PAGES

MISSING

The Canadian Engineer

VOL. XI.—No. 2. TORONTO AND MONTREAL, FEBRUARY, 1904. PRICE 10 CENTS $1.00 PER YEAR.

The Canadian Engineer.

ISSUED MONTHLY IN THE INTERESTS OF THE

CIVIL, MECHANICAL, ELECTRICAL, LOCOMOTIVE, STATIONARY; MARINE, MINING AND SANITARY ENGINEER, THE SURVEYOR, THE MANUFACTURER, THE CONTRACTOR AND THE MERCHANT IN THE METAL TRADES.

SUBSCRIPTION—Canada, Great Britain and the United States, $1.00 per year, foreign, 6s. Advertising rates on application.

OFFICES—18 Court St. Toronto ; and Fraser Building, Montreal.
Toronto Telephone, Main 4310. Montreal Telephone, Main 2589.
BIGGAR-SAMUEL, LIMITED, Publishers,

All business correspondence should be addressed to our Montreal office. Editorial matter, cuts, electros and drawings should be addressed to the Toronto Office, and should be sent whenever possible, by mail, not by express. The publishers do not undertake to pay duty on cuts from abroad. Changes of advertisements should be in our hands not later than the 15th of the preceding month or if proof is desired, 4 days earlier.

CONTENTS OF THIS NUMBER :

	PAGE		PAGE
American Institute of Electrical Engineers, Toronto Branch	43	Marine News	46
Canadian Society of Civil Engineers.	33	Metric System, The	52
Catalogues	41	Mining in Southern British Columbia	54
Dratting Room, Saving Time in	45	Municipal Ownership of Public Utilities	31
Electric Light Statistics	46	Municipal Works	45
Electricity and Fires	33	Peat Fuel, The Manufacture of Compressed	47
Electricity Supply Stations in Great Britain	56	Personal	44
Engineers' Club of Toronto	55	Pumping by Electricity	52
Girders, Large	46	Railway Notes	39
Industrial Notes	38	Steam Clamp, The Climax	43
Light, Heat and Power	40	Steam Turbine, The MacCollum	41
Lightships, New Canadian	60	Telegraph and Telephone	41
Literary Notes	42	Tidal Mill	43
Machine Shop Notes from the States	59		

MUNICIPAL OWNERSHIP OF PUBLIC UTILITIES.

In the last session of the Ontario Legislature, a Select Committee on Municipal Trading or Municipal Ownership or Operation of Public Utilities was appointed. The net result of the labors of these gentlemen is the publication of an epitome of the periodical and other literature produced within the last few years on these subjects, prepared by A. Pardoe, librarian of the Legislative Library. The report devotes 220 pages to reprints of articles for and against municipal ownership in Europe and the United States, and thirteen pages to the financial returns of municipal water, gas, electric light and street railway undertaknge in Ontario. While much credit is due to Mr. Pardoe for the vast amount of material he has compiled, it cannot be said that the labors of the seven gentlemen comprising the Select Committee have resulted in throwing any new light upon this important subject or in anything which would assist the public in arriving at the correct solution of the problem of municipal ownership. The desirability or otherwise of municipalities owning and operating public utilities is not to be decided by the evidence of writers and experts acting for interested corporations whose articles in many cases are published as paid advertisements, on the one hand; or of social reformers and economists on the other, but by the actual results of municipal systems in operation, and the benefits, if any, which the community at large obtain from such services.

It is to be regretted that the Select Committee did not see their way to present the people with an intelligent record of solid facts showing the comparative results of private and municipal ownership, rather than a confusing mass of controversial matter and figures which do not afford the average citizen any basis on which to form an opinion. We would here call attention to the misleading effect produced in the public mind by combining the terms municipal trading with the municipal ownership of public utilities. These terms have no relation to each other and therefore should be treated as separate subjects. Municipal trading means the trading by municipalities in commodities in which there already exists open competition among the citizens, such as the supply of electric light, gas, and water fittings; bakeries, dairy and agricultural produce, etc.; in fact any article in which the consumer is not at the mercy of a monopoly, and the provision of which by the municipality, means competition with the legitimate business of individual citizens. Municipal trading, as here defined, is wrong in principle, and should be discouraged in every way possible. There are, of course, some phases of municipal trading which can only be judged by the peculiar needs of individual localities, such as the housing of the poorer classes, model lodging houses, public baths, and other undertakings, which in crowded cities ameliorate the conditions of the poor and protect them from oppression, but fortunately the necessity for such does not exist to the same extent in Canada as in Europe, and therefore need not be here discussed.

Regarding the municipal ownership and operation of public utilities, this has been defined by the Right Hon. Joseph Chamberlain, than whom no better authority on practical public questions exists, in the following terms: "The true sphere of municipal activity is limited to those things which the community can do better than the private individual. To take a single illustration: It is evident that the main drainage and sewering of a town can only be undertaken by the representatives of the town as a whole, and cannot safely be left to, or, indeed, be possibly carried out by, each individual citizen for himself. But besides works which, from their magnitude, or from the necessity of concerted action in regard to them, must necessarily be placed in the hands of a central author-

ity, all undertakings which are in the nature of monopolies may also rightly be claimed as fit subjects for municipal control. The supply of gas and of water, electric lighting, and the establishment of tramways must be confined to very few contractors. They involve interference with the streets and with the rights and privileges of individuals. They cannot, therefore, be thrown open to free competition, but must be committed, under stringent conditions and regulations, to the fewest hands. As it is difficult, and, indeed, almost impossible, satisfactorily to reconcile the rights and interests of the public with the claims of an individual, or of a company seeking, as its natural and legitimate object, the largest attainable private gain, it is most desirable that, in all these cases, the municipality should control the supply, in order that the general interests of the whole population may be the only object pursued."

These words were spoken before municipal ownership had assumed its present proportions, but the experience of municipalities has taught the people that wherever a monopoly has been created in the use of the ratepayers' property by a private company, the stockholders have enriched themselves at the expense of the people, by the watering of stock and the exaction of excessive charges for inferior service, the municipalities being powerless to interfere, or even control their own streets. As a result of these practices, the corporations are themselves responsible for the growth of public opinion in favor of municipal ownership. Had they been satisfied with a reasonable profit on a capitalization free from water, and been less autocratic in their dealings with municipalities and the public, the present conditions would never have arisen.

On another page of this issue will be found data regarding the operation of electric light systems in Great Britain, from which it will be seen the price obtained by private companies is much in excess of the charges made by municipalities. This is one of the best testimonies in favor of municipal ownership. If a citizen can get a car ride for 3 cents instead of 5, gas at 60 cents instead of 80, or electric light at 8 cents per unit instead of 12, it requires a great deal of argument to convince him that municipal ownership is a failure.

It is well to note who are the opponents of municipal ownership, and on this point it is obvious to those who have studied the question that the opposing evidence comes in every case from the corporations who are struggling for existence. As an illustration of this, an association was formed in London, England, last year, called the "Industrial Freedom League," which posed as a disinterested society whose only object was to protect the poor citizens from losing their money in municipal ownership. A glance at the executive, however, revealed the fact that it was composed mainly of the directors and officers of the British United Traction Co., a corporation that had been endeavoring to monopolize the street railway franchises in all the Midland towns, and whose agents have been accused of buying votes at a shilling each to defeat a municipal street railway by-law in Birmingham. The Hon. R. Porter, late of the Standard Oil Trust; J. Pierpont Morgan, and other trust magnates also figured as patrons to the League.

Take the telephone question, again the only opponents whose evidence is worth anything in England consist of the officers of the National Telephone monopoly, J. E. Kingsbury, manager of the Western Electric Co., which is controlled by the American Bell Company, and, a recent arrival, H. L. Webb, late of the New York Telephone Co., also a Bell corporation.

There is no objection to an impartial investigation of this important question, but it must be admitted that evidence coming from the sources named, is absolutely valueless. As far as Canada is concerned, an enquiry into this subject by such a body as the Union of Canadian Municipalities, comprising as it does men of different views, and yet having the interests of municipalities at heart, might result in much good.

A stock argument used against municipal ownership is that sufficient allowance is not made for depreciation, yet they overlook the existence of a sinking fund which has an important bearing on the matter. Take, for instance, money borrowed for ten years to build a wall, the supposition being that it will last ten years. It deteriorates one-tenth each year, and one-tenth of its cost is repaid each year. Is this one-tenth not depreciation, for at the end of ten years there is no wall and no capitalization account? Examine a company's books using plant worth $5,000, and deteriorating ten per cent. per annum. A year after, the plant is worth $4,500 and from profits $500 is added to the account, and so on every year until the tenth, when you have no plant, and $5,000 capital indebtedness, which if paid off, would wipe out the $5,000 set aside for depreciation. Thus we have a distinction without a difference. It is interesting to note the inconsistency of this depreciation argument, for it is well known that the corporations do not practise what they preach in this matter. An examination of the Bell Telephone Co.'s accounts, for instance, reveals the fact that on January 1st, 1902, with a capital account of $6,750,000, the total amount of the contingent fund, after 22 years' existence, was only $900,000, while in that year nothing was set aside for contingencies, and only $50,000 was written off the plant and patent account. Many other examples could be shown in proof of the fact that companies do not make the provision for depreciation which they are so concerned about in municipal accounts. The explanation lies in the fact that companies construct and reconstruct their capital accounts, which municipalities do not, in order to provide for the renewal of their plant out of capital instead of revenue. In other words, their customers have to find the dividends on increased capital, while the stockholders go comfortably along without such an encumbrance as a sinking, and only an apology for a depreciation or contingent fund.

During the current year articles will be published in the "Canadian Engineer" dealing with the municipal ownership of public utilities, containing facts and figures regarding the operation of systems in Canada and other parts of the world, and at the same time comparisons will be made with the operations of companies, under similar conditions. It is not pro-

posed to publish the opinions of interested individuals, but rather to furnish records of actual results, leaving the public to form their own judgment. This, we believe, to be the only true method of assisting towards a satisfactory solution of the matter.

❧ ❧ ❧

—For the Canadian Society of Civil Engineers, the year 1903 has been one of great expansion, and Mr. Blackwell and his co-workers in the executive council can look back upon their term as one of greater progress than any in the history of the society. They have worked like beavers, and like that noble type of Canadian industry, have carried out their plans without undue noise and ostentation, building for the future. The membership of the society has increased notably, and its influence has extended in every province in Canada.

❧ ❧ ❧

ELECTRICITY AND FIRES.

One result of the recent terrible holacaust in Chicago has been to turn the attention of authorities in every city to the condition of the fire prevention and protection facilities of theatres and public halls. It is to be hoped that steps will be taken in this matter which will effectually prevent a repetition of such a catastrophe as that of the Iroquois Theatre fire. Some doubt exists as to the actual cause of the fire, although it is alleged that it was due to some of the stage drapery coming too close to a naked arc-light. Be this as it may, electricity is generally believed to have started the fire, and this raises the question as to whether sufficient precaution is taken in the equipment of electric light in buildings, to prevent fires occurring. In this connection it is well to note that following close upon the Chicago fire, the report of the Fire and Light Committee of Montreal for the last three months in 1903, records no less than 150 electrical fires, with losses aggregating $1,500,000. We have no reports from other cites, but there is reason to believe that in this respect Montreal is no worse than other places that make no such records, and these facts must seriously prejudice the public mind against the use of electricity. It is, therefore, in the interest of the electrical industry that attention should be called to this condition of affairs, and that some steps should be taken to ascertain its causes and remedy them.

An analysis of the Montreal report shows that twenty-two fires were due to crosses of telephone, telegraph and low potential wires with high tension circuits. Seven pole and tree fires are also recorded. It is clear that underground wires would have prevented these fires. Nineteen were due to wires grounded on gas pipes, eleven to defective wiring of fixtures, five by flexible cords wrapped round gas pipes, the current having punctured the pipe and the gas had ignited; three by short circuits in mouldings; three to open link fuses in porcelain cut out bases; fifteen to overheated resistance coils and heating devices, and nine to incandescent lamps coming in contact with inflammable material. It will be seen that all these fires were due to preventable causes, and this fact emphasizes the necessity of adopting some method of better supervision in the carrying out of electric light fitting and wiring, and also of educating the public in exercising proper care in the use of electrical apparatus.

In the report referred to, 135 fires are also recorded, where electricity was suspected as the cause, but could not be proved owing to conclusive evidence having been destroyed. Thus it will be seen that wherever a building in which electricity is used is destroyed, there is a tendency to put the blame down to this cause. It is therefore incumbent on electric light contractors to use every means in their power to carry out their work in the most perfect manner. Steps should be taken to ensure that every one undertaking this work is properly qualified and that only reliable material is used.

Unfortunately, the competition in this business has educated the public to sacrifice efficiency for economy, with the result that in this country, where there is no Government supervision, the class of material used in the wiring and fitting of electric light systems in buildings is much below the standard of that in Great Britain, so much so that notwithstanding the preferential tariff, English makers cannot compete with the United States. The onus of the present condition of affairs lies upon the public who insist on the first cost of an installation at the lowest possible figure, they being too short-sighted to see the possibility of being "penny wise and pound foolish." Electrical engineers and contractors are not to blame in this matter, they are only too willing to put in the best work, if they get a fair price for it, and the time is now an opportune one for them to get together and devise some scheme which will result in the universal adoption of only the highest standard of material and workmanship in electrical installations.

❧ ❧ ❧

CANADIAN SOCIETY OF CIVIL ENGINEERS.

The annual meeting of the Canadian Society of Civil Engineers was held in the society's rooms, Dorchester St., Montreal, on the 26th, 27th, and 28th January, the president, K. W. Blackwell, in the chair.

There were present during the convention the following members:

From Montreal—K. W. Blackwell, W. J. Sproule, R. Bickerdike, Jr.; C. H. McLeod, W. McLea Walbank, Joseph W. Heckman, J. A. Jamieson, H. R. Lordly, Wm. Arch. Duff, Charles S. Leech, L. G. Papineau, H. Irwin, Ernest Marceau, J. M. Donaldson, George Holland, Henry Goldmark, R. M. Hannaford, W. M. Reid, Henry Holgate, Robert A. Ross, James S. Costigan, J. A. U. Beaudry, Marcil Beullac, H. G. Rogers, C. Percival Metcalfe, H. L. Jordan, R. S. Lea, A. W. Robinson, G. Fiset, R. S. Kelsch, A. A. Blanchard, S. Blumenthal, J. M. Nelson, E. Vautlet, K. B. Thornton, A. Dedman, J. A. Burnett, C. de B. Leprohon, Stuart Howard, T. W. Lesage, George Janin, Alcide Chausse, R. A. Kimber, J. G. G. Kerry, Lewis Skaife, John Kennedy, N. Hanson Greene, Dr. J. B. Porter, J. M. Shanly, F. H. Pitcher, John R. Barlow, J. Ewing, Gordon Grant, H. C. Grant, Wm. Kennedy, Jr.; D. MacPherson, F. L. Gagnon, F. J. Gilman, O. Hall, E. Belanger, E. S. Mattice, W. McNab, H. R. Ives, H. A. Haffner, Dr. A. Stansfield, A. D. Dubuc, R. H. Balfour, W. Redpath, J. L. Allison, J. N. Smith, J. W. G. Greey, P. W. St. George, F. L. Fellowes, G. B. Ashcroft, H. L. Price, G. Le Grand, A. D. Porcheron, J. H. Edgar, Hon. J. P. B. Casgrain, C. V. Corless, R. F. McIntosh, D. W. McLachan, M. J. Butler, George Kydd, W. F. Drysdale, W. D. Lawrence, C. R. Young, H. Idsardi, A. P. Joseph, F. C. Laberge, L. A. Herdt, Phelps Johnson, O. H. Cote, W. Chase Thomson, T. Kirk, E. B. Jost, F. P. Shearwood, F. Lambart, C. F. Eicks, F. S. Keith, H. W. Jones, E. A. Wallberg, T. M. Fysche, C. C. Richards, J. Duchastel, Alex. Peden, Jr.; A. E. Smaill, W. V. Taylor, E. Fusey, J. T. Lemire, S. F. Rutherford, C. L. Trimmingham, E. G. M. Cape, E. A. Rhys-Roberts, Frank Peden, Fred. A. McKay,, R. B. Kennick, C. N. Monsarrat, Le A. Desy, Arthur Marsey, W. P. Boucher. From Toronto—C. H. Rust, A. A. Bowman, C. E. Cooper, N. B. MacTaggart, Alfred J. Stevens. From Ottawa—C. T. Pinhey, A. S. Laurent, Louis Coste, Robert A. Surtees, W. Dale Harris, Col. W. P. Anderson, G. H. Blanchet, A. D. Harris, G. A. Mountain. From Quebec—Thomas Breen, A. Rhodes, G. G. Gale. From Levis—A. H. Larochelle. From Sorel—G. J. Desbarats, J. D. Lachapelle. From Charlottetown—R. A. Morrow. From Glace Bay—C. M. Odell. From Sherbrooke—C. K. Addie, J. T. Morkill. From Amherst O. W. Smith. From Indian Lorette—Henry O'Sullivan. From Niagara Falls—G. A. McCarthy, A. C. Blanchard. From St. John's, Nfld.—H. C. Burchell. From Vancouver, H. E. Carry, G. H. Dawson. From Three Rivers—G. R. Duncan. From Ste. Anne de la Pocatiere—J. E. Serois. From Cornwall—A. L. Killaly. From Peterboro—Richard B. Rogers. From Iroquois—F. R. Wilford. From Carleton Place—E. T. Wilkie. From Ste. Anne de Bellevue

—J. L. Michaud. From Farnham—W. H. Benny. From Kingston—J. Sears, L. W. Gill, J. Grant, H. G. Goulet. From Brantford—F. C. D. Wilkes. From Barbados — Clifton H. Wright. From Hawkesbury — H. C. Kennedy. From Lindsay—H. W. D. Armstrong. From Pembroke—J. L. Morris. From St. Hermanegilde—D. W. Lippe. From Winnipeg—J. G. Sullivan.

After the reading of the minutes of the last annual meeting by the secretary, Prof. C. H. McLeod, the president, nominated the following as scrutineers of the ballots:

For election of officers and council: C. S. Leech, J. Ewing, Gordon Grant, R. A. Kimber, J. A. Burnett, and H. C. Grout.

For nominating committee: H. R. Lordly, C. P. Metcalfe, and M. Donaldson.

For amendment of by-laws: J. M. Nelson, and A. W. Robinson.

REPORT OF COUNCIL.

The following is a summary of the report of the council for the past year. There were elected during the year two honorary members, 28 members, 37 associate members, six associates, and 111 student members, in all 186, including two associate members reinstated. There were eight struck off for non-payment of dues, and eight deaths, leaving the membership roll as follows:

	Res.	Non-Res.	Total.
Honorary members	2	8	10
Members	72	306	378
Associate members	97	265	362
Associates	16	19	35
Students	112	250	362
Total			1,147

The total of previous year was 982, and an increase in each class was shown. The technical work of the society has during the latter half of the session, in accordance with the instructions of the last annual meeting, been conducted by four sections, Electrical, Mechanical, Mining and General. The papers were of a high order and the meetings well attended. The success of this plan of work warrants its continuance.

The committees on professional status were re-appointed, but no special action has been taken in regard to legislation in the provinces. In the Dominion Parliament, an application was made by a few engineers and others for the incorporation of an engineering society to be known as "The Dominion Institute of Amalgamated Engineering," but on coming before the Private Bills Committee the act was thrown out, by unanimous vote, on the reading of the preamble. Acting upon the suggestion of an ordinary meeting, the council addressed a letter to a number of Cabinet Ministers, asking their co-operation towards providing that none but Canadian engineers be employed on the Trans-Continental Railway surveys.

The proposed summer excursion did not meet with enough support to warrant carrying it out.

The Gzowski medal for the year 1901-02 was awarded to H. D. Bush for his paper upon "The Erection of the Alexandra Bridge at Ottawa," and the committee on the award for 1902-03 has reported, recommending the presentation of the medal to A. W. Robinson for his paper on "The Hydraulic Dredge, King Edward VII."

The examiners appointed for the award of prizes for students' papers, recommended an award as follows:

Electrical—E. A. Foreman for his paper on "Core Type Transformers."

Mechanical—S. Gagné for his paper on "Mechanical Wood Pulp."

Mining—Norman W. Parlee for his paper on "Methods of Mining and Timbering Large Ore Bodies in British Columbia and Michigan."

General—G. H Blanchet for his paper on "Trans-Continental Transportation."

A committee of council had a conference with the Government in connection with the remodelling of the Canadian Patent Laws during the last session of Parliament. The committee appointed to consider the practicability of inaugurating the measurement in connection with the flow of streams, has held several meetings and will report during the meeting. The council obtained the opinion of its solicitors in regard to the standing of the society under the Quebec Act, 61 Victoria, chapter 32. This opinion is to the effect that the Act cannot be affected either as to its validity or effectiveness by non-user.

The report concluded with a biographical sketch of the late Thomas Munro, president of the society in 1895.

TREASURER'S REPORT.

H. Irwin, treasurer, presented his report which showed that the society held its annual meeting for the first time in a building entirely free from debt, the mortgage of $2,000 having been paid off last July. The arrears of fees received last year were almost double those paid during 1902. There was an increase in current fees of $760, during 1903, as compared with 1902, and a corresponding increase of $103 in advance fees. The increase in entrance fees amounted to $350. There was an increase during 1903 of $2,210 in total receipts, as compared with 1902. The total expenditure out of the general fund for 1903 amounted to $6,682.35, but from this should be deducted an extraordinary expenditure of $1,247.68 in part payment of the mortgage on our property, leaving an ordinary expenditure of $5,434.67, which is $168.88 less than total expenditure during 1902. There was an increase this year of about $600 in cost of transactions, printing, etc., and a decrease of about the same amount in cost of furniture and legislation expenses. An estimate of the value of books and furniture has been prepared by the librarian, assisted by an expert valuator, so that the statement of assets and liabilities can now be entered in a complete form..

LIBRARIAN'S REPORT.

The report of the librarian, E. G. M. Cape gave a list of twenty-five books of reference purchased, and a number of donations of books and pamphlets during the year. A list was given of the engineering papers subscribed for or received as exchanges. The receipt of portraits of two past presidents—W. T. McN. Thompson and Thomas Monro—was acknowledged, the former having been presented by Mr. Thompson's family and the latter by several members of the society.

The reports were adopted, on motion of J. M. McCarthy, seconded by H. R. Lordly.

The treasurer in his report, having referred to the proposal to allow a rebate of $2 from the fees of members outside of Montreal who desired to form branch libraries, R. A. Ross expressed the opinion that something should be done at once to carry out the suggestion of having branches of the society in the chief cities of Canada. The American Institute of Electrical Engineers adopted this plan in the United States, and had moreover a branch in Canada, one having been recently formed in Toronto. He moved that it be an instruction to the incoming council to take up the question of establishing such branches with power to refer it to a committee to do what is necessary to that end.

The motion was seconded by Ernest Marceau.

The president said he presumed the motion, if adopted, would carry with it the power to grant pecuniary aid to the branches.

H. Irwin said that the proposed rebate of $2 per member was to aid in the formation of branch libraries, but he would approve of giving financial aid to the extent of $500 in certain cases to put the branch on its feet.

C. S. Leech thought this would be moving in the dark, and that it would be better to take the opinion of local members in the chief centres before taking action.

Henry Goldmark said the only society he knew of which had branches in the way proposed was the American Institute of Electrical Engineers. It appeared to have been very successful in its plan.

On the suggestion of a member, Mr. Ross added a clause to his resolution giving council the power to deal with the financial side of the question, and the resolution, as amended, was carried.

Louis Coste, of Ottawa, brought up a question of privilege in connection with the presentation of J. A. Jamieson's

paper on the "Pressure of Grain in Bins," which he complained contained personal references.

Mr. Jamieson said he mentioned no names in his paper, and did not mean to be personal, but desired to give facts as they were, and to present the results of his investigation into grain elevator construction.

After further discussion, a committee, consisting of the retiring president, the incoming president, and the vice-president, (Messrs. Blackwell, Anderson and Marceau), were appointed a committee to investigate and report, the report to be sent to every corporate member.

On motion of L. Skaife, seconded by C. de B. Leprohon, it was decided to ask the incoming council to formulate a rule by which one of the vice-presidents should be put in the place of seniority for the position of president.

The afternoon was taken up chiefly with the reading and discussion of Dr. Stansfield's paper on Electricity in the Metallurgy of Iron. The lecture, which was illustrated by lantern slides, showing on the screen the actual effects produced in the smelting of metals in an electric furnace in use in the room, was very instructive. It will be referred to in another issue.

