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CANADIAN ELECTRICAL ASSOCIATION CONVENTION
Niagara Falls, Ont.
JUNE 2nd, 3rd and 4th, 1897

CANADIAN ELECTRICAL NEWS AND STEAM ENGINEERING JOURNAL

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

MAY, 1897

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$1.00 PER YEAR.

CANADIAN

ELECTRICAL NEWS

AND

STEAM ENGINEERING JOURNAL.

VOL. VII. MAY, 1897 No. 5.

CANADIAN ELECTRICAL ASSOCIATION CONVENTION.

ARRANGEMENTS for the approaching Convention of the Canadian Electrical Association at Niagara Falls, Ont., are so far completed that we are able to present on this page a copy of the programme which has been arranged for the occasion. A brief study of the programme will suffice to show that the coming convention is likely, from every point of view, to be one of the most interesting in the history of the organization, if indeed it does not surpass any that has preceded it.

CONVENTION HALL—DUFFERIN CAFE, QUEEN VICTORIA PARK, NIAGARA FALLS, ONT.

BUSINESS PROGRAMME.

WEDNESDAY, JUNE 2ND.

2.00 P.M. Opening of first session in Convention Hall, Dufferin Cafe', Queen Victoria Park.
President's Address.
Reading Minutes of last Meeting.
Secretary-Treasurer's Report.
Reports of Committees.
General Business.
Presentation of Papers.
Discussion.

THURSDAY, JUNE 3RD.

9.00 A.M. Consideration of Reports of Committees.
Election of Standing Committees.
Selection of Place and Time of next Meeting.
Election of Officers and Executive Committee.
General Business.
Presentation of Papers
Discussion.

LIST OF PAPERS.

"Day Loads for Central Stations and How to Increase Them." J. A. Kammerer, Toronto.

"Submarine Cables Dealing more especially with the Actual Experience in Cable Laying and Maintenance in this Country" D. H. Keeley, Ottawa.

"Determination of the Heating Power and Steam Producing Value of Coal from a Preliminary Examination." Wm. Thompson, Montreal.

"Water-Driven Plants." John Murphy, Ottawa.

"The Commercial Aspect of Electric Railways." C. E. A. Carr, London, Ont.

"Accumulators. Their Application to Central Station Lighting and Power" W. A. Johnson, Toronto.

"Why Some Lighting Plants do not Pay." F. C. Armstrong, Toronto.

"Steam End of an Electric Plant." A. M. Wickens, Toronto.

NOTE.—It is proposed to introduce at this Convention a Question Drawer. Members are invited to forward questions to the Secretary prior to May 22nd, and an effort will be made to furnish satisfactory answers at the Convention.

VIEWS AT QUEENSTON HEIGHTS.

SOCIAL FEATURES.

WEDNESDAY, JUNE 2ND.

7:00 p.m.—By special invitation of the management of the Buffalo and Niagara Falls Electric Railway Co., an Excursion by special electric cars from Niagara Falls, N.Y., to Buffalo. Visit of inspection to Buffalo Railway Power House. Returning, reach Niagara Falls about 11 p.m. By courtesy of the Suspension Bridge Co., members taking part in this Excursion will be permitted to cross the Suspension Bridge in both directions without charge.

THURSDAY, JUNE 3RD.

8.00 p.m.—Annual Banquet at Dufferin Cafe'.

FRIDAY, JUNE 4TH.

By courtesy of the undermentioned companies, the following programme has been arranged:—

9:00 a.m.—Special car will leave Hotel Lafayette for a trip over the Niagara Falls Park and River Railway to Queenston.

9:45 a.m.—Cross Niagara River by Niagara Navigation Company's Steamer to Lewiston, N. Y.

10:00 a.m.—Leave Lewiston by special cars on the celebrated Gorge Electric Railway, reaching Niagara Falls at 10:45.

11:00 a.m.—Visit of inspection to Hydraulic Power House.

11:30 a.m.—Descend by Incline Railway and take steamer "Maid of the Mist" for a trip to the foot of the Cataract, landing on Canadian side.

1:30 p.m.—Cross Suspension Bridge.

2:00 p.m.—Inspection of the Power House and Works of the Cataract Construction Co.

3:00 p.m.—Visits to various Electro-Chemical Works.

STEAMBOAT AND HOTEL ARRANGEMENTS.

The Association are indebted to the Management of the Niagara Falls Park and River Railway Co., and the Niagara Falls and Suspension Bridge Railway Co., for having kindly tendered the freedom of their respective roads to the members of the Association during the Convention.

The Niagara Navigation Co. offer a reduced rate of $1.25 from Toronto to Niagara and return to members and their friends on presentation of certificates signed by the Secretary.

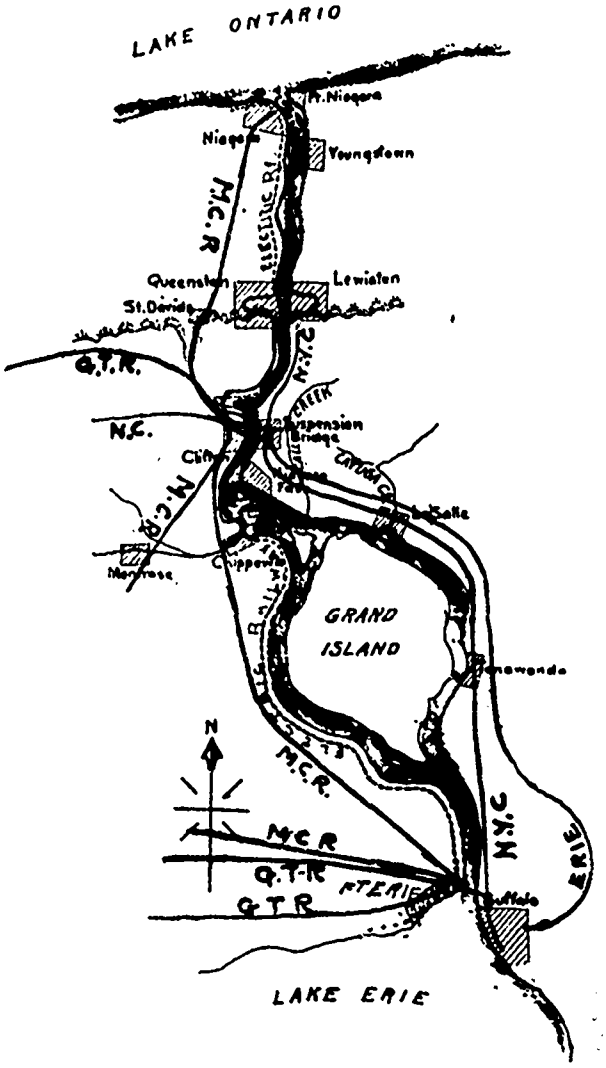
The Hotel Lafayette, situated opposite the Upper Suspension Bridge, offers a special rate of $2.00 per day to members and friends of the Association in attendance on the Convention.

A great transformation has taken place in the vicinity of Niagara Falls in recent years, and persons who may not have visited the locality will find much that is new, interesting and instructive. For the benefit of those who may not be familiar with the locality, especially since these changes were effected, we present in the accompanying views some of the points of greatest interest, but, as will be seen by reference to the programme, there are many others on both sides of the river, which will be visited, and which are calculated to please and instruct the beholder.

In accordance with a suggestion made by Lord Dufferin the legislatures of the State of New York and the Province of Ontario, acting in concert, upwards of ten years ago took steps towards securing control of a sufficient quantity of land on both sides of the Falls for the free use of the public, where they would be protected from the annoyances and exorbitant charges to which they had hitherto been subjected. Under an act passed by the Ontario legislature in 1885 the Lieutenant-Governor was authorized to appoint a Board of Commissioners, whose duties were to select such lands as might be required for the above purpose. The Commissioners so appointed had surveys made, and recommended the purchase of the territory extending from the Clifton House southwards following the general direction of the river, and back therefrom a distance of about 300 yards to near the top of a wooded escarpment. The total area of these lands is 154 acres, including Cedar Islands, the Dufferin group of islands and the talus under the cliff from the Clifton House southwards to the margin of the Horse Shoe Fall. These lands were afterwards purchased by the government of Ontario by arbitration, at a cost of $436,813.24, and now comprise the Queen Victoria Niagara Falls Park, the management of which is vested in the Board of Park Commissioners. Subsequently the Dominion government transferred all its rights in these lands to the Commissioner. Since the purchase by government of the lands comprising the Queen Victoria Park, a large amount of skilled attention, as well as expenditure of money has been devoted to the beautifying of the park grounds. It will be remembered that towards this object the annual payment of $25,000 by the Niagara Falls Power Co. has for a number of years past been devoted.

THE HOTEL LAFAYETTE, NIAGARA FALLS, ONT.

In this connection additional interest has been given to the coming convention by the recent refusal of the Ontario government to extend the time within which the power company might begin the construction of works for the utilization of the power of the cataract on the Canadian side of the river, and actual commencement of operations by the company on the first of the present month, in fulfilment of the terms of their agreement. Visitors to the convention will have the opportunity of viewing these operations, and of learning the plan on which the company propose to utilize and transmit power from the Falls to manufactories in the immediate locality and eventually to distant points.



ROUTE OF THE NIAGARA FALLS PARK & RIVER RAILWAY.

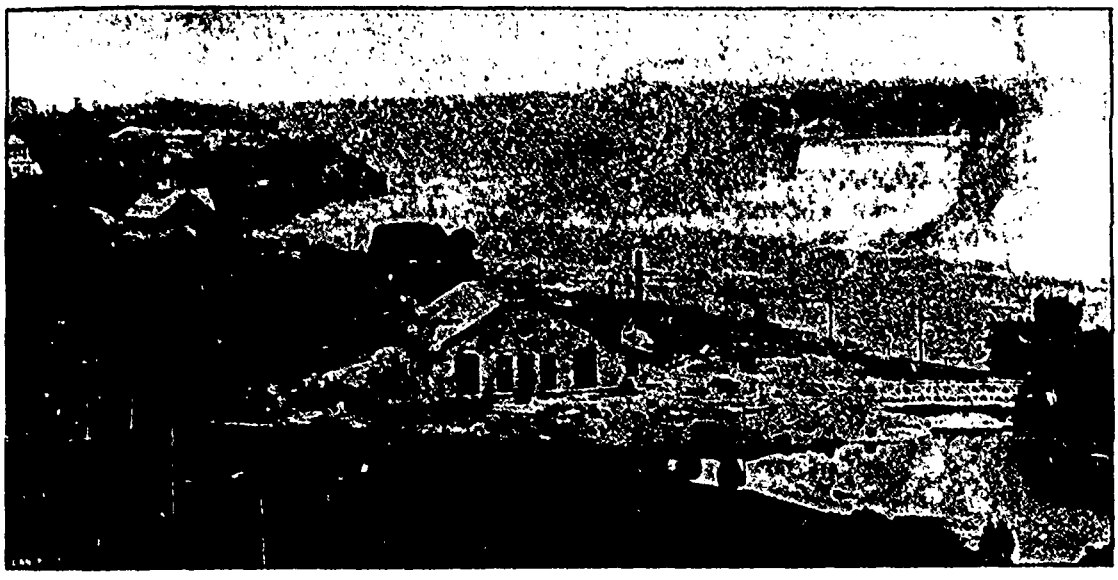
The company's agreement provides that they shall have completed by 1st November, 1898, water connections for the development of 25,000 h. p., and have actually ready for use 10,000 developed h. p. of electric or pneumatic power. After the visitors to the convention shall have seen the herculean task which has been accomplished on the American side of the river by the Cataract Construction Co., with which the Canadian company is closely identified, they will not be disposed to doubt the certainty of the successful completion of the Canadian undertaking.

Closely skirting the Canadian side of the river from Chippewa to Queenston runs the Niagara Falls Park and River Railway. A plan of the route, together with an illustration of the power house above the Falls, accompany this article. From the cars on this road the visitor is given a complete view of the river throughout those parts which are visited by the tourist. The road, which was completed in 1893, connects at Queenston with the Niagara Navigation Company's steamers from Toronto. The trip over this road from Queenston to the Falls is one of the most delightful to be found in the world. As will be seen by the programme, the freedom of the road, which is under the able management of Mr. Wilfred Phillips, has been generously tendered to members and friends of the Association while in attendance on the convention.

On the American side of the river the visitors are invited to witness many highly interesting and instructive sights, including a trip over the gorge railway, which, as stated in a previous issue, is built on the face of the cliff down near the edge of the seething current as well as visits of inspection to various electric, hydraulic and chemical works clustered about the American

the annual Banquet, the success of which is assured, the above brief outline should suffice to show the attractive character of the arrangements which have been made for the entertainment and instruction of those who may attend this Convention.

Viewing the programme from a scientific and commercial point of view, it will be found to be not less



UPPER POWER HOUSE, NIAGARA FALLS PARK AND RIVER RAILWAY.

DUFFERIN ISLANDS FROM ABOVE WYNN'S.

Falls, and of which the gigantic works and equipment of the Cataract Construction Co. forms a fitting center.

The excursion to Buffalo and the inspection of the power house there, in which the current generated at Niagara Falls is received, transformed and put to commercial use, will certainly not be the least pleasant and instructive feature of the occasion.

Without entering into further details, such as are given in the programme, beyond a special reference to

satisfactory. The papers are of a highly interesting and instructive character, and should evoke valuable discussion.

Realizing that the Association should be made as helpful as possible to the electrical industries of the country, the Executive have recently issued a letter to electric lighting companies throughout the country, asking their attendance at this Convention in order that proper consideration may be given to ways and means

whereby the interests of private lighting companies may be saved from annihilation at the hands of the municipalities. As was pointed out in our last issue, this is a subject which should engage the immediate attention of all persons who have capital invested in electric lighting machinery. In the Canadian Electrical Association there exists ready to hand an organization which can be made use of to further this object. We therefore hope and expect to see the electric lighting interest largely represented at this Convention, and action taken which will prevent the wiping out of the large amount of private capital which has in good faith been invested in the electric lighting business.

