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The Canadian Engineer

ESTABLISHED 1893.

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Index of this issue will be found on page 687.

A PROFESSOR OF MINING FOR THE FACULTY OF ENGINEERING, TORONTO UNIVERITY.

For two reasons we shall be pleased at the appointment of Mr. H. E. T. Haultain as Professor of Mining Engineering in the Faculty of Applied Science, Toronto University. First, because at last Toronto University is recognizing the importance of the Mining Industry in Ontario and in Canada; and second, that Mr. Haultain, who has been a successful field man, should in his two years at Toronto University win for himself such a prominent place among educationalists having to do with university work in Canada.

The School of Mining, Kingston, was organized in 1893 with the avowed object of giving a thorough, scientific education, both theoretical and practical, to men studying for the profession of the mining and chemical engineer, the assayer, the consulting geologist and the metallurgist. Shortly after their organization they appointed men to full professorships in mining, metallurgy, chemistry and mineralogy. The remarkable growth of this young college is evidenced both by the opportunities afforded the graduate in these departments and of the demand there has been, and is, for university training in these departments.

McGill University has had its faculty of applied science for years, professor (and associate professors) of mining, professors of metallurgy, mineralogy, and chemistry. The Faculty of Applied Science of Toronto University has developed strong departments in Civil Engineering, Electrical Engineering, Mechanical Engineering and Chemical Engineering. (Her department of mining had a lecturer and an associated professor.) The few graduates of this department who have entered the mining profession have done excellent work, some as prospectors, some as mining engineers, and in odd cases they have joined the teaching staff of large universities. In these positions they have quickly made their way to the front.

Canada as a mining country and a mineral-producing district has, in the ten years, trebled the value of her output. To-day, the mineral output of Canada is well over $90,000,000. Among the Provinces, Ontario stands first, and has stood first for the last three or four years. British Columbia comes second, and these two Provinces combined control over 63 per cent. of the output. The most recent semi-official returns indicate her mineral output to be in the neighborhood of $40,000,000 per annum. It is little wonder, then, that the Faculty of Applied Science of the Provincial university should strengthen its department of mining by the appointment of a professor, and the Board of Governors of the university increases the appropriation for this department of Applied Science.

The development of the Cobalt camp and its immense production is an indication of the possibilities of this Province. Cobalt made Ontario a silver-producing Province, and we hear whispers from the Porcupine which would indicate that Ontario will yet have a large and permanent gold mining camp.

It is a good business for a manufacturing concern to have its output just a little ahead of the market. It is a wise policy for our university to spend money and energy in developing the department that will be in a position to produce trained men for the openings which will arise with the development of our mineral lands. It is fortunate that the Provincial universities have men who know the possibilities of our mineral lands, who, knowing, have the faith that Ontario will come quickly to her own, and with that faith the courage that makes it possible for them to develop a policy that will provide for the coming needs of the mining industry and to meet the aspirations of our young Canadians.

"CANADIANS OF TO-DAY AND TO-MORROW."

Under this heading the Toronto "Globe" has been giving their readers a series of personal sketches, descriptive of the personality and work of a number of Canadians who, because of their material advancement, are said to have "made good."

Leaders in law and commerce and railway building have had their success pictured, and of the series none have been more interesting than that of last week's issue, when Paul E. Bilkey, in three thousand words, gave us a pen picture of R. J. Fleming, Genial Despot. Mr. Fleming has handled successfully one of the most complicated transportation problems of Canada, Toronto Street Railway, owned by a private corporation, yet acting under franchise, which requires that the citizens of Toronto shall give their approval to new extensions, makes it necessary for the railway to even build where the uninitiated imagine they should extend or attempt to crowd in the old channels the largely increasing traffic.

Toronto is none too well served by their street railway, but none but a Fleming could give so good a service and avoid so successfully complaints.