The evening was taken up with a lecture by M. J. Butler on the new shops of the Locomotive and Machine Works, Longue Pointe, and one by Henry Goldmark on the new shops of the Canadian Pacific Railway in East Montreal, both lectures being well illustrated.

WEDNESDAY, 27TH JANUARY.

The day was spent in visiting the works above mentioned. The Montreal Street Railway kindly provided special cars for the trip, and Mr. Macdonald, the superintendent, accompanied the party. A generous lunch was provided by the Locomotive and Machine Co., M. J. Butler, the chief engineer, acting as host at the table and as guide through the works. Henry Goldmark performed the same service in the same agreeable manner at the C.P.R. shops.

THURSDAY, 28TH JANUARY.

The first business of the day was the amendment to by-laws, which had been submitted to ballot in November, and which were carried as follows:

To amend by-law 19 by adding "Student members who are also active members of an Engineering or Scientific Society in any University or Engineering school in Canada may, with the approval of the Council, have one dollar of the above fee remitted to them.

(New By-Law.)

21a. On the first of July of each year, interest amounting to two and one-half per cent. shall be added on each succeeding first of January and first of July until the said fees be paid. This interest shall be collectible in the same manner as the annual fees.

To amend By-law 27, by changing the last sentence to read: "Of the fifteen councillors elected, at least eight shall be representative of the four sectional departments of engineering, not less than two for one section, having been nominated as such. Of these representatives of sections, at least one for each section must be resident at headquarters."

(New General Heading.)

28a. There shall be four sections of engineering in the Society, viz.: Electrical, Mechanical, Mining and General. At its first meeting after the annual meeting, the Council shall name for each section a president and a vice-president, both of whom shall be members of Council, and at least one resident at headquarters, to hold office for one year from the first day of June next following. Each section may at its first meeting appoint a member, associate member, or student to act as recording secretary at all meetings of the section during the year. The several sections are empowered to extend the privileges of their meetings under such conditions as they may prescribe to engineers not members of the Society, or other persons interested in engineering. The papers read and discussed by each section shall be published in the Society's transactions, if approved by the committee on papers.

To amend By-Law 29 by adding: "The sectional meetings shall be presided over by the president or vice-president of the section, or, in their absence, by a member of the Society."

To amend By-law 35, second paragraph, to read: "This list shall contain at least 34 names of members, viz.: One for president, five for vice-presidents, one for treasurer, one for secretary, one for librarian, and twenty-five for councillors, and of the twenty-five nominated as councillors at least eight shall be representative of the four sectional departments, not less than two for each, and at least eight of the twenty-five must be resident at headquarters. Amongst the eight resident at headquarters must be included at least four representatives of sections, at least one for each section, nominated as such. The list shall be signed by a majority of the Nominating Committee."

To amend 44 (C) by changing the words preceding "during the months of October," to read as follows: "Ordinary meetings of the Society, or of one of the sections thereof, shall be held at eight in the evening of every Thursday.

The ballot for the nominating committee resulted as follows:

For Ontario—Cecil B. Smith, Richard B. Rogers, and Professor John Galbraith.

For Quebec—W. McLea Walbank and G. L. Papineau.

For the Maritime Provinces—F. W. W. Doane.

For N.W.T. and British Columbia—George A. Keefer.

For Newfoundland and Foreign—H. Irwin.

The following were elected

OFFICERS FOR 1904:

President, Col. W. P. Anderson; vice-presidents, Ernest A. Marceau, C. E. W. Dodwell, and C. H. Keefer; secretary, Prof. C. H. McLeod; treasurer, H. Irwin; librarian, E. G. M. Cape; council, G. H. Duggan, John Kennedy, W. McLea Walbank, M. J. Butler, H. J. Cambie, Phelps Johnson, P. W. St. George, D. McPherson, W. R. Butler, R. B. Rogers, Cecil B. Smith, W. B. Mackenzie, Prof. R. B. Owens, E. H. McHenry, St. George Boswell.

Mr. Blackwell then delivered his presidential address, in substance, as follows:

PRESIDENT'S ADDRESS.

This is an age in which everything is measured by results. Some results are measured in dollars and cents, others in "kilowatt hours," and others in "foot pounds" and "ton miles," etc. It is probable that a large number of our members are interested in the question of "ton miles." The economies that have been brought about in transportation on this continent are so much in advance of what has been done in England, and Europe generally, that I have confined my remarks to the ton mileage results of this continent, and in the American Atlantic trade.

In speaking on this subject, Mr. James J. Hill, of St. Paul, who is president of the largest system of railways in the world, when addressing the members of the Commercial Club of St. Paul, remarked as follows: "Regarding land transportation in Great Britain, it costs $2.35 on an average to haul a ton of freight 100 miles; on the continent of Europe it costs $1.90, and in the United States 70 cents. We pay four times the wages they pay, and yet we furnish the transportation for little more than one-third of the average of Europe, and still we are hardly happy."

The engineer, who is interested in works that have brought about such gratifying results commercially, is now invited to look at the following table of freight rates reduced to a ton mileage basis:

ALL RAIL RATES.

	Rate.	Miles.	Per Ton per Mile, Cents.
Chicago to Portland, grain, per 100 lbs.	16c.	1138	.31
Chicago to New York, grain, per 100 lbs.	16c.	971	.37
Brandon to St. John, N.B., grain, per 100 lbs.	35c.	2038	.37
Springhill, N.S. to Montreal, coal per ton	1.80	738	.25

LAKE AND RAIL RATES.

Chicago to Montreal, grain, per 100 lbs.	13c.	1080	.26
Brandon to St. John, N.B., grain, per 100 lbs.	25c.	2038	.22

Chicago to Montreal, (via Canada Atlantic), grain, per 100 lbs.	8c.	827	.21
INLAND WATER RATES.			
Duluth to Cleveland, iron ore, 80c. per ton..		875	.09
Chicago to New York, grain, via Erie Canal, 9c. per 100		1330	.15
Chicago to Montreal, grain, 12c. per 100.....		1175	.23
Duluth to Quebec, grain, 12c. per 100		1580	.17
OCEAN RATES.			
Montreal to Antwerp, grain, 1s. 3d. per qr...		1250	.044
Antwerp to Montreal, steel rails, 7s.3d. per ton		3250	.053
Montreal to Liverpool, grain, 1s. 3d. per qr...		2900	.046

The rates in the foregoing table are all important commercial examples, and cannot fail to convey to the mind of the engineer exactly what has been accomplished up-to-date. In putting forward these rates, no effort was made to search for isolated cases of unusually low rates, but rather to furnish an idea of what the regular every day freight rates actually are. To what extent these rates can be bettered by engineering improvements is the interesting point. The foregoing rates per ton per mile are not of course the average rates which apply on miscellaneous articles, but are the low long haul rates which obtain to-day in the handling of grain, coal, iron, etc., and which constitute the greatest part of our tonnage. These splendid results from an economical point of view are what you are invited to consider.

Let us analyze the details of the water carriage of iron ore from Duluth to Cleveland, Ohio. The particulars of a standard ore carrying lake steamer are as follows: Length 416 ft., keel over all 436 ft., 50 ft. beam, 28 ft. depth moulded, carrying capacity 6,500 gross tons of iron ore, consumption of coal on round trip of 875 miles, going up light and returning with ore, 180 tons, approximate value of boat, $280,000. The engines of this boat are of the vertical type with three inverted cylinders, diameter of cylinders being 22 in., 35 in. and 58 in. by 42 in. stroke, indicating 1,300-h.p., which propel the boat 11 miles per hour. Cost per day for wages about $70. This steamer can be loaded from the ore pockets in 50 minutes, and unloaded by mechanical means in six or seven hours. You will observe that this ore business is done at .09 of a cent per ton mile at present, when rates are supposed to be very remunerative. And it is a well-known fact that these vessels have made profitable returns on a 60c. rate, which is .06 of a cent per ton per mile, or in round numbers less than 1-10 of the average rate of freight per ton per mile that is earned by the railways of this continent. It may be interesting to you to know, because it confirms these figures, that the Dominion Coal Company find by their large experience in the transport of coal, of say about 1,000,000 tons per annum, from Sydney to Montreal, that the actual cost of transportation owning or chartering their own vessels is 55c. per ton for the distance of 780 miles or say about .06 of a cent per ton per mile.

The history of the competition between the Erie Canal and the railways paralleling it is most instructive in connection with this question of cost of carriage per ton per mile. The present old fashioned canal boats have a capacity of 240 tons, and the grain rate this summer from Buffalo to New York by canal was 2.6c. per bushel, or .23c. per ton per mile, and while it is a fact that the parallel roads were charging nearly four cents per bushel, or say .35c. per ton per mile for the same haul, the canal is now more or less out of business, and many of the boats laid up. This state of affairs has been brought about by the railways, which on more than one occasion during the last few years, made a cut on the grain rate from Buffalo to New York, to 2.5c. per bushel, which so disturbed the canal traffic as to leave the railways the masters of the situation. The tax-payers of the State of New York have now decided to spend $110,000,000 in enlarging the Erie Canal, giving it a depth of 12 ft. so that 1,000-ton barges can be used, and the rates reduced to .06 of a cent per ton per mile, or less than ¾ of a cent per bushel, Buffalo to New York. The New York State Canal Committee, after a careful enquiry into this matter, reported that there was no probability of the railways ever being able to carry freight at .1 of a cent per ton per mile, which would be a guarantee of the continued and uninterrupted value and usefulness of the canal to the State. I think you will agree that the estimate these commissioners made was a pretty safe one, and that the figures have a most important significance with reference to the whole question of the relative cost of land and water transportation.

The exhibit given in the table of rates on the Atlantic shows still lower rates per ton per mile, but it is generally conceded by shipping men that these rates are more or less unprofitable and are about rock bottom. While shipping men are not holding out hopes of any substantial reduction in rates in the near future, railway men on the other hand appear to be alive to the possibility of further economies.

The present comparatively low railway freight rates have come from many causes, larger locomotives, larger cars, and the practice of making up train loads to the full capacity of each locomotive, and also to that most important work of improving the grades and curvature. This last question is one to which all railway officers are now fully aroused. It is with them the most important question of the hour. Nearly every railway company in good standing financially is making marked progress in this respect. The railway president of to-day, who has mapped out a plan of improvement for his road that will result in a reduction of controlling grades of say from one per cent. to four-tenths of one per cent., has, so to speak, a "level head." Such a change will reduce the cost of hauling freight per ton per mile very largely, and he will be able to give to the community served by his road lower rates, and at the same time place the railway in a better position to give its shareholders fair returns on their investments.

A very brief examination of the subject of engine loads upon varying gradients affords the most convincing proof of the value of easy grades. A. M. Wellington, in his work on the economic theory of railway location, gives the following figures to show what is a working load of a locomotive upon various grades. For instance he sets forth in his tables that an 18 by 24 freight engine could haul the following load of net tons on varying grades as under:

Load Rating for 18-in. by 24-in. Locomotive, in Net Tons, Including Weight of Cars.

Incline of Grade.	Total load in net tons, Mr. Wellington's Table. Tons.	Total load in net tons, C.P.R. Ratings. Tons.
Level	2,183	
1/10 of 1 per cent.....	1,733	1,500
2/10 " 1 "	1,433	1,400
3/10 " 1 "	1,219	1,300
4/10 " 1 "	1,058	1,200
5/10 " 1 "	933	1,100
6/10 " 1 "	883	1,000
7/10 " 1 "	751	900
8/10 " 1 "	682	800
9/10 " 1 "	625	700
One per cent.	578	607

I have examined the working ratings and loads for locomotives, as adopted by the Canadian Pacific Railway, after they had arrived at the same by making an exhaustive investigation of the subject by aid of a dynamo-meter car, and find that they work out approximately as shown. This is an interesting and satisfactory comparison.

In explanation of the discrepancies in the above table, it must be remembered that a level piece of road free from the complications of curvature is very rare, and Mr. Wellington's figures giving the load for a level piece of road as 2,183 tons were no doubt arrived at after making a test on an ideal piece of level tangent which is hard to find in actual practice. The question also of speed has to be considered very carefully in making a comparison of this nature.

With regard to possible further reductions in rail rates in the future, I have analyzed the results of some of the most economically operated railroads on this continent, as shown in Poor's Manual. The public of this country are paying on an average, as before stated, about .70 of a cent per ton per mile for their freight rates by rail, but at the same time a large amount of mineral and grain traffic is handled, as

shown in this paper, below .35 of a cent per ton per mile. In fact that remarkably well equipped railway, namely, the Bessemer and Lake Erie, which handles most of the iron ore coming from the Great Lakes to Pittsburg, is able to show very good returns on its capital and make extensive betterments to its system at the same time, on an average rate of .4 of a cent per ton per mile. The tonnage statistics as published in the annual report of this road, are of great interest, and having one of the heaviest mineral traffics in the world, it has conditions for making a good showing, which are quite ideal; for instance, its average load of freight for last year on South bound iron ore trains was 1,479 tons, and its average train load for North and South bound trains was 913 tons. These are remarkable figures, and are more than 100 per cent. better than are shown by such roads as the Transcontinental systems, all of which handle a mixed traffic, and the train load results which they show of from 300 to 480 tons per train mile is all that can be expected under the circumstances. With regard to the future of railway rates, a study of the subject forces one to the conclusion that railway companies are so progressive and enterprising, that, given a large and steady volume of traffic, they will equip themselves to carry it cheaply, as the Bessemer and Lake Erie Railway and others have done, and that in the future we shall see rates that are substantially lower than those we have considered in this paper. It is generally conceded that the rapid progress that has been made by the railways in operating economies has been largely brought about up to the present time by the improvements that have been made in locomotive and car construction. The latest statistics obtainable on the trainload questions as given below, would indicate that the rate of improvement in the train load figures have not been so well maintained during the past year, and that the yearly improvements in the train load, which have been accomplished by increasing the size of locomotives and cars, have about reached their limit.

TRAIN LOADS INCREASED.

	1903.	1902.	1901.	1900.
Lehigh Valley	485	466	463	429
Atchison	279	247	242	221
Illinois Central	288	274	235	221
New York, Ontario & West.	287	285	290	287
Norfolk & Western	486	476	461	345
C., C., C. & St. Louis	333	332	333	335
St. Louis & San F.	195	186	200	154
Wabash	302	285	283	269
Toledo, St. Louis & W.	295	285	250	..
Wisconsin Central	303	286	260	258
Erie	406	376	375	369
St. Louis South West.	252	232	210	207

TRAIN LOADS UNCHANGED.

	1903.	1902.	1901.	1900.
New York, N. H. & H.	218	218	208	204
Louisville	231	231	222	239

TRAIN LOADS DECREASED.

	1903.	1902.	1901.	1900.
Northern Pacific	344	346	324	317
St. Paul	244	254	237	205
Southern	193	195	192	176
Chesapeake & Ohio	493	509	511	488
Chicago & Great West.	277	291	313	261
Chicago & New Orleans	231	249	232	235

In order to make further reductions the railways must continue the work of cutting down their grades, and will also probably obtain additional economy from the adoption of the alternating current electric locomotive. The question of coal consumption in relation to ton mileage is also of interest, in large freight vessels fitted with marine engines of the most advanced type for fuel saving, a consumption of 2.5 lbs. of coal per 100 ton miles of freight carried, has been claimed as a record, but marine engineers generally regard a consumption of 5 lbs. of coal per 100 ton miles as the average. Whereas the consumption of coal upon railways is about 19 lbs. per 100 ton miles.

I commenced my early engineering training in locomotive work, and have the highest appreciation of the locomotive in all the stages of its wonderful development. But it would seem that it has now nearly reached its limit, and is destined to be out-classed by a machine which will merely consist of a group of four or more electric motors mounted on as many driving axles. There is no doubt that such electric apparatus has been designed and can be built upon the basis of the electrical engineering science as it now exists, and that such a machine would give better results than the locomotive in fuel economy," "Draw Bar Pull," and the economical and elastic distribution of wheel load with reference to wear and tear on rails, road bed and bridges.

There is no data in existence based upon results that can lead us to any definite conclusion as to what the relative consumption of fuel and power would be as between the handling of freight trains as they are now handled by steam locomotives, compared with the electric locomotive driven from a central power station.

Still we have the very instructive and significant comparison which exists between the fuel consumption on steam tram cars, as compared with the consumption on electric cars in street railway service. In the case of the former, the consumption of coke, which is the usual fuel used, is 15 lbs. per car per mile, and in the latter 8 lbs. of coal per car per mile.

The address was received with applause, and the retiring president was complimented on the practical turn of his departure from tradition in selecting his topic.

Colonel Anderson, the president elect, was then invited to take the chair, and expressed his appreciation of the honor done him in placing him in the highest position to which a Canadian civil engineer could aspire.

Votes of thanks were then passed to the retiring president and other officers, to the street railway company, and the companies whose works were visited, to the railway companies for special rates of transportation, to the press, and the dinner committee.

On motion of H. R. Lordly, seconded by F. C. Laberge, the incoming council was instructed to appoint a special committee composed of one representative each from the Mechanical, Electrical, Mining and General sections to prepare a card index system for trade catalogues and other current publications, and a similar index of current technical literature to be used for the reference library and to be kept up-to-date. The council was authorized to incur any necessary expenditure up to $100.

Mr. Lordly also brought up the subject of Sunday opening of the rooms, and said that less than twenty different people had used the rooms on Sunday during the whole year, while the caretaker was kept on duty during the whole day. After discussion, it was decided to limit the Sunday hours to 9 to 10 a.m., and 2 to 4 p.m., the rooms to be entirely closed on Sundays in July and August.

This closed the business of the convention. In the afternoon the members entertained a number of friends to a tea, to which a large number of lady friends were invited.

A meeting of the general section was held the same evening to hear the reading and discussion of Mr. Jamieson's paper on Grain Pressure in Bins, and the reading of a paper by J. J. Taylor on the Shubenacadie Bridge. These papers are crowded out of this issue. The meeting closed with "God Save the King."

The annual dinner of the Society was given at the Windsor Hotel, on Wednesday evening, 27th January, and was a very successful reunion. Mr. Blackwell occupied the chair, and was supported by Col. Anderson, the president elect. The principal toasts were: the "Sister Societies," proposed by R. A. Ross, and replied to by Senator J. P. B. Casgrain and B. T. A. Bell; "Our Guests," acknowledged by M. J. Connolly, president of the Locomotive and Machine Co.; "the Society," proposed by G. A. Mountain and responded to by E. A. Marceau; the "Retiring Officers," proposed by Col. Anderson and replied to by K. W. Blackwell; the "Visiting Members," proposed by Major Stuart Howard, and responded to by R. B. Rogers, and Henry O'Sullivan, and the "Press," proposed by W. McLea Walbank, and responded

to by representatives of the Engineering News of N.Y., and the Canadian Engineer. The songs of the evening, for which the society was indebted to Messrs. Poole, Bowman, Courtice Brown and O'Sullivan, were very much enjoyed. The entertainment committee was specially thanked in the closing toast of the evening.

COL. W. P. ANDERSON, PRESIDENT CANADIAN SOCIETY OF CIVIL ENGINEERS, 1904.

Col. Anderson is chief engineer of the Department of Marine and Fisheries, Ottawa. A biographical sketch of the new president appeared in the Canadian Engineer for March, 1902.

INDUSTRIAL NOTES.

Alex. Webber will erect new boiler workshops, at Dartmouth, N.S.

The brass and steel works, at Stouffville, Ont., have been sold under a mortgage.

The Frost Wire Fence Co will move its factory from Welland to Hamilton, Ont.

The foundry of Frost & Wood, Smith's Falls, Ont., was consumed by fire on January 7th.

The Western Foundry Co., of Wingham, Ont., have established a branch in Winnipeg.

T. McAvity & Sons have purchased the Whelpy skate factory, at Greenwich, Sussex, N.B.

The Vulcan Iron Works, Winnipeg, Man., will build new boiler, blacksmith and machine shops.

The Government contract with the Ross rifle factory, Quebec, calls for the delivery of 1,000 rifles monthly.

The Dodge Manufacturing Co., of Toronto Junction, have opened a branch at 419 St. James street, Montreal.

Hugh McDonald, of North Sydney, C.B., will, this spring, build a wharf at Big Pond, C.B., estimated to cost $10,000.

The Sydney Manufacturing Company, Sydney, C.B., contemplate enlarging their plant, to include the manufacture of cars.

Fires occurred at Aitchison's planing mills, Hamilton, Ont., on December 25th and January 16th. Incendiarism is suspected.

The Perth Solid Steel Car Wheel Company is in operation, after several years' stoppage, and has a daily output of ten wheels.

The Bridge and Structural Works bonus by-law, at Galt, Ont., was defeated by 59 votes. It will probably be submitted again.

The Pere Marquette car shops will be removed from Walkerville, Ont., to St. Thomas, which town has granted $20,000 bonus.

The result of the surtax on German goods is a decline of 40 per cent. in the imports from Germany in the three months ending December.

The Kingston Locomotive Works, have enough work to last till October, and are refusing orders owing to the uncertainty of the steel market.

The new works of the Canada Radiator Co., at Lachine, Que., are fast approaching completion. The plant has a capacity six times that now at Port Hope, Ont.

The Canadian Elevator Co., Winnipeg, Man., with which is associated the American Cereal Co., Peterboro, Ont., will build an elevator at Port Arthur, Ont., of 1,250,000 bushels' capacity; also immense storage warehouses.

The Jeffrey Manufacturing Company, of Columbus, Ohio, through its connection with the Ohio Malleable Iron Company, of the same place, are now in the field soliciting orders for high grade malleable castings.

The new mills of the Echo Milling Co., Gladstone, Man., were started on January 13th. The capacity is 250 barrels a day. The Goldie-McCulloch Co., Galt, Ont., supplied the mill machinery, and the Vulcan Iron Works, Winnipeg, the elevator plant.

Canada's Pavilion at the World's Fair is finished. The structure is one of the most ornate among the many attractive foreign buildings, and occupies an advantageous site north of the Palace of Agriculture. The intra-mural railway passes the main entrance.

The Smooth-On Mfg. Co., of Jersey City, have issued a booklet telling about Smooth-On, its different combinations and their applications. The latest combination is Smooth-On with rubber, which makes an excellent sheet packing, that will withstand very high temperatures and pressure. Catalogues will be sent to anyone asking for them.

The Sunbeam Incandescent Lamp Company, of Toronto, are placing on the market a special Mill type lamp, for use in factories having a number of running belts. The difficulty with ordinary lamps for moving belts is that the filament is attracted to the glass by static electricity. In the Mill type, is a double-anchored filament lamp, which overcomes this difficulty.

The Packard Electric Co., Limited, makers of lamps, transformers and meters, write to thank their many customers for orders during the past year, and state that the uniformly high standard of their Packard lamps, type "G" meters and type "R" transformers will be maintained. The lamp department has recently been increased in capacity so that orders may be shipped quickly.

An English company, manufacturing ice-making and refrigerating machines, wish to find an engineering firm in Canada who would purchase their Canadian patents or manufacture the machines under royalty. The company make several types of refrigerators, which may be operated by electricity, gas, oil or steam. A. C. Leslie & Co., Montreal, will be pleased to supply further information.

Among recent installations of the Cyclone grate bars, by P. E. Durst & Co., Yonge St. Arcade, Toronto, are: The Elliott Mfg. Co., the School of Practical Science, the Toronto Technical School; J. F. Brown Co., Limited, the G.T.R., Jones & Moore, the Rolston Laundry Co., Toronto, the Kingston Hosiery Co., Kingston; the Crown Furniture Co., Preston; Normal School, London; Alex. Mann, and Flumerfeldt Bros., Orangeville.

The France Packing Co. have secured from the Rapid Transit Subway Power-house, New York, a contract to pack the piston rods of all engines with their "Steam Stopper" metallic packing. They also acknowledge the support given their new "Steam Stopper" and "Water Stopper" brands of fibrous packing. They have placed on the market a new high pressure packing ring, made of the finest long-fibre asbestos yarn, and spun with a metallic wire, which has met with success, a number of railroads having adopted it exclusively for use on their locomotive air pumps. Their 1904 catalogue is ready, and can be had on application.

J. L. Allan, of the Hamilton Motor Works, Hamilton, Ont., has assigned, and the business is on the market. W. G. E. Boyd is the assignee.

The council of East Toronto will issue debentures, value $25,000, to purchase a factory site, and loan the Globe Manufacturing Co., Walkerville, Ont., $20,000.