AUTHORS OF C. E. A. CONVENTION PAPERS.

THAT our readers and members of the Canadian Electrical Association may become acquainted with the gentlemen who have consented to read papers at the forthcoming convention at Ningara Falls, we present the accompaninyg portraits and brief biographical sketches. One or two photos had not come to hand at time of going to press, consequently the omission.

MR. JOHN MURPHY,
Superintendent of Power Houses, Ottawa Electric Company.

Mr. Murphy was born in Ottawa and educated at the common schools. During a term at Ottawa University he acquired a taste for electrical work, and entered into employment with the Bell Telephone Company in 1884. He has been continuously engaged in various branches of electric light and power work since that time, and during the past three years has occupied the position of superintendent of power houses for the Ottawa Electric Company.

MR. F. C. ARMSTRONG,
Chief Sales Agent Canadian General Electric Company.

For a number of years Mr. Armstrong has been connected with the Canadian General Electric Company, of late years as chief sales agent. He is well-known in electrical circles, and has taken an active interest in the work of the Canadian Electrical Association, having served as a member of the Executive Committee, as well as contributed papers on different subjects at past conventions.

MR. J. A. KAMMERER,
Chief Sales Agent Royal Electric Company.

Born at Suspension Bridge, N. Y., Mr. Kammerer was educated at the public and private schools at that place. Up to the year 1880 he was engaged in different branches of railway work, and for the following eleven years in train dispatching in the United States and Canada. Since April, 1891, he has been connected with the Royal Electric Company, of Montreal, and now occupies the position of chief sales agent, with head office at Toronto. We regret that we are unable to publish portrait herewith.

MR. W. A. JOHNSON.

Mr. Johnson has been connected with electrical matters and manufacturing for 22 years, for the last 15 years having made a specialty of dynamos, arc lamps, accumulators, etc. Previous to 1894 he was general manager of the Ball Electric Light Co. (the pioneer manufacturing company of Canada), he having successively acted for said company as mechanical superintendent, secretary and engineer. Early in 1894, after disposing of his interest in the Ball Company, Mr. Johson started a manufacturing and contracting business under the style of W. A. Johnson Electric Company, and has built up a large and increasing trade. His long practical experience has secured to his firm the Canadian representation of several well-known American firms, such as the Electric Storage Battery Co., the Walker Railway apparatus, the Wagner transformer, the Manhattan and Puritan arc lamp, etc.

MR. WILLIAM THOMPSON,
Superintendent Waterworks and Electric Light Plant, Montreal West, Que.

Mr. Thompson was born in Middlesbro, Eng., the home of the iron trade, and came to Canada in 1883, finding employment in Toronto and Brampton.

Since 1891 he has been employed by Armstrong & Cook, as superintendent and chief engineer, operating

their waterworks and electric light plant at Montreal West, Que. Both the electric and waterworks systems were installed under his supervision.

To thoroughly equip himself and master all the details of his profession, Mr. Thompson has taken a special course in analytical chemistry under the tuition of the well-known chemist, Prof. J. T. Donald, of Bishop's University, Montreal.

MR. A. M. WICKENS,
Electrician and Engineer for the Ontario Government.

Mr. Wickens served his apprenticeship as a machinist at the works of the Waterous Engine Works Company, Brantford, leaving there at the expiration of his term for the western states. Returning to Canada in 1874, he was employed as erecting engineer for the Worswick Engine Co., of Guelph, until 1885, at which time he moved to Toronto, taking the situation of engineer at the Globe office. This was when the first incandescent lights were installed in Toronto. When the Globe office was moved to the new building at the corner of Yonge and Melinda streets, a change was made from a shafting and belt transmission to an electric drive and transmission of power, this equipment being the first of its kind in Canada, and consisting of a motor for each machine, making a total of 14 motors for 58 or 60 h.p. These were the first motors in use in the city of Toronto. Shortly after this plant was installed Mr. Wickens accepted his present position as engineer and electrician for the Ontario government.

MR. C. E. A. CARR,
Manager London Street Railway Company.

Mr. Carr was born at Barrie, Ont., and at the age of sixteen years removed to Toronto, where he took a three years' course in a commercial college. He was afterwards employed for three years in the office of Mr. W. T. Jennings, then city engineer of Toronto, during which time the street railway was transferred from the Frank Smith Company to the city, and afterwards to the present company. In this connection Mr. Carr became familiarly associated with street railway matters Early in the year 1893 he accepted the position of private secretary to Mr. H. A Everett, manager of the Toronto Railway Company, and shortly afterwards the greater portion of the system was converted into an electric road, which afforded Mr. Carr much practical experience in the equipment and operation of an electric railway. His appointment as manager and treasurer of the London Street Railway Company was made on February 11, 1895, since which time the road has been changed to an electric system.

MR. D. H. KEELEY,
Superintendent Government Telegraph Service.

Mr. Keeley has long been prominently connected with telegraph work, having for a number of years been employed as assistant to the late Mr. F. N. Gisborne, who was superintendent of government telegraphs from the beginning of the service until his death in the year 1892. Since that time Mr. Keeley has had entire charge of this service, executing his duties in a manner which is said to be highly satisfactory to the department. His wide and varied experience, as may be estimated from the fact that the government telegraph service now includes 2,451 miles of land lines and 206 miles of submarine cables, assures an interesting paper at the approaching convention.

A BIT OF TELEPHONE HISTORY.

At the annual dinner of the National Telephone Company of Great Britain, held in London the other day, Mr. W. H. Preece, in responding to a toast on "Telephony," gave an intetesting bit of history anent the early days of the telephone. "Exactly 20 years ago," said he, "the postmaster general of that day commissioned Mr. Fischer and myself to proceed to America for the purpose of inquiring into the invention of a curious instrument that transmitted the voice from one end of the land to the other." He went determined to expose the fraud, but had not been in company of Graham Bell five minutes before he became an ardent believer, and ever since then the apostle of the telephone. Comparing the receiver of to-day with what he brought from the States 20 years ago, there was not very much difference. In extending the use of the telephone in England they had to encourage mutual assistance between the suppliers and the subscribers. The system was growing very rapidly in England, and although the trunk wires had fallen into the hands of the post-office, there were more trunk wires being operated in Great Britain than in the whole of Europe.

A good artificial water cement is obtained by heating for some hours to redness a mixture of 3 parts of clay and 1 part of slaked lime by measure.

The Consolidated Railway Company's system in Victoria, Vancouver and New Westminster, has passed into the hands of an English syndicate, to be known as the British Columbia Electric Railways Company, Limited.

Mr. A. J. Corriveau, who was one of the promoters of the Montreal Park and Island Railway, is now forward with a scheme to construct a network of trolleys through the eastern townships of Quebec, connecting Montreal and the south shore with St. Johns and other leading towns. The line as proposed would be one hundred and fifty miles in length, and would pass through Chambly, St. Johns, Bedford, Cowansville, St. Hyacinthe, Sweetsburg, Knowlton, Magog and Sherbrooke. The power is to be obtained from the Chambly Water Power Company, and the cars are to be run forty miles an hour. The capital required, which is to be provided by Canadians, Americans and Parisians, is placed at $2,000,000.

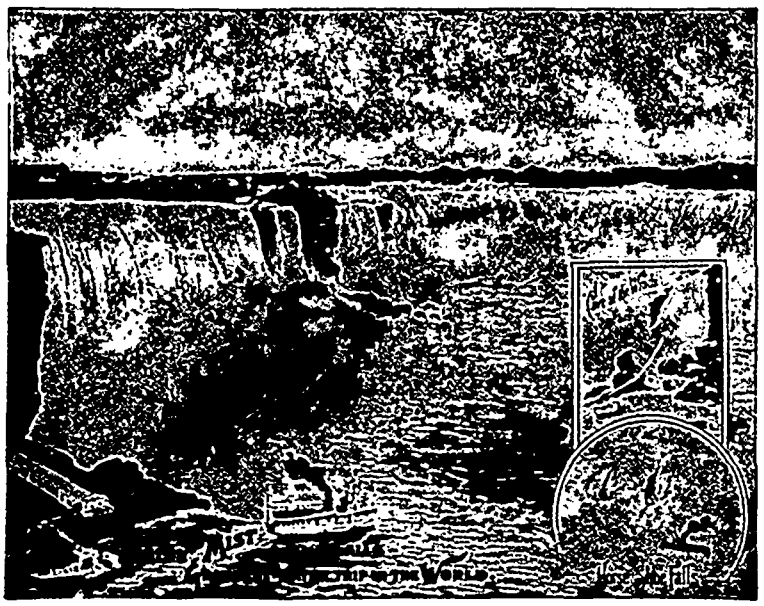
An engineer gives an account of a method of removing and replacing a broken foundation bolt for an engine as follows: A 3-inch bolt was broken off below the capstone, about 40 inches from the top nut. The upper piece was removed and a one inch ratchet bit inserted through its 4-inch pipe case and a short vertical hole drilled in the top of the broken piece and threaded to receive a left-hand eye bolt, by which the bolt was unscrewed from lower nut (that was fortunately set in a pocket of the bearing casting) and lifted out of the hole, a piece welded on threaded, provided with a right-handed stud eye in the top to handle it and screw it into the bottom nut again, and it was successfully replaced and the connection with the bed plate restored.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

NOTE. Secretaries of Associations are requested to forward matter for publication in this Department not later than the 25th of each month.

BROCKVILLE NO. 15.

J. Aikens, secretary of the above association, writes: "At our last regular meeting we had the pleasure of initiating two new members, and several others are making enquiries about joining. Bro. John Grundy suggested the plan of having junior and senior classes in our educational department, as some members could not work out the more advanced rules. The idea proved to be a good one, and much appreciated by the members. Brother Grundy is junior teacher and past president; Bro. Chapman senior teacher.



ANNUAL BANQUET OF HAMILTON NO. 2.

A large number of engineers and their friends gathered at the Commercial Hotel, Hamilton, on the evening of the 15th ultimo, the occasion being the annual banquet of Hamilton No. 2, C.A.S.E. Mr. R. Mackie performed the duties of chairman in his usually happy manner. Among those present were Ald. Findlay, Donald and McLeod; Messrs. Geo. Black, manager G. N. W. Telegraph Co.; W. H. Ballard, Inspector of Public Schools, and Mr. Gill, B.A., of the Collegiate Institute. A first-class supper was served by Mr. Maxey, and was followed by the toast list, "The Queen" and "Governor-General" being duly honored by singing "God Save the Queen" and "The Maple Leaf Forever." The various toasts were responded to as follows: "Dominion Parliament and Local Legislature," Mr. James McGlanchlin; "Our Army and Navy," Mr. T. Carter; "The Mayor and Corporation," Ald Findlay, Donald and McLeod; "Executive Head," Messrs. A. M. Wickens, W. Blackgrove and R. Pettigrew; "Manufacturers," Mr. Rodgers, "Sister Associations," Messrs. Walter Hosie, Toronto, and J. Geary, Guelph; "The Learned Professions," Messrs. George Black, W. H. Ballard and Mr. Gill; "The Press," Mr. J. H. Mattiee, of the Globe, and the Host and Hostess, Mr. Maxey. The musical programme consisted of solos by Messrs. W. S. Hyslop, M. Wilson, W. Hood, Rod Hariss and W. S. Wilson, and duets by Messrs. Hyslop and Wilson, Mr. T. Blain playing the accompaniments. The committee in charge of the banquet was composed of Messrs. R. Mackie, chairman, J. Ironsides, secretary, W. Norris, W. Stevens, J. Johnston and W. Cornish.

THE ENGINEERS' ACT.

The committee appointed by the Canadian and Ontario Associations of Stationary Engineers to look after the proposed license bill to be presented to the Dominion government expect to go to Ottawa early this month. The bill will likely be considered by the committee within the next two weeks, and Messrs. A. M. Wickens, Arthur Ames and James Devlin will be present to explain its objects. It is the desire of the stationary engineers to be placed on the same footing as the marine engineers, and it is hoped that this will finally be accomplished.

The Bedford Electric Company will shortly erect a power house at Halifax, N. S.

Mr. J. G. Lawson, for several years past foreman engineer on the construction staff of the Canadian General Electric Company, has severed his connection with that company and gone to England to join Mr. W. Rutherford, formerly chief engineer of the Canadian General Electric Company and now manager of the electric traction department of the English firm of Dick, Kerr & Co. Mr. Lawson's departure is much regretted, not only by the members of the C. G. Company's staff, but also by the electrical public generally in Canada who have had an opportunity, through personal contact, of appreciating his thorough knowledge of practical electric-technics and his estimable personal character.

"MOWAT GATE," AT ENTRANCE TO QUEEN VICTORIA PARK, NIAGARA FALLS, ONT., SHOWING N. F. P. & R. R. IN THE DISTANCE.

CANADIAN ELECTRICAL NEWS AND STEAM ENGINEERING JOURNAL

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ADVERTISEMENTS.

Advertising rates sent promptly on application. Orders for advertising should reach the office of publication not later than the 25th day of the month immediately preceding date of issue. Changes in advertisements will be made whenever desired, without cost to the advertiser, but to insure proper compliance with the instructions of the advertiser, requests for change should reach the office as early as the 22nd day of the month.

SUBSCRIPTIONS.

The ELECTRICAL NEWS will be mailed to subscribers in the Dominion, or the United States, post free, for $1.00 per annum, 50 cents for six months. The price of subscription should be remitted by currency, registered letter, or postal order payable to C. H. Mortimer. Please do not send cheques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters will be at senders risk. Subscriptions from foreign countries embraced in the General Postal Union $1 50 per annum. Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for if so stipulated by the subscriber, but where no such understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.

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The Publisher should be notified of the failure of subscribers to receive their paper promptly and regularly.

EDITOR'S ANNOUNCEMENTS.