The "Globe" is doing a service to Canada in picturing pleasantly the men who are held by the public responsible for the business misfits of our community. In Toronto's case, the public, just as much as the railway, are at fault in the unsuccessful dealing with their transportation problem, and because one man stands to represent the railway is no reason why he should be the abused one, and it is fortunate that our journalists are content to show the pleasant side of the lives of the men who, though successful in business, are disliked because of their success.

RAILLESS TRACTION.

The possibilities of railless traction for transportation of passengers and freight on the public highway is being demonstrated in Italy and Austria with some considerable success. It will be surprising if some such system of transportation does not quickly find a place on highways in Canada.

In Italy, one route is sixty miles long. The average fixtures are much similar to the average work for the ordinary rail traction, with the difference, of course, that there are two wires.

Many districts in Canada require better transportation facilities, but the service demanded is not heavy enough to guarantee returns on large outlay. The perfecting of motor carriages and drays as to carrying capacity and running gear; completion of long distance transmission lines, making the sale of electric energy possible over wide areas; and improvement of our highways are conditions which are very favorable for the installation of railless cars.

We understand some of our Canadian engineers, very familiar with transportation problems, are now working on such schemes as those which are successful in Europe, and we look to their early adoption in some of our similar municipalities.

THE SANITARY REVIEW.

In its issue of March 5th, 1909, the Canadian Engineer announced a new departure. The "Sanitary Review" became an addition to the usual columns.

It was felt that, in Canada, a demand would be met by devoting a portion of the journal entirely to engineering problems affecting sewerage, sewage disposal, water supply, water purification, and kindred subjects.

The effort has been to put before our readers as concisely as possible the results and conclusions of the world's investigations in these subjects, as well as to deal with home sanitary interests.

With the continuously increasing population of Canada and centralization of people in cities, towns and villages, a greater proportion of civil engineers than in the past are now giving attention to subjects relating to municipal hygiene.

The United States, Great Britain and Europe have given years of attention to this particular line of engineering, and it was felt that much gain would result in focusing engineering attention in this direction.

The Canadian Engineer flatters itself that its effort has not been without results, and that the "Sanitary Review" portion has played, and will continue to play, a leading part in the very apparent advance which this country is making in sanitary engineering enterprise.

The difficulty at first felt was in obtaining the right man to edit this special department. This difficulty was overcome by the services of Mr. T. Aird Murray, who has had charge of the "Sanitary Review" since its commencement, and who contrives, in spite of his many other engagements, to direct this section of the Canadian Engineer.

Mr. Murray's extensive and wide knowledge, backed by practical experience, has enabled him to contribute articles which have been referred to and quoted throughout Canada from time to time, and, we think, have not been without effect in adding interest and knowledge to many sanitary problems relating to sewerage and water supply.

No doubt exists in the mind of the "man who knows" but that Canada is fast realizing the prime importance of exact and efficient sanitary knowledge, and that the time is past for unscientific, haphazard and temporary work of an expedient character.

The Canadian Engineer takes this opportunity of thanking its many readers who, from time to time, have marked their appreciation of our effort as illustrated in the "Sanitary Review."

EDITORIAL NOTES.

Toronto does not require, as the "Telegram" suggests, a new head for their Engineering Department, nor, as the "Star" suggests, a man whose specialty is engineering, but what Toronto does require is a Board of

Control and a City Council that will accept and act upon, not newspaper advice, but when offered, engineering advice.

* * * *

The chain-gang upon our highways is now an accomplished fact. The Porcupine Trail is being built by prisoners from our northern jails. In addition to being deprived of their liberty, our fellow-citizens, who have made a misstep, are to be humiliated by working on the public road in prison gangs, and highway building, instead of becoming one of the most pleasant occupations, is being branded as a prison job.

* * * *

The tenth annual convention of the Union of Canadian Municipalities will be held in Toronto, August 31st to September 2nd. A very interesting programme has been arranged for those interested in municipal enterprises, and it is expected that a large number of Canadian municipalities will be represented.

CANADIAN ELECTRICAL ASSOCIATION.

The twentieth annual convention of the Canadian Electrical Association will be held at Royal Muskoka, on July 6-8, 1910. The programme will be as follows:

JULY 6TH.