The Cling-Surface Mfg. Co., of Buffalo, N.Y., announce that their product, Cling-Surface for belts, will now be handled in Ontario and the Western provinces solely by the Eureka Mineral Wool and Asbestos Co., James Sinclair, manager, 74 York St., Toronto, or their agents. The Eastern provinces will be supplied as heretofore from the Boston office, 170 Summer street.

The Lunkenheimer Company, Cincinnati, makers of brass and iron steam specialties, report that owing to the unprecedented demand for their specialties, they have again greatly increased their facilities, and are now in a position to guarantee reasonably prompt shipments. They also report, through their foreign branches, an increasing export demand, and announce that they will shortly place some new lines upon the market which will be described in a very complete catalogue to be issued in the course of a few months.

The Dominion Tar and Chemical Company, Limited, commenced operations in October last, and is now in full working operation at Sydney, Nova Scotia. It is engaged in the distillation of coal tar on the most modern principles, and has equipped the largest distillery on this continent. The chief products are pitch for patent fuel making, roofing, etc., and creosote oil of all grades either for timber preservation, creosoting, lighting, etc. The company is shipping, besides these products, many specialties, such as specially prepared varnishes, disinfectants, etc. The works are fully equipped with railroad sidings in direct touch with the I.C.R. system and with the Sydney shipping piers. The president of the company is S. B. Boulton, who is the largest tar distiller in the world, and the oldest authority on timber creosoting.

RAILWAY NOTES.

The projected extension of the Hampton-St. Martin's Railway to St. John, N.B., will be built this year.

The Cape Breton Electric Co. will inaugurate an express service between Sydney, Glace Bay, and other mining towns.

The North Easthope, Ont., council will give a bonus of $2,000 to the Berlin, Waterloo, Wellesley and Lake Huron Railway.

The G.T.R. will build a new bridge across the narrows at Orillia, Ont., and will relay the line from Gravenhurst to North Bay with new 80-lb. rails.

The contract for the substructure of the swing bridge on Lachine Canal, on the site of Brewster's bridge, has been let to John Quinlan & Co., Montreal.

The promoters of the Windsor, Essex and Lake Shore Electric Railway have obtained a 50-year franchise, and 21 years' exemption of taxation from Windsor, Ont.

The G.T.R. has ordered 15,000 tons of the best English rails, at $23.50 per ton, as against $26 for 25,000 tons of United States rails bought by the Canadian Northern.

An electric railway from Fredericton to Woodstock is projected. The Shaw-Cassells Co. are said to be willing to put $100,000 in the road. Power will be generated at Pokiok Falls.

Efforts are being made to induce the T.L.E. and P. Railway, recently built from Port Burwell to Ingersoll, and which is to be extended to Berlin and Collingwood, to run through Guelph, Ont.

Work has been started in Nebraska, on the Winnipeg, Yankton and Gulf Railway, to run from Lake Winnipeg through the Mississippi valley to the Gulf of Mexico. Winnipeg will be the northern, and Galveston the southern terminus.

The first regular passenger train on Chateauguay and Northern and Great Northern Railways was run from Montreal to Quebec on January 11th, leaving at 8.45 a.m., and arriving at 7.40 p.m.

The Winnipeg, Selkirk and Lake Winnipeg Railway is seeking powers to construct a belt line and to operate within the city of Winnipeg, Man. Also to build to Tyndall and Winnipeg river.

Daly & Crichton, Winnipeg, Man., have given notice of an application for powers to construct a railway from the international boundary to Winnipeg, Brandon, Portage la Prairie, and other points in Manitoba.

A daring attempt was made on January 10th to wreck the power plant of the Brantford street railway, by driving spikes through the generators. The spikes were, fortunately, discovered before any damage was done.

The Railway Commission will comprise the Hon. A. G. Blair, chairman; the Hon. M. E. Bernier, and Prof. J. Mills, of the Ontario Agricultural College, Guelph. The chairman's salary is $10,000, and the other commissioners $8,000 each.

Brown Bros., of Richibucto, N.B., completed seven miles of line from the Imperial Coal Co.'s mine, Beersville, to the I.C.R., at Adamsville, for the Beersville Railway Co., on December 22nd, having only commenced the work on Sept. 21st last.

The Temiskaming Railway Commission has awarded the following contracts: Angle bars, 15,500, Hamilton Steel and Iron Works; spikes, Pillow & Hersey Manufacturing Co., Montreal; bolts, Toronto Bolt and Forge Works; nutlocks, W. C. Nun, Montreal.

J. P. Geddes, of New York, manager of the Canadian Coal Mining Co., has applied to the New Brunswick Legislature for a charter to build a road from their mine in Kent County to Richibucto, eight miles; to the I.C.R. at Coal Branch, six miles, and to Chipman.

Advices from Guatemala state that American and Canadian capitalists will complete within three years the Northern Railroad into Guatemala city, completing the inter-ocean railway for a distance of 270 miles. It will transfer the commerce of Guatemala from the Pacific to the Atlantic.

The Hampton and St. Martin's, N.B., Railway is closed until spring. Repairs will be made to the road before reopening, 15,000 new sleepers are to be put in, the bridges will be overhauled, and some new rolling stock will be secured.

A report from a reliable source states that Port Simpson has been decided upon as the Grand Trunk Pacific terminus. Also that the main line will not touch Winnipeg, but that Mackenzie & Mann's system west of that point will be acquired.

The Ottawa and New York Railway got $73,000 bonus for constructing a railway to Ottawa, Ont., and establishing workshops there. It is claimed that the shops were erected but the equipment remains at Santa Clara, N.Y., where the greater part of the work is done. The city council proposes to take action in the matter.

The stations on the Lindsay, Bobcaygeon and Pontypool Railway, will be Blackstock, six miles north of Burketon; Lindsay, Dunsford, and Bobcaygeon, also two flag stations not yet located. Delivery of 4,000 tons of 60-lb. rails of Belgian and German make, with 24-inch angle-bars for this line, is due early in the spring.

The new I.C.R. roundhouse, at St. John, N.B., costing $72,000, is nearing completion. It comprises engine house, machine house, water tank holding 100,000 gallons, and turntable, the latter being set and furnished by the Hamilton Bridge Co. The Sturtevant hot air system is used for heating the machine shops.

Application will be made at the next session of Parliament to confirm a trackage agreement between the Canadian Southern Railway, the Michigan Central, and the Pere Marquette Railway, and to empower the Canadian Southern Railway to acquire the Sarnia, Chatham, and Erie Railway, and the Leamington and St. Clair Railway.

Additions to the Grand Trunk repair shops, at Stratford, Ont., are contemplated, which will make room for 400 more men.

Stratford, Ont., has two radial electric railway projects; from N. M. Cantin, for a line to St. Joseph, on Lake Huron, via Avonton, Carlingford, Fullarton Corners, Russeldale, Cromarty, Chiselhurst, Hensall, and Zurich. Also from H. M. Sloan, Chicago, for a line to take in Sebringville, Mitchell and St. Mary's.

Charles H. Fisk has asked Detroit for a franchise to build a tunnel across the Detroit river. It is proposed to use the McBear system of building through the river by dredging out the course for the tunnel and constructing it therein.

The Grand Trunk have erected a new coal shute in Toronto, known as the Fairbank-Morse machine, of Chicago. It has two pockets, one on each side of the building, capable of holding 250 tons of coal each, and locomotives can be loaded in thirty seconds. It will do the work of twelve men.

Chrysler & Bethune, Ottawa, for the Central Ontario Counties Railway, are applying for a charter to construct a railway from Ivanhoe, Ont., to Agincourt, Ont. A. B. Colville, Campbellford, Ont., for the Campbellford, Lake Ontario and Western Railway, is also applying for a railway from a point on the C.P.R., between Blairton and Ivanhoe, to a point on the C.P.R. bewteen Locust Hill and Leaside Junction, Ont. Either of these lines would materially decrease the distance between Toronto and Ottawa.

The New York Central has introduced a new passenger engine styled the Pacific type, which differs in many respects from the Central Atlantic type. Instead of two drive wheels the Pacific has three. The tank has a capacity of over 6,000 gallons. In the trial trips these engines have displayed excellent speed, they possess enormous hauling power, and, it is said, will excel the reputation of the Central Atlantic. They will do service on the main line fast trains.

The following applications are to be made to the Ontario Legislature: The Toronto Suburban Railway for power to extend through Hamilton, the Counties of Wentworth, Lincoln and Welland, to Niagara Falls, also to Woodbridge and Brampton. To construct branch lines, etc. The Schomberg and Aurora Railway for an extension of time, and that King Township be empowered to pay a bonus. The Strathroy and Western Counties Railway for power to extend through St. Thomas to Port Stanley, Ont. The Hamilton, Beamsville, and Grimsby Railway to confirm a by-law to build branches and establish parks. J. H. Coburn, Walkerville, for an electric railway charter from Windsor, via Walkerville, to Chatham. The Sandwich, Windsor and Amherstburg Railway, to confirm a bond issue of $600,000, and power to take over the Windsor system. The Brantford and Erie Railway for a charter to build a line from Brantford, via Waterford and Simcoe, to Port Dover, with a loop line from Waterford, via Delhi and Lynedoch, to Simcoe.

It is proposed to found a school of railroad engineering and transportation in connection with McGill University, Montreal. The C.P.R. and G.T.R. will grant an annual subsidy of $3,000 each, while the Canadian Northern will contribute $2,000 yearly and negotiations are in progress with other roads, including the Intercolonial. It is believed to be possible to secure $20,000 annually for maintaining the school, and it is anticipated that the railroads will afford facilities which will enable students to undertake practical work, under supervision, concurrently with the theoretical teaching at the university. The drawing up of a scheme of studies has been entrusted to a committee which includes Mr. Morse, of the G.T.R., and Mr. McHenry, chief engineer of the C.P.R. The syllabus will include: (1) Location, including all branches of surveying. (2) Construction, including the laying out of work, the construction of bridges, buildings, etc., track laying and ballasting, organization, specifications, etc. (3) Operation, including: (a) Maintenance of way and structures; (b) the conducting of transportation; (c) equipment, organization, legislation, etc. It is expected that work in the new department will be commenced in September.

LIGHT, HEAT, POWER, ETC.

Work on the power scheme at Koochiching Falls, Rainy River, will be started at once.

Edmonton, N.W.T., has granted a franchise to a company for whom N. D. Beck is acting, for the production of natural gas.

A fall of ice on January 18th damaged the Niagara Falls Hydraulic Power and Mfg. Co.'s power house, shutting down four generators.

Ada Parker, whose son was killed by a live wire in Ottawa, on May 21st last, has obtained $500 damages from the Ottawa Electric Light Co.

The Sherbrooke, Que., Heat, Light and Power Co. has agreed to accept the city's offer of $200,000 for the electric plant, if the latter will purchase the gas works.

T. Wilson, said to be acting for J. J. Hill, has obtained controlling interest in the Stave Lake Power Company to supply power to a new line from Westminster to Vancouver.

It is stated that the Electrical Development Co., of Ontario, and the Toronto-Niagara Power Co. have purchased 85 per cent. of right of way eighty feet wide, between Niagara and Toronto.

A charter is to be applied for with power to construct, on the Roseau river and elsewhere in Manitoba, water and other power, and to construct an electric railway line within seventy-five miles of Emerson, Man.

J. M. Campbell, of the Gananoque Electric Light Co., and the Kingston Milling Co., has purchased the old mill, at Kingston Mills. He will build a power house and develop the electrical power to run his mill in Kingston, Ont.

The C.P.R. is contemplating the use of electricity in their elevators at Fort William and Port Arthur. The plant will be at Fort William, and sufficient power generated to supply the elevators at Port Arthur. The cost is estimated at $500,000.

Electricity promises to be an important factor in the Rossland, B.C., mining industry. The West Kootenay Power and Light Co., and the Rossland Power Co., are supplying a rapidly increasing amount of power. The cost is 50 to 60 per cent. of that in the Pacific North-West mines.

In the case of the city of Ottawa v. the Ottawa Electric Co., Judge Ferguson has dismissed the motion. The case in dispute was as to the right of the Consumers' Electric Co. to use certain poles of the Ottawa Electric Co. for the purpose of stringing wires, and this decision gives the former company that right.

The Vancouver Power Company completed the big dam on Lake Beautiful last month. It is 360 feet long, 50 feet deep, and 40 feet wide at the bottom, tapering to ten feet at the top. It is built on solid concrete, with a foundation on the mountain rock. When the tunnel connecting Lakes Beautiful and Coquitlam is completed, 30,000-h.p. will be available.

Major VanBuskirk, city engineer, Rossland, B.C., is preparing estimates for a civic lighting plant capable of supplying 7,000 to 10,000 inhabitants. Notice will be given the Rossland Water and Light Company that the city purposes taking over their system at the expiration of the contract.

Westinghouse gas engines will be installed in the new Central Station, at Berlin, Ont. The initial installation will aggregate 460-h.p., comprising three 13 by 14 three-cylinder, 125-h.p., and one 11-in. by 12-in. three-cylinder, 85-h.p. vertical engines. These engines will operate on city illuminating gas of 650 B.T.U. calorific value, and drive direct-current generators for furnishing municipal lighting.

The Shawinigan Water and Power Company has completed the transmission line to Sorel, Que. A transformer station, at Joliette, reduces the 50,000 volt current to 12,500 volts, which is transmitted across the St. Lawrence river, near Lanoraie, by a heavily insulated submarine cable. The circuits are of aluminum throughout, made by the Northern Aluminum Company, at Shawinigan Falls. Power is to be supplied to other points between the Falls and Montreal.

TELEPHONE AND TELEGRAPH.

North Monaghan is now connected by "Bell" telephone with Peterboro.

Regina, N.W.T., will soon have "Bell" long distance connection with Winnipeg.

An effort is being made to establish a telephone service at Channel, Newfoundland.

A telegraph line is to be constructed from Edmonton, N.W.T., to Athabasca Landing.

A telephone cable has been laid across the river from a point on the Strait Shore to Market Slip, in Carleton, N.B., a distance of 1,200 feet.

The Immigration Department announced recently that the telegraph line from near Fort Pitt to Barr Colony would be completed by January 20th.

The C.P.R., under the terms of their agreement with the N. B. Telephone Co., has refused connection to the Union Telephone Co., at Woodstock, N.B. The matter is to be brought before the Railway Commission.

The automatic telephone system of the Citizens' Telephone Company, of Grand Rapids, Mich., was put in operation on January 9th, with 5,300 phones attached to it. This is the largest exchange in the world operated without girls.

The Canadian Machine Telephone Co., owners of the patent rights in Canada of the "Lorimer" automatic telephone exchange, will shortly open their new factory on Duncan street, Toronto. Most of their staff have already arrived from Ottawa.

The Southern Telephone Company has purchased the Western Union Company's line between the coal pier, Sydney, C.B., and Centreville. The telegraph company had to abandon this line on account of the tramway interfering with the working of it.

A case of interest to municipalities was decided recently by Judge Chisholm, at Galt, Ont. The Bell Telephone Co.'s assessment was raised from $2,200 to $6,000, and the company contested. The company had 445 poles in Galt, with 652 cross arms, 4.480 feet, 25 pair cable, and 1,920 feet, 50 pair cable, and 86 miles of wire; seven 50 line switchboards and about 350 telephones in use. Expert testimony valued each pole and its cross-arms at $11.50. The judge decided the assessment was too low and raised it to $4,999.50.

❧ ❧ ❧

NEW CATALOGUES.

Copies of these may be had on writing any of the firms named, mentioning the Canadian Engineer:

The Sunbeam Incandescent Lamp Co., of Canada, McKinnon Building, Toronto. Standard miniature and decorative incandescent lamps.——The Jeffrey Manufacturing Co., Columbus, Ohio. Catalogue, No. 52, "Jeffrey Coal-Washing Machinery," "Jeffrey Machinery" for sawmill, lumber, and wood-working industries. Also Jeffrey screening machinery.——The Westinghouse Electric and Mfg. Co., Pittsburg, Pa. No. 1,032, the "Westinghouse No. 56 Railway Motor Motor;" No. 1,059, "Electric Motor-Vehicle Equipments," and No. 1,066, "Type H. Induction Motors." ——The Brown & Sharpe Mfg. Co., Providence, R.I. Mechanical machinists' tools.——The J. Stevens' Arms and Tool Co., Chicopee Falls, Mass. Rifles, pistols and shotguns.——Goudey-McLean Co., New York. Bulletins No. 16, "Type A, Generators and Motors;" 17, "Type B, Belted Generators;" and 18, "Type C, Engine Type Generators." ——The Armstrong Bros. Tool Co., Chicago, "Armstrong Tool Holders."——The Chicago Pneumatic Tool Co., Chicago. Pneumatic drills, hammers, hoists, etc.——The Buffalo Steam Pump Co., Buffalo, N.Y. Fire and, boiler feed pumps.——The Diamond Saw and Stamping Works, Buffalo, N.Y. Sterling hack saws.——James Cooper, Montreal. Scrapers, wheel-barrows, hoisting buckets, diaphragm pumps, etc.——The Buffalo Forge Co., Buffalo, N.Y. A series of bulletins: "A Compound Engine Test," "Buffalo B. Volume Blowers and Exhausters," "Buffalo Improved Ventilator." ——The B. Greening Wire Co., Limited, Hamilton, Ont. "Wire, its Manufacture, Antiquity and Relation to Modern Uses."——The Canadian General Electric Co., Toronto. "About Track-Cleaning Devices," the "Thompson High Forge Induction Wattmeter."——Belt Engineering Co., Philadelphia. "Link-Belt Case-Hardened Sprocket Wheels." ——The Carborundum Co., Niagara Falls, N.Y. Carborundum wheels, sharpening stones, etc.——James McCrea & Co., Chicago. Steam specialties, joint clamps, steam traps, drilling and boring machines.——The Bignall & Keeler Mfg. Co., Edwardsville, Ill. Pipe threading and cutting machinery.——The A. S. Cameron Steam Pump Works, New York. Illustrated pamphlet of steam pumps.——The Erie City Iron Works, Erie, Pa. "Erie City Water Tube Boilers."——The United Telperage Co., New York. Circulars No. 37, "Cable Lines;" 38, "Automatic Telpher Plants," and 42, "Reserve Coal Storage."——The Bradford Machine Tool Co., Cincinnati, Ohio. "Bradford Lathes."——The Hyatt Roller Bearing Co., Harrison, N.J. Bulletin No. 20, "Hyatt Flexible Roller Bearing as applied to Heavy Duty at Slow Speed."——The Power and Mining Machinery Co., New York. "Gas for Furnace Work," also "Gas Engines." ——The Rotary Engine Co., Philadelphia. Direct power generating belts.——American Steam Pump Co., Battle Creek, Michigan. Marsh boiler feed pumps.——The Atlas Car and Mfg. Co., Cleveland, Ohio. Catalogue No. 1,018. Mine and ore cars, dump cars for smelting and roasting plants, etc.——Holden & Brooke, Limited, Manchester, Eng. Catalogue C, Steam plant specialties, injectors, ejectors, and feed water heaters, water and oil separators, etc.——The David Bell Engineering Works, Buffalo, N.Y. "Bell Steam Hammers."——The C. W. Hunt Co., New York. Mine hoisting equipments, automatic, industrial and cable railways; conveyors and locomotives.——Queen & Co., Incorporated, Philadelphia. Optical and scientific apparatus.——The Cling-Surface Mfg. Co., Buffalo, N.Y. "Cling-Surface and Belt Management," by J. E. Powers, M.A.——The Crocker-Wheeler Co., Ampere, N.J. "The Mechanical Equipment of the Orange Brewery, N.J.

Calendars have also been received from the undermentioned firms, and are acknowledged, with thanks: The Alexander Engraving Co.——The Smooth-On Mfg. Co.——The Intercolonial Railway.——The Quebec and Lake St. John Railway.——The Knoxville Engraving Co., Knoxville, Tenn. ——The Standard Tool Co., Cleveland.——The American Steam Gauge and Valve Mfg. Co., Boston, Mass.——The News and Eastern Townships' Advocate, St. Johns, Que.

❧ ❧ ❧

THE MACCOLLUM STEAM TURBINE.

Having described the Parsons and the Curtis and other types of steam turbines, we now describe one of Canadian origin, viz., the MacCollum Steam Turbine, invented by J. H. K. MacCollum, of Toronto. The illustrations show the principal parts of the experimental machine built by the Dominion Motor and Machine Co., Toronto, lately. This turbine consists of a series of wheels forming the rotating member, mounted on a tool steel shaft (Fig. 1, Z), each wheel being identical with the other, consisting of a hub and web, carrying a rim with parallel edges, the face of the rim being turned out in the form of a semi-circle, seventy-five slots being milled on the face at a tangent with the bottom of the groove; into these slots sheet brass strips are driven (U), the edges then have a portion turned out of each side, and a steel T-shaped ring fitted to anchor in the blades. Bronze rings were tried first, but they expanded by centrifugal force due to the high speed, and had to be replaced by the steel ones. After the wheels are finished and put on the shaft, a collar is screwed up against one end, (a fixed collar being at the other), which presses all the wheels together sufficiently tight to prevent them moving, the first and last wheels having feathers in them to assist the collars in securing them to the shaft. A special plate was put on each end. The stationary member, or case of the turbine is shown at Fig. 2, and consists of a series of rings; section of which is shown in Fig. X; the nozzles are shown at Y in figures X and 2. The first ring of the case (not shown in the cut), is arranged to go between the end plate Fig 3, and the

second ring (shown at A). It simply forms a steam belt, to supply steam freely to the series of nozzles around the ring extending into the steam belt, as shown at B. The steam passing through the nozzles, Y, enters the bucket at the edge, and as the bucket has an oval section, due to blades being inserted in the curve at a tangent, the steam is completely reversed in the first wheel. It discharges from the first wheel into the slot, C, formed by the nozzle ring of one case being separated from the next case, as shown at C, Fig. X, and 2, and as the steam enters the case it is again reversed in direction by the curve in the case. The direction of the current of steam is in the direction of rotation, and also longitudinally. The nozzles are drilled at a similar tangent to the bucket blades, and as the steam turns the outer case it meets the extending ring containing the nozzles for the next wheel, as shown at D Fig. X; it passes through these as before, and so on through the entire length of the machine into the exhaust end case at E, and out through the opening F into the condenser.

The case is shown up at an angle of 90 degrees from its position, when in place, to show the row of openings that were arranged for drips, and also to connect gauges to, but it was found on testing the machine that it would clear itself of water without using the drips, so they were only used for the gauges, one of which was attached to each case to show the drop in pressure from one end to the other. The end cover, with foot attached, shown at Fig. 3, carries the case on the ring at G, and the bearings shown at H. The bearing consists of a cast iron shell bolted to the cover, and bored out to secure a bronze shell a few thousandths smaller than the bore. In this shell is fitted another which carries the shaft. The outer shell is adjusted to bring the shaft

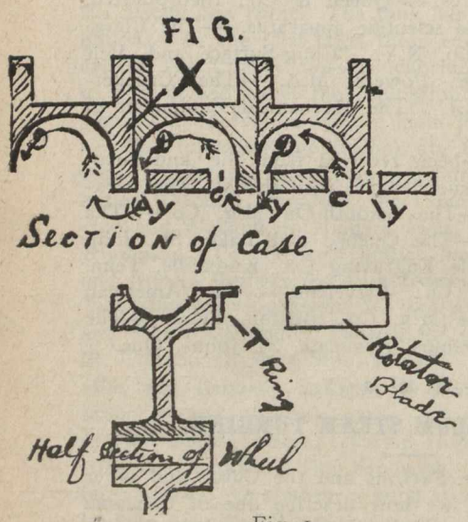
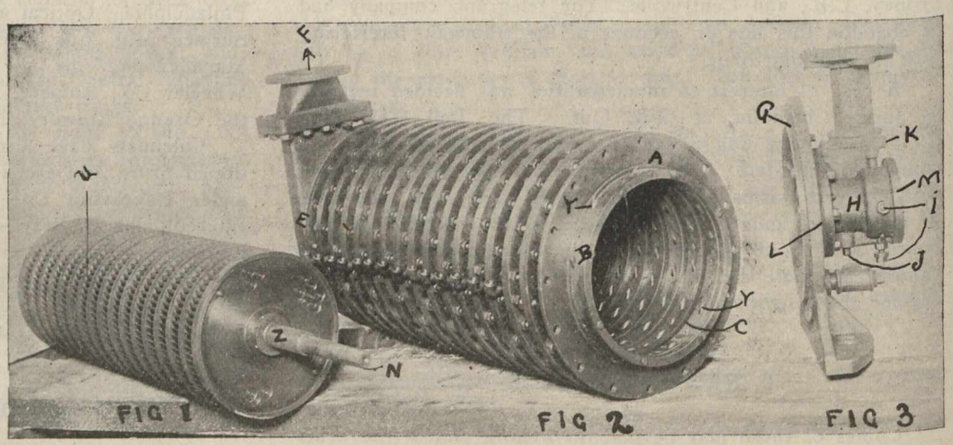


Fig. 1.



centred by the screw shown at I. Oil is forced in under pressure at J. and escapes at K, being prevented from entering the turbine by a set of metallic packing rings between the corner plate and bearing case at L. On a flange shown at M. on the opposite or exhaust end was attached a thrust bearing (not shown), to take up the end thrust which was very great, due to steam being on one end and a vacuum on the other. The entire machine was mounted on a cast iron base, the pulley for the Prony brake being mounted on a separate shaft between a special pair of bearings. The power was transmitted through a square sleeve between the rotating shaft and the pulley shaft; the end of the rotating shaft is shown square at N Fig. 1, where sleeve is slipped out.