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

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

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TORONTO BRANCH NO. 1.—Meets 1st and 3rd Wednesday each month in Engineers' Hall, 61 Victoria street. John Fox, President; Chas. Moseley, Vice-President; T. Eversfield, Recording Secretary, University Crescent.

MONTREAL BRANCH NO. 1.—Meets 1st and 3rd Thursday each month, in Engineers' Hall, Craig street. President, John Murphy; 1st Vice-President, J. E. Huntington; 2nd Vice-President, Wm. Smyth; Secretary, R. Archibald York; Treasurer, Peter McNaughton.

ST. LAURENT BRANCH NO. 2.—Meets every Monday evening at 43 Bonsecours street, Montreal. R. Drouin, President; Alfred Latour, Secretary, 306 Delisle street, St. Cunegonde.

BRANDON, MAN., BRANCH NO. 1.—Meets 1st and 3rd Friday each month in City Hall. A. R. Crawford, President; Arthur Fleming, Secretary.

HAMILTON BRANCH NO. 2.—Meets 1st and 3rd Friday each month in Mechanics Hall. Wm. Norris, President, E. Teeter, Vice-President, Jos. Ironside Corresponding Secretary, Markland St.

STRATFORD BRANCH NO. 3.—John Hoy, President, Samuel H. Weir, Secretary.

BRANTFORD BRANCH NO. 4.—Meets 2nd and 4th Friday each month. J. L. Forsyth, President, Jos. Ogle, Vice-President, T. Pilgrim, Continental Cord and Co., Secretary.

LONDON BRANCH NO. 5. Meets on the first and third Thursday in each month in Sherwood Hall. C. B. Rixtel, President, D. Campbell, Vice President, Wm. Meaden, Secretary Treasurer, 533 Richmond street.

GUELPH BRANCH NO. 6.—Meets 1st and 3rd Wednesday each month at 7.30 p.m. H. Geary, President, Thos. Anderson, Vice-President, H. Hewelling, Rec.-Secretary; P. Ryan, Fin.-Secretary; Treasurer, C. F. Jordan.

OTTAWA BRANCH NO. 7.—Meet every second and fourth Saturday in each month, in Borbridge's hall, Rideau street, Frank Robert, President, T. G. Johnson, Secretary.

DRESDEN BRANCH NO. 8 Meets 1st and Thursday in each month Thos. Steeper, Secretary.

BERLIN BRANCH NO. 9. Meets 2nd and 4th Saturday each month at 8 p.m. J. R. Utley, President; G. Steinmetz, Vice President; Secretary and Treasurer, W. J. Rhodes, Berlin, Ont.

KINGSTON BRANCH NO. 10. Meets 1st and 3rd Thursday in each month in Fraser Hall, King street, at 8 p.m. President, F. Simmons; Vice-President, J. W. Tandvin; Secretary, A. Macdonald.

WINNIPEG BRANCH NO. 11. President, C. M. Hazlett, Rec. Secretary, J. Sutherland; Financial Secretary, A. B. Jones.

KINCARDINE BRANCH NO 12.—Meets every Tuesday at 8 o'clock, in McKibbon's block. President, Daniel Bennett, Vice President, Joseph Lighthall, Secretary, Percy C. Walker, Waterworks.

WIARTON BRANCH NO. 13. President, Wm. Craddock, Rec. Secretary, Ed. Dunham

PETERBOROUGH BRANCH NO 14 Meets 2nd and 4th Wednesday in each month W. L. Outhwaite, President, W. Forster, Vice-President, A. E. McCallum, Secretary.

BROCKVILLE BRANCH NO. 15.—Meets every Monday and Friday evening, in Richards' Block, King St. President Archibald Franklin, Vice President, John Grundy; Recording Secretary, James Aikins.

CARLETON PLACE BRANCH NO 16. Meets every Saturday evening President, Jos. McKay, Secretary, J. D. Armstrong

ONTARIO ASSOCIATION OF STATIONARY ENGINEERS.

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Information regarding examinations will be furnished on application to any member of the Board.

A New Department.

THE attention of our readers is directed to the "Educational Department" which appears for the first time in this number. This department has been established in the interest and for the benefit of students of electricity and steam engineering who may be desirous of qualifying themselves to fill positions of responsibility in the future. The first of a series of articles by Mr. Wm. Thompson, of Montreal, written with this object in view, appears in the new department in the present number. Much of the information which will appear from month to month in these articles will be adapted to the requirements of engineers who may wish to qualify themselves to pass the examinations of the Ontario Association of Stationary Engineers. These articles will well repay perusal by persons desirous of gaining a clear and thorough knowledge of the foundation principles of mathematics, and of electricity and steam engineering, for the proper understanding of which a knowledge of mathematics is essential. In anticipation of large additions to the number of our subscribers, several hundred copies of the issues of THE NEWS containing the first of this series of articles, will be preserved. Our readers will confer a favor by making as widely known as possible the fact of the publication of these articles.

Value of Mechanical Stokers.

THE American Steam Users' Association recently sent out enquiries designed to draw forth information as to the value of mechanical stokers. The questions asked were: "Do Stokers Save Coal over Hand Firing?" "Do Stokers Save Labor over Hand Firing?" "Do Stokers Save Smoke over Hand Firing?" In answer to the first question, one report showed a loss, five no saving, and six a saving. To the second question one

answer showed an increased cost for labor, three no saving, and eight a saving. To the third question replies from two soft coal plants were in the negative, and seven in the affirmative. None of those who sent in replies would undertake to state that a net gain had been effected by the use of the stoker. We would be pleased to print the views of any of our readers who may have had experience with apparatus of this character, or with any kind of apparatus by the use of which it is claimed to be possible to effect a saving in fuel while maintaining the efficiency of the steam plant. The coal pile is the direction in which every owner and operator of a steam plant should turn his attention in these days of enforced economies. In times past, when the principles of combustion and of steam generating appliances were less perfectly understood than to-day, many a fortune went up the chimney in the form of smoke. And notwithstanding the advancement that has taken place in engineering knowledge, the waste of fuel is still enormous.

Transformers

TRANSFORMERS are frequently regarded as a very simple piece of apparatus, that need not be taken any further notice of once they are securely put up on their pole and connected into the lines. And yet the more they are studied the more features they present worthy of careful attention. We have referred before to the advantage of selecting transformers less on the basis of price than on that of efficiency, and we would draw attention to some of the effects of the "drop" as seriously affecting the service. It is becoming more and more usual to use transformers "banked" on secondary mains, so that more equal distribution of potential may be attained, and to economize in the matter of transformers. Now if different makes, or even different sizes of the same make be employed, it is extremely probable that they will have different "drops," so that if they be all connected to the same secondaries, it is evident that those that have the smallest drops will take more than their due share of the load. This condition may exist to such an extent that a very few low-drop transformers may have to take the whole load of a circuit, in which case the least unfavorable result will be the diminution of the voltage on the lamps, and may possibly even cause fuses to go on the transformers; or if overfused they may burn out. That this is not a visionary result, the possibility of which exists only in the mind of a pure theorist, is evidenced by the recent trouble on a system in western Ontario, which was traced to this cause.

Process of Restoring Belting.

THE Electro Zeitschrift describes a new process of restoring worn out belting which has recently been brought out by Max Krieger & Co., Berlin, and which consists essentially in imbedding the belting, after it has been thoroughly cleaned, in a special composition and subjecting it therein to a moderate heat. This composition, which contains a number of different silicates, serves two purposes, namely, to add fat to belts which have lost their pliability, and abstract it from those which already have too much. The fat seems to flow from the belt to the composition, or vice versa, till a kind of equilibrium is established. The effect of the silicate composition can be increased by raising the temperature, so that by this means old resined belts can be restored to their original pliability, and made available for use for a considerable time longer. A second advantage of this moistening of the leather consists in this, that stretched belts under this treatment return to their original length. If a belt, therefore, is first saturated with fat and then deprived of it by this process, it becomes more dense and lasts longer. It acquires an extraordinary power of resisting subsequent stretching. Belts that have been treated in this way work very uniformly for a long time, and require very little lubricating. The use of resin, etc., for increasing friction becomes altogether unnecessary. The power of absorbing lubricants is very much reduced, so that the belts will run a long time before they require to be treated again. The inventors assert that the life of a belt is doubled by this process, an assertion which, if verified, ought to lead to its being extensively adopted.

Central Station Management.

ELECTRIC lighting companies and consumers alike, are interested in the matter of rates, and this is a matter to which a great deal of attention is being paid by the more enterprising class of managers. In order to popularize electric light, it is necessary to give good light, and to supply it at a very reasonable cost. More especially is this so in places where consumers are under the necessity of exercising economy, and where, in consequence, the relative value of coal oil is higher than in towns where business is larger and more renumerative. As a general rule, not sufficient attention is paid to offering inducements to the more remunerative class of consumer, while such poor business as that afforded by churches, lodges, rinks, &c., is eagerly sought for. A church, contracting for 100 lights, must have that capacity always kept for it by the central station, which therefore cannot obtain for that 100 light capacity as high figures as it does for 100 light capacity rented for commercial or residential purposes, because churches and halls usually obtain considerably reduced rates. It is not safe to assume that the churches will be lighted only on nights when stores, &c., are not, because there are evening services on week days and festivals, when their load is on at the same time as the ordinary commercial load. It is therefore only just that such places should pay for their lighting a proportionately higher rate. The lighting period should be divided into parts, representing period of heavy load, of half load and of light load; and inducements should be offered to consumers to arrange for such consumption as they require to be at light load periods as much as possible. A little reflection will indicate to thoughtful, enterprising managers many ways of increasing their income without proportionately increasing their expenses.

State Regulation of Companies.

THE extent to which socialistic ideas prevail in these modern times is forcibly illustrated by the recent enactment of the Indiana State Legislature reducing street car fares in Indianapolis from five to three cents. It seems a monstrous thing that companies who have interested large amounts of capital in an enterprise designed to serve the public convenience, should be obliged to charge for their service whatever price the legislature may determine. No objection is raised to the right of the municipal and state governing bodies to regulate within reasonable limits the charges of com-

panies operating under public franchises, but it is manifestly unjust that these bodies should have the power to absolutely fix a maximum price for the service rendered by such companies. In nine cases out of ten governing bodies lack the requisite information regarding cost of plant and operation of such companies to enable them to determine what the charge for service should be in order that the company may realize something upon its invested capital and the labor devoted to the conduct of the enterprise. The public are too prone to regard companies as proper objects for assault in any and every form. The suspicion that a company is making a few dollars as the result of its enterprise, is sufficient to arouse public jealousy and opposition. If this condition of affairs continues to develop it will be the means of checking enterprise and improvement to a very deplorable degree. The decision of the Courts as to the legality of the Indiana Statute above referred to will be awaited with interest. It is extremely doubtful whether under the most favorable circumstances a street railway company can pay its way on a three cent fare, especially in view of the fact that the traffic is constantly being reduced by the use of the bicycle. If we mistake not, one or two American street railway companies voluntarily gave the three cent fare a trial a year or two ago, but were compelled to abandon the experiment, on the ground that it could not be made to pay.

BY THE WAY.

A LEARNED commission of German experts has arrived at the following definition of a boiler explosion:—"A steam boiler explosion takes place when the walls of a boiler undergo, through the working of the boiler, a rupture in such a way that, through an outburst of water and steam, a sudden equalization of the pressures interior and exterior to the boiler occurs." That is to say, a steam boiler explosion is what takes place when the boiler bursts!

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WE are told that instead of the word "Hello," which has come to be the recognized introductory to a conversation by telephone in all parts of America, the Japanese use words corresponding in meaning to "You! You!" The opening of the first telephone line in Japan was made the occasion of a public holiday, and it is recorded that thousands of the natives took up a position along the line for the purpose of seeing the first message travel along the wire.

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I LEARN that you propose to publish, before the thermometer takes another rise, and the recollection of the recently vanished coal pile passes out of mind, some particulars and illustrations of electric heating appliances, and the uses to which they are adapted. In next issue I may feel called upon to dilate upon the heat dispelling qualities of the electric fan. It is thus that in the endeavor to be up-to-date we must suddenly switch out of one set of conditions into another.

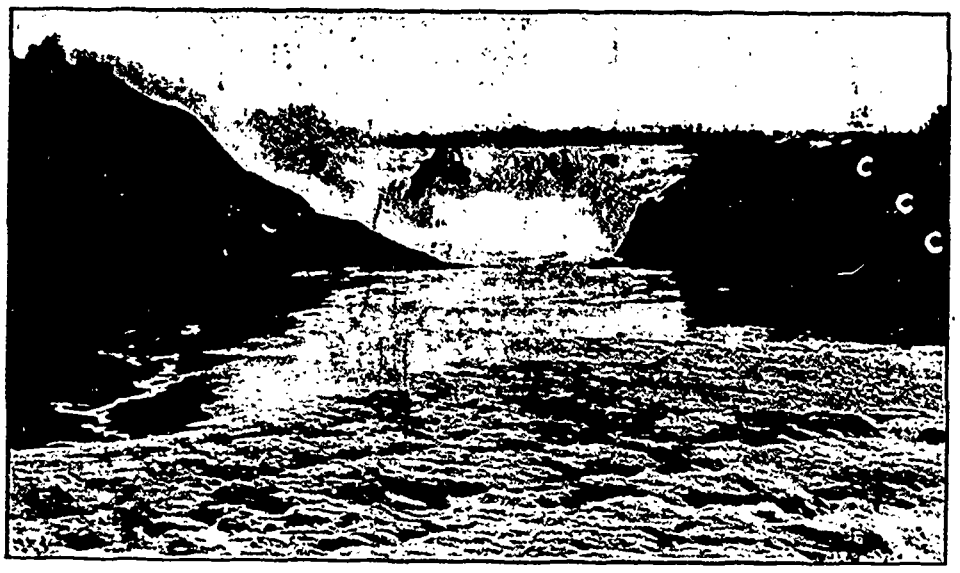
ELECTRIC HEATING AND COOKING APPLIANCES.

