been located from Toronto Junction to Islington. It is hoped Lambton Mills will be reached this fall.

An electric railway is projected from the Grand Trunk in the Township of King to the village of Schomberg. Mr. Jamieson, of Toronto, has been looking over the ground.

The Toronto Railway Co. is well equipped for the coming winter. It has ten snow ploughs, five more than last year, and two cars on each route are fitted with apparatus for removing ice from the rails.

John C. McDonald, of the Auditor-General's office, Ottawa, had his leg fractured in two places, while alighting from an electric car on the civic holiday. He is suing the Ottawa Railroad Company for $10,000 damages.

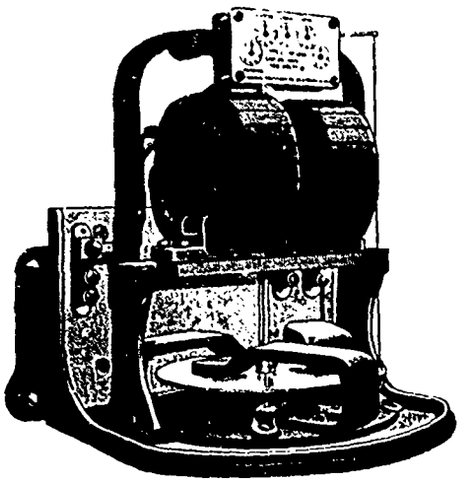
The Ottawa Carbon Works have commenced operations. They employ 29 men and a few girls, which staff will shortly be increased. They have six months orders ahead.

The Toronto and Richmond Hill Electric Railway Company have entered suit against the Township of York, claiming $100,000 damages for preventing them from completing the road within the specified time to claim the bonuses of $60,000.

At the opening of the Guelph electric railway one of the speakers rejoiced that the people would be able to reach the cemetery so quickly. Whereupon a contemporary remarks that if Guelph citizens have not been getting to the cemetery fast enough they can rest assured that the trolley cars without fenders will do much to remove that grievance.

The London electric road carried over 100,000 passengers to the Western fair. On Wednesday 34,000 tickets were taken up, and on Thursday 31,000. Seven tickets are sold for a quarter. The manager claims that the business during the exhibition week was 250 per cent. greater than that of the Toronto road during the industrial. But then it was a new thing for London and everybody wanted to take a ride.

CANADIAN GENERAL ELECTRIC CO.
(LIMITED)



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Suited for Direct and Alternating Circuits, Arc Lighting, Railway and Stationary Motor Service.

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Durability which means saving in repairs and reliability of service.

Efficiency which means saving in power and plant capacity.

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SPARKS.

A company is being formed to build an electric street railway in Sherbrooke, Que.

Mr. W. H. Frost, of Smith's Falls, is now running his malleable iron works by electricity.

The contract for lighting Trenton for ten years by electricity has been awarded to an American company.

During August the Galt, Preston and Hespler electric railway carried 27,000 passengers and over 600 tons of freight

A sale of 100 acres of mica land in the township of Hull, to a United States firm is reported. The price paid was $6,500.

The city's percentage of the earnings of the Bell Telephone Co. in Toronto for the past three months amounted to $1,926 64 and increase of $70.87 over the corresponding period of last year.

It is contemplated to enter into the manufacture of acetyline at Ottawa. Mr. W. C. Edwards, M. P., and other prominent capitalists are interested. Power, material to furnish lime and material for carbon are required, and all three are in abundance at the capital, in water power, limestone and mill waste.

The Syracuse, N. Y., Street Railway Company recently placed four cars on four of their lines at the disposal of the Women's Christian Association for one day. About fifty of the most fashionable young ladies of the city acted as conductors, relieving each other at stated intervals. The regular conductors were on board to prevent accidents. The cars were gaily decorated and were crowded all day. The funds of the association benefitted to the extent of nearly $2,000.

An agreement has been signed between the city of Vancouver and Mr. Stewart, acting on behalf of the Western Electric Light, Heating and Power Co., Ltd., for the lighting of the city. The latter agree to supply lamps of 2,000 candle power at the following prices: Not exceeding 27½ cents per night per lamp up to 200 lamps, 27 cents per night per lamp for 200 up to 250 and 26 cents per night for 250 lamps and over, the lamps to be kept burning at least 310 nights in each year. That in the event of the City requiring 1,000 candle power lamps instead of 2,000 candle power, the charge to be 2 cents per lamp less. The company will also supply incandescent light to the city and any citizen that may require it at the price of ½ cent per amphere hour by meter. The plant to be of the best modern description in use in public lighting, and to be in operation in the principal streets in sixty days, and in the rest of the city in 90 days. The contract is for 10 years, the city to have the right to purchase the plant at actual value at any time.