A series of tests was conducted and experiments made to determine the value of certain changes, and after getting away from some thrust-bearing troubles, the average tests showed approximately 20 lbs. of water per horse-power per hour. The first test was rather disappointing, as about 7-h.p. was the best obtained, but after two changes they obtained 47-h.p. This is exceptionally good, as the highest pressure obtainable was 100 lbs., whereas the machine should have had 150 lbs. with a considerable degree of superheat. The vacuum was very poor also, but sufficient information was obtained to warrant the Bertram Engine Works taking up the patent for Canada, and we understand they are preparing to build an improved machine that is expected to get below 14 lbs. per horse-power per hour. The type of machine, as built, shows the MacCollum turbine to be almost indestructible; the rotator can be taken out and rolled on the floor without injuring it, whereas other machines have to be handled with the greatest care and with special slings. The leakage between the cases and the wheels was not very material, although it reduced the economy, no doubt.

LITERARY NOTES.

"The Mechanical Engineer's Reference Book," by Henry Harrison Suplee, B.Sc., M.E.; 801 pages; published by the J. B. Lippincott Co., Philadelphia, at $5 net; with patent thumb index, $5.50. This work, which is the result of years of careful work on the part of the author, is a valuable book of reference on engineering matters, and should be in the hands of every engineer, student, and draftsman. 228 pages are devoted to mathematics, 48 to mechanics, 135 to engineering material, 65 to machine design, 111 to heat, air, water, fuel and steam, 107 to steam boilers, engines, and internal-combustion motors, and 82 to electric power and the cost of water, steam, gas and electric power. Very comprehensive and valuable data are given upon each subject, with useful diagrams and drawings. The concluding pages are devoted to works' management, and an appendix is added comprising data regarding aluminum, locomotives, the powering of steamships, conversion of horse-power into kilowatt and unit equivalents for electric-heating problems. In view of the fact that the metric system is being discussed, a number of tables, in both British and metric units, are presented, so that engineers may use the latter system if desired. Among these may be mentioned metric steam tables for steam computations.

"The Factory Manager and Accountant," by Horace L. Arnold; 432 pages, six by nine; published by the Engineering Magazine, New York, at $5. This book contains some examples of the latest American factory practice, and is made up of several complete systems of factory-accounting forms, the costing and commercial blanks being accurately reproduced. The function and manner of using each form are carefully detailed, so that the reader can make an intelligent estimate of its value, if applied to his own uses. The systems in vogue at several of the most successful factories in the United States are fully explained and illustrated. Factory managers will find in this book many hints and examples of the greatest value in arriving at a satisfactory system of cost-finding and other methods of accounting essential to successful management.

"Machine Design," Part 2, third edition; by Forrest R. Jones, Professor of Machine Design, Cornell University; 426 pages, 6½ by 9½; published by John Wiley & Sons, New York, at $3. This book treats of many subjects of importance to the designer, including bearings and lubrication; spur and friction gears; belts, ropes, and screws for power transmission; screw gearing and fastenings, shafting, shaft and friction couplings, and brakes; fly-wheels and pulleys, and cylinders. The data have been gathered from numerous sources during the last fifteen years, and the equations and

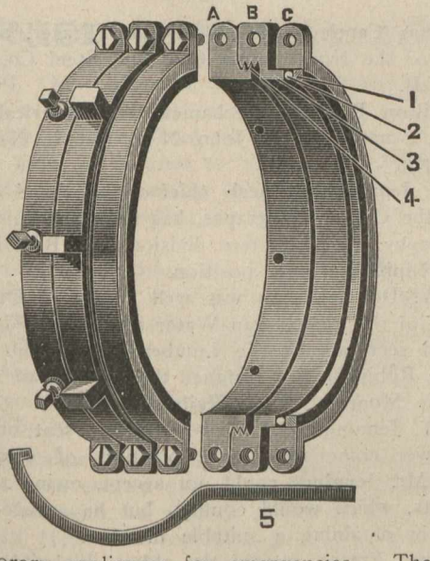
formulas are in such form as to afford a ready means of application. Numerous examples from practice, representing the experience of engineers, are given in preference to abstract statements, thereby affording the reader a better means of studying the facts incidental to any particular case. Much new data relating to roller and ball bearings, not contained in the preceding edition is included; 32 pages and 23 new figures are devoted to these subjects. Throughout the book new problems have been added and revision made to bring this work up to the most recent practice.

"Steam Boilers, Their Theory and Design," by H. de B. Parsons, B.S., M.E.; 367 pages, 6½ by 9½; published by Longmans, Green & Co., New York, at $4. This work is a series of lectures delivered to the senior class of the Rensselaer Polytechnic Institute, Troy, N.Y., and while the author makes no claim to originality, his object has been to cover such points as in practical office work may be perplexing. The book covers the field of boiler making and operation in a comprehensive manner, the subjects treated including physical properties, combustion, fuels, materials, boiler details, mechanical stokers, artificial draft, incrustation, corrosion, explosions, smoke prevention, testing and the care of boilers. It is well illustrated and will be found a useful work in the hands of the designer, steam engineer, and student.

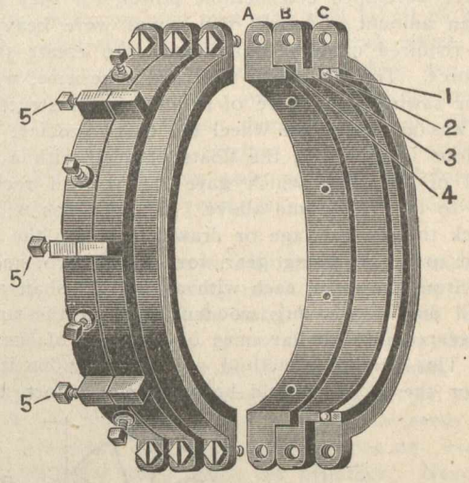
The Electric Club Journal is the title of a new illustrated monthly magazine, published by the Electric Club, Pittsburg, Pa., the members of which comprise the officers and employees of the Westinghouse Electric Mfg. Co. The first number will appear this month, and its immediate purpose is to put into permanent form the engineering papers and technical discussions of The Electric Club. Many of the papers will be written by the engineering staff of a leading electric company, and much of the material will pertain to the latest apparatus and to the newest problems in engineering work. This matter will be published in a form suited to the needs of intelligent young men. The circulation is not restricted to the members of the club, but the privilege of subscribing is extended to others. Subscriptions, $1 per annum, to be forwarded to the Electric Club Journal, Box 911, Pittsburg, Pa.

THE "CLIMAX" STEAM CLAMP.

James McCrea & Co., steam specialty manufacturers, Chicago, who for the past six years have devoted much attention to leak-closing clamps, have placed on the market a perfected clamp which embodies the benefits of their experience and eliminates all the difficulties found in former home-



made temporary appliances for emergencies. The advantages to be derived from the use of these improved clamps are: They can be applied in a few minutes without shutting down or shutting off steam, and will effectually stop the leak, thereby saving the expense of pulling down and renewing the piping; they make a permanent repair job, which never wears out, the covering being replaced as readily as on any other section of the pipe, and save many times their cost every month. They are made in all sizes, and two designs, No. 1 to tighten with a right and left connection with a spanner, and No. 2 by set screws. They are practically unbreakable, combining lightness with good service. In the illustrations, Fig. 1, showing the spanner design, A is a rigid clamp with male thread, held firmly to the pipe with set screws; B a loose clamp with female thread and lugs for the spanner, which screwed away from A forces with blank face packing through clamp C to joint; C is a loose clamp holding pack-



ing 1, and follows ring 2. In Fig 2 ring B is forced by set screws 5, 5, 5. The clamps are made in halves and held together, enabling rapid adjustment without removing the pipe. All steam engineers realize the importance of being able to repair a leak, without shutting down, which in some case would entail the loss of thousands of dollars, therefore the importance of such an appliance as the "Climax" clamp, especially in high pressure plants, should be readily appreciated. The makers will be pleased to furnish further information regarding this cheap and efficient means of effecting speedy repairs, on application.

TORONTO BRANCH AM. INSTITUTE OF ELECTRICAL ENGINEERS.

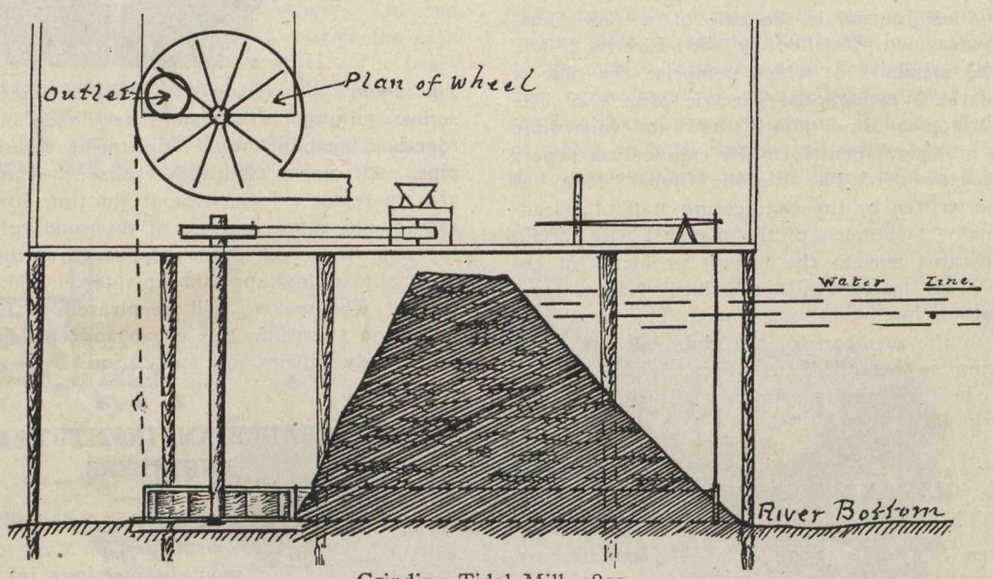
The Toronto branch of "the American Institute of Electrical Engineers" was organized in May, 1903, and since then have been holding monthly meetings in the rooms of the Engineers' Club. The papers discussed by the parent Institute usually form the subjects for discussion at the meetings of the Toronto branch, but a number of papers by local members, of subjects peculiarly interesting to Toronto and vicinity have been brought out and have proved extremely interesting. From an initial membership of thirteen, the branch has grown to thirty-eight members. Their next meeting will be held at the Engineers' Club, Friday, February 12th, when "Transformers" will be one of the subjects for discussion. The officers of the Toronto branch are: J. A. Kammerer, chairman; Prof. Rosebrugh, vice-chairman; R. T. Mackeen, secretary-treasurer; W. C. Hawkins, James Kynoch, T. R. Rosebrugh, executive committee.

TIDAL MILL.

Editor, Canadian Engineer:—

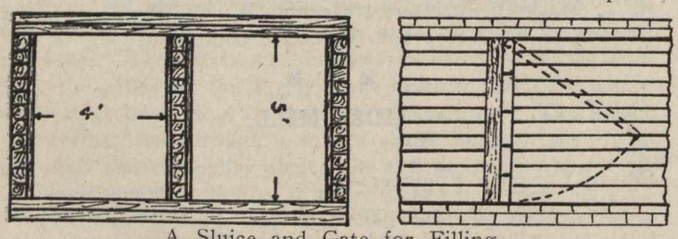
Sir,—Conforming to your wish for a sketch of an old tidal mill, which I referred to in the December issue, under "Power from the Tides," I beg to hand you the enclosed, which is a reconstruction from remains in sight and the memories of the older residents of the localities. These mills must have possessed considerable power, for they ground all the grain of the community, including the wheat, and this particular one had near it a dry house, where oats were first dried and then made into oatmeal, or "groats," and where human nature, ever true to itself, instinctively assembled the primitive bad boys of the grocery, who filched to the capacity of yawning pockets, the sweet, nut-flavored oat grains. I measured the old stones. They were four feet in diameter and many one foot thick, of granite, and were of

course set horizontally, the product of the grinding being thrown off by centrifugal force. The motor was made entirely of wood. The vanes were horizontal, and the shaft upright. The former were made of deal, and mortised directly into the latter, which was about twelve to fourteen inches in diameter, and carried on its upper end a large wooden pulley with a belt running directly to the mill stone spindle which was of iron. The diameter of these motors must have been from six to ten feet, and they must also have developed considerable power, for they performed no mean amount of work; the stones were heavy, and of course required quite a high velocity to create the centrifugal force. The old mills, tidal and otherwise, which were built for sawing logs, were of a different construction. The motor was an undershot wheel ten to twelve feet long, and about four in diameter, the floats of deal, with a crank at the end of the shaft which gave the vertical reciprocating motion to the saw frame above. When it was necessary to run back the log carriage or draw a log into the mill, they resorted to no reversing gear, for one or two small flumes opened from the main, each with an upright shaft and wheel of small diameter having wooden cogs on the upper end, which geared into similar ones on the side of the log carriage. This primitive method was not without its advantages, for the motors could be built in a short time, and



Grinding Tidal Mill, 1825.

power could be applied at any point independently of the others. I remember my first impressions of one of the latest, or possibly the last, of these old mills. I was awed by its multiplicity of levers, and unnumbered pin holes in wooden uprights, between any two of which the long end of the levers were confined, while the miller, inflated with responsibility and importance, strided now here, now there, hurling numerous orders at his single assistant, taking respite only to project an oath down the tail race at farmers who had assembled with their numerous flocks of sheep for



A Sluice and Gate for Filling.

their yearly washing before shearing; and who had by their demand in unparliamentary language for more water from the sluice gates, roused the miller's wrath.

The tidal dams were built wholly of the alluvial mud or clay. The tendency was to split in a heavy dam, so the structure was filled with small trees, which tied it together care being taken that none extended through and made a leak. These dams could be made in any position required, that is, directly across a river at any point, or at the mouth of a creek which emptied into a river, or a dam in the form of a semi-circle could be constructed anywhere, and the ingress sluices with gates opening inwardly only must conform in capacity to the area inside the dam. These old pioneers were not lacking in boldness of conception, for the grinding mill of which I speak was not fully filled by the sluices, but its top was several feet below high water, so it simply poured over and the ebb tide left it full to the brim. These mills must have been built about 1820, and been in operation forty years or more. As to the oldest, I can give no information. Probably they would date to 1800.

Office of County Engineer,
Canning N.S.

WM. RAND.

PERSONAL.

Capt. J. C. Ferris has been appointed harbor-master of St. John, N.B.

James Menzies succeeds the late Thomas Weeks as superintendent of the Sydney, C.B., waterworks.

H. J. Saunders, deputy commissioner of public works in the N.W.T., has resigned, to join Mr. Dennis, late of the C.P.R., to carry on work as civil engineers, with headquarters at Edmonton.

A. E. Ames has resigned the chairmanship of the Temiskaming Railway Commission, and is succeeded by Robt. Jaffray.

Thomas Cantley succeeds Graham Fraser, as managing director of the Nova Scotia Coal and Steel Co., at Sydney Mines, C.B.

Hamilton Ruddick, mechanical and electrical consulting engineer, a native of St. John, N.B., died in New York on January 7th.

F. T. Jennings, formerly chief operator and circuit manager of the C.P.P. Telegraphs, has been appointed inspector of telegraphy of the Eastern division. H. Bott is promoted to Mr. Jennings' former position.

R. W. Douglas, who was well known in Quebec, when secretary of the Shawinigan Water and Power Co., has been appointed secretary of the Lumber Trade Club of Boston.

Luke Robinson has resigned the position of superintendent of the Montreal Street Railway.

W. T. Jennings, C.E., was offered a seat on the municipal power commission, with position of consulting engineer. Mr. Jennings could not accept, owing to prior engagements, which would conflict, but he assisted the commission in obtaining a suitable member.

Thomas Fraser, one of the oldest shipbuilders in Nova Scotia, died recently. The deceased had four sons: Graham, general manager of the Dominion Steel Co.; Simon A., who at the time of his death was manager of the Nova Scotia Steel and Coal Co.; James, connected with the N.S.S. & C. Co.'s works, at Wabana, and John W., superintendent of the smelting works, Trenton.

S. Coulson, vice-president and general manager of H. R. Ives & Co., Montreal, died suddenly in Toronto on Jan. 4th, from heart trouble. Deceased was connected with the firm of Coulson, Quinlan & Robinson, who have secured a million dollar contract for repairs on the Lachine Canal, and was regarded as one of Montreal's prominent business men.

Elijah E. Abbott, Gananoque, Ont., died on January 8th, aged 77. Deceased was born in Connecticut. On coming to Canada he joined his brother, D. S. Abbott, who established the Globe Works, Gananoque. On the latter's death, Elijah acquired the machine shop, which he ran for several years. Afterwards he built the factory on the west side of the river, now owned by the Gillies Co. About fifteen years ago he sold out to a company. Mrs. Abbott, four sons and one daughter, survive him.

D. Nicoll is now vice-president and general manager of the C.P.R. and William Whyte, of Winnipeg, Man., second vice-president, and manager of the lines west of Lake Superior. Mr. Whyte is a Scotchman, and began railway life in the North British Railway, coming to Canada in 1863 and entering the G.T.R. Subsequently he became manager of the Toronto, Grey and Bruce, now part of the C.P.R., Ontario and Quebec division. In 1897 he was appointed manager of the lines west of Fort William, and two years ago assistant to Sir Thomas Shaughnessy.

N. S. Braden, formerly manager of the Westinghouse Electric and Manufacturing Co.'s district office, at Cleveland, Ohio, has succeeded the late Thomas C. Frenyear, as sales manager of the Canadian Westinghouse Co., his headquarters being at Hamilton, Ont. Mr. Braden was born at Indianapolis, Ind., thirty-four years ago, and entered the Jenny Electric Motor Co. in that city in 1892, remaining there until 1899, when he joined the Cleveland district sales office of the Westinghouse Electric and Manufacturing Company, as a salesman, subsequently becoming manager.

Sir William Allan, marine engineer, ship owner and member of Parliament for Gateshead, Eng., died last month, aged 67 years. He was well known as an engineer, was chairman of the Albyn line, and a director of Richardsons, Westgarth & Co., Limited. He was born at Dundee, and of his education often said: "The world has been my chief educator, and men my books." Sir William was chief engineer on a blockade-runner during the American Civil War, and was captured and lodged in the Old Capitol Prison, but was released on parole. For fifteen years he managed the North-Eastern Marine Engineer Co., and was proprietor of the Scotia Engine Works in Sunderland.

MUNICIPAL WORKS, ETC.

Stratford, Ont., proposes to spend $70,000 for permanent asphalt block roadways.

St. John's, Newfoundland, is applying to the Government for a grant of $100,000 to improve the water supply.

The Maritime Contracting and Mining Co., Charlottetown, P.E.I., are constructing a gravitation water system, at Springhill, N.S.

Toronto is investigating the Edson system of garbage disposal with a view to installing a plant. The purchase of an asphalt plant is also contemplated.

Justice Davidson has granted an interlocutory injunction to prevent the city of Montreal working the McTavish street reservoir electric pump, owing to the noise and vibration caused by its operation.

What is claimed to be the first solid cement bridge in Ontario has been erected over a creek, near Tavistock. The span is 30 feet with no support between the abutments, which are 3½ feet at the base and 2½ feet at the top. The flooring is 14 inches thick. Cost, $635.

The new cantilever bridge, across the Strait of Canso, will have the longest span in the world, being 1,800 feet. Its total length will be 3,300 feet. Estimated cost, $5,000,000. The Dominion Iron and Steel Co. will supply 35,000 tons of steel for its construction. Waddell & Herrick prepared the plans.

SAVING TIME IN THE DRAFTING ROOM.

BY F. W. SALMON, C.E.

The man who sits on a high stool before a big table and looks serious a number of hours a day, and very often sharpens his pencil, is not always the man who gets out the most drawings or the best. This was very forcibly impressed on the writer's mind some time ago where there were several changes in the office force, and amongst the new comers there was one man who told us all of his long and varied experience in every line of work which, as the writer remembers correctly, included air ships and various devices in the use of radium, and of course all such common things as battle ships, dynamos, electric travelling cranes, blast furnaces, gas engines and racing yachts had been constructed in various parts of the world for all the great millionaires, by this young man whose beard was quite short.

Of course we learned the history of this young man by degrees, but we were all very much impressed by the very complete kit of tools that he carried, which was certainly very attractive and seemed to cover about everything that a man could expect to use in a drafting room, and as chance would have it, this young man was put on the same table beside the middle-aged man who did not seem to have anything, and who was continually borrowing everything (except a two-foot rule), from his neighbor. Nevertheless the man without the tools was busy all the time and did get the drawings and tracings made.

Now the particular incident that I think will prove interesting to the reader happened shortly after dinner, before the engineer had returned, the chief draftsman having come in, looked around very seriously and seeing that everybody was busy left the office, when our young friend with the large box of tools started out to borrow an oil can to oil the small screws on his bow-pen-compasses, which he had said had got dry and were sticking. He had been doing more or less cussing all the forenoon about the "bum-office, without an oil can," and so he went around from one to another telling us all what a beautiful silver plated bicycle oil can had been given him in some town, the name of which I don't remember, which he always carried with him full of a special grade of watch oil, but which he had not thought to bring down to this office, and that he just wanted to borrow ours for a few minutes. Now the chief draftsman always scolds everybody unmercifully that produces a tracing in which the lines appear to have been made on greasy cloth, so we are all desperately afraid of everything greasy, and for that reason used to wear high white collars and long white cuffs, and keep a long way from everything that looked like machinery, so nobody had an oil can, and our young friend with the large number of small tools commenced his second pilgrimage around the office, telling every one of us what a miserable, poor, shiftless, worthless, good-for-nothing, bad, bad, bum-office ours was, because it did not have an oil can. After this had been gone through with, our friend without any tools, called the other man over and asked him what was the matter, and what he wanted, and after receiving the explanation he told him he would fix his instruments, so our young friend seemed to at once jump at the conclusion that he would now get repaid for all the lending that he had done. So taking all the small tools over to the other man, he watched him rub the point of a soft black lead pencil on the screw of each instrument and then run it back and forth, when it appeared to be better lubricated that it would have been with oil, and since that time we have always taught the new-comers to rub a soft pencil on the screws of their instrument with very satisfactory results.

C. E. Brown, recently assistant works manager of the Canadian General Electric Works, Peterboro, Ont., was the recipient of a dress suit case, presented by the employees, on his retiring from the company to accept a position on the Government Commission, appointed to investigate electrical smelting in Europe.

MARINE NEWS.

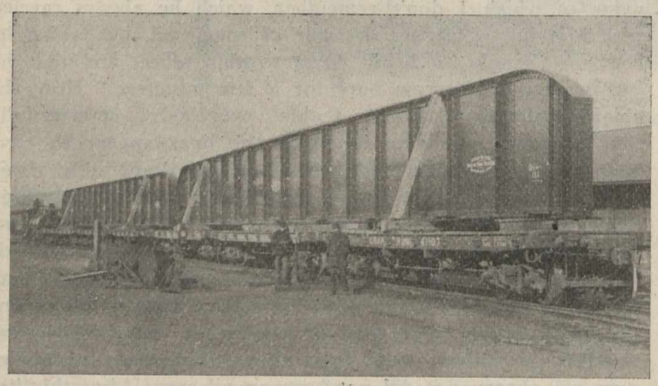
It is proposed to construct a deep ship canal between Lake St. John and Lake Erie.

Across the Missouri river, near St. Joseph, is a ferry run by the river's current. A steel cable is passed across the stream over the boat, and this cable passes through two stationary pulleys on the deck. The boat is held so that the current strikes it at an angle of about 45 degrees, and forces it across the channel. It carries 100 tons of cargo over in four minutes.