THE Canadian General Electric Company are now offering for sale a complete line of electric heating and cooking appliances, manufactured by the American Electric Heating Corporation of Boston. These appliances have been worked out very carefully in detail, so as to secure the greatest possible durability and economy in operation, and seem likely to find a very wide market throughout the Dominion, especially at points where a day service is furnished by the local *lighting company*. The convenience, cleanliness and general desirability of electrical appliances for heating and cooking will be recognized, while at the prices at which current is sold now-a-days, their economy is sufficiently high to admit of their having in the immediate future a wide field for usefulness. We present a cut showing an assortment of these appliances, which include a wide range of articles for different purposes, including room heaters, *car heaters, baking ovens, chafing dishes, five o'clock* tea sets, portable stoves, broilers, sad irons, curling tong heaters, tailors' irons, hot water urns, glue pots, and a great number of equally useful articles.

ELECTRIC HEATING AND COOKING APPLIANCES.

THE WATER POWER OF THE CHAUDIERE FALLS.

THE attention now centred in water powers as a means of developing electricity, and the increasing adaptability of the latter for commercial purposes, justifies the following description and illustrations of the Chaudiere Falls. These falls are situated on the Chaudiere river, about two miles from its junction with the St. Lawrence river,



CHAUDIERE FALLS—LOOKING SOUTH.

six miles below the city of Quebec, and are said to offer excellent facilities as a manufacturing centre. It is the only water power of any size now available on the south shore of the St. Lawrence in that vicinity, and will probably be utilized at an early date for supplying electric light and power to the adjacent municipalities.

At the request of Messrs. Hall & Price, of Quebec, a report on the power of the river at the falls was made by Mr. W. A. Ashe, C.E., of Quebec. The report states that from the cross-section of the river, at the point A-B on the accompanying "plan of a part of the Chaudiere river," the river was discharging 1,365 cubic feet per second, or 5,118,750 foot pounds per minute, or the equivalent of 155.1 h.p.

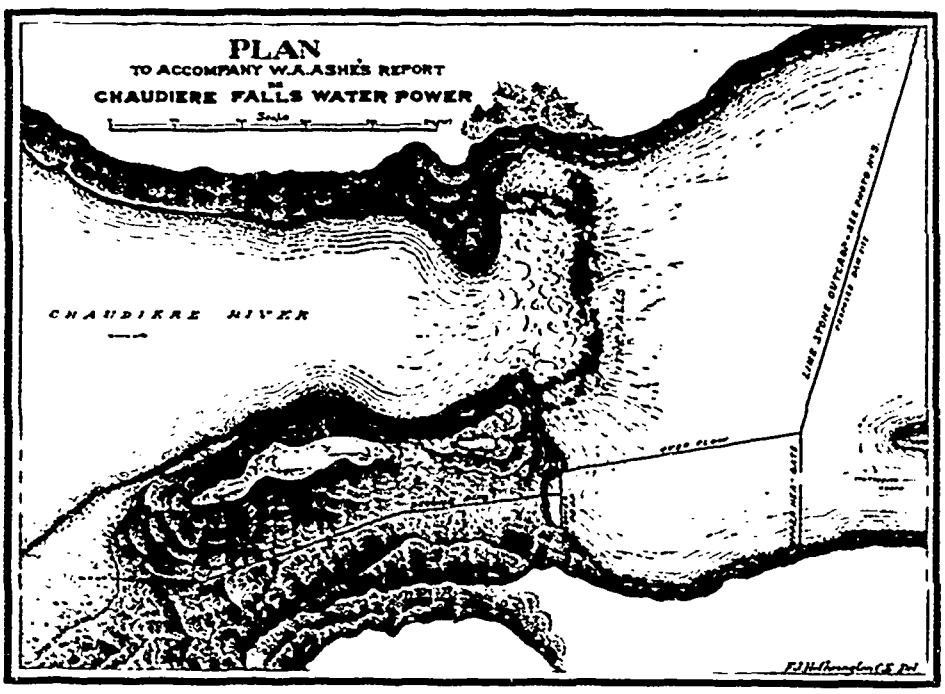
Mr. Ashe further says: "Ninety-four (94) feet of head could be obtained between the point marked "high water level" and the crest of the falls, and it is this head that I should recommend the use of, when the fullest power is required of the falls. With this head and the flow we have determined, we should obtain 14,610 gross horse power, and, assuming the effective horse power as being 65 per cent. of this (really 10 per cent. less than we should get from a properly constructed turbine), this head would give us 9,497 effective horse power; and, as we have decided to only count on half these amounts, the greatest horse power that these falls can be certainly depended on to furnish at the lowest stage of the river would be 4,750 h. p.

The head which I should recommend on account of convenience in situation, being some 350 feet nearer the falls than in the last case, would be at the point "C" (see plan of Chaudiere Falls). Here we should obtain a head of 70 feet, and the powers which we should obtain would be as follows: 12,253 gross, or 7,964 effective horse power. So that, assuming half this amount as being absolutely safe to count upon for the lowest possible stage of the river, we should obtain 3,980 effective horse power."

There is a natural trench through which the conducting pipe could be laid from the level of the top of the falls to the point "C," and at the lower point where the "lower head" with the intake to the conducting pipe would be made, the river bed between the island and main land is only about 100 feet wide, and could be easily dammed, having an outcrop of limestone which would form an excellent foundation, while the overflow would discharge immediately into the falls without further expense.

Concluding his report, Mr. Ashe states that the Chaudiere Falls as a power is superior in every sense to that of the Falls of Montmorency. Great as is the total available head of the Montmorency River, this is more than compensated by the greater volume of water passing through the Chaudiere, not at any particular time, but at the lowest stages of either river.

The latest turbines being guaranteed to reproduce 80 per cent. of the gross horse power, and taking the gross horse power as calculated by Mr. Ashe as 12,253 at 79 feet head, we find the actual effective horse power to be 9,802; and taking one-half of this as he does for the lowest possible stage of the river, we get 4,901 effective h.p.



This valuable water power is now owned by Mr. H. M. Price, of Quebec.

IMPROVING EVERY YEAR.

MR. Harry Kendrick, Walkerville, Ont., writes: "Find enclosed $1.00 for my subscription to May, 1897. I think your journal is improving every year. I think every number is worth keeping for future reference. I have all the numbers for at least four years back."

Close the valve on the discharge pipe of your steam pump while it is running, and unless it stops, the valves, plunger, or both leak

TORONTO TECHNICAL SCHOOL EXAMINATIONS.

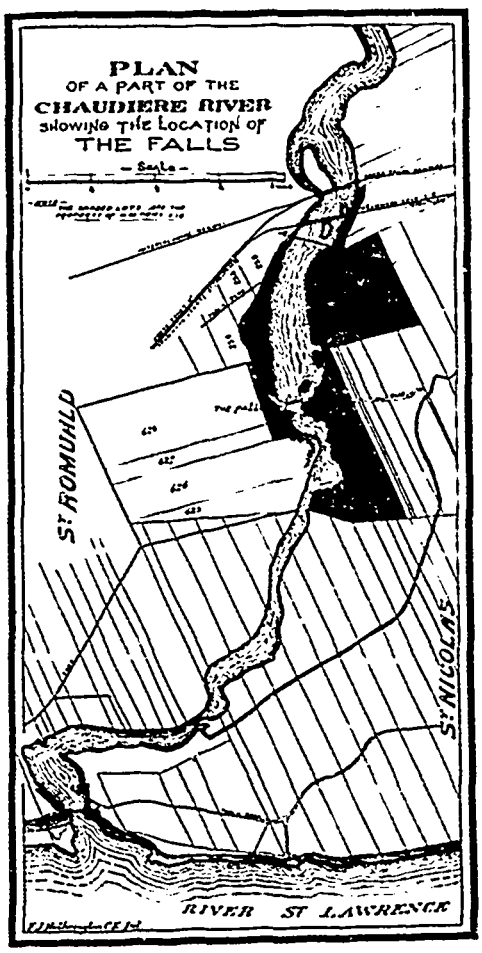
We print below a copy of the examination papers in Electrical Engineering and Steam and Steam Engine, submitted to students of the Toronto Technical School at the close of the session, these subjects being under the direction of Mr. Jas. Milne. In our July issue we hope to publish correct solutions of the questions, and students and others interested are asked to work out the problems and compare their results with the answers to be given.

ELECTRICAL ENGINEERING.

200 marks will constitute a full paper The value attached to each question is shown in brackets.

1. What data do you require for determining the amount of current as measured by the Tangent or Sine galvanometer? Work out the formula, and make the necessary sketches to illustrate your answer. [25]

2. How would you determine the value of an unknown resistance if you were supplied with a Weston voltmeter, the resistance



of which is known, together with a known E.M.F. and whatever wires, etc., are necessary for making the necessary connections? If voltmeter has 20,000 ohms R, and the E.M.F. is 500 volts, when the unknown R is put in circuit voltmeter shows 375 volts, what is the value of the resistance? [25]

3. With a shunted galvanometer, when a resistance of .1 megohm was in circuit, a deflection of 10° was observed when battery key was pressed. With same battery and shunt removed, there was a deflection of 5° when a certain resistance was in the circuit. Determine the value of the resistance. The resistance of the galvanometer was 7,920 ohms, and the shunt was 1/99th. Omit in the calculation the battery resistance. Make a sketch of the arrangement, and show clearly how you arrive at your results. [30]

4. The electro-chemical equivalent of zinc is .00034. What do you understand by this? What would be the deposit in an Edison chemical meter, the German silver shunt having a resistance of .01 ohms, and the resistance of the voltameter and the coil in series with it is 48.96 ohms, when a current of 100 amperes has been passing for 4 hours. Make a diagram showing the arrangement. [35]

5. In an Edison underground 3-wire system, the distance from power-house to feeder junction box is 6,000 feet. The copper resistance is .017 ohms per 1,000 feet. The two outside wires are looped together at one end (the junction box), and at the other the ends of the loop are attached to the terminals of a galvanometer. A 150-ohm resistance coil of 200 turns is also connected to the terminals of the galvanometer, and at a distance of 20 turns from one end one pole of a 4-cell battery is attached, the other pole being attached to ground. In this position there is no deflection of the needle. Find the location of the fault, and give distance in feet from the power-house. [35]

6. What is the size of the conductor in the above question? [25]

7. What data would you require to determine the permeability of an electro-magnet core which lifts a weight of P pounds? Investigate a formula. What do you understand by permeability? [40]

8. A current of 20 amperes, flowing through a resistance of 10 ohms, heats 20 lbs. of water from 60° to 70° Fah. How long was current flowing, supposing there was no loss by radiation? [30]

9. What is the efficiency of an electric motor when running up to its maximum? Prove it. [30]

10. Describe the Aron or Thomson wattmeter. [30]

11. Make a diagram showing the connections in the Brush or Thomson-Houston arc dynamos. Make sufficient sketches to fully illustrate the changes that take place in one revolution. Also describe some form of regulator for arc machines. [30]

12. What does the torque of a motor depend on? Prove your statement. [30]

13. What do you understand by the "Constant" of a galvanometer? What data do you require in determining it? Give an example, and show clearly what is meant by it [30]

STEAM AND STEAM ENGINE.

ELEMENTARY.

115 marks will constitute a full paper.

1. Distinguish between heat and temperature. What are the units by which each are measured? How many units of heat are required for raising 1 lb. of water from 32° F. to 212° F. and then evaporating it into steam? How much mechanical work would be done in each operation? [15]

2. Steam expands in the cylinder of an engine from a pressure of 35 lbs. above to 5 lbs. below atmosphere; at what part of the stroke was steam cut off? Find the mean pressure, taking 15 lbs. per square inch as atmospheric pressure. [15]

3. Sketch in section the parts of a steam cylinder, and show by means of three separate sketches any form of slide valve you prefer to illustrate, wherein (1) the valve has no lap; (2) the valve has lap on steam side; (3) the valve has lap on both steam and exhaust sides. In each drawing the valve must be shown in its mid position. [15]

4. What diameter of a cylinder will be required to develop 60 h. p. in a non-condensing engine. Stroke 3 feet, 60 revolutions per minute. Initial gauge pressure, 60 lbs. Cutting off at 1-5 stroke. [15]

5. A safety valve, 3" diameter, is held down by a uniform lever and weight. The lever is 30" long and weighs 10 lbs., and the valve weighs 4 lbs.; distance from fulcrum to centre of valve, 4". If the weight at the end of the lever is 60 lbs., at what pressure will the valve be lifted? Make a sketch showing the valve, seating, and the general arrangement. [15]

6. What do you understand by jet and surface condensation respectively? Give a sketch of each arrangement. In a surface condenser there are 1,000 brass tubes, each 6 feet long and 1 inch outside diameter; what amount of cooling surface would such a condenser provide? Allowing 3 square feet per horse power, what would be the rating of it? [15]

7. Sketch a link motion reversing gear for a locomotive or marine engine, and explain how the reversal is effected. [20]

8. Taking steam at 50 lbs. above that of the atmosphere, sketch three diagrams showing the amounts of work obtained from a given weight of steam: (1) when used in an engine without expansion or condensation; (2) when the steam is cut off at ¼ stroke, but not condensed; (3) when cut off at ⅓ stroke and condensed. [20]

9. Make a sketch showing the setting of a return tubular boiler. Which of the seams are double rivetted and which of the seams are single rivetted, and why? [20]

10. What is the height of the cone of an ordinary pendulum governor which makes 80 revolutions per minute? Make a diagram of the arrangement, and show how the movement at the governor is communicated to the throttle valve. [20]

11. If 200 tons be lifted 6' in 10 minutes by a steam engine, wherein the diameter of the piston is 20", the mean pressure on the piston is 20 lbs. per square inch, length of stroke 4', and the number of double strokes 15 per minute. What proportion of the power applied is lost in the working of the machinery? [15]

ADVANCED.