9.30 a.m.—Opening Remarks.
Secretary-Treasurer's Report.
General Business.

10.30 a.m.—Paper: "Power Contracts," W. N. Ryerson, Great Northern Power Co.
Paper: "The Commercial Agent and the Community," C. A. Littlefield, New York Edison Co.

Afternoon.

2.00 p.m.—Paper: "The R. C. M. Electric Service Rate System," S. Bingham Hood, Toronto Electric Light Co.
Paper: "The Residential Lighting Field: How It Can Be Profitably Cultivated," A. T. Holbrook, New York.
Report of Committee on "Uniform Accounting."
Report of Committee on "Central Station Statistics."

4.00 p.m.—Canoe Races, Tilting Contests, Golf, Tennis etc.

Evening.

8.00 p.m.—Informal Reception and Dance.

JULY 7TH.

9.30 a.m.—Paper: "Protection of Service in Large Electric Systems," A. S. Loizeaux, Consumers' Gas Electric & Power Co., Baltimore, Md.
Paper: "Notes on Transmission Line Regulation," Paul M. Lincoln, Westinghouse Electric and Manufacturing Co., Pittsburg.
Report of Committee on Standardization of Line Construction.
Report of Committee on Grounding of Transformer Secondaries.

Afternoon.

2.00 p.m.—Meeting of Executive Section.
4.00 p.m.—Baseball Match—Manufacturers versus Operating Companies.

Evening.

7.00 p.m.—Banquet for Members and Guests.

JULY 8TH.

9.30 a.m.—Paper: "How to Increase the Station Load," Sidney G. Redway, Toronto Elec. Light Co.
Paper: "Electric Heating and Cooking Appliances," Harold S. Brown, Can. Gen. Electric Co.
Report of Committee on Installation, Care and Testing of Meters.
Report of Committee on Conservation of Natural Resources.

Afternoon.

2.00 p.m.—Paper: "The Attitude of the Central Station Manager Towards Illuminating Engineering," R. E. Scott, National Electric Lamp Association.
Paper: "Tungsten Street Lighting with Special Reference to 25 Cycle Circuits," C. L. Stephens, Pittsburg.
Paper: "The Diesel Oil Engine," F. A. Yerbury, Toronto.
Naming of Standing Committees.
Next Place of Meeting.
Unfinished Business.

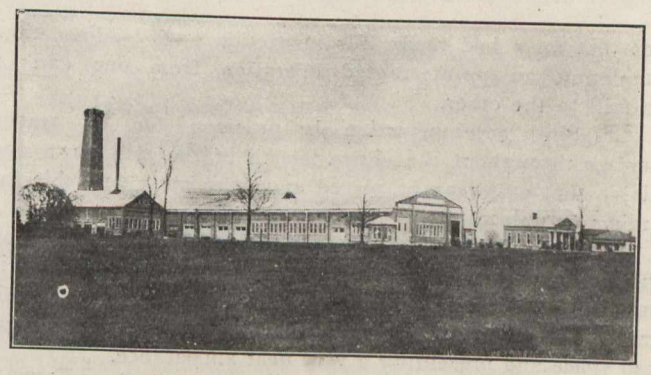
Evening.

8.00 p.m.—Informal Concert and Dance.

THE FIRST CANADIAN RE-ROLLING MILL.

T. R. Loudon, B.A.Sc., A.M. Can. Soc. C.E.

In these days of commercial development, the steel trade of Canada has shown the same healthy growth that has characterized most of the country's industries. Each year brings with it some new project, so that now it is no longer necessary to go abroad for all of our iron and steel. In spite of this activity, the re-rolling business up to the present time has been entirely neglected in Canada. The re-rolling of old



Provincial Steel Plant, Cobourg, Ont.