The Polson Iron Works, Toronto, is building a composite, double-ended steam ferry boat for passengers, horses and wagons for the Burrard Inlet service of the North Vancouver Ferry Co., B.C. The steel work will be fitted up in Toronto, taken down and re-erected at Vancouver, where it will be riveted up and the work completed. The dimensions are: Length, 148 ft.; beam, 28 ft.; draught, 6 ft. 2 in., with a capacity for twelve double teams and 600 passengers. The engines will be fore-and-aft compound, having cylinders 14 and 28 in. diameter by 20 in. stroke, and two Scotch boilers, 7½ ft. diameter by 10 ft. long, built for a working pressure of 150 pounds. The same firm is also constructing a fast river barge for the Roman Catholic mission in the Peace river district. She is 80 ft. long, 15 ft. beam and 5 ft. draught,, having fore-and-aft compound engines, equipped with a Fitzgibbon boiler. The steel work will be fitted complete in Toronto, and re-erected and completed at its destination.

LARGE GIRDERS.

The accompanying engraving illustrates two heavy girders recently shipped by the Hamilton Bridge Works Co., to the Intercolonial Railway, at Levis, Que., where they will be used for Government street crossing about one mile east of that city. As will be seen, these girders take up the entire space of six cars four of them being 60,000 lbs'. capacity each. The length over all of each girder is 112 ft. and the depth 9½ ft., and the weight of one girder only is 79,000 lbs. or the total weight of the span when put in position will be 266,000 lbs. This is the heaviest plate girder span ever built in Ontario, and has been seldom exceeded in the United States. This bridge is being erected at the point above mentioned under the supervision of W. B. McKenzie, chief engineer of the Intercolonial Railway, and the structure was designed under the supervision of C. G. Milne, chief engineer of the Hamilton Bridge Works Co. It is built as one of the eleven which the company is now erecting on the line of the Intercolonial Railway.



Four new turbines of 6,000-h.p. each have been ordered from a German firm by the Cataract Power Co., of Hamilton, for installation in their power station at De Cew's Falls. These turbines are of the inward discharge type with horizontal shaft.

The Ontario Power Co., whose electrical developments at Niagara Falls are progressing, has let the contract for three turbines of over 11,000-h.p. each. The contract went to a German firm. These turbines are of the inward discharge type with horizontal shaft, and will be the largest in the world.

ELECTRIC LIGHT STATISTICS.

The use of the electric light has increased during the past year in Canada. According to the returns of the officers carrying out the Electric Light Inspection Act, there were last year 324 plants in the Dominion with 14,780 arc lights, and 1,212,861 incandescent lights. Taking the arc as equal to ten incandescent lights, the country had on 30th June, 1903, 1,360,661 lights in use. This is an increase of 236,865 lights in the twelve months, or over 21 per cent. Where there were five lights in 1902, there were six in 1903.

The growth since 1898 has been, establishments, 1903, 324; an increase of 65; arc lights, 14,780; increase, 4,391; incandescents, 1,212,861; increase 749,246, showing an increase of 42 per cent. in the number of arc lights and of 161.6 per cent in the incandescents.

Of the provinces, Ontario is far away the chief employer of the electric light. This province has 205 of the 324 plants in use in the Dominion. It has considerably more than one-half of the total number of arc lights, and 47 in each hundred of the incandescents. All over the province, cities, towns and villages are lighted with electricity supplied either by companies, firms, or the municipalities themselves. Of the latter, thirty-four in the provinces supply themselves with electric lighting.

The province of Quebec, though possessed of enormous water-power, has not adopted electric lighting to the same extent as the sister province. It has 53 plants, 3,853 arc lights, and 409,503 incandescents. It is, therefore, behind Ontario by 4,571 arcs and 158,990 incandescents. It has made, however, greater proportionate gain since 1898 than Ontario, the gain in arcs being: Ontario 36.2 per cent., Quebec 47.6 per cent., and in incandescents, Ontario, 138.6 per cent., and Quebec 212.3 per cent. During the period 1898-1903, the number of plants in Quebec increased by thirteen.

The plants in Quebec are larger than those in Ontario, the average of Quebec's 53 being 15,000 arcs and incandescents, and that of Ontario's 203 being 3,215.

The largest single plant in the Dominion is that of Toronto with its 170,000 lamps, arcs being taken as each equal to 10 incandescents. The next largest is that of the Lachine Rapids Hydraulic and Land Company, 158,503. The third in size is the Ottawa Electric Company with 111,927 lights.

The other provinces have made considerable progress. In the West, Manitoba has increased in 1898-1903 its arc lights from 162 to 373, and its incandescents from 13,800 to 31,905.

The North-West Territories have not increased as rapidly as the other parts of the Dominion, their arcs numbering 29, an increase of four in the period named, and their incandescents numbering 6,677, an increase of 1,997. British Columbia shows the largest proportional increase of any of the divisions of Canada, its increase of arcs being 377 or 82 per cent., and of incandescents 74,297 or 257 per cent. In 1898 British Columbia and Nova Scotia had almost the same number, British Columbia having seven more arcs and 169 more incandescents. British Columbia has now 384 more arcs and 42,326 more incandescents, yet Nova Scotia has increased the number of its incandescents by 32,140 or 111.6 per cent.

The three Maritime Provinces had in 1898, 951 arc lights and 46,977 incandescents, and in 1903 they had 1,267 arcs and 93,120 incandescents, an increase of 33 1-3 per cent. for arcs and of over 98 per cent. for incandescents.

These figures show that an increased use of electric lights is general throughout the Dominion, and that proportionately British Columbia stands first in that increase, with Quebec second, Ontario third, Manitoba fourth, and Nova Scotia fifth.

The Westport, Ont., Milling and Electric Light Co. will have their plant in operation in about a month.

The Electro-Manganese Co. have leased from the New Brunswick Government the Grand Falls water-power for 30 years, and will manufacture ferro-manganese from bog ore The company is now operating a plant at Shawinigan Falls.

THE MANUFACTURE OF COMPRESSED PEAT FUEL.

In its crude state, peat, generally known by the name of "turf," has been the fuel of many in Ireland, Scotland, Holland, Germany, and other European countries. The usual method of preparing peat for fuel is to cut it from its native bed in oblong pieces by specially constructed spades and set them out to dry. After lying for some time they are "turned" (several times if the weather is bad), "footed," "stooked," and "stacked" all by hand labor, but at a cost which prohibits its becoming a commercial article to any great extent. In its crude state peat is bulky, dusty, very friable, and not easily handled, which doubtless has the effect of confining its consumption to the neighborhood of the bog from which it was taken. Machinery for the manufacture of "machine peat," as it is called, has been introduced in Holland, Germany, and other European countries, a report of which may be found in Bulletin No. 5 of the Bureau of Mines, Ontario, which states that: "The drying process occupies from six to eight weeks, and when finished the peat bricks contain about 22 per cent. water, below which point it is scarcely possible by air drying to reduce the moisture in machine peat." As 12 per cent. of the calorific value of any fuel is required to evaporate each 10 per cent. of moisture it contains, it will be seen how important it is to have a minimum amount of moisture in peat as in any other fuel.

T. H. Levitt, of Boston, invented machinery for the purpose of making peat fuel some thirty-five years ago; several plants were erected and his machinery installed in the New England States, but after the attempts had been proven commercially unsuccessful, they were all given up, and nothing has been heard on the subject for many years. In 1866 a company was formed in Montreal to make peat into fuel and succeeded in supplying the G.T.R. with a considerable portion of the fuel used on the Montreal division. The mode of manufacture was taking the peat from its bed by a floating dredge, mixing it with sufficient water to form a thin paste which was "flowed" over the prepared surface of the adjoining bed and allowed to partially dry, when it was cut into blocks, "turned," "footed," "stooked," by hand labor and sent to market containing from 25 to 30 per cent. moisture. The cost of hand labor necessary for this treatment, and the fact that men were hard to get in summer, when no winter work was found for them, constituted the chief difficulties. This, with the short drying season, many weeks being required to prepare fuel in this way, proved too much for those engaged in its manufacture, and the attempt was given up after five years' work, and the expenditure of over $100,000.

This was followed by an attempt to make a peat fuel by a continuous process. Machinery was installed on a scow which excavated the peat, and passed it on to a mechanical expeller, where the water was to be reduced as much as possible. The material then entered a heater where the temperature was over 212 degrees, and the moisture was reduced still further. It was then conveyed in the condition of hot paste into an open tube in which worked an archamedean screw and subjected to a considerable pressure which formed it into a column four inches in diameter. The product was a high class fuel, but the cost made its manufacture a commercial impossibility.

It is only within the last few years that any serious attempt has been made to manufacture "compressed peat," a hard, dense fuel, handled and shipped like anthracite coal, except that it must be kept dry in transit, a commercial article which under certain circumstances takes the place of anthracite coal and replaces wood entirely where used. At the Industrial Exhibition, held in Toronto in September, 1898, great interest was manifested in a Dickson peat press, which ran at intervals during the fair, making an excellent sample of peat fuel which was tested in all kinds of stoves, furnaces, and heaters on exhibition, and proved satisfactory in every case, establishing the fact that compressed peat is a high-class domestic fuel. The only thing necessary after this demonstration was to make it in sufficient quantities to supply the demand, and during the following winter preparations were made for active operation in the opening of spring. Presses were built and companies formed for the purpose of manufacturing peat fuel, and the following summer saw no less than eight plants erected in different parts of Ontario, with fourteen presses installed.

It is to be regretted that so much money, about $100,000, was spent before any one plant had been shown to be commercially successful, but the importance of the enterprise caused money to flow into it in large sums, and had the method and appliances then in use been adequate, large quantities of peat fuel would have been put upon the market during that summer. It was found, however, that hand labor and air drying could not be depended upon for a supply of raw material. In fact, air drying peat cut by hand labor was proven a failure, and new methods and appliances were sought out to meet the difficulty. It was also proven that the press, which was thought to be the most important appliance, was unable to stand the heavy duty required of it, and was practically useless. The power required being far too great and the cost for repairs ruinous. It may be well to state here that peat in its natural bed, even where well drained, contains over 80 per cent. water. Ignorance of this fact and of the nature of the material caused a vast expenditure of money in costly experiments. The Trent Valley Peat Fuel Co., of Peterboro, spent about $100,000 and three years' time in proving that peat cannot be taken from its bed, the water squeezed out, and fuel made by any known continuous process commercially. At other places different methods were tried and much money spent but with one exception, without success. Peat is a most deceiving substance to handle, possessing properties which give totally unexpected results and entirely upsetting all theories and the most carefully considered conclusions, unless based upon scientific principles combined with full practical knowledge gained by actual experience in the field.

The report of the Bureau of Mines comments upon these experiments as follows:

"Drying by Pressure not Successful.—Countless attempts have been made to mechanically expel the water from crude peat by pressure, filtration or centrifugal force, all applied in a multitude of ways, but so far these attempts have invariably ended in failure. At the Trent Valley peat works hydraulic presses built for the purpose by Boomer & Boschert, of Syracuse, N.Y., capable, it is stated, of exerting a pressure of 300 tons, or two tons per square inch, were employed, the peat after passing through the macerating machine being loaded on trucks in layers between perforated trays overlaid with filter cloths ,and in this manner subjected to pressure. Nineteen pressings were made in 10 hours, the output being 14.42 tons of partially dried peat per press. The following summarizes the results so far as removing the water is concerned: Average water contained in peat, entering press, 77.71; leaving press, 63.48.

It will be seen, therefore, that an average of 63.48 per cent. water remained in the peat after pressing. This is almost too high for subsequent drying by artificial heat; but criticizing the results from the other point of view, namely, that of expense, four men and an engineer being required to tend the machine, it must be conceded that the cost was out of proportion to the comparatively small quantity of peat handled and the low extraction of water. The last momentous experiments in this line were carried on for a period of several years at Dusseldorf, Germany, with a patent hydraulic filter press. Unlimited capital was available, and the expenditure amounted to about $100,000, every idea which appeared feasible receiving a thorough trial, so that if at all possible the aim of the process might be accomplished. But all in vain, for the attempt has recently been abandoned as impracticable. Mr. Thaulow thus reports on this point: "It was contended that this press would bring the peat down to contain 50 per cent. water, but it proved difficult to reduce the water even to 66 per cent.; and this required so long a time that for a greater production it would be necessary to employ several presses, which means a large expenditure of capital."

A Successful Canadian Plant.—To Alexander Dobson, of Beaverton, Ontario, belongs the credit of bringing this important enterprise to a commercial success. In the spring of 1899, he purchased a "Dickson" press and breaker, and having erected a small plant

about a mile and a half south of Beaverton on a piece of bog land he had purchased, began the manufacture of peat fuel. The first difficulty he encountered was the impossibility of procuring a sufficient quantity of raw material by the method of hand digging and air drying. Cultivating the surface of the bog and harrowing has also been tried and found inadequate. Any considerable lump of peat even the size of a walnut holds its moisture so long that it makes the harvesting of peat impracticable except by reducing the peat to very finely divided particles and spreading it out over the surface of the peat bed in order that the free moisture may be readily evaporated as in the "Dobson" method. Being of an inventive turn of mind and a practical mechanic, experienced in overcoming difficulties in other branches of manufacturing in which he is engaged, Mr. Dobson soon had an excavator or digger of his own invention driven by electric power at work, which proved satisfactory in taking the peat from its bed, reducing to small particles and depositing it in windrows from which it was spread by hand labor over the prepared surface of the peat bed to dry.

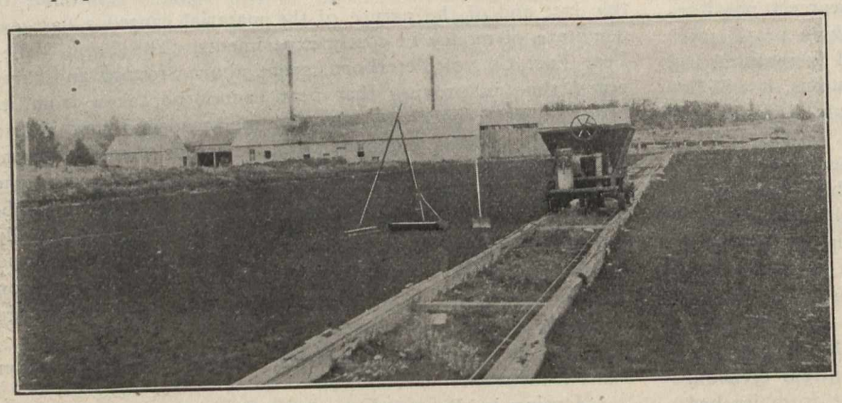


Fig. 1—View of Dobson's Peat Plant, Beaverton. —

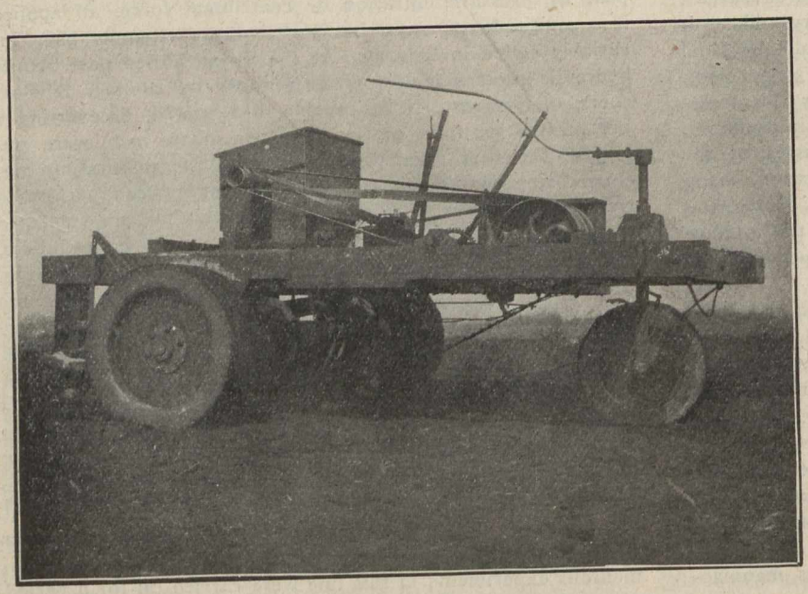


Fig. 3—Dobson's Peat Gatherer.

This machine has been improved and tested during the past five summers, a device for spreading the peat by power being added until now but little resemblance to the original digger is left and the "Dobson" Patented Peat Excavator and Spreader is the result, (Fig. 2), an appliance without the use of which it is claimed to be impracticable and next to impossible to make peat fuel commercially under conditions of both labor and climate obtaining in Canada and the United States. By its use and the labor of one man, 250 tons per day of the raw material is excavated, pulverized, and spread out to dry, the evaporation on an ordinary summer day being so rapid that the 80 tons of water in each 100 tons of raw material is reduced to 10 or 12 tons in less than 24 hours; so that the peat excavated to-day is in the storehouse as finished fuel to-morrow. The gathering of the semi-dried peat is done by another machine of Mr. Dobson's invention (Fig. 3), driven by electric power and directed by one man. It gathers the semi-dry material from the surface of the bed and deposits it in a windrow alongside the tram track, from which it is elevated by another appliance driven by electricity into a motor dumping car and conveyed to the works or stack in which it is stored for winter use. Experience shows that peat once dried is very slow in taking up moisture again, and that only six to eight inches of the top of a stack of semi-dry peat will be affected by the rains or snow of autumn and winter, the use of sheds for storing the peat being of little advantage and unnecessary.

Mr. Dobson found it practically impossible to manufacture peat without means of reducing the moisture remaining in it to the required degree for making a proper block of fuel. Again his inventive genius came to his assistance and before the first season was over he had a mechanical drier at work envolving new principles which met the necessity in a remarkable manner and reduced the moisture to any required degree at a small cost for fuel. This was the forerunner of the "Dobson" Patent Dryer, which for four years

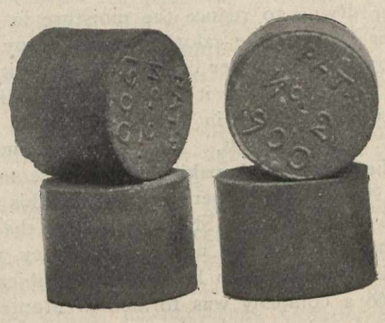


Fig 6—Dobson's Peat Briquettes.

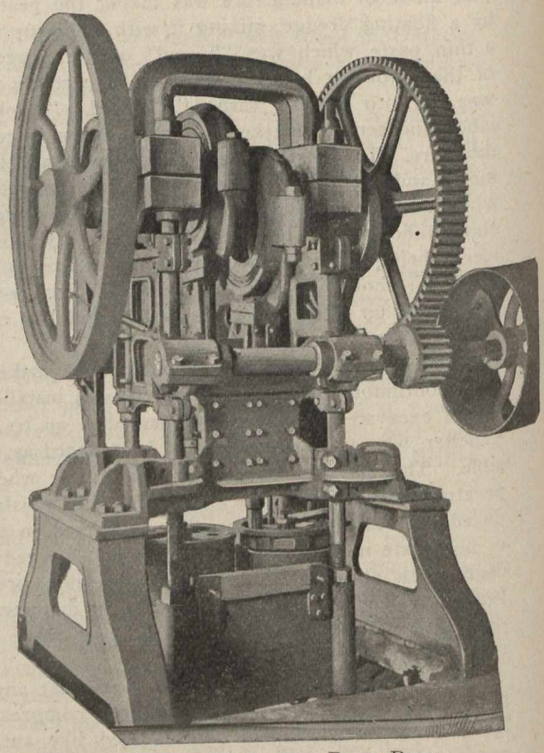
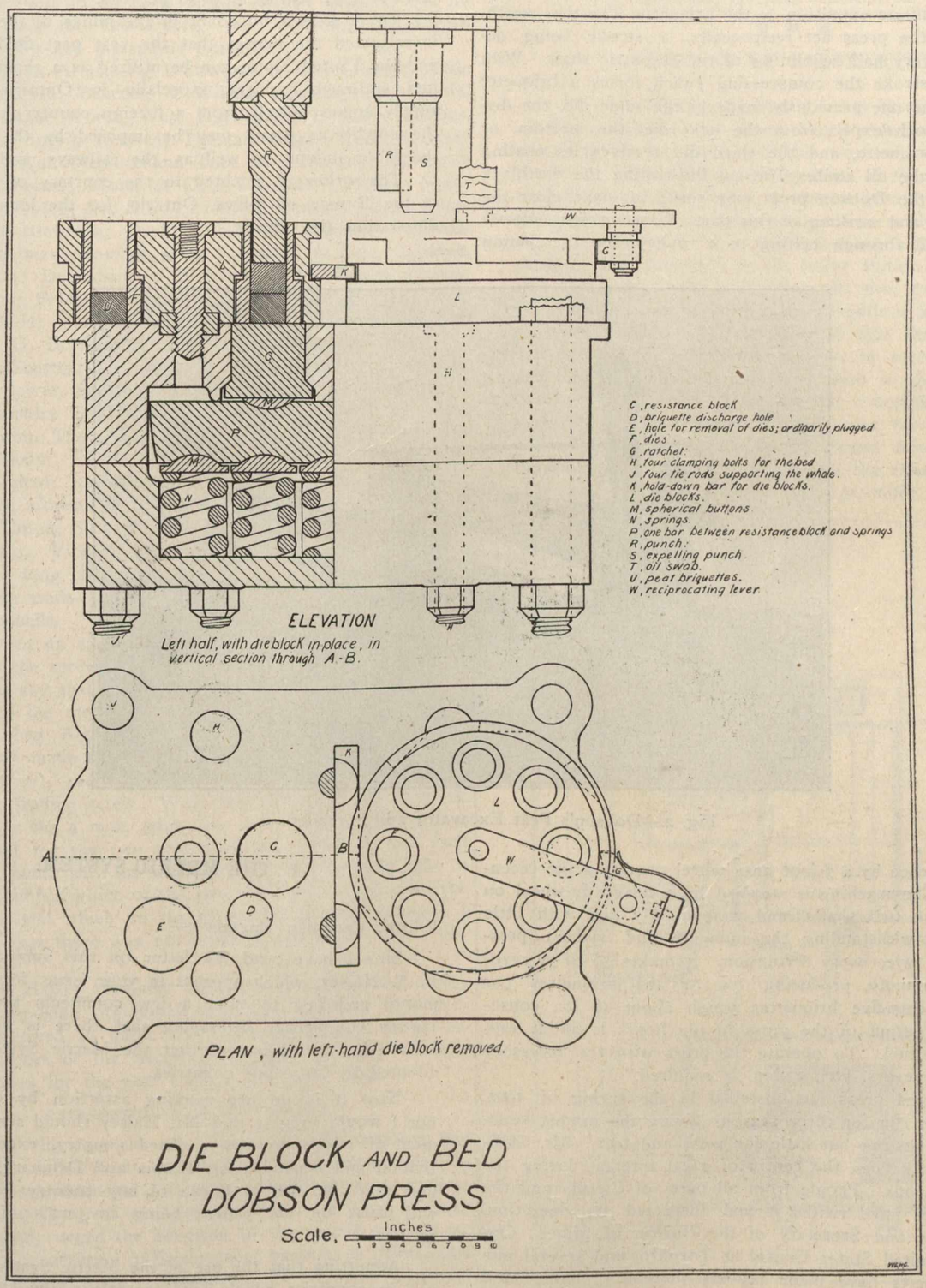


Fig. 5—Dobson's Patent Peat Press.

has proven satisfactory, both as to output and cost of repairs. The cost of installation is moderate, the operation simple and effective, and results most satisfactory.

These two inventions were the result of Mr. Dobson's first season, and being now able to furnish material for the press, he found to his dismay that the very principle of the open tube in which the friction was in opposition to the power, was wrong. On this point the Bureau of Mines' report says: "One difficulty in operating this style of press satisfactorily has proven to be the excessive consumption of power in simply moving the column of briquettes in the dies; in other words, in expelling the briquette from the die.

The tube cannot be of shorter length than sufficient to ensure a sound briquette being made from the poorest quality of peat; but with dense or gritty peats the resistance rises far beyond the required point. This in turn heats the die, causes an appreciable wear on the inner surface, and consumes unnecessary power. The end of this severe duty is usually a broken die or a ripped or cracked gear wheel. A water-jacketting device has been introduced to keep the tubes cool, but apparently not with complete success." The opening of the spring of 1900 found Mr. Dobson at work as follows: "In the 'Dobson' press, friction is almost entirely eliminated, each die previous to being re-charged being oiled to prevent friction of the peat against the die wall in the subsequent expulsion of the briquette. The large number of dies employed for each punch keeps the temperature low. The briquette is allowed to remain in the die in which it is formed for one cycle of the system (about six seconds), and is then subjected to another compression by a second briquette being formed on top of it. Immediately after this, it is expelled and the second block takes its place. It is



upon a press, entirely different in principle, having a fixed, instead of frictional resistance in which all the power would be applied beneficially in compressing the artificially dried, powdered peat into a dense block of fuel and the wear and tear reduced to a minimum (Fig. 4). The result of his experiments in this line is the "Dobson" Patent Peat Press (Fig. 5), which turns out nearly double the quantity of fuel with less than half the power required by the "Dickson" open tube press.