200 marks will constitute a full paper

12. The steam ports in a cylinder are 2½" wide, the lead of the valve is ⅛", outside lap 1¼", inside lap ⅛". Valve travel, 5¼". Determine the maximum openings for steam and exhaust. [25]

13. The stroke of an engine is 24"; connecting rod, 4' long; valve travel, 4"; outside lap, 1", inside lap, ¼"; lead ⅛". Find the positions of the piston at the points of cut-off, release, compression, and admission respectively. Draw the hypothetical indicator diagram which such an engine would afford. [30]

14. The diameter of a steam cylinder is 8"; piston stroke, 18"; number of revolutions, 150 per minute; initial pressure, 85 lbs. gauge; cut-off, ⅓th stroke, 3 lbs. back pressure above atmosphere. Find 1 h.p. hyp. log 5 = 1·61. The same engine is tested by a brake pulley on crank shaft 5' diameter, the effective load being 260 lbs., radius 2·5 feet. Find the Brake h.p. and the working efficiency of the engine. [25]

15. In a marine engine fitted with surface condenser the steam reaches the condenser at a mean absolute pressure of 3 lbs. per

square inch, and is condensed to water at 120° Fah. How many pounds of circulating water, which enters at 60° Fah. and is discharged at 100° Fah., would be required for every pound of steam condensed? The temperature of steam at 3 lbs. pressure being 142° Fah. [30]

16. Explain the effects of inside and outside "lap," "lead," "cushioning," "wire-drawing," and "release" on the indicator diagrams, making such sketches as may be necessary to render your answer clear. Mark on your diagrams the points of admission and cut-off. [25]

17. Explain clearly in what manner and to what extent clearance will affect the indicator diagram of an engine. What would be the difference in the diagram of an engine working with steam at 100 lbs. absolute, cutting off at ·25 stroke, when the volume of the total clearance in cylinder and in passages is equal to $\frac{1}{10}$th and $\frac{1}{8}$th respectively of the contents of the cylinder? [30]

18. How would you combine into one diagram the indicator cards from the two cylinders of a compound engine? State fully what data you would require in addition to the actual cards. [30]

19. Given Unwin's proportion $d = 1{\cdot}2\sqrt{t}$, determine the pitch, size of rivets, together with the relative strengths of single, double and triple rivetted joints for $\frac{3}{4}$" plate, assuming that the shearing strength of the rivet is equal to the tensile strength of the plate. [35]

20. In a boiler 25' long and 7' diameter, having two flues 30" diameter, find the bursting pressures in the longitudinal and transverse seams, if the ultimate strength of the double and single rivetted joints are 35,000 and 28,000 lbs. per square inch respectively, thickness of plate $\frac{1}{2}$". [30]

21. In the city of Toronto a boiler test was being conducted, and it was found that the average evaporation for 10 hours was 4,000 lbs. water per hour, and the average hourly consumption of coal was 400 lbs. The water was supplied from the city mains at 40° Fah., after which it was pumped through an exhaust steam heater, which raised the temperature to 200° Fah. At this temperature the water entered the boiler. The average gauge pressure was 150 lbs. If the calorific value of the coal is 12,800 B. T. U. per pound, calculate the efficiency of the boiler, and taking what is known as the Centennial Standard as a basis of computation, find the horse power of the boiler. What is the equivalent evaporation from and at 212° per pound of coal, and what is gained by having the feed water heater? The temperature of steam at 150 lbs. pressure is 366° Fah. [50]

22. In a triple expansion engine the ratio of the cylinders are as 1 : 2·5 . 6, and the M. E. P. brought to a low pressure cylinder basis is 30 lbs. Find the M. E. P. on each piston, so that all three cylinders will be doing exactly the same amount of work, the stroke being the same in each case. If the area of the L. P. cylinder is 4071·5 sq. in., what is the diameter of the high and intermediate cylinder? [25]

23. Sketch and describe the action of the indicator for measuring the power of an engine. The scale of an indicator diagram is 60 lbs. to the inch, the area of the diagram 4 square inches, and the greatest length parallel to the atmospheric line is 2·5", the crank 13", the diameter of the cylinder 15", and the number of revolutions per minute 80. Find the I. H. P. [25]

TRADE NOTES.

Mr. Edward Slade has recently commenced business at No. 137 St. John street, Quebec, as an electrical engineer and contractor.

Messrs. Geo. White & Son, the enterprising proprietors of the Forest Machine Works, London, have moved into their new machine shops, which have been thoroughly refitted. They report good business in their line, and excellent prospects.

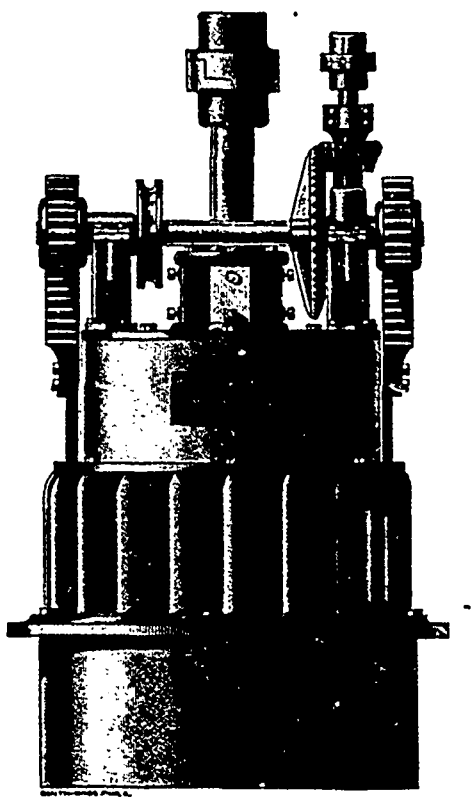
Messrs. Collyer & Brock, electrical engineers and contractors, of Montreal, have been retained by the Stadacona Water, Light and Power Company, as consulting and supervising engineers in the installation of an electric light and power plant in the town of Huntingdon, Que. A fine water power is being developed on the Chateauguay river, and the plant will be operated on the 220-volt direct current system. They expect to have the plant in operation by the first of June.

W. A. Johnson Electric Company, 34 York st., Toronto, report the following sales made during the last 60 days, and not previously reported: Thos. B. Angrove, Kingston, Ont., 3 h.p. motor; Theo. Fredrick, Ottawa, Ont., 1 h.p. motor; Antelope Bicycle Works, Toronto, 12 h.p. motor; Nasmith & Co., Toronto, 4 h.p. motor, D. Hibner & Co., Berlin, 150-light incandescent plant; W. J. Miller, saw mill, Thessalon, Ont., 30-light incandescent plant; Grip Engraving Co., Toronto, 8 h.p. motor; Murray Printing Co., Toronto, four 3 h.p. motors; Luxfer Prism Co., Toronto, one 600-ampere dynamo for depositing copper, and one 4 h.p. and one 6 h.p. motor, McLaren & Co., St. Catharines, one 3 h.p. motor; Rat Portage, Ont., two 3 h.p. and one 5 h.p. motor; New Denver Electric Co., 500-light incandescent plant complete; Rat Portage Electric Co., 100 arc light automatic dynamo and lamps, one 4-panel marble plug switchboard 12 x 5 for four alternating dynamos and eight circuits, and for one arc dynamo and one power generator; Waterloo Electric Co., 1,000-light incandescent plant complete, with wiring for residences, stores, etc., 25-light arc plant complete with long-burning arc lamps, and one marble switchboard; Macgregor, Gourley & Co., Galt, Ont., two power generators, two 8 h.p. motors, two 6 h.p. motors and wiring for incandescent lamps, one marble switchboard panel. Messrs. W. A. Johnson Electric Co. further report that they have also made many sales of their long-burning arc lamps for direct and alternating circuits, chloride accumulators, Wagner transformers, etc.

McCORMICK TURBINES.

York is one of the many noted manufacturing centres in Pennsylvania, and prominent among the manufacturing plants found in that city is that of the S. Morgan Smith Company, whose works were illustrated in our March issue. The buildings are chiefly of stone and brick, and are more than 1,100 feet long, and cover several acres of ground. This plant has been built within the past six years and equipped with new and modern machinery.

The many railroad tracks, travelling cranes and elevators in use upon the premises and within the buildings are so well placed that all articles of machinery manufactured, whether in their crude or finished condition, up to 60,000 pounds weight, are handled as readily as a farmer handles his ploughs upon the farm, or the merchant his goods in the store. The plant is supplied with the latest and most improved machine tools, such as boring mills, pit lathes, shafting lathes, planers and whatever else is needed in the construction of turbine water wheels, iron flumes shafting, pulleys, gearing, steam boilers, etc. some of the boring mills and pit lathes being large enough to allow of pulleys, rope sheaves and fly-wheels being turned off and bored out, as great as 25 feet in diameter and six feet wide upon their face. There are also some remarkably large and fine machine tools for cutting



and dressing gear wheels up to 20 feet in diameter and as much as 30 inches on the face.

On looking through this shop and noting the many massive and modern tools it contains and the conveniences for handling every article manufactured, one readily understands why it is that the McCormick and New Success water wheels and other machinery for cotton, paper, pulp, flour and saw mills, so extensively built and sold by the S. Morgan Smith Co., give such excellent satisfaction.

The company is composed of father and three sons, who own nine-tenths of the plant. All of them are hydraulic and mechanical engineers, as well as practical business men. These facts explain why it is that the buildings composing the shops are so well constructed and arranged, why all the railroad tracks, travelling cranes, trolley lines, elevators, boilers, engines, cupolas for iron and brass foundries and great lathes and boring mills, are each and all seemingly located just in the right place. An important feature in the plant is the many windows in the ceilings and walls, flooding every department through the day with light, and at night the whole is illuminated with arc and incandescent lights, supplied by the company's dynamos. Large sums have been spent in improving and testing these water wheels, and in this way they know the speed and power of each size of their water wheels so perfectly, that when informed as to what power is needed, and head of water available, they claim never to make a mistake in the size and number of water wheels required to operate the plant to the best advantage.

The McCormick wheel is the invention of John B. McCormick,

who also invented the Hercules wheel and did much toward the designing of the Victor wheel. The McCormick is his latest invention, and embodies new points of merit in its construction. It is very heavy, strong, well-built and nicely finished. It is a cylinder gate wheel. The gate consists of a ring or cylinder, which is raised or lowered by means of the gate operating device, thus regulating the flow of water to the runner. The guides through which the water passes to the runner are stationary. The gate is balanced, thus making it operate very easily. Hundreds of these wheels are in operation throughout the world, driving all kinds of machinery. A great many have been sold in Canada. The following is a list of some people in Canada who

CORRECTION.

By inadvertence in the advertisement of the Canadian General Electric Company appearing in our April issue, the two 600 horse power railway generators which they are supplying for Quebec are credited to the Quebec District Railway instead of to the Montmorency Electric Power Company, who are furnishing the power for the system.

PERSONAL.

Mr. F. X. Moisan, president of the Merchants' Telephone Company, Montreal, died in that city last month from paralysis. At a special

This engraving represents two pairs of horizontal 42 inch McCormick turbines, mounted in iron cases on horizontal shafts. They are coupled together, and the power is taken off at one end of the water wheel shaft, which extends into the mill, by three rope sheaves 10 feet in diameter, having 45 grooves for 1¼-inch ropes. There is also a 27-inch McCormick turbine on horizontal shaft, direct connected to a 1,000 gallon fire pump. This turbine also drives the dynamo. The combined power of these turbines is 2,355 horse. The water is supplied to the turbines by two pipes 10 feet in diameter, which are attached to the sides of the wheel cases. The entire outfit was built and erected by the company at the new No. 3 mill of the Clifton Manufacturing Co., Clifton, S. C.

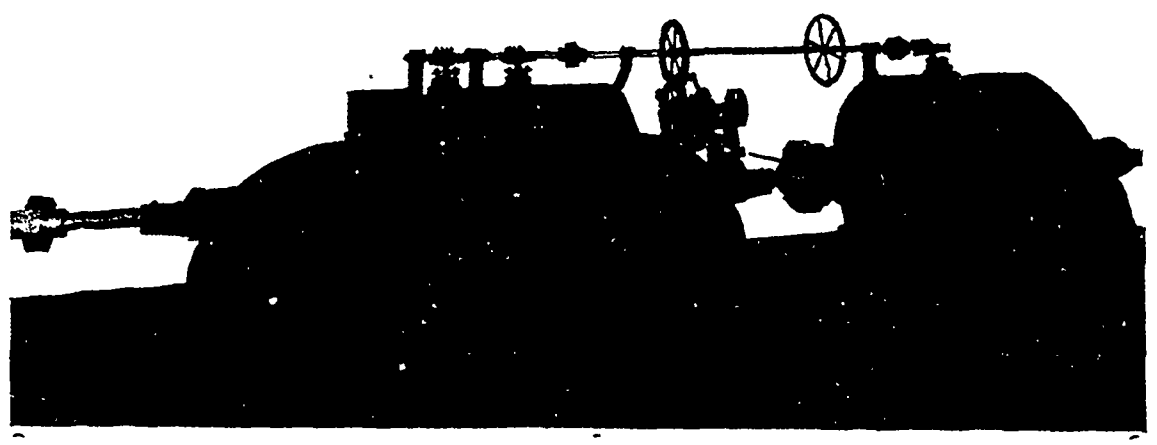
are using McCormick wheels furnished by this company:—Sault Ste. Marie Pulp and Paper Co., Sault Ste. Marie, Ont, 18 vertical 51-inch; E. B. Eddy Co., Hull, Canada, 2 pairs of horizontal 42-inch; Riordan Paper Mills, several different sizes; the Montreal Cotton Co., Valleyfield, Quebec, 2 60-inch, together with gears and shafting, and a duplicate of this order now being built for the same company; municipality of Valleyfield, Que., a 60-inch, together with gears, shafting, friction clutches, etc.; Milton Pulp Co., Milton, Nova Scotia, 4 33-inch; Morgan Falls Pulp Co., New Germany, N. S., 3 33-inch; Sissiboo Falls Pulp Co., Weymouth Bridge, N. S., 1 45-inch, 1 27-inch and 2 33-inch; Farnham Electric Light Co., Farnham, Quebec, 42-inch; G. K. Nesbit, Cowansville, Que., 1 27-inch, etc.

meeting of the board of directors, resolutions expressing sympathy with the family were passed.