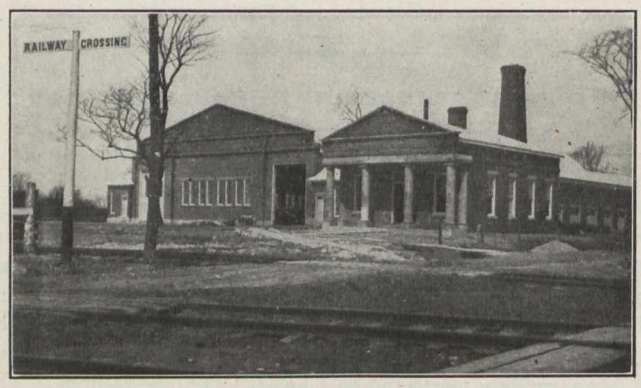
stock down to new sections is carried on at several places in the United States, and even allowing for the comparative sizes of the steel business of the two countries, the wonder is that this proposition has not been inaugurated on Canadian territory long before this. In view of these facts, it is pleasing to note that quite recently a company has been organized at Cobourg, Ontario, under the name of the Provincial Steel Company, Limited, whose purpose is to go actively into the steel rolling business, both re-rolling and rolling direct from billets.

The location of this company's plant as regards the all-important item of shipping facility has been very well chosen The Grand Trunk Railway double track main line runs along

the southern boundary of the property within 50 yards of mill No. 1, the station and freight yards of Cobourg lying a quarter of a mile to the east. Along the northern boundary of the site, the Canadian Northern Railway will run the main line track with its station placed close to that of the Grand Trunk. Then to complete matters, Cobourg harbor, one of the best ports on Lake Ontario, lies to the south within easy reach of the mills.

At the time of writing, mill No. 1 is in active operation, re-rolling rails from large sections down to smaller sizes. This portion of the plant is equipped with two 21-inch three high mills placed side by side, steam being used for motive power. As will be inferred from the dimensions just given, it is the intention to roll the heavier sections in these mills, sections such as rails, I-beams, etc.

Situated immediately behind these mills is a gas-fired furnace in which the stock to be rolled is heated. This furnace, fed by an electrically-driven charging machine, may be charged either continuously or in batches to suit convenience. At the other end of the mill building, the saw and hot bed, on which the finished sections cool, are so placed as to feed two straightening presses, and in direct communication with these, provision is made to punch rails and pass



Offices of Provincial Steel Works.

them out on a bed ready for inspection and loading, thus completing an uninterrupted operation from one end of the mill to the other.

Shipping accommodation is provided for by tracks running throughout the entire length of the mill down one side so that cars may be placed anywhere most desirable for loading or unloading, as the case may be.

It may be pointed out in passing that the plant workshop where the general machine work and roll turning is done is installed in a portion of mill No. 1, the shafting being all placed underground in concrete trenches giving a clear overhead space and presenting a very neat appearance.

Mill No. 2, now nearing completion, will be essentially a merchant mill rolling rounds, flats, small angle bars, etc. This will be accomplished in four 12-inch three high mills electrically driven. It is not possible to give further data on this part of the plant, but from the portion already constructed, it is evident that the installation will be extremely modern which would be expected with rolls operated by electric motor.

That this rolling mill, besides being a worthy addition to the steel industry, is a great benefit to the community in which it is located is readily seen from the fact that with one or two exceptions, the mill hands all come from the neighborhood of Cobourg. So adaptable have these men proven that it has been found unnecessary to import labor.

The company is to be congratulated on securing, as general manager, the services of Mr. A. L. Reading, whose familiarity with matters pertaining to the steel business is well known throughout this country and the United States. Mr. S. J. McCrudden, the general superintendent, has also had a wide experience in this line of business; so that in its selection of officials, the company has given to the buying public a safe guarantee of good material and workmanship.

SPECIFICATIONS FOR WOOD BLOCK PAVING FOR RICHMOND ROAD VIADUCT, OTTAWA, ONT.

Work—

1. The work is to consist of the construction of a creosoted wood block pavement laid on a sand cushion on a plank foundation or floor supported by the longitudinal steel flour beams of the viaduct. This wood block pavement extends for the full length of the viaduct. The clear width is to be thirty (30) feet.

Foundation.