The report of the Bureau of Mines refers to this press found that after the first compression a certain amount of expansion—about one-eighth of an inch in the length of the briquette—takes place, due to the escaping of the imprisoned air forced into the briquette by the descending punch, and this expansion the second compression counteracts, leaving the briquette more solid and compact. There are two punches in each machine, and to each punch a die block containing eight snugly fitting dies. The dies are heavier in the lower end where the compression takes place. The base block, against which the briquettes are formed, remains rigid, un-

less for any reason the strain exceeds the working pressure, when a set of spiral steel springs, on which the block rests, takes up the excess pressure and prevents any breakage. The down-thrust of the punches is imparted by two heavy eccentrics faced with roller bearings, and with each stroke of the punch the die block is turned through one-eighth of a revolution. Working in the next die to the compressing punch is the releasing punch which expels the finished briquette, while the third receives an oil swab which coats the inside of the die with a film of crude petroleum, to lessen the friction and facilitate expulsion of the briquette. The two punch-systems of the press act reciprocally, a stroke being delivered at every half revolution of the eccentric shaft. With each down stroke the compressing punch forms a briquette on top of the one previously made in the same die, the discharging punch expels from the next die the bottom or completed briquette, and the third die receives its coating of oil from the oil swab. The cut illustrating the die block and bed of the Dobson press may serve to make clear the construction and working of this part of the machine. Power is transmitted through belting to a pulley on the pinion shaft, and thence by a 5-foot gear wheel operating the eccentric shaft. The machine is steadied by a heavy fly-wheel on each of these two shafts, and runs quietly and with little vibration, notwithstanding the immense and sudden pressure exerted twice every revolution. It makes 50 to 51 revolutions per minute, producing 100 or 102 briquettes per minute. Twenty-five briquettes weigh about 10 lb., consequently the output of the press in ten hours is about 12½ tons finished fuel. To operate the press with the accessory shafting, conveyors, etc., 13-h.p. is required."

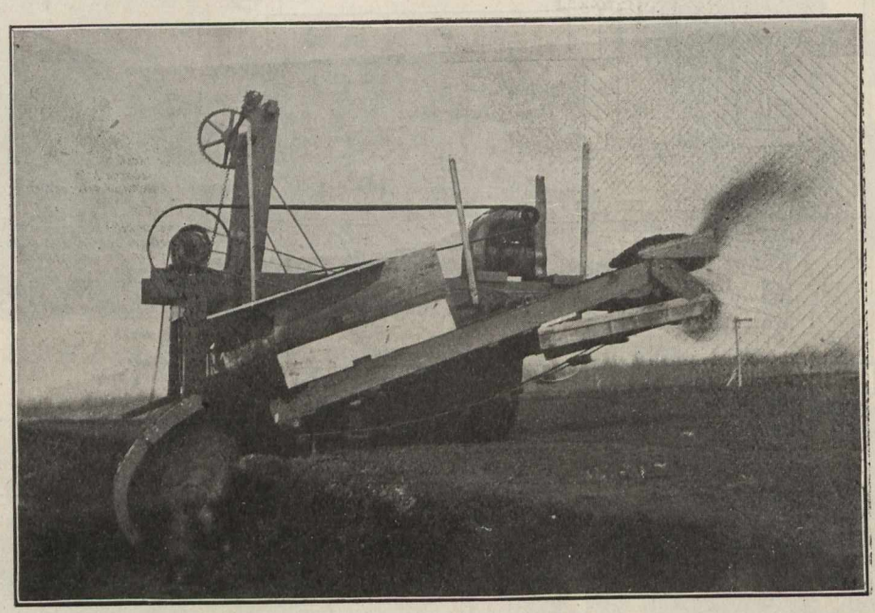


Fig. 2.—Dobson's Peat Excavator and Spreader.

A perfected press was installed in the spring of 1901, and has been run for three seasons giving the utmost satisfaction, and costing but little for wear and tear. Mr. Dobson's plant has been the centre of great interest during the past two seasons. People from all parts of Canada and the United States have visited it and inspected its operation. The Director and Secretary of the Bureau of Mines, Ontario, the United States Consul at Toronto, and several mechanical experts have made reports thereon. Three well known mechanical experts of Toronto, one representing the Norwegian Government, besides several sent by interested parties from the United States, England, Mexico and India, have inspected the plant and process, and given estimates on the cost of production. Without exception, all have reported that Mr. Dobson's claim is more than filled, viz., that with his appliances installed upon a suitable bog, a good commercial article of fuel can be made from peat in a plant of the capacity of 50 tons per day of twenty hours at a manufacturing cost of less than $1.25 per ton. On this point we quote, as follows, from the Bureau of Mines' report on the plant at Beaverton, as found by their expert: "On an output of 12½ tons per day, the total cost of manufacture is $1.01 per ton for the actual operating cost, nothing being allowed for interest on capital invested, wear and tear of machinery, royalty charges, or profits."

Mr. Dobson has installed but one press at his plant, as his peat bed is not large enough to warrant more and the product is sold mostly in the immediate neighborhood. About 500 tons were shipped to Toronto during the past year where it sold at $5 per ton, giving general satisfaction, anthracite coal selling at $6.50 per ton.

There is now no doubt in the minds of those who have investigated the matter that the vast peat fields of Canada and the United States can be utilized as a superior domestic fuel, so much required, especially in Ontario, where the supply comes largely from a foreign country, subject to all the conditions which may be imposed by the demands of the labor unions, as well as the railways and coal trust.

The writer is indebted to the courtesy of the Minister of the Bureau of Mines, Ontario, for the loan of the cuts illustrating this article.

* * *

THE METRIC SYSTEM.

Editor, Canadian Engineer:—

Sir,—I have read the letter on this subject, signed by F. A. Halsey, which appears in your issue for the current month and beg to offer a few comments thereon. Mr. Halsey commences by saying that there is no foundation in fact for the statement that the Metric System has been adopted by forty-four countries.

Now it is no use meeting assertion by contradiction, but I would suggest that Mr. Halsey should send a consignment of goods to any civilized country, excepting Great Britain and dependencies, Russia and Denmark, and he will find that the custom house of any country he may select will insist on his papers being in terms of the Metric System.

Admitting that the use of the Metric System has not as yet, in countries which have recently adopted it, permeated the whole of the interior commerce, your readers will quickly appreciate the argument that, for all purposes of international trade it involves the use of the system by consignors to that country, if it be officially adopted and required by the customs houses.

It is not a fact that in France and Germany there are used old units, side by side with those of the Metric System. There do exist old names—or nicknames—for some of the present units, but it would be just as true to say that we have two coins here of the value of 6d. because it is sometimes called a "Tanner" as to assert that the "Livre" as a

definite weight is still used in France. It is a nickname sometimes applied to half a kilogram.

There are so few opponents of the proposed adoption of the Metric System in this country that it is really helpful to the movement aimed at by my Association to find such an advocacy as that of Mr. Halsey, but he makes a great mistake when he says that the strength of the movement lies with the scientific men. This Association was organized under the auspices of the London Chamber of Commerce, and is supported (as you will see by the enclosed list), by thirty chambers in all parts of the British Empire. It includes among its subscribers, the following well-known manufacturing and mercantile firms:

Sir W. G. Armstrong Whitworth & Co., Limited, Atkin Bros., Sheffield; Babcock & Wilcox, Limited, The Central Marine Engine Works, West Hartlepool; J. Bibby & Sons, Liverpool; Bovril, Limited; Thomas Briggs, Limited, Manchester; British Mannesmann Tube Co., Limited; Brown & Polson; Brunner, Mond & Co., Limited; Cadbury Bros., Limited; Clayton, Son & Co., Limited, Hunslet, Leeds; Clayton & Shuttleworth; David Colville & Sons, Motherwell; J. & J. Colman, Norwich; Jos. Crossfield & Sons, Limited, Warrington; Debenham & Freebody; The Messrs. Denny, Dumbarton; Fraser & Chalmers, Limited; R. A. Hadfield & Co., Sheffield; Harrod's Stores; Hobson, Houghton & Co., Sheffield; G. B. Hunter, Wallsend-on-Tyne; Ipswich Engineering Society; Dr. Jaeger's Sanitary Woolen System; Jonas & Colver, Sheffield; Kayser, Ellison & Co., Sheffield; The Lancashire Explosives Co., Limited; Manfield & Sons, Northampton; The Salford Iron Works; Mappin Bros.; Sir Hiram Maxim; North British Locomotive Co.; A. & F. Pears, Limited; Ransom, Sims & Jeffries, Ipswich; Rudge-Whitworth, Coventry; Rushton, Proctor & Co., Lincoln, The Salt Union; Siemens Bros. & Co.; The Tyne Iron Shipbuilding Co.; Vickers, Son & Maxim. Moreover, it has been for a long time supported by retail trade associations, and by the trade unions and lately by several town and county councils.

I am not an engineer, so must not attempt to deal too fully with the screw thread difficulty, but I may perhaps be allowed to say that I was present at a debate on this subject before the members of the Institute of Electrical Engineers, when Alexander Siemens, C.E., produced four screws, two made on a lathe with a metric lead (a 4 m.m. leading screw), and two made on a bench with an eighth of an inch leading screw. With these he produced two nuts. The nut for the 4 m.m. pitch was made with a French tap, and the nut for the two screws of the eighth of an inch pitch was made with an English tap. No one was able to tell Mr. Siemens which of the two screws were made on the m.m. pitch and which on the other. From this example I concluded that there was not much in the screw thread objection.

As Mr. Halsey concludes his letter by reciting the names of some opposing organizations in the States, I may perhaps be allowed to quote the following passage from the Annual Report of the Secretary of the Treasury of the United States for the year ending June 30th, 1903:

INTERNATIONAL METRIC SYSTEM.

"During the year the attention of this Department has been forcibly called to the growing need for international uniformity in so fundamental a necessity as weights and measures. The Customs Congress of American Republics, held at New York, strongly urged the adoption of the metric system to simplify the transaction of Government business in connection with international trade. Moreover, the National Board of Trade of the United States, the Board of Trade of Canada, and the Congress of Chambers of Commerce of the British Empire have recently urged by strong resolutions the adoption of the metric system. The experience of forty countries of the world has proved beyond question that the international metric system is unsurpassed for practical convenience.

The United States Metric Bill, which Mr. Halsey, in a note, states did not become law, has again been introduced into Congress and has been referred to the Committee on Coinage, Weights and Measures at Washington.

Whether there be a desire for the change in the United States or not, the question is receiving a constantly increasing amount of support throughout the British Empire, and there is every prospect that legislation, which will secure our object, will be passed next session of Parliament.

To take a self-interested view of the matter, it would be better for us if the United States did not follow our lead in this matter, for it would leave us in a position much better able to compete with her in supplying goods to those countries, where the Metric Weights and Measures prevail.

E. JOHNSON,
Secretary, Decimal Association, London, Eng.

PUMPING BY ELECTRICITY.*

(Continued from January Issue.)

The population had more than doubled in the four years preceding the completion of this work of connecting up all the towns. The distribution systems of the towns were extended during that period in even a greater proportion; so that, when finally the pipe system was ready to supply the whole territory, it was apparent that additional pumping capacity was necessary at the lower station if the company was to supply all the water from its own source. An additional capacity of 5,000,000 Imperial gallons was then decided on for the lower station. At that time the Chambly and Lachine Rapids water powers were in successful operation and offering power at attractive rates in the city. Moreover, the load curve of the electric companies had then a severe peak between 4 and 8 p.m., due to the incandescent lighting. This peak during the winter nearly reached the limit of their full capacity. During the other twenty hours there was more than three times as much unused power.

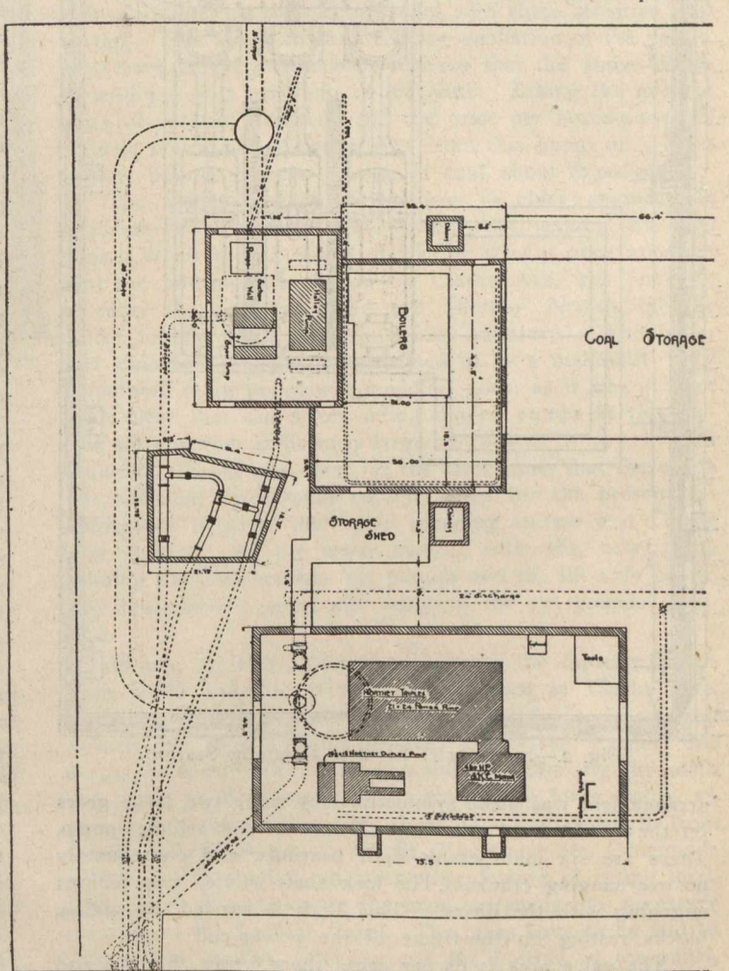


Fig. 1.—Plan of St. Gabriel Station.

Accordingly, by arranging to take the greater portion of power during the twenty hours outside of the peak load, very reasonable flat rates were obtained.

The capital cost of a 5,000,000 Imperial gallon electric pump was then considerably less than that of a steam plant of equal duty reckoned on a steam basis. The estimated at-

* From a paper read before the New England Waterworks Association, by F. H Pitcher, C. E., Chief Engineer Montreal Water and Power Co.

tendance was only two-thirds of that for a steam plant. Electric pumping was therefore decided upon.

Accordingly, the 5,400,000 Imperial gallon triplex electric pump now running at the lower station was installed, and put into operation in 1899.

FIRST ELECTRIC PUMP INSTALLED AT THE LOWER STATION.

This pump is a 21-inch by 24-inch horizontal double acting, outside centre packed power pump, and is direct connected through single reduction gearing, and a "Worrall" friction clutch to a 480-h.p. S.K.C. synchronous motor. The frequency of the power was 66 cycles per second, and a 22-pole machine was adopted. This gives the comparatively low motor speed of 180 revolutions per minute. A piston speed of about 80 feet per minute was fixed, and single reduction gearing adopted with a ratio of 8.88. The gearing

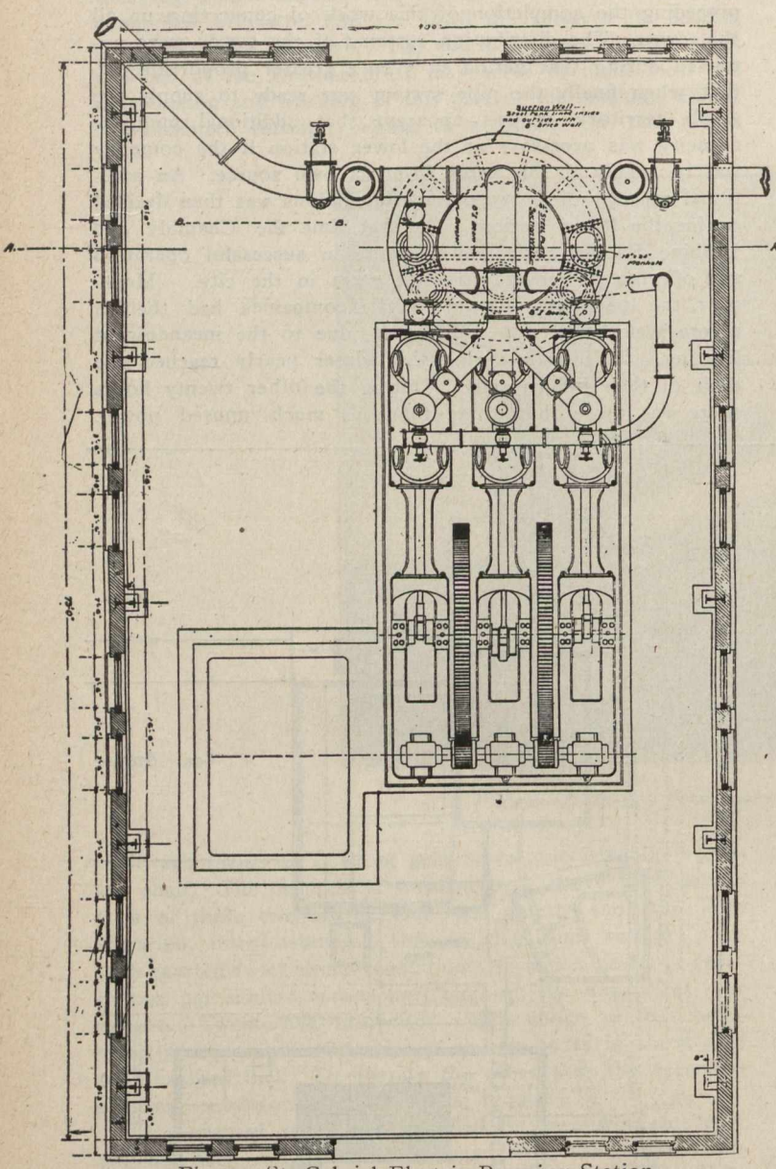


Fig. 2.—St. Gabriel Electric Pumping Station.

arrangement was made symmetrical by using two large gears on the crank shaft, one on each side of the middle pump. There are six main crank shaft bearings, and consequently no overhanging cranks. The jack shaft carries two pinions engaging with the gears. This shaft is carried by pillow blocks resting on the frame of the power end.

The valve area is 65 per cent., there being 36 three and one-half inch valves in each deck. The water chambers are of the externally smooth vertical cylindrical type, having internal ribs. The rigid frame carrying the jack shaft and crank shaft is tied to the pump ends in the usual way by heavy castings, which form the guides for the cross heads. This makes a very symmetrical and pleasing design, with at the same time almost a maximum compactness. Other principal data concerning the power end of this pump are as follows:

2 C. I. Gears 178-in. pitch dam. 160 Teeth 3,494 circular pitch.

2 C. I. pinions 20.12-in. pitch diam. 18 Teeth 3.494 Circular pitch.

Reduction ratio, 8.88.

Average speed of pump shaft has been maintained at 21 revolutions per minute. The three-throw crank shaft is a steel forging, 10 inches in diameter through journals and crank pins, and 12 inches diameter at gear hubs; over all, length 16 feet 2 inches. Steel pinion shaft is 7½ inches diameter through bearings, 9¼ inches at pinions. Rectangular locomotive type connecting rods, 6 feet long, centre to centre. Cast-steel cross heads, circular brass shoes, cross head pins 7 inches diameter. The main bearings consisted originally of solid phosphor bronze boxes and journals as well as the crank pin journals. The bronze plunger rods are 4¾ inches diameter. The three pinion shaft bearings were of the spherical self-aligning type, common to electric generators and motors. They were babbited. The water end was provided with the usual suction run around pipe, a discharge air chamber over each uptake, and one main suction air chamber. Discharge pipe is 20 inches diameter, suction 24 inches diameter. Separate suction and discharge stop gates are provided for each pump, so that any or all pumps could be cut out at will. In addition, a main hydraulic by-pass valve was provided for starting and also for reducing the load on the motor during the four hours of the peak of the load of the electric power company. By means of this valve the pressure is held at any desired point below that of full load. There was also provided an 8-inch spring relief valve of the Ashton type for each pump. These remained set at the same maximum pressure. There are, of course, the usual main discharge, check, and foot valves. A feature of this installation was a new steel intake well, or rather tank, below high-water level in the river, and a 36-inch steel intake pipe connection between this and the 36-inch wooden intake pipe to the old station. The air-charging device is the usual water column and air valve arrangement.

The motor, as above mentioned, is a 480-h.p. two-phase, 66-cycle, 2,400-volt synchronous machine of the S.K.C. type, that is, a stationary field and armature with a revolving inductor. There are then no revolving coils, whatever, merely a cast-iron spider carrying laminated steel pole pieces. A feature of this machine is its large air gap, as compared with induction motors. This gives perhaps greater security in its operation. The fields of this machine are excited in the usual way by a belted 10-K.W.D.C. generator. This little machine is shunt wound, and has a rheostat in both field and armature by which the exciting current of the motor is adjusted. The starting motor is a small 15-h.p. S.K.C. two-phase, 500-volt induction machine, which can be thrown in or out of gear with the 5-foot 4-inch cast-iron spur gear carried on the motor shaft. The speed of the starting motor is regulated by a water rheostat in its motor by means of which the large motor, when in mesh with the starter, is brought into synchronism with the line. There are the usual ammeters, voltmeters, etc., on the switch-board, as well as fuses, lightning arresters, etc. No wattmeters were provided on account of the power being bought on a flat rate based on the maximum load. The lower voltage required for the starting motor necessitates two transformers, one on each phase. During the four years this machine has been operating, the company has had every reason to be satisfied with the motor itself. One stator coil was burned out some years ago, due to the motor going out of step on a short circuit and not being taken off the line in time. As long as normal conditions are maintained on the line, this machine runs with little trouble. This type, and more especially this particular machine has not sufficient regulation to stay in step when a sudden drop in line voltage of any considerable amount occurs. Unfortunately, however, for this type much auxiliary apparatus is found to be necessary. A flat on the commutator of the exciter, not quite enough resistance in its fields, may cause, and has caused in this case, a shut down of serious import. An extra armature is carried for the exciter; but this part of the apparatus has been uniformly found to be the weakest in the electrical equipment. Trouble has also been experienced with

the starting motor transformers. Lightning, not grounded, burned them out at first. They were then provided with switches which enabled their primaries to be taken off the line when not in use. The above accident caused a shut down of nearly a day. The burning out of the little transformers for the synchronizing lamps has also shut the pump down.

On the whole, the points against a synchronous motor from the user's standpoint are found almost entirely in its auxiliary apparatus. On the other hand these motors are virtually more efficient than their induction rival, inasmuch as the central station, or people selling the power, often take account, in fixing the rate, of the power factor of the motors they operate. By over excitation, as is well known, the power factor can be brought practically to unity; in other words, the wattless current is wiped out. In that case the consumer gets all the power he pays for; in the other

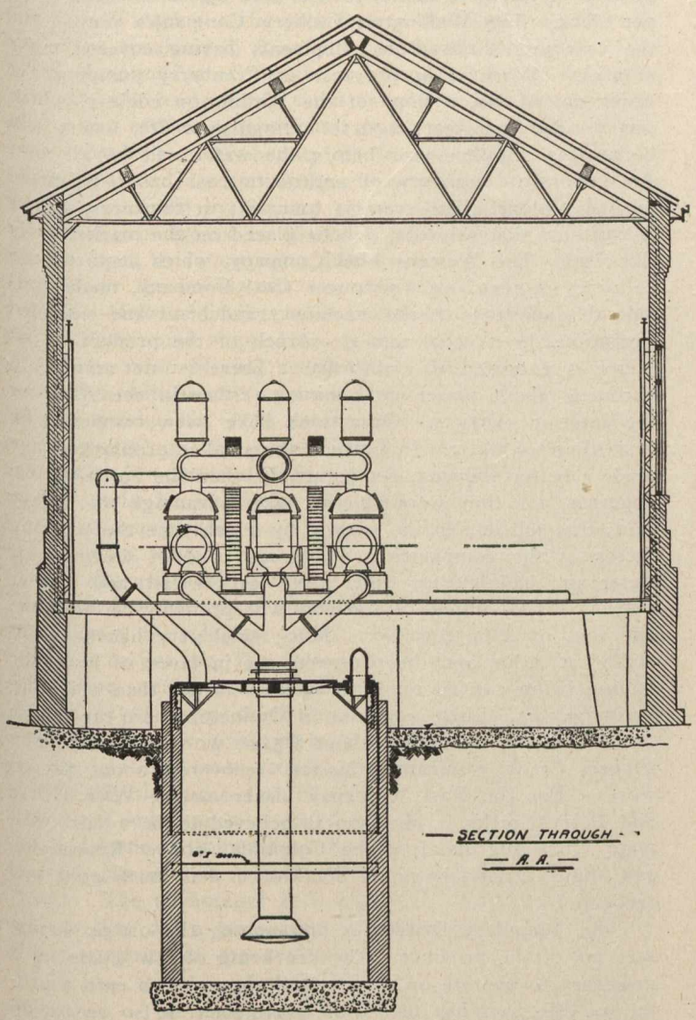


Fig. 3.—St. Gabriel Electric Pumping Station.

only, say, from 70 to 90 per cent., depending on the ratio of the true to the apparent watts of the motor. If no account of this is taken by the central station then everything is in favor of the induction motor. However, more will be said about this type of machine when describing the Clarke Ave. plant.