Mr. William Westhead, engineer of the McClary Mfg. Co.'s works at London, Ont., died of apoplexy recently, after a few hours' illness.

Mr. Henry N. Bartlett, inspector of the Ottawa Electric Railway Company, has severed his connection with the company to accept a position in Montreal.

Messrs. James Ross and Granville C. Cunningham, of the Montreal Street Railway Company, returned a fortnight ago from a trip to England. On being asked if there was anything in the report that Canadians would enter new fields of electrical work in England, the latter remarked that these reports were premature, but that if good opportunities presented themselves, he had no doubt that those who were alive to electric railway possibilities in Canada would again go into the business abroad.



This engraving represents one pair and one single 21-inch McCormick turbines, mounted on horizontal shafts in iron cases, operating under 64-feet head, the ice manufacturing plant of Chas. T. Westcott, Baltimore, M. D. By means of the Worrall friction clutch between the pairs and the single wheels, the latter can be disconnected from the former, when it becomes necessary, owing to lack of water, to operate but two wheels. A shaft about 50 feet long is connected with the shaft of the turbines and on the extreme end of it is a rope sheave, from which the power is transmitted to another rope sheave, located in the mill, about 200 feet distant. The water is supplied through a pipe about 125 feet long. The entire outfit was built and placed in position by this company.

INTERESTING AND USEFUL.

Mr. P. H. Dickenson, of the Brantford Electric Company, in renewing his subscription to the ELECTRICAL NEWS, states that he is much pleased with the publication, and finds it very interesting and useful reading.

It is estimated that a good railway engine will travel about 1,000,000 miles before it wears out. However, the life of an engine depends as to its length upon the treatment it receives. With ordinary care it ought to last twelve years.

INCANDESCENT DYNAMOS.*

By G. W. Mackie.

We as engineers are often called upon to take charge of a dynamo for shop lighting, therefore I think a little study in this direction will be profitable. Before considering the dynamo, let us see what relation electricity and magnetism bear to each other. If we take a piece of iron (Fig. 1) and wind a few turns of insulated or covered wire upon it, and then pass a current through the wire, we will find the iron magnetized, or having the power to pick up pieces of iron and steel; and the more current we apply the stronger will be the magnetism up to a certain point. But bear in mind that just as soon as the current is stopped the iron loses its magnetism. Then again, if we take two horse shoe mag-

Fig. 1.

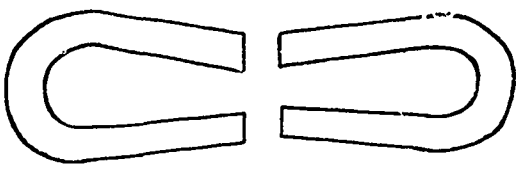


Fig. 2.

nets (Fig. 2) and place them end to end, so that the magnetism will flow from one to the other, then pass a piece of wire rapidly up and down between them, it will become hot from generating a current, thus showing us that electricity and magnetism go hand in hand. The principal parts of a dynamo are as follows, viz., armature, commutator, field magnets and brushes. The armature consists of a drum built up of iron discs, on which are wound coils of wire at right angles to the pole pieces P. The coils, revolving rapidly between the pole pieces, "thereby cutting through the magnetism," generates a current, which is passed out to the commutator. The commutator C is composed of a number of

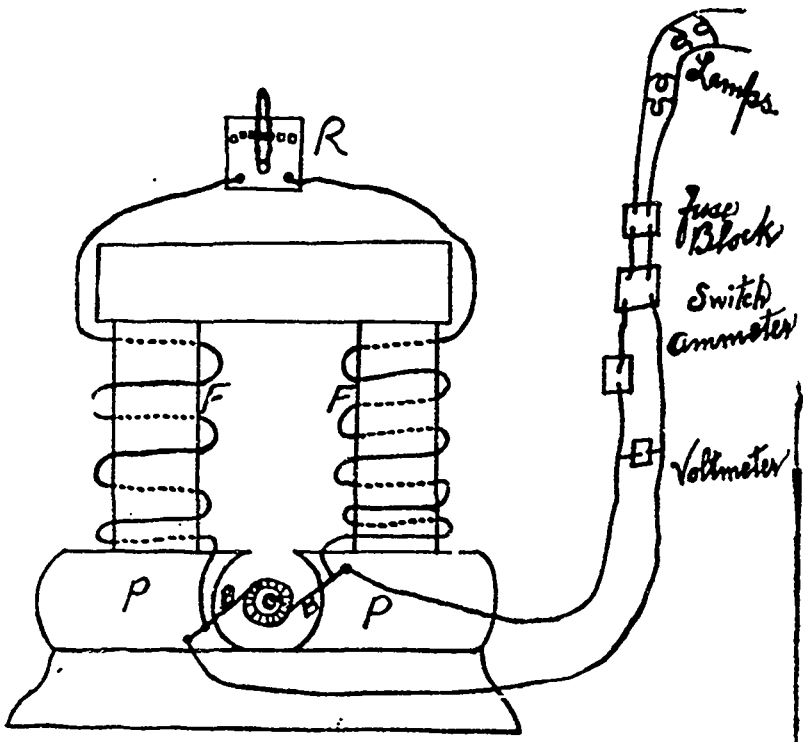


Fig. 3.

bars of copper, insulated one from another. If we had not a commutator, just a plain ring, we would then have an alternating current, but with the use of the commutator we straighten the current so that it will flow in one direction.

Field magnets F is an iron core on which is wound many turns of fine wire, so that when part of the current of the machine passes through this wire it will magnetize them: and the more current we pass through this wire the stronger will be the magnetism of the pole pieces. The brushes B are either copper or carbon. Resting on the commutator, they carry off the current generated in the armature and pass it into the circuit.

There are two kinds of machines used for incandescent lighting —shunt and compound. In a shunt machine (Fig 3), the current leaves one brush, passes around one field magnet, through a rehostat, or resistance box R, around the other field magnet, back

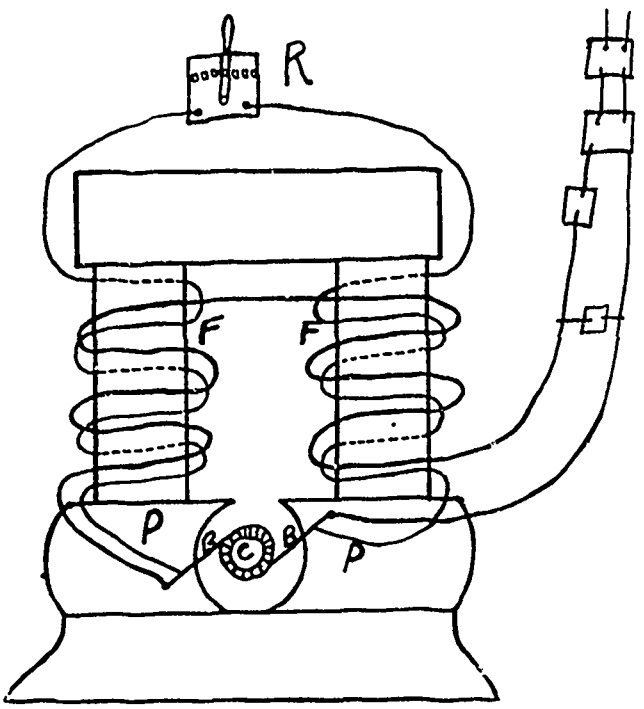


Fig. 4.

to the other brush. To regulate this machine, we move handle of rehostat so as to put more or less resistance to the current flowing in field magnets. This rehostat is composed of a number of coils of German silver wire, "which has a high resistance to the current," and by moving the handle of rehostat we put a greater or less length of this wire in the field wire, thereby varying the resistance. Supposing we were carrying 50 lights, and then added 50 more, we would require more current. To get this extra current we move handle of rehostat so as to cut out some of the resistance, which would let more current flow in the field magnets, making the pole pieces stronger, and the armature, revolving in stronger magnetism, would generate more current. With this machine we would have to regulate for every change of load.

A compound machine (Fig. 4) has the shunt or fine winding the same as the shunt machine, but in addition, has a few turns of heavy or series wire, as shown by the heavy lines (Fig. 4) on field magnets—the light lines showing shunt winding. This heavy or series wire leaves one brush, passes around both field magnets, then to the circuit. With this machine, we bring it up to voltage by rehostat; then it takes care of itself. Whatever current passes to the circuit has first to pass around the field magnets, and the more current flowing to the circuit the stronger will be the magnets. Then again, the less lights we have on the less current will be flowing; thereby the field magnets will be weaker. This machine will regulate itself from full load to no load. In the circuit we have a volt meter, to register voltage or pressure; an ammeter, to give quantity of current flowing; a switch, to open and close the circuit; a fuse block, in which is placed two pieces of soft wire, so that in case of a short circuit or overload, it will burn out this wire and save the machine.

Some of the causes of sparking are:—Carbon brushes becoming glazed, making a poor contact with commutator—this should be sand-papered off; brushes not set at neutral point; brushes not exactly opposite each other; brushes making contact with too many sections of commutator; some of the armature coils short-circuited; rough commutator; copper dust between sections of commutator; loose connection in commutator; machine overloaded.

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

ELECTRIC RAILWAY DEPARTMENT.

IMPROVED RAILWAY CARS.

The Toronto Railway Company have in course of construction at their car shops in Toronto twenty open cars, to be known as "Jubilee cars," the intention being to have them ready for operation on the Queen's birthday. They are 27 feet long and seven feet six inches wide, the additional length permitting of more room between the seats. Each car will have a seating capacity for 70 persons, and will be fitted with C. G. E. motors and Blackwell trucks. The sills which support the steps are of Georgia pine, the cross sills and floor of oak, the posts of ash, the seats of maple and cherry, and the roof of cherry and basswood, covered with canvas and coated with fire-proof paint. Iron panels support the seat on each side.

A new feature of these cars will be the double steps at the sides. Bicycle racks will be fitted on the back of each car. The cars will be painted white with a gold finish, and each will weigh about ten tons. The manager of the Street Railway Company considers that these will be the finest open cars in America. It is also the intention of the company to build twenty more open cars and ten large moonlight excursion cars, the latter to be ready by Dominion Day.

LEGAL DECISIONS.

Davis vs. Ottawa Electric Railway Company.—John Davis, of Ottawa, recovered $200 damages in an action against the Ottawa Electric Railway Company for being forcibly ejected from a street car because his foot was on an opposite seat and he refused to remove it at the request of the conductor. The railway company appealed from the verdict to the Divisional Court at Osgoode Hall and the verdict was set aside. During the argument an interesting discussion ensued between council and the court upon the right of passengers in railway trains and street cars to put their feet upon the opposite seats. Counsel for Davis contended that if there was room in the car a man with clean boots on had a right to put his feet on the opposite seat. Chief Justice Armour pointed out that this would lead to fine distinctions as to what boots were clean and what were not, and expressed the opinion that he would feel inclined to put a man off the car if he would not take his feet down. It appeared in evidence that Davis had just had his boots cleaned before getting on the car, but the verdict was nevertheless set aside.

City of Kingston v. Kingston, Portsmouth & Cataraqui Electric Railway Co.—Judgment in action tried without a jury at Kingston. The action was brought to compel the defendants to run their cars during the winter months as well as the rest of the year over the portion of the railway from Alfred street along Princess street westward to the city limits, in accordance with the terms of the agreement between the plaintiffs and defendants. Held, that in the face of the line of authorities referred to in the judgment of Ritchie, C. J., in Bickford v. Chatham, 16 S.C.R., 235, a judgment for specific performance could not be pronounced, because such a judgment would necessarily direct and enforce the working of the defendants' railway under the agreement, in all its minutiae for all time to come. Held also, that the enforcement of a judgment for the performance of a long series of continued acts involving personal service, and extending over an indefinite period, would be equally difficult if the judgment were in the form of mandamus. The plaintiffs were not entitled to the prerogative writ of mandamus, because that writ is not obtainable by action but only by motion. Held also, that to grant an injunction restraining the defendants from ceasing to operate their cars on the part of line in question would be to grant a judgment for specific performance in an indirect form, and that a declaration of right under sec. 52, sub-sec. 5, of the judicature should not be made, as the terms of the contract were plain and were confirmed by statute, and the only difficulty was that of enforcing them. Held lastly, that no evidence of any actual damage having been offered a reference could not be directed. Action dismissed with costs.

SPARKS.

Kirkton citizens are asking for the construction of an electric railroad from London via Bryanson and Granton.

The Cornwall Electric Street Railway Company will probably be given the contract for lighting the streets of Cornwall by arc lights.

It is expected that the electric street railway at Quebec will be in working order early in June. Mr. Evans, manager of the road, has a large staff of men at work.

The Railway Committee of the Dominion parliament have refused to allow the Hull and Aylmer Electric Railway Company to operate their cars on the streets of Ottawa.

The bill to incorporate the Toronto Radial Railway Company, promoted by E. A. Macdonald and Frank Pedley, was thrown out at the recent session of the Ontario legislature.

Messrs. D. B. Maclennan, Q.C., and J. T. Kirkpatrick have been elected directors of the Cornwall Electric Street Railway Co., vice Mrs. H. R. Hooper and Mr. F. N. Seddall, resigned.

Mr. R. H. Fraser, manager of the Toronto and Suburban Electric Railway, is at present in the gold mining regions of the Rainy River district, where he is interested in several claims.

The project of an electric railway from Hamilton to Beamsville, to connect with the H. G. & B. electric road, is still under consideration. Mr. J. S. Campbell is one of the promoters.

A syndicate is still negotiating with Col. Stacey, of St. Thomas, to electrify the street railway in that town. The same parties are said to be considering the construction of an electric railway from London to Port Stanley.

Mr. Auld, of Amherstburg, Ont., has filed plans in Toronto of the proposed railway to be built from Amherstburg to Windsor. A rival company has also filed plans for a similar road, which would indicate that a bitter fight between the two companies might develop.

W. G. Walton, president of the Hamilton & Barton Incline Railway Company, has invented a power transmitter which gives a motor vehicle a speed of from 4 to 24 miles an hour. All the machinery is hung on the frame separate from the body, so that no jar will be felt.

The shareholders of the Montreal Street Railway Company have authorized the directors to issue new stock to the extent of one million dollars, to provide for further expenditure in connection with the extension of the company's lines and the increase of rolling stock, plant, etc.

Mr. D. McDonald, superintendent of the Montreal Street Railway, has received a resolution from the Woman's Club, thanking him for the courtesy with which he received and acted upon their request that stringent measures should be taken to prevent the practice of expectoration in the street cars.

At the last session of the Ontario legislature incorporation was granted to the Ingersoll Electric Radial Railway Company, to construct an electric railway from Ingersoll to St. Marys, Tilsonburg and Brownsville, with power to build telegraph or telephone systems. The capital stock is placed at $500,000.

The franchise of the Lower Town Street Railway at Quebec has been finally sold to the new electric railway company for the sum of $20,000. The old company retain their buildings, horses, cars, rails, etc., and have permission to run their cars until the electric road is ready to commence traffic in Lower Town and St. Roch.

The Montreal and Bout de L'Isle Railway Company has secured the contract to carry the mails from Maisonneuve to Longe Pointe, Point aux Trembles and Bout de L'Isle, suburbs of Montreal, the contract in question calling for a service twice a day each way. Two new eight wheeled cars have just been finished for the road by the Ottawa Car Company.

The annual meeting of the Hamilton Radial Electric Railway Company was held at Hamilton on the 5th of April, when a contract was let to extend the road through Burlington to Brant street. The following were elected directors: A. Turner, president; T. Leather, vice-president; J. E. Malloch, managing director; W. A. Wood, treasurer; J. Dixon, George Staunton, T. H. Watson, J. Moody.

The residents of the village of St. Louis du Mile End, a suburb of Montreal, are not satisfied with the service afforded by the Montreal Park and Island Railway, and as a result Mr. Albert E. Lewis, real estate agent, has entered an action against the village claiming $50,000 damages from the corporation for not compelling the railway company to provide a more efficient service. The plaintiff claims that his property has been depreciated in value by lack of speedy transportation.

EDUCATIONAL DEPARTMENT

INTRODUCTORY

After mature deliberation the publisher of this journal has decided to devote a certain amount of space each month to what may be termed an Educational Department, wherein both mechanical and electrical formula and mathematical problems will be discussed, illustrated, and as far as possible rule and example given. At the request of the editor, I have with pleasure undertaken to contribute to this department regularly each month, and before discussing actual mathematical problems, wish to briefly introduce the subject at issue.

The primary object of this department is chiefly to increase the value of an already valuable paper, by placing in the hands of every engineer who has any knowledge of the rudimentary principles of mathematics, such matter as will enable him by a little study to master the most intricate mechanical and electrical formula. Many of our most valuable engineering works and publications from time to time contain formula that is in many cases but vaguely understood, and very often entirely misunderstood, thus rendering an otherwise valuable work practically valueless to the reader.

Just at what particular point our calculations should commence became a matter of serious thought, and past experience had to be carefully considered, bearing in mind the fact that there are many really good engineers whose early education has, through force of circumstances, been deficient, and many others who, through lack of opportunity, have not been able to review their early education for years. Knowing by observation and experience the great necessity of having a thorough elementary education before attempting to digest and calculate problems, and the almost utter impossibility of the student arriving at a satisfactory conclusion of his studies without a thorough knowledge of the principle of mathematics involved, I have decided to commence at a point and carry out the programme outlined in this journal—commencing at the foundation and advancing by easy stages until the principles underlying the most obtuse and difficult formula can be readily explained and easily understood. The advantages to be derived from an education of this kind, coupled with practical mechanical ability, is too well understood to require comment.

The programme which has been outlined for the succeeding nine months will embrace:

DECIMAL FRACTIONS—Definitions and explanation of principles of, and method of reduction to common fractions, and vice versa.
SQUARE AND CIRCULAR MEASURE—Definition and explanation and practical demonstrations of.
CUBICAL AND CYLINDRICAL MEASUREMENTS—Definitions and explanations of, with practical hints.
SQUARE AND CUBE ROOT—Definitions and explanations of.
SAFETY VALVE CALCULATIONS—(Spring and Lever Types)—Principles of, with practical demonstrations.
BOILER CONSTRUCTION—Stays, rivets, joints and seams, iron and steel plate—strength of, with formula and practical demonstrations.

It is not the intention to fill these columns with a mass of figures hastily compiled without reference to any particular object; on the contrary, every problem will be carefully thought out, and only such information given as will be of use to you, and an effort will be made, based on experience and a knowledge of the requirements, to make this series of tests complete in every particular.

WM. THOMPSON.

COMMON FRACTIONS.

A FRACTION is one or more of the equal parts into which a unit, or that which is considered as a whole, may be divided.

[NOTE.—Thus a two foot rule is divided into $\frac{1}{4}$, $\frac{1}{2}$, $\frac{1}{16}$, $\frac{1}{8}$, $\frac{1}{4}$, and so on, and consequently this style of numeration is constantly occurring in mechanical engineering.]

The terms of a fraction are styled and distinguished as the Numerator and the Denominator.

The numerator of a fraction indicates the number of parts of the unit considered or taken.

The denominator indicates the number of parts into which the unit is divided.

To express a fraction is to indicate by figures the number of parts in the numerator and denominator respectively above and below a horizontal line.

Thus $\frac{1}{16}$, $\frac{1}{4}$, $\frac{1}{2}$.

Common Fractions are known as Simple, Compound and Complex.

A simple fraction is a fraction whose numerator and denominator consist of simple numbers.

Thus $\frac{1}{4}$, $\frac{1}{2}$, $\frac{1}{8}$, $\frac{1}{2}$.

A compound fraction is a fraction whose value is not fully expressed, but must be arrived at by computation.

Thus $\frac{1}{2}$ of $\frac{1}{2}$, $\frac{1}{8}$ of $\frac{1}{4}$, etc.

A complex fraction is one which contains a fraction in the numerator or denominator, or in both. Its value must be found by computation.

Thus $\frac{\frac{1}{2} \text{ of } 6}{\frac{2}{3} \text{ of } 1}$ $\frac{\frac{1}{2} \text{ of } \frac{1}{2} \text{ of } 4}{\frac{1}{4} \text{ of } 6}$

The numerator or figures above the line correspond with the dividend, and the denominator or figures below the line with the divisor.

The chief principles relating to fractions are:

1. Multiplying the numerator by any number multiplies the fraction.
2. Multiplying the denominator by any number divides the fraction.
3. Dividing the numerator by any number divides the fraction.
4. Dividing the denominator by any number multiplies the fraction.
5. Multiplying both numerator and denominator by the same number does not affect the value of a fraction.
6. Dividing both numerator and denominator by the same number does not affect the value of a fraction.

Giving us the important general principle that any change in the numerator produces a corresponding change in the value of the fraction, and any change in the denominator produces an opposite change in the value of the fraction.

COMMON DENOMINATOR.

A common denominator is a denominator which is common to two or more fractions.

Rule: To find a common denominator to two or more fractions, multiply together all the denominator and the product will be the common denominator.

Example. Find common denominator of $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{1}{16}$ = The denominators multiplied together, as $2 \times 3 \times 4 \times 16 = 320$, which becomes the denominator common to the whole of these fractions.

This rule often entails a lot of work, consequently I prefer to reduce denominators to their simplest form and multiply together the final quotient and the divisors, which will give the common denominator in lowest form.

Example: Find the common denominator of

$\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{32}$, $\frac{2}{3}$, $\frac{1}{2}$

Reduce denominators to lowest form, thus:

$$\begin{array}{r|l} 3 & 3 \cdot 8 \cdot 32 \cdot 3 \cdot 5 \\ \hline 2 & 1 \cdot 8 \cdot 32 \cdot 1 \cdot 5 \\ \hline 4 & 1 \cdot 4 \cdot 16 \cdot 1 \cdot 5 \\ \hline & 1 \cdot 1 \cdot 4 \cdot 1 \cdot 5 \end{array}$$

Then by multiplying final quotient and divisors together, thus, we get

$$5 \times 1 \times 4 \times 1 \times 4 \times 2 \times 3$$

Since, however, single units do not in any way effect results we write it

$$5 \times 4 \times 4 \times 2 \times 3 = 480 \text{ C. D.}$$

Rule: To reduce two or more fractions to equivalent fractions having a common denominator, divide the common denominator by the denominator of the given fraction, multiply the quotient so found by their numerators, and write the results over the common denominator.

Reduce to equivalent fractions having a common denominator.

$\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{32}$, $\frac{2}{3}$, $\frac{1}{2}$

Since we have just found the common denominator of these fractions to be 480 we place it thus

$$\frac{400\ 420\ 225\ 320\ 384}{480}$$

and proceed as in rule to divide the common denominator by the denominator of the first of our fractions, $\frac{1}{8}$, which equals $480 \div 6 = 80$. Proceeding again as by rule, we multiply this product by the numerator, 5, thus $80 \times 5 = 400$, which result we place in first position above the common denominator. Proceeding similarly with the other fractions in our example, we get a series of fractions having a common denominator and equivalent to the fractions from which we started computation.

ADDITION OF FRACTIONS.

Addition is the process of finding the sum of two or more fractions.

Principle involved: Fractions to be added must be reduced to equivalent fractions having a common denominator.

Rule: To find the sum of two or more fractions having different denominators, reduce the given fractions to equivalents with a common denominator. Add the numerators so found, and if their sum is greater than the common denominator divide the numerator by the common denominator and the result will be the sum of the given fractions.

Find the sum of $\frac{1}{16} + \frac{3}{8} + \frac{3}{4} + \frac{1}{2}$.

Proceeding as before we find the common denominator to be 16, thus

$$\begin{array}{r|l} 4 & 16 \cdot 8 \cdot 4 \cdot 2 \\ \hline 2 & 4 \cdot 2 \cdot 1 \cdot 2 \\ \hline & 2 \cdot 1 \cdot 1 \cdot 1 \end{array} = 16$$

Proceeding exactly as before we find the equivalent fractions having a common denominator to be expressed thus:

$$\frac{5 + 14 + 12 \times 8}{16 \text{ C. D.}} = \frac{115}{16}$$

Adding these numerators together, as in rule, we get the

fraction $\frac{7}{8}$. Now dividing the numerator 39 by the denominator 16 we get $39 \div 16 = 2\frac{7}{16}$, then our question may be expressed thus:

$$\frac{5}{16} + \frac{7}{8} + \frac{3}{4} + \frac{1}{2} = \frac{5+14+12+8}{16} \quad \frac{7}{8} = 2\frac{7}{16}$$

This principle underlies the whole subject of addition, and needs no further demonstration.

SUBTRACTION OF FRACTIONS.

Subtraction of fractions is the process of finding the difference between two fractions.

Principle involved: Fractions, to be subtracted, must be reduced to equivalents with a common denominator.

Rule: To find the difference between two simple fractions, reduce the fractions to equivalents having a common denominator and subtract the numerators, and reduce the result to its simplest form.

Find the difference between $\frac{7}{8}$ and $\frac{7}{8}$.

Proceeding as already described in addition of fractions, we get

$$\frac{7}{8} - \frac{7}{8} = \frac{15-14}{16} = \frac{1}{16}.$$

It will be observed that the process is exactly similar to the process of addition, and exceedingly simple, requiring practically no explanation when we have mastered the principles.

MULTIPLICATION OF FRACTIONS.

Multiplication is the process of finding the product of two factors, one or both of which may be fractions.

Rule: To multiply a fraction by a fraction, multiply the numerators together and also the denominators, and reduce to simplest form.

Multiply together $\frac{1}{2} \times \frac{1}{2}$. Proceeding as per rules and multiplying the numerators together and the denominators likewise, we get

$$\frac{1}{2} \times \frac{1}{2} = \frac{1 \times 1}{2 \times 2} = \frac{1}{4}.$$

Following out the principle set forth in clause 6 of our introduction, multiply together

$$\frac{4}{5} \times \frac{5}{8} \times \frac{7}{8} \times \frac{9}{16}.$$

Following out this principle we proceed by a process of cancellation to reduce to simplest form, thus

$$\frac{\cancel{4}^{1}}{5} \times \frac{\cancel{5}^{1}}{\cancel{8}_{2}} \times \frac{7}{\cancel{8}_{2}} \times \frac{\cancel{9}^{3}}{16} = \frac{21}{64}$$

By applying this system of cancellation, based upon the principle set forth in clause 6, you will observe we materially shorten the process of calculation without in any way affecting the result.

Rule: To multiply a fraction by an integer or an integer by a fraction,

1. Divide the denominator of the fraction by the integer and place the result under the numerator, and reduce to simplest form, or

2. Divide the integer by the denominator of the fraction, and multiply the result by the numerator, or

3. Multiply the numerator of the fraction by the integer and place the result over the denominator. (See clauses 1 and 4 of principles).

Example (employing 1st method):

Multiply $3\frac{1}{2} \times 8 = 32 \div 8 = 4 \quad \frac{7}{8} = 6\frac{3}{4}$.

Example (employing 2nd method):

Multiply $3\frac{1}{2} \times 64 = 64 \div 32 = 2 \times 27 = 54$.

Example (employing 3rd method):

Multiply $\frac{5}{8} \times 8 = \frac{40}{8} = 5$.

It will be observed that the first of these methods can only be employed when the integer can be divided into the denominator an equal number of times, and the second when the denominator can be divided into the integer similarly, and the third method can be used at any time, but when either of the other methods can be used, lengthens the process, as is evidenced by calculation in this case. Employing method 1 and embracing principle 6, calculation would have been made as follows:

$$\frac{5}{\cancel{8}_{1}} \times \cancel{8}^{1} = 5.$$

DIVISION OF FRACTIONS.