To return to the operating of the pumps: In order to reduce the noise of such heavy and comparatively high-speed gearing (980 feet per minute), to a minimum, raw-hide pinions were at first adopted. These were built up in the usual way with layers of raw-hide on a cast-iron centre and held between shrouds in one piece with the centres. Steel bolts were inserted from end to end and an inch or more extra raw-hide face provided to allow for taking up shrinkage. These, when they ran well, were very noiseless and smooth, but it was soon apparent that they would not answer. The middle of the tooth seemed to spring away from the work and leave the ends near the shrouds to do most of it. This caused excessive wear. Moreover, the shrinkage with this raw hide was so great that fibre had to be inserted at the ends in order to take it up. Finally it became impossible to take up the shrinkage. The raw hide seemed to loosen between the shrouds, and the pinions failed by cracking at the root of the teeth. While this was going on the vibration in the large gears was extreme and the noise excessive. It was essential to start this pump again without any unnecessary delay. Shrouded machine moulded pinions were therefore put on and are running to-day, but, as might be expected, with considerable noise. The wear has also been great, and the writer has concluded to abandon the two sets of gearing, substituting therefor one set in the pit next the motor. The frames are fortunately wide enough to allow a 21½-inch face, which will be ample for the 300-h.p. now transmitted by those gears. The crank shaft is also sufficient to allow this change. It has, moreover, been decided to get 10 per cent. more water out of that pump than at present by reducing the reduction ratio. A single pair, consisting of a machine-cut cast-iron gear and machine-cut steel pinion, is now on order for this pump. Another source of trouble at the start was found in the phosphor bronze boxes. There was too much anxiety for the water from this pump to give these a fair chance to come to a surface. They took this occasion to heat badly and seize, and therefore had to be afterwards lined with babbit. Thus equipped, this pump has run without any extraordinary repairs since October, 1899, to the present time.

EFFICIENCY TESTS.

By testing this plant with a Weston direct reading wattmeter on the motor circuit, and indicating the water cylinders at the pump end with Crosby indicators, an overall efficiency as high as 85 per cent. from electric line to water has been observed. There is, however, considerable difficulty in observing the electric input with these sensitive watt meters. This is due to the irregular oscillation of the needle. But there is every reason to believe that the above figure is within 2 or 3 per cent. of the truth. Taking the average price of coal in Montreal, and the price per horse-power of electric power, we obtain a duty from this pump on a basis of foot pounds per 100 pounds of coal, about 87,000,000.

The writer entered the company as chief engineer in September, 1899, while this pump was making its trial runs. When it was finally started, it was at once apparent that the intermediate station on Clarke Ave. was not able to carry the additional load and thereby furnish all the water for the high levels and back territory. The boiler and chimney capacity were added to as a makeshift until something more permanent could be done, as it was at once made clear that the direct acting duplex pumps at this station were neither sufficiently large or efficient to do the work required. It was also clear, at the same time, that there was not sufficient force main capacity even for the present requirements between the lower pumping station and Clarke Ave. Station. At the lower station, with the new pump running, the pressure was 145 pounds and the lift only 200 ft. The new electric pump was designed for 120 pounds' pressure.

It was, therefore, decided to increase the capacity of the force mains and that of the pumping plant at Clarke Ave. Accordingly, a new 24-inch main was laid to St. Henri, and 14-inch and 16-inch mains in that town—the former one across the town from east to west,and the other straight north and south to Westmount. This gave three force mains, 12, 14 and 24 inches in diameter, about 6,500 feet in length from the St. Gabriel Station to the St. Henri and Ste. Cunegonde gridirons. In passing, an interesting feature of laying force mains from this station to the main system is the necessary crossing of the Lachine Canal. The pipes have to be laid to give a clear 20-foot waterway and the bottom of the canal, where the company's crossings have been made, is a *quasi* quicksand. The work is, of course, done at the low water during the Government repairs to the canal in the spring, but the material in the bottom renders coffer damming and trenching difficult. This new work when completed reduced the pressure to 85 pounds, with 5,500,000 Imperial gallons' consumption. It has now worked up to between 93 and 94 pounds.

Besides the consideration of economy, there was another and perhaps a more important factor to consider in deciding

on the type of pump for Clarke Avenue. The surrounding property is of a purely residential character and of a good order. The pumping station is on a very steep hillside. The smoke and hauling of coal up the hill incident to the operation of a commercial steam plant were much complained of by the neighbors, and proceedings were threatened. Knowing, however, that it was a choice between some noise and vibration in the immediate vicinity on the one hand, and smoke and dirt over a broader area on the other, the choice fell to an electric plant.

(Continued in next issue.)

✤ ✤ ✤

MINING IN SOUTHERN BRITISH COLUMBIA.

The New Year issue of the Nelson, B.C., Daily News contains a very comprehensive review of the mining industry in southern British Columbia, based upon authentic information obtained by reliable writers, of which the following is a summary:

A mineral production, value nearly $12,000,000, is the result of mining in southern Kootenay and the Boundary district of southern Yale for the year 1903. These are approximate figures, but they are as accurate as the necessarily incomplete data obtainable before the year closed, and the final figures available permitted. To be exact, the estimate of the president of the Associated Boards of Trade of Eastern British Columbia, was $11,932,639.10, in the following proportions:

	Quantity.	Value.
Gold, ozs.	204,147	$4,219,718 49
Silver, ozs.	3,471,421	1,839,953 13
Copper, lbs.	24,866,977	3,332,174 92
Lead, tons	10,168	489,792 56
Total metallic production		$9,881,639 10
Coal, tons	652,000	1,304,000 00
Coke, tons	166,000	747,000 00
Total mineral production		$11,932,639 10

The total production of gold, silver, copper and lead in Canada east of the Rocky Mountains in 1902 was: Gold, $279,836; silver, $399,629; copper, $1,107,022, and lead, $11,038; total, $1,837,525. The figures for 1903 are not available for comparison, but with a liberal increase for last year it is apparent that southern British Columbia leads the way, besides which the remaining mining sections of the province last year had a total production equal to 80 per cent. of that east of the Rockies. The Kootenay is behind the eastern provinces in coal production, but this industry is making rapid progress. It must be stated, however, that in 1902, besides coal and coke, value $12,245,284, the other provinces had a production of iron and nickel valued at $6,103,882, so that the aggregate production of metallic minerals was proportionately larger than the mineral production of British Columbia. The aggregate production of metallic minerals in Canada east of the Rocky Mountains in 1902 was, however, nearly $2,000,000 less than that of the Kootenay and Boundary districts in 1903. It is claimed for this province that it is the mining province of the Dominion and the foregoing comparisons are made to emphasize the fast increasing right British Columbia has to this distinction.

Before noticing the Kootenay and Boundary, some general remarks relative to other parts of the province are given. On Vancouver Island and other coast parts there was considerable development and production in several mining sections. At Mount Sicker work was confined to the Tyee, Lenora and Richard III. properties. At the Tyee two miles of work have been done underground in this copper-gold mine, chiefly in the opening up of the southern ore body occurring on it, this being up to 40 feet in width in places. A cross cut from the south walls is being run at the 165-foot level to explore the property to its full extent. Two ore bodies been have passed through, and beyond these lode matter has been encountered. During the year the capacity of the mine aerial tramway was doubled, enabling shipments to be made at the rate of 5,000 to 6,000 tons per month. At the Ladysmith smelter, owned by the Tyee Copper Company, there was smelted in 1903, 50,000 tons of ore (including custom ore), this producing 4,700 tons of matte valued at $590,000. The company owning the Lenora mine got into financial difficulties, but the property is now under lease to the principal members of the Northwestern Smelting and Refining Co., operating the smelter at Crofton. The outlook for the Lenora is favorable, with a considerable amount of ore of a commercial grade in sight and other shoots within reach. The tonnage of ore treated at Crofton could not be ascertained, but besides the Lenora ore shipments were received from Marble Bay and Van Anda, on Texada Island; Quatsino Sound, where the smelter people are now operating the Yreka mines; Gribble island, Republic (Washington), Alaska, and other parts.

Coal mining on Vancouver Island was seriously interfered with in 1903 by labor troubles. Since then the production at all three collieries has been 15,000 to 20,000 tons per week. The Wellington Colliery Company's output for the year was 581,013 tons, shipments having covered eight months. Work is in progress at Cranberry pumping the water out of No. 2 slope of the Wellington colliery, which was flooded two years ago to extinguish a fire, but it will be at least another year before the water will be all out. An important discovery of anthracite coal has been made in No. 7 slope. The seam is four feet in thickness, and it is expected that this coal will be placed on the market early this year. The Western Fuel Company, which acquired the collieries of the New Vancouver Coal Company, made considerable additions to the machinery and plant and extended operations in its coal mines. Much of the product of its mines is exported to California. There is not much to chronicle about placer gold mining, either in the Atlin or the interior districts. Operations have been restricted by a shortage of water. In Cariboo the smaller properties have made a better showing, comparatively, than the big hydraulic concerns, for they were able to take advantage of heavy rains that fell late in the season, by which time the working forces of the companies had become tired of waiting for water and had left for other parts for the fall and winter seasons. The output of Cariboo will probably be $300,000, and that of Atlin $400,000. Much machinery has been installed at Atlin, and the prospects are in favor of hydraulic mining being carried on by companies rather than placering by individuals. Little was done in Omineca, where the Arctic Slope Company recovered about $15,000 worth of gold. The Thibert Creek Company, Cassiar, recovered about $25,000 worth. For the East Kootenay placer camps, Wild Horse and Perry Creeks, a like sum is believed to be a fair estimate. The Big Bend of the Columbia, above Revelstoke, saw some activity, but it is not known that much gold was recovered.

The Boundary District is first among the ore-producing sections of the province. The ore being of low grade, it is necessary to operate on a large scale in order to earn a profit, and this fact has tended to amalgamation, so as to secure uninterruptedly a large supply of ore. The larger mines have a daily output of 600 to 800 tons, and in one case 2,000 tons. Those mines owning smelters are making money, most profitable results ensuing where several furnaces can be kept running continuously. The British Columbia Copper Co., Limited, of New York, owning the Mother Lode mines and the smelter at Greenwood, and the Snowshoe Gold and Copper Mines, Limited, of London, England, owning the Snowshoe group, near Phoenix, have agreed to consolidate, and it is proposed to organize a new British company with a capital of $5,000,000.

In the Rossland district, a more hopeful feeling exists, due, no doubt, to the adoption of new methods and the introduction of more modern machinery, amongst which may be mentioned, the "Elmore" oil concentrator at Le Roi No. 2, the preliminary mill and concentrator, and 50-ton "Elmore" oil plant of the Rossland Power Co. The belief that the "Hendryx" electro-cyanide process is suitable to the low grade ores, and the success attending deep mining at Le Roi and White Bear, at depths of 1,350 feet, and 1,000 feet respectively, also tends to justify a more encouraging outlook for 1904.

In the Slocan district two matters stand out prominently: (1) The bounty to be paid on lead produced in Canada, and its effect on the silver-lead mining industry of the Slocan, and (2) the importance of turning to profitable account the zinc contained in some of the Slocan ores. The Payne Consolidated Mining Company, Limited, has got to a point where it can put on the market a desirable quality of zinc product averaging 55 per cent. zinc and carrying some silver values, at the rate of 350 to 450 tons per month. The growing importance to the Slocan of this zinc production question, as compared with that of lead, should be emphasized. In support of this contention it is pointed out that spelter is quoted in London at £21 per ton, while the price of lead, which rules quotations for British Columbia, has been about £11, rather more than half the price of spelter. Further, there is a growing demand and a shortage of desirable zinc ore; while there is an abundance of lead coming from South America and other parts in a position to flood the British market. The president of the Associated Boards of Trade, speaking in Rossland last month, prophesied that under the stimulus of the liberal bounty offered by the Government, the lead mining industry of the province will revive and attain proportions greater than ever before. It is added, that the bounty on lead shipped to Canadian smelters since July 1st, 1903, will probably be settled, and 60 per cent. paid by January 15th. This would involve the distribution of $50,000 to $60,000 at least. With the retained 40 per cent., to follow after June 30th next, the total earnings under the bounty are, approximately, $105,000.

The Nelson district made substantial advances. The Silver King mine shipped nearly 5,000 tons of silver-copper ore to the Hall Mining and Smelting Co.'s smelter at Nelson. The Athabasca-Venus mines had a profitable and continuous production. The development of the May and Jennie property, on Forty-Nine creek, was continued, and in the spring a quartz mill and cyanide plant of 100 tons daily capacity will be installed. The Star group of four claims has been acquired by the Sharpless Mining and Milling Co., Philadelphia, which has leased the Granite-Poorman 20-stamp mill and aerial tramway, and let a contract for hauling from the Star mine about sixty tons of ore a day. Another tram to complete connection between the mine and mill will be put in. The Duncan United Mines, at its Poorman mine, mined and milled 10,000 tons of ore producing approximately 2,500 oz. bullion and 270 tons concentrates. The Juno is now in shape to ship regularly.

One of the most striking developments in the Nelson mining division was the Hunter V. property, near Ymir. The great importance of the discovery, made in 1902, of the large deposit of mineralized limestone, was not recognized at first, but now it is being demonstrated to an increasing extent. The advantages here combined are unusual, including, as they do, a wide area of mineralization with an immense quantity of ore available.

In the Ymir camp several properties were successfully developed. The Ymir mine was operated under difficulties, and, it is understood owing to the low grade of the ore, at a loss, but efforts are being made to find ore similar to that which formerly made the mine a dividend payer. The Ymir district, at the annual Interstate Fair, held in October in Spokane, Washington, secured first prizes for gold nugget and free milling gold ores.

An industry connected with mining and centred in Nelson is that of B. C. Riblet's aerial tramway construction, for which, in 1903, about eighty miles of cable was used. All the metal equipment for these trams, except the cable, was manufactured in Nelson.

In the Kamloops district, the outlook is bright. The failure of the dredge upon the North Thompson river caused disappointment. The dredge changed hands and was moved to Tranquille creek, eight miles west of Kamloops. There it has remained, forcing its way up stream, cutting down the banks, and throwing up a barrier which will prevent its return. There is, however, work ahead of it for years. The dredge has handled 1,800 cubic yards of gravel per day. The gravel is at present dredged to a depth of 18 feet, the best values being found in clay at 15 feet. It is understood to be a paying venture, and operations will be renewed next year. Other streams in the district being known to contain gold, it is predicted that the next few years will see several dredges operating. On Coal Hill the Iron Mask and Copper King properties are making good progress.

Some months ago, the B. C. Exploring Syndicate, which owns the Iron Mask mine, arranged with the Ashanti Lands, Limited, London, England, for the latter to instal a power plant, and a concentrator, and continue development work. Prior to this about 4,000 feet of work had been done above the 500-foot level, and below this depth prospecting with the diamond drill has been carried on. An order for the power plant and concentrator was placed with the Vancouver Engineering Works, and the Canadian Rand Drill Co.

The Copper King property, after many vicissitudes, has at length become a shipper, and satisfactory returns have been received from the smelter.

In the Lardeau district substantial progress has been made. In the Fish river portion the erection of two stamp mills at Camborne gave an impetus to mining, the two properties directly affected being thereby placed in a position to pay the cost of operating. The similar development of other properties is being also encouraged. In the vicinity of Ferguson, the further development of the mines of the Great Western and Silver Cup Companies, and the extensive provision of plant and other facilities for the reduction of their ores, and, in a smaller degree, the working of the Triune mine, prevented retrogression; while the discoveries of rich surface showings of gold at Polar Creek caused an influx of population and a general prospecting, with results that appear to justify the expectation of permanent mines being developed there.

THE ENGINEERS' CLUB OF TORONTO.

The annual meeting of the Engineers' Club of Toronto, was held in the club rooms, 94 and 96 King St. West, Toronto, on January 7th, under the presidency of C. H. Rust. The report of the executive committee was presented showing a total membership of 139, an increase of eighteen members during the year. Seventeen meetings were held in 1903, and an excursion to Niagara Falls was made on May 30th last. The treasurer's report showed that the Club is out of debt and has a reserve fund of $326. The weekly luncheons have proved a success, in that they afforded members, unable to attend in the evening, an opportunity of meeting each other, which they otherwise would not have. Additional furnishings have been added to the rooms, thereby improving their appearance, and increasing the comfort of the members. The following were elected officers for the ensuing year: President, Captain Killaly Gamble; vice-president, R. F. Tate; second vice-president, James McDougall; treasurer, A. C. Larkin; secretary, Willis Chipman; directors, J. G. Sing, A. J. Van Nostrand, and W. H. Patton.

The retiring president, C. H. Rust, gave a review of the progress made in a few branches of engineering in the past decade, in the course of which he referred to the questions of sewage disposal, garbage destruction, and street paving, saying in part:

"Dealing with the question of sewage disposal; ten years ago, if purification of sewage was necessary, the system generally adopted was precipitation by chemical means. The number of chemicals that were used or advocated as precipitation agents were numerous, many of them on practical tests proving worthless. Others were abandoned on account of the expense, and after a number of experiments it was found that lime and sulphate of alumina were the most reliable and satisfactory. The process of precipitation removes from 50 to 60 per cent. of the organic matter and while fairly satisfactory is objectionable on account of the large amount of sludge resulting, and the difficulty of disposing of the same. A number of cities at the present time are still using this method of disposal. The systems of broad irrigation and intermittent downward filtration are satisfactory, providing a sufficient quantity of land of a suitable soil can be procured at a reasonable cost, and proper supervision is exercised, but in many cases, through care-

lessness and on account of placing more sewage upon the land that it could possibly dispose of, a nuisance has been created and other means of treatment had to be adopted. These methods of treatment have in some instances been superseded by septic tanks and contact beds, which has to some extent remedied the sludge nuisance. It is estimated, I believe, that the sludge produced after septic tank treatment is only one-seventh of that resulting from chemical precipitation. After tank treatment, the effluent is passed on to contact beds, composed generally of cinders, although broken stone and gravel have been experimented upon with fairly good results; coke, which was generally used, having proved unsatisfactory. A number of towns and cities in England have been experimenting with this method of sewage disposal for a number of years, and the results have been on the whole satisfactory, so much so that Manchester has adopted this system and the works are now under construction. The method of disposal in that town up to the present time has been precipitation by chemical means. Two important points which have not yet been fully decided upon is the life-time of the beds and the annual cost of operation. I, however, think that in this country, where suitable land can be obtained at a reasonable cost, septic tank treatment followed by after purification upon land will be found the most satisfactory method of disposal. I do not anticipate any difficulty owing to our severe climate. In England, in some cities the sewage is placed upon the contact beds by means of a continuous, revolving sprinkler, which has been found very satisfactory, but I do not think it would be possible to adopt this system during our winter months. I need hardly point out that in the operation of any sewage disposal works it is absolutely necessary, in order to ensure good results, that the works are placed in charge of experienced men, and that a chemist be employed to make frequent analysis of the effluent.

"Another important matter that municipal engineers have to deal with is the question of garbage disposal. Until recent years, the method of disposing of garbage, street sweepings, ashes, etc., was by dumping them in some low and unfrequented spot, but the great growth which has taken place during the past ten years in our large cities has rendered this impossible, and other means of disposal had to be considered. In England and on the Continent every city of importance has one or two garbage destructors in service and this method of disposal has been adopted in a number of American cities. In England these destructors not only satisfactorily dispose of garbage, but also generate steam for commercial purposes, such as electric street lighting, etc. There has recently been introduced in the United States what is known as the "Edson" system of garbage disposal, whereby the garbage is treated in digesters and the grease and fertilizing material extracted. The patentees of this process anticipate a considerable profit, their estimates running as high as $4 per ton."

Referring to the paving of streets and sidewalks, in Toronto, Mr. Rust said: "In 1887 the first asphalt pavement was laid in this city and there is now about 46¼ miles of this class of pavement. At that time the only paving material used was cedar block and macadam. In 1892 the mileage of cedar block pavements had reached 117, and it is now reduced to 45. This class of pavement has never been a favorite, largely owing to the fact that the first pavements laid were allowed to become worn-out and dangerous, as no repairs were attempted nor was any repaving done. Cedar block makes a very good pavement for five or six years: it is cheap, noiseless, and easily repaired, whereas macadam is very dirty in wet weather and very dusty in dry weather, and a very expensive pavement to maintain. I think the ideal pavement for city streets are wooden blocks treated with a preservative and laid on concrete, asphalt and brick, although the latter is objected to on account of the noise. One of the most important questions to be considered in the construction of pavements, especially in large centres of population, is freedom from noise. This matter has not received the attention that it should, especially in American cities, but in London it was an important factor in deciding upon the use of the wooden block pavement. There is about 14 miles of brick pavement in this city, and so far it has given good satisfaction, with the exception of the noise. Very few repairs are required, whereas during the past year we spent about $18,000 upon asphalt repairs, exclusive of the repairs carried out by the various contractors under their guarantees. In this connection there is another matter that has been very much discussed and upon which engineers hold diverse opinions, viz., the question of the guarantee. In Toronto for some years past we have called upon the contractor to guarantee all asphalt pavements for a term of ten years, which I think is the most satisfactory method. In one or two of the large American cities they are now, I understand, only calling for a short term guarantee. This entails an outlay for a very extensive system of tests and even with exhaustive laboratory tests, I do not think it is as satisfactory as a long-term guarantee. I think it is a question whether we are justified in throwing upon the property owners the extra expense involved owing to the contractor being called upon to keep the pavement in repair for ten years. Within the past few years concrete has been substituted for plank in the construction of sidewalks, and up to the present time there is about 35 miles of concrete sidewalks, as compared with one and one-half miles in 1890. It is very satisfactory, except during extremely cold weather, when it becomes slippery, and we are now considering the question of having the surface coat roughened to obviate this difficulty.

"Regarding waterworks matters, during the past ten years, owing to the improvements made in pumping engines, the cost of pumping water has been very much reduced. For instance, in 1890, the cost of pumping water in this city, including coal, wages, maintenance, interest and sinking fund, was 7.52c. per 1,000 gallons. In 1900 this was reduced to 4.86c., and we are now installing a 15-million gallon triple-expansion vertical engine, by which we hope to still further reduce this cost."

* * *

ELECTRICITY SUPPLY STATIONS IN GREAT BRITAIN.

In a paper read before the last convention of the Municipal Electrical Association, of Great Britain, Alderman J. P. Smith, ex-Mayor, and chairman of the Electricity Committee, Barrow-in-Furness, calls attention to some very important facts, regarding the supply of electricity by companies and municipalities, which cannot fail to be encouraging to all who are in favor of the supply of electric light and power, by the municipalities. Mr. Smith states that the difficulty and danger of dealing with figures has not been overlooked, but in this case the figures have not been selected to try and prove any theories previously held, but rather the whole of the available returns are presented to see whether any instructive lesson can be deduced therefrom.

It will be seen from the following table, that the number of municipal stations in operation is practically double that of the companies, while of the works under construction, the proportion is nearly three to one, and of the orders still to be put into operation, almost the whole are in the hands of the municipalities:

	Municipal.	Companies.
Works in operation	204	103
Works under construction	104	36
Orders obtained	114	19
Totals	422	158

In the earlier days of the industry, most of the pioneer work was done by companies, but the majority of municipalities soon saw the advantages to be derived from having the control of such an important and profitable undertaking in their own hands, and it is an interesting and notable fact that fifteen towns and cities who allowed private enterprise to step in and take up this work at the commencement have since seen the folly of that course and have bought them out, often at a very big price. In no case has

a municipal supply station, when once started, been transferred to a company.