Division of fractions is the process of finding the quotient when either dividend or divisor is a fraction or mixed number, or when both dividend and divisor are fractions or mixed numbers.

Rule: To divide a fraction by an integer, divide the numerator or multiply the denominator of the fraction by the integer. The result will be the quotient. (See principles, clauses 2 and 3).

Example: $\frac{3}{4} \div 9 = \frac{3}{36}$.

Rule: To divide an integer by a fraction, multiply the integer by the denominator of the fraction and divide the product by the numerator, or divide the integer by the numerator and multiply the quotient by the denominator.

Example (by 1st method):

Divide $100 \div \frac{3}{4} = 400 \div 4 = 133\frac{1}{3}$.

Example (by 2nd method):

$30 \div \frac{3}{4} = \frac{120}{4} = 10 \times 4 = 40$.

Rule. To divide a fraction by a fraction, multiply the numerator of the dividend by the denominator of the divisor and set down the product as a new numerator, then multiply the denominator of the dividend by the numerator of the divisor and set down the product as the new denominator—reduce new fraction to simplest form, or

Invert the terms of the divisor and proceed as in multiplication of fractions.

Example: Divide $\frac{7}{8} \div \frac{3}{4}$ (following 1st rule). Since numerator of dividend is 7 and denominator of divisor 4, we get $7 \times 4 = 28$, which becomes new numerator or dividend.

Since denominator of dividend is 8 and numerator of divisor 3, we get $8 \times 3 = 24$, which becomes new denominator or divisor and giving $\frac{28}{24}$ $1\frac{4}{24}$ $1\frac{1}{6}$, that is, $\frac{3}{4}$ is contained in $\frac{7}{8}$ $1\frac{1}{6}$ times.

Employing 2nd method:

$$\frac{7}{8} \div \frac{3}{4} \quad \frac{7}{8} \div \frac{3}{4} \quad \frac{7 \times 4}{8 \times 3} \quad \frac{28}{24} \quad 1\frac{4}{24}.$$

Again employing 2nd method and applying clause 6 of principles:

$$\frac{7}{8} \div \frac{3}{4} = \frac{7 \times \cancel{4}^{1}}{\cancel{8}_{2} \times 3} = \frac{7}{6} = 1\frac{1}{6}.$$

It occasionally occurs in computation of formula that a fractional part of a fraction requires to be divided by a fraction or a fractional part of a fraction.

Rule: To divide a compound fraction by a compound fraction, first reduce the compound fraction to a simple fraction, and then follow rule laid down for dividing a fraction by a fraction.

Example: Divide $\frac{1}{2}$ of $\frac{7}{8}$ by $\frac{3}{4}$ of $\frac{7}{8}$.

To reduce compound fractions $\frac{1}{2}$ of $\frac{7}{8} \times \frac{3}{4}$ of $\frac{7}{8}$ to simple fractions, proceed as in multiplication of fractions.

Then $\frac{1}{2}$ of $\frac{7}{8} = \frac{1}{2} \times \frac{7}{8} = \frac{7}{16}$, and $\frac{3}{4}$ of $\frac{7}{8} = \frac{3}{4} \times \frac{7}{8} = \frac{21}{32}$; then question becomes a simple matter, since we proceed exactly as in division of fractions from this point.

Since dividend $\frac{1}{2}$ of $\frac{7}{8} = \frac{7}{16}$,

Since divisor $\frac{3}{4}$ of $\frac{7}{8} = \frac{21}{32}$,

we get $\frac{7}{16} \div \frac{45}{64} = \frac{7}{\cancel{16}_{1}} \times \frac{\cancel{64}^{4}}{45} = \frac{28}{45}$

SPARKS.

An electric light plant will probably be installed at the consumptive sanitarium at Gravenhurst, Ont.

The Halifax Tramway Company have placed a large order for G. E. 1,000 equipments with the Canadian General Electric Company.

Mr. D. C. Dewar, recently manager of the Bell Telephone Company at Ottawa, was presented with a gold watch by the employees before his departure for Montreal.

The Hull Electric Company have placed an order for two 300 k.w. generators and several additional G. E. 1,200 and G. E. 51 equipments with the Canadian General Electric Company.

The Lachine Rapids Hydraulic & Land Company, of Montreal, have decided to issue $750,000 of debentures. It was stated at a special meeting that one thousand horse-power of current had been sold to the Standard Light and Power Company.

Plans have been submitted to the Ontario and Dominion governments for the construction of a dam and lock across Ash Rapids, in the Lake of the Woods. It is proposed to utilize the water power so provided in generating electricity to light the mines and drive the power drills in the vicinity.

The Canadian General Electric Company have been awarded the contract for a 1,000 light incandescent plant by the corporation of Port Arthur. The plant, which is now being installed, will be of their standard single phase alternating type, and will be in operation in the course of two or three weeks.

Mr. E. J. Lennox, architect, has reported to the City Council of Toronto regarding the establishment of an electric plant at the new city buildings. He estimates that 700 horse power will be required to light the buildings, and 200 horse power for running the electric elevator. Should the plant be placed at the wateworks it would necessitate an extra boiler, while if placed at the buildings the exhaust steam could be utilized.

The Hamilton Radial Electric Railway Company are extending their system in the direction of Oakville. They have ordered four 45 ft. passenger cars from the Crossen Car Company, of Cobourg, which are to be models in every respect. These cars will each be equipped with a four motor equipment of G.E. 1000 motors, for which an order has been placed with the Canadian General Electric Company. These four motor equipments are guaranteed to have a speed of 38 miles an hour, but with acceleration on the level will easily make from 45 to 50 miles, thus making the Burlington line, by long odds, the highest speed electric road in the Dominion.

SPARKS.

An electric light plant will probably be installed by the village of Exeter, Ont.

The Huntsville electric light plant, installed by the Canadian General Electric Co., was recently put in operation.

The Canadian General Electric Company have installed a direct-current lighting and power plant for Messrs. Bertram & Sons, Dundas, Ont.

The Finance Committee of the Hamilton City Council have passed the by-law for the conversion of the Hamilton and Dundas railway into an electric system.

The Canadian General Electric Company have sold a 1,000 light standard alternator to the Full Electric Light Company, Charlottetown, P.E.I.

The Montreal Island Belt Line Railway Company have ordered additional G.E. 1,000 and G. E. 1,200 equipments from the Canadian General Electric Company.

Mr. Fred Parkin, electrician for the Canada General Electric Co., Toronto, returned lately from River du Loup, Que., where he installed a new incandescent system

Mr. J. Seguy, of Quebec, has invented an apparatus, one part of which is placed on the inside and the other on the outside of steam boilers in order to economize heating. It can be applied to all old boilers.

The Galt, Preston and Hespeler Railway Company have placed an order for an additional G.E. 1200 equipment with the Canadian General Electric Company.

A new electric railway company has been formed at Niagara Falls, Ont., composed of H. C. Symmes, R. Paine and others. It is proposed to construct a line which will connect with the Niagara Falls Park and River Railway and extend to Lundy's Lane battle ground.

The Consolidated Railway Company of Vancouver, B.C., have placed a large order for G.E. 1000 motors with the Canadian General Electric Company.

The 1,000 light standard alternator purchased by the corporation of Huntsville from the Canadian General Electric Company, was put in successful operation last week.

The town of Thorold has purchased the incandescent electric light system from Mr. McGill.

The Stadacona Water, Light and Power Company, of Huntingdon, P. Q., ordered a 60 k.w. 1,000 light standard alternator from the Canadian General Electric Company.

A new electric light company has been formed in Aylmer, Ont., to be known as the Aylmer Electric and Manufacturing Company, Ltd. The directors of the company are: Hugh McDiarmid, Daniel C. Davis, John Simpson, all of Aylmer, and Jos. W. Campbell and W. H. Irving of Toronto. Extensive improvements and additions are to be made to the present plant.

The Hamilton, Grimsby and Beamsville Railway Company have purchased G.E. 1,200 equipments from the Canadian General Electric Company for the improved freight and express services which they are about to commence. Their intention is to load C. P. R. express cars with fruit, along the line, and draw them over to the T. H. & B. road for carriage to Toronto and other points.

The Brockville Electric Light Company are making extensive improvements in their incandescent lighting plant. They have placed an order with the Canadian General Electric Company for a 100 k.w. monocyclic alternator of their new 125 cycle type. The use of 125 cycles in this case was rendered necessary by the fact that the old transformers, of which between three and four thousand lights capacity were installed, were unsuited for operation on a lower frequency.

Patents have recently been granted for Canada as follows: Canadian General Electric Co., Toronto, *dynamo*, *Wm. Smith, Sheldon, Iowa*, rotary steam engine; James and Emery Caldwell, Auburn, N. Y., turbine water wheel; E. J. Armstrong, Oswego, N. Y., crank disk for steam engines; C. P. Choquette and Antoine M. Morin, St. Hyacinthe, Que., acetylene generator; A. C. Fraser, Brooklyn, N. Y., process for generating acetylene; A. M. Scott, Hamilton, acetylene gas apparatus, John E. Friend, Lambton Quay, New Zealand, steam boiler; G. H. and M. G. Broder, Winchester, Ont., journal bearing; R. S. Hill, Detroit, valve for steam engine; General Electric Co., Schenectady, N. Y., electric brake; insulation of electric cable, Max Guilleaume, Mulheim-on-the-Rhine, Germany; The Stilwell-Bierce & Smith-Vaile Co., *Dayton, Ohio, electric water wheel governor*; *Bell Telephone* Co., Montreal, multiple switchboard spring jack; Franz L. Barthelmes, Toronto, wood pulley.

The electric light company at Rat Portage, Ont., are putting in new generators for arc lighting and power.

The Hamilton Street Railway Company have placed an order for G.E. 1,200 motors with the Canadian General Electric Company.

The Canadian General Electric Company have furnished 10 additional G.E. 1000 motors to the Kingston, Portsmouth and Cataraqui Railway Company.

George White & Sons, Limited, London, Ont., are seeking incorporation as manufacturers of steam engines, boilers and other machinery, with a capital of $170,000.

The Electrical Construction Company, of London, Ont., has been incorporated, to take over the business of the London Electric Motor Company. The capital stock is $45,000.

F. E. Harvey, doing business as the Citizens Telephone Exchange, Waterloo, Que., is reported to have assigned, with liabilities of $12,000. The estate will probably pay fifty cents on the dollar.

The Canada Permanent Loan and Savings Company have awarded the contract for a 500 light direct-connected incandescent plant, for the Clarendon Hotel in Winnipeg, to the Canadian General Electric Co.

SPARKS.

An addition has been built to the electric light works at Newmarket, Ont.

C. J. Edgar, M. D., is putting in an electric plant at North Hatley, Que.

Dr. C. J. Edgar is putting in an electric plant at Magog, Que., for street lighting.

The ratepayers of Picton, Ont., will be asked to provide funds to increase the electric light plant.

The town of Dartmouth, N. S., will submit a by-law to the ratepayers to raise $50,000 with which to purchase the present electric light plant.

Mr. George White Fraser, of Toronto, recently had a conference with the authorities at Magog, Que., regarding a proposed electric plant.

The town council of Owen Sound has engaged Mr. Jas. C. Kennedy, C. E., to prepare a plan and specifiaation for a new contract for streetlighting, also to furnish an estimate of the value of the electric light plant of the company now supplying the street arc lights, and also to furnish an estimate of the cost of putting in an entirely new electric plant by the town. In the meantime tenders are asked for lighting the streets by arc lights for a term of 5 or ten years.

CANADIAN GENERAL ELECTRIC CO.
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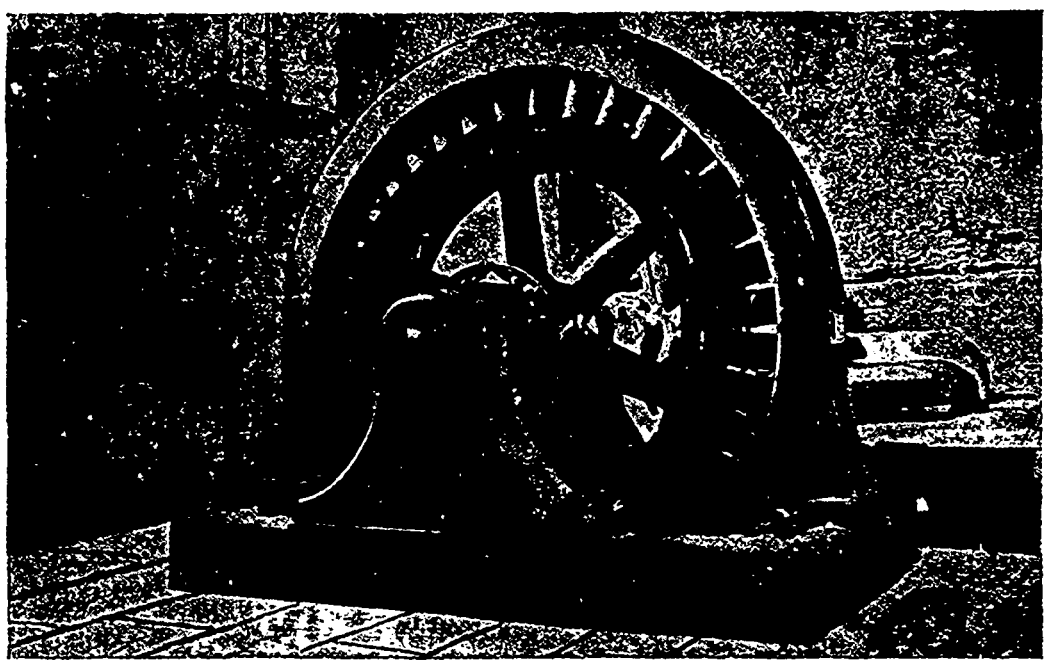

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