Financial Results of British Municipal Electricity Undertakings for Years 1896-1901, Inclusive.

Undertakings. No. of	Year.	Capital.	Revenue.	Total Costs.	Gross Profits.	Interest.		Sinking Fund.		Interest, Depreciation and Sinking Fund.				Units of 1000 Watt Hours sold.
							Per 1000 Watt Hour.		Per 1000 Watt Hour.		Cost per 1000 Watt Hour,	Total Cost per 1000 Watt Hour, including Interest, Sinking Fund, etc.		
		$	$	$	$	$	Cents.	$	Cents.	$	Cents.	Cents.		
50	1896	17,357,480	2,028,065	990,910	1,037,155	431,580	2.10	470,030	2.28	901,610	4.84	4.38	9.22	19,691,042
60	1897	22,647,725	2,814,155	1,493,605	1,420,550	549,600	1.72	557,285	1.74	1,106,885	4.34	3.46	7.80	30,721,564
66	1898	33,366,700	3,968,770	1,940,845	2,027,925	746,140	1.52	788,350	1.60	1,534,495	3.94	3.12	7.06	47,204,575
75	1899	45,902,240	5,237,400	2,778,015	2,459,385	1,168,660	1.62	943,695	1.30	2,112,355	3.82	2.92	6.74	69,562,652
97	1900	65,647,660	7,592,170	4,519,900	3,072,270	1,304,275	1.14	1,352,615	1.20	2,656,890	4.00	2.34	6.34	108,681,443
123	1901	84,525,170	9,979,105	5,339,815	4,639,290	2,390,905	1.48	1,838,845	1.14	4,229,750	3.30	2.62	5.92	154,615,339
			$31,619,665	$16,963,090	$14,656,575	$6,591,160		$5,950,820		$12,541,980				430,476,615

CAPITAL INVESTED, 1902-03.

213 municipalities $117,087,050
157 companies 107,800,995

OUTPUT IN KILOWATTS.

178 municipalities 162,505,417
92 companies 84,404,279

Dealing with the average capital outlay per kilowatt, for the past eight years, it is gratifying to notice that, whatever the system in vogue, the municipalities show much the better results. Thus in the case of alternating current plants the municipal cost is only $460 per kilowatt, as against $530 for the companies, whilst a comparison of direct current stations shows an outlay of $445, against $645; or, by grouping the whole of the stations together, the cost to municipalities is $450, and of companies $585. These figures cover a period of eight years, totalling altogether 829 returns, and in the case of the last year, extend over no less than 182 separate stations, and may, therefore, be taken as a pretty reliable estimate of the cost per kilowatt installed. They should satisfy the most rabid anti-municipalist that in electricity supply stations at least, local authorities obtain good value for the money spent.

Dealing with the relative cost of alternating and direct-current systems, it will be seen that in the case of municipalities the balance is in favor of direct current, whilst in the case of companies it is very strongly the other way.

COST OF PRODUCING 1,000 WATT HOUR IN 1901.

	Direct Current.		Alternating.		Total.	
	Stations.	Cost in Cents.	Stations	Cost in Cents.	Stations	Cost in Cents.
Municipal ...	78	4.2	51	4.6	129	4.40
Companies .	34	4.18	18	4.12	52	5.50

Taking the returns for eight years, with the exception of the first year, municipal stations show much lower costs all round than those of companies, the average of all the returns available being 5.50 cents per 1,000 watt hour, as against 6.6 cents, a saving of 1.1 cents per kilowatt hour.

Alternating current plants run by local authorities show an increased cost of production per kilowatt hour over direct current in the proportion of 6.2 cents to 4.8 cents, a difference of 1.4 cents in favor of direct current. In the case of company stations, both systems show the same results. By grouping all the returns together, a balance of 0.70 cents per kilowatt hour in favor of direct current is observed.

With a view to seeing how far it is possible to reduce the cost of production, without assuming any radical change in the present methods of generation, the following imaginary cost sheets are given. The first is obtained by taking the absolute lowest ascertained cost of each item, and combining same. The result is a total cost of 1.9 cents per kilowatt hour. The second table is one which is more likely to obtain in practice, and is made by taking the average of the ten lowest costs in each item and this gives a total of 2.82 cents per kilowatt hour.

TABLE I.—MINIMUM COST PER KILOWATT HOUR.

	Cents.	Cents.
St. Helen's—Coal	.52	
Oldham—Stores	.04	
Bradford—Wages	.18	
Ealing—Repairs	.14	
	——	.88
Nottingham—Rent, etc.	.04	
Stockport—Salaries, etc.	.16	
	——	.20
		1.08
Bootle—Interest	.44	
Shoreditch—Sinking fund	.38	
	——	.82
		1.90

TABLE 2.—AVERAGE MINIMUM COST (AT 10 STATIONS) PER KILOWATT HOUR.

	Cents.	Cents.
Coal	.68	
Stores	.06	
Wages	.30	
Repairs	.18	
		1.22
Rent, etc.	.06	
Salaries, etc.	.26	
		.32
Interest	.84	
Sinking fund	.44	
		1.28
		2.82

the list of forty lowest costs. Turning next to the influence of "load factor," it is seen that there are only twenty-three appearing in the table giving the best results; and finally, the importance of low fuel costs is shown by the fact that out of about forty best returns twenty-nine appear in the list of lowest total costs. All these figures tend to show that no single favorable factor is in itself sufficient to command success.

Referring to the average price per kilowatt hour obtained for private supply for the years 1896-1901, inclusive, it must be noted that during these six years, the companies have reduced their average charge from 12.02 cents to 9.92 cents, a difference of 2.1 cents per kilowatt hour; while the municipalities although starting at the lower level of 10.76 cents, have been able to reduce their charges by a still greater amount of 2.22 cents, bringing down the price to 8.54 cents.

No.	OUTPUT.		LOAD FACTOR.		FUEL COSTS.		TOTAL COSTS.	
	Town.	1,000 Watt Hrs.	Town.	Per Cent.	Town.	Per 1,000 Watt hour. Cents.	Town.	Per 1,000 Watt hour. Cents.
1	Liverpool	20,018,142	Bootle	29.42	Accrington	.32	Bolton	1.92
2	Manchester	10,502,299	Liverpool	24.23	Monmouth	.38	Bradford	2c.
3	Glasgow	9,282,044	Stepney	22.74	St. Helen's	.52	Liverpool	2c.
4	Edinburgh	7,760,807	Shoreditch	21.29	Leeds	.54	Nottingham	2.62
5	Bradford	4,901,172	Leith	19.79	Wakefield	.64	Leeds	2.08
6	Brighton	4,860,480	Rathmines	19.16	Edinburgh	.68	St. Helen's	2.08
7	St. Pancras (London)	4,729,840	Ayr	18.31	Leigh	.70	Edinburgh	2.14
8	Nottingham	4,094,897	Wimbledon	18.05	Glasgow	.72	Bootle	2.18
9	Birmingham	3,391,099	St. Helen's	17.84	Burton	.76	Stepney	2.46
10	Bolton	3,120,709	Bolton	17.81	Bradford	.78	Southport	2.46
11	Leeds	3,055,165	Ashton-under-Lyne	17.11	Burnley	.80	Leith	2.48
12	Bristol	2,756,624	Monmouth	16.88	Manchester	.82	Glasgow	2.54
13	Shoreditch	2,734,613	Pembroke	16.77	Govan	.84	South Shields	2.58
14	Halifax	2,557,548	St. Pancras	16.55	Bolton	.88	Sheffield	2.62
15	Sheffield	2,487,584	Sunderland	16.54	South Shields	.88	Darwen	2.68
16	Sunderland	2,375,557	Halifax	16.40	Wigan	.90	Crewe	2.74
17	Islington	2,186,044	Blackburn	16.28	Motherwell	.92	Dundee	2.74
18	Hampstead	2,127,173	Barking Town	16.00	Nottingham	.92	Motherwell	2.90
19	Blackpool	2,018,132	Stafford	15.94	Sheffield	.92	Halifax	2.94
20	Blackburn	2,002,141	King's Lynn	15.58	Dundee	.96	Blackburn	2.96
21	Dundee	1,859,943	Bradford	15.57	Halifax	.96	Ashton-under-Lyne	2.96
22	Portsmouth	1,847,790	Brighton	15.56	Swansea	.96	Sunderland	2.98
23	Croydon	1,810,387	Leyton	15.01	Bury	.98	Aberdeen	3.02
24	West Ham	1,583,421	Aberdeen	14.92	Southport	.98	Ayr	3.10
25	Aberdeen	1,546,569	Edinburgh	14.75	Stepney	1c.	Huddersfield	3.16
26	Hull	1,490,099	South Shields	14.67	Liverpool	1c.	Chester	3.18
27	Southport	1,462,407	Wigan	14.61	Newport, Mon.	1c.	Govan	3.24
28	Hammersmith	1,461,427	Govan	14.60	Huddersfield	1.2	Leicester	3.26
29	Southampton	1,430,222	Ealing	14.52	Nelson	1.6	Stockport	3.28
30	Bootle	1,327,432	Crewe	14.47	Leicester	1.10	Wakefield	3.30
31	St. Helen's	1,237,965	Bedford	14.36	Leith	1.10	Leigh	3.32
32	Belfast	1,206,699	Southampton	14.28	Chester	1.12	Wigan	3.36
33	Huddersfield	1,179,849	Southwark	14.23	Darlington	1.14	Cheltenham	3.38
34	Derby	1,081,487	Southport	14.22	St. Anne's	1.14	Manchester	3.38
35	Leicester	1,042,302	Hammersmith	14.20	Gloucester	1.16	Burnley	3.40
36	Oldham	1,042,055	Blackpool	14.18	Lincoln	1.16	Swansea	3.42
37	Stepney	1,008,037	Chester	14.14	Bootle	1.18	Brighton	3.44
38	Cardiff	1,006,763	Harrogate	14.08	Crewe	1.18	Tynemouth	3.48
39	South Shields	985,646	Worcester	14.06	King's Lynn	1.18	Worcester	3.48
40	Ashton-under-Lyne	977,044	Croydon	14.04	Dewsbury	1.20	King's Lynn	3.50

In connection with the cost of production, there are many factors which have an important bearing upon this, but the three which are usually considered to have the greatest influence on costs are output, load factor, and cost of fuel. In order to see how this works out in actual practice, four tables have been prepared. The first one consists of the forty stations having the largest output. The second gives the forty stations with the highest load factor. The third shows the forty stations with the lowest costs per kilowatt hour for fuel, and the fourth gives the forty stations with the lowest total costs per kilowatt hour. Referring first to the influences of "output" on costs, out of the forty stations with the highest "output," only twenty-four appear in

It will be noticed that, taking the last year's returns available, viz., 1901, that no less than 50 per cent. of the companies are obtaining 10 cents per 1,000 watt hour and over for their current, whilst in the case of the municipalities only 19½ per cent. obtain such a large rate of revenue. This is an important point to notice, as municipalities are often twitted with showing a very poor return on the capital expended. They can at least point to the fact that they are supplying their consumers at a much lower rate than is the case with private companies. Had the municipal stations charged the same rate as the companies, they would have enjoyed an increased revenue during 1901 of no less than $2,222,595, equal to 2.62 per cent. on the capital invested.

Average Price Obtained per 1,000 Watt Hour for Private Supply in Great Britain.

Year.	Companies. 14c. and over.	12c. and under 14.	10c. and under 12.	8c. and under 10.	6c. and under 8.	4c. and under 6.	Total Stations.	Average price obtained.	Municipalities. 14c. and over.	12c. and under 14.	10c. and under 12.	8c. and under 10.	6c. and under 8.	4c. and under 6.	Total Stations.	Average price obtained.
1896	6	11	12	5			34	14.02		13	23	12	2		50	10.76
1897	6	14	10	9			39	11.86		6	24	23	7		60	9.98
1898	3	15	11	8	1		38	11.48		1	21	32	11	1	66	9.36
1899	2	6	19	10	3		40	10.56	1	1	13	43	15	2	75	8.92
1900		7	20	15	5	1	48	10.04	1	4	15	48	26	3	97	8.72
1901	1	3	20	17	6	1	48	9.92		1	23	49	43	7	123	8.54

MACHINE SHOP NOTES FROM THE STATES.

BY CHAS. S. GINGRICH, M.E.—LETTER NO. 2.

One of the common sights in an engine manufactory is a row of engine beds mounted crosswise on the platen of a large planer for the operation of planing the crank shaft bearings. Even small gas engine frames require a large planer, so that the work may pass between the housings,

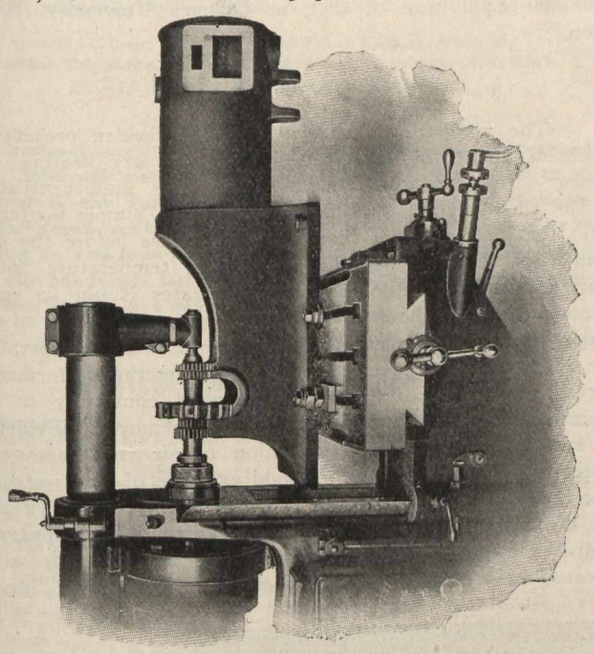


Fig. 1.

and such a planer is invariably a great deal larger than the size of the cut to be taken would warrant. We are so accustomed to doing the work in this way, that we accept it as a matter of course, and forget how awkward a job it really is, until we see someone handling it in a great deal more simple manner. That was the writer's experience when, after having seen a well-known engine builder plane

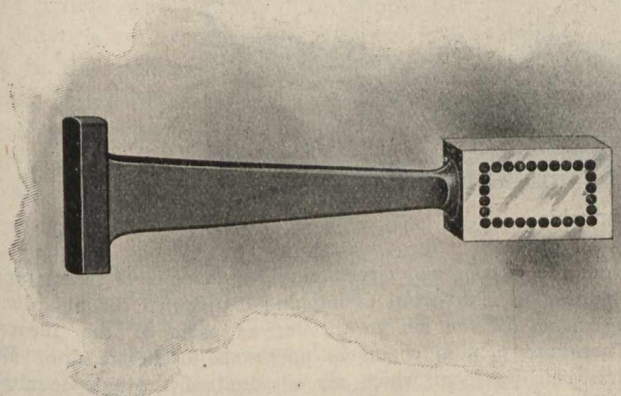


Fig. 2.

one of these pieces, he stepped into the shop of the Root & Vandervoort Engineering Co., East Moline, Illinois, and saw them milling the crank shaft bearing on gas engine frames up to and including their 8-h.p. engines in the manner shown on illustration herewith. The engine frame is strapped to the planer of the miller in just as simple a manner as it would be strapped to the platen of a planer. The entire bearing for the crank shaft boxes and for the cap is finished at one cut, using a suitable gang of cutters, as illustrated.

The machine is worked at a feed of more than 1-in. per turn of cutter when the large cutter is entering the work. After it has entered full depth, the feed is dropped down to about 3 ft. 32 in., and is again raised to the initial rate when the large cutter begins to come through. This is accomplished by the convenient arrangement of feed levers on this particular miller, whereby the rate of feed can be changed without stopping the machine; no matter how fast the cutters are turning; or how heavy a cut is being taken. The mechanism is positive, and there are no feed belts to shift. The distance travelled at the fast rate of feed about equals the distance travelled at the slow rate, so that the average rate of feed for the entire cut is nearly 15 per cent. faster than it would be if the feed were not changed to suit the cut when the work is passing through the machine.

I mention these details, because it is close attention to these little things that enables the twelve-and-a-half-cent-an-hour boy who operates the milling machine, to finish one of these engine frames in 28 minutes, which includes the time of handling and chucking the work. The shortest time in which an expert planer hand did this same work was one hour and thirty-five minutes.

The caps to fit these frames are milled on the same machine by using another suitable gang of cutters, and we are assured by Mr. Vandervoort that the saving effected is not all in the actual finishing of these pieces, but that the vise work, which was formerly required in order to fit the pieces after they came off the planer, is now done away with entirely, and the parts are all completely interchangeable.

A large number of other parts of the engine, such as brackets and pedestals, are being milled very economically. In some of the shops that build engines using the solid end type of connecting rod, the milling machine is coming into use for finishing these also. Fig. 2 shows one of these rods with a series of holes drilled along the line of the rectangular hole into which the brasses are to be fitted. This is the method that has been in use ever since this style of rod was

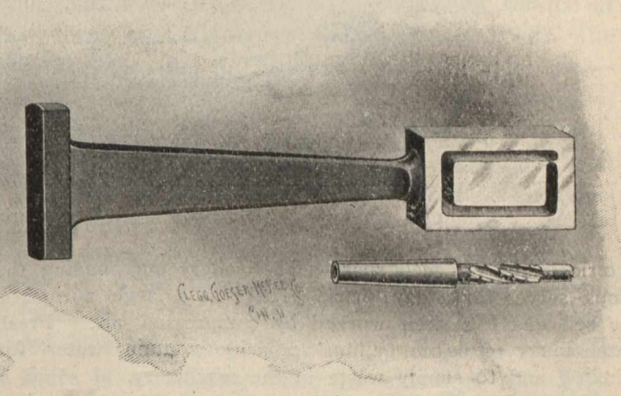


Fig. 3.

first made. After the holes are drilled, the centre is driven out and the hole is finished to a size on a slotter.

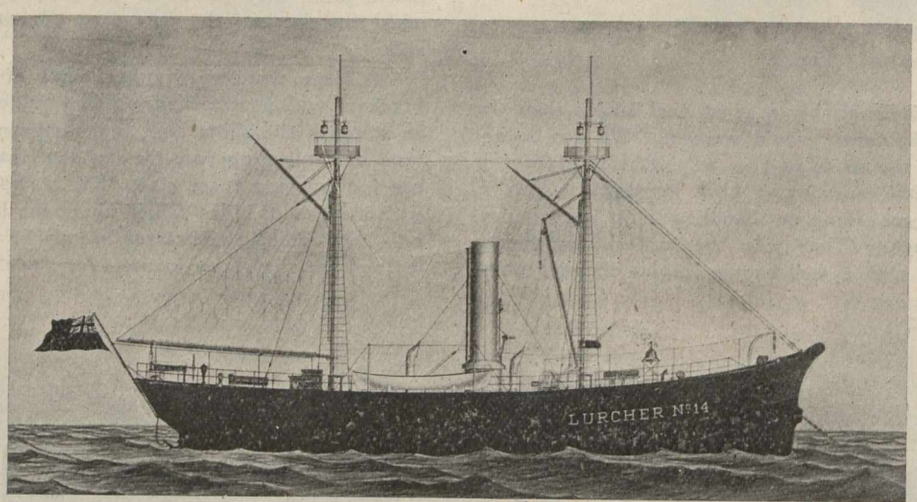
Those of us who have gone through this work are pretty sure to fully appreciate just how tedious and expensive is this drilling and slotting process. In the shops of the Gray & Blaisdell Co., Bradford, Pa., and the Contractors' Plant

Mfg. Co., Buffalo, N.Y., we have seen this work performed on a milling machine similar to the one mentioned above. We are informed that the Cincinnati Milling Machine Co., have fitted up machines to do this same work for H. Bollinckx, Brussels. A single hole is drilled at one corner of the rectangular into which the brasses fit, and a cutter like that shown in Fig. 3 is passed through and removes the stock at a single cut, as shown in illustration. A second cut is then taken to finish the hole to size. The rod illustrated is 40-carbon hammered machinery steel 2-in. thick, and the finished hole is 3 by 6-in. with corners ½-in. radius. The total time consumed in milling this rod; from the moment the first cut was started until the finishing cut was completed, was 42½ minutes. Of course in doing this, a good bit depends on the cutter. It must be held firmly in the spindle of the machine and its outer end must be supported in the same manner as a cutter arbor is supported. The chips are also somewhat of a problem, but if a strong stream of oil is delivered to the cutter under pressure, it will keep it clear of chips. This operation brings into play both horizontal and vertical automatic feeds of the miller, and since the feed must be stopped and reversed at the corners, it calls for a machine that has all the levers conveniently located.

NEW CANADIAN LIGHTSHIPS.

The Polson Iron Works, Toronto, Ont., recently completed and despatched to its destination one of a pair of steel lightships, which it is under contract to build for the Dominion Government. These vessels are the first of their class built in Canada and have a large amount of free-board and are sheered very high in the bows, so as to keep dry when pitching in a heavy sea. They are in excess of Lloyd's requirements for vessels of their size, and have water-tight bulkheads, which will make them almost absolutely unsinkable.

The Lurcher No. 14, which left for its destination just before navigation closed, has a length over all of 124 ft., beam 28 ft., depth from top of keel to spar deck 21 ft. 6 in., draught, fully loaded, 11 ft. 6 in. It has two steel pole spars, on which, 50 feet above the deck, are swung three powerful



The Lurcher Lightship.

electric lamps on each spar. The gallery surrounding the lamps serves for a day mark. There is a large automatic fog bell and fog siren worked by compressed air. Fresh water tanks of 60,000 gallons' capacity contain water for drinking and to supply waste in the machinery.

The engine is of the high-pressure, surface-condensing, vertical, marine type, cylinder 23 in. diameter, with 22 in. stroke. Steam is supplied by two navy-type boilers, with a working pressure of 140 lbs. All the pipes are of copper. The vessel will be moored by three mushroom anchors, each weighing 5,000 lbs. The mooring chains are 1⅝-in. stud link, specially made and tested for this work. The ship is furnished with 240 fathoms of this chain, also with 120 fathoms of 1¼-in. stud link chain. The auxiliary outfit is most complete, and comprises steam windlass, capstans, pumps, electric gears, steering gear, etc.; also complete life-saving apparatus constituting it a well-equipped life station. The fittings and furnishings throughout are first-class in all respects and provide everything requisite for the comfort and convenience of the crew.

The Lurcher will be stationed at the Lurcher shoals in the Bay of Fundy, off the Nova Scotia coast. The second light-ship, which will be completed next spring, will be stationed off the island of Anticosti in the Gulf of St. Lawrence.

J. Walter Wells, formerly Provincial Assayer for Ontario, in connection with the Bureau of Mines, has been appointed Chief Assayer for the Dominion Government Assay Office, at Vancouver, B.C. Mr. Wells resigned his position with the Bureau of Mines to investigate the industrial use of low-grade iron ores in Ontario. For this work he was awarded the nomination for the scholarship of the Colonial Exhibition of 1851, at Queen's University, Kingston.

—The ventilation and heating of a theatre presents a problem not easily mastered by the ordinary heating engineer. In a crowded auditorium of this kind ventilation is the all important question. It may be a simple matter to heat the building to a required temperature before the curtain rises, but to maintain a constant temperature and a pure atmosphere while the play progresses is not so easily accomplished. The heat given off from the bodies of the closely seated audience is sufficient to raise the temperature in the house from 5 to 10 degrees during the performance. Fresh air to breathe must be supplied constantly to the occupants and the impure air must be removed. Evidently a system giving forced circulation of air is necessary to meet these requirements. A good example of this system is the recent installation in the New Franklin Square Theatre, at Worcester, Mass. The heating and ventilating apparatus consists of an electrically driven fan and heating coils, located in a corner of the basement. Fresh air is drawn from the outside and circulated through coils of steam pipes enclosed in a fireproof casing and distributed through ducts by means of the fan to the desired parts of the theatre. There are plenum chambers under the orchestra floor and first balcony from which air is admitted through openings in the chair legs giving an even distribution throughout the house. The low velocity with which the air enters prevents annoyance from draughts. The foul air is exhausted through grills in the dome of the theatre and by means of an electric exhaust fan is discharged through the roof. The B. F. Sturtevant Co., of Boston, Mass., were the heating and ventilating engineers, and the apparatus installed is of the Sturtevant manufacture.