2. On the longitudinal floor beams nailing strips are to be securely bolted to give the proper crown to the finished roadway. There is to be a drop of four (4) inches from the centre of the pavement to the gutter.

On the nailing strips three (3) inch planks are to be laid and securely fastened. The planks are to be laid at right angles to the centre line of the viaduct. On the planks one (1) inch boards are to be laid diagonally. The upper surface of the boards is to be covered with refined paving tar containing not less than seventy (70) per cent. pitch. The whole surface is to be thoroughly coated and the cracks between the boards filled with the tar, which is to be applied when the boards are warm and dry.

Curb.

3. On each side of the roadway a ten (10) by ten (10) pine is to be bolted to the foundation planks laid as above. This forms a curb to which the iron railing is to be fastened on the north side and the side-walk on the south side. The distance between the faces of the curbs across the roadway is to be thirty (30) feet.

Cushion.

4. On the foundation a cushion of dry sand one (1) inch thick is to be laid. This is to be rounded to conform to the camber of the finished roadway.

Wood Blocks.

5. On the cushion coat laid as above creosoted wood blocks four (4) inches thick are to be laid with the grain vertical. The blocks are to be laid diagonally across the roadway and at right angles to the inch boards, and care must be exercised to break joints at least one (1) inch.

Expansion Joints.

6. Every fifty (50) feet along the centre line of the viaduct an expansion joint five-eighths (⅝) of an inch wide is to be left. This joint is to be filled with sand and tar. Along the gutters a similar expansion joint is to be left.

Gutter.

7. The gutter is to be made four (4) by eight (8) plank twelve (12) feet long, dressed to be four (4) inches thick at one end and two and one-half (2½) inches thick at the other. These planks are to be laid along the curb with the thick ends abutting. At the low points four (4) inch galvanized iron drains are to be fastened to discharge under the viaduct.

Surface.

8. The blocks when laid are to be grouted with a coat of refined paving tar so as to fill all joints. On this is to be spread an inch coat of crushed limestone, which shall not exceed five-eighths (⅝) inches in largest dimensions.

THE

Sanitary Review

SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND WATER PURIFICATION

HEALTH ADMINISTRATION IN ONTARIO.

The Hon. W. J. Hanna has the opportunity of putting health administration in Ontario on a more effective footing than it is at present.

A live "Bureau of Public Health," with a Health Commissioner having full executive power, is required.

Cities, towns and villages throughout the Province find themselves face to face with serious and expensive sanitary problems in sewerage, sewage disposal, water supply and water purification.

These cities, towns and villages should not be allowed to waste money in vain, ineffective and costly experimental work. The Provincial Health Government should be their adviser, tutor and friend.

Such a fiasco as that of the Lindsay ozone venture should not be possible with expert and efficient central control.

Such a fiasco as that of Lindsay is only made possible when the central authority has no control, is disjointed and incapable of effective administration.

When a new and untried method of water purification is introduced into Ontario, it should first be accepted as worthy of trial by the experts of the Government, and then watched, inspected and examined at every stage of its installation.

It should not be possible for a town to throw away $8,000 upon a scheme which is subsequently condemned as entirely useless by the central advising authority.

Behold some interesting dates:—

July 23rd, 1909.—Dr. Archibald (Toronto University) examines Lindsay plant and passes it, after which the town pay the contractors in full.

Sept. 17th, 1909.—Provincial Board of Health commence an examination of the plant after it is paid for by the municipality.

Feb. 1st, 1910.—Provincial Board of Health finish their examination.

Feb. 8th.—Dr. Amyot presents report to Dr. Hodgetts, secretary of the Board.

June 1st.—The report is printed and given out to the public. The report absolutely condemns the plant.

For about four months a valuable report is held up and not a single scrap of information contained in it made public, because it had not gone through the mechanical process of being printed. During the whole of this period the Provincial Board of Health were fully aware that the filters were defective and surface water was leaking into them; but never a cheep on the part of this august authority, no order to one of its officials to warn the Lindsay people of conditions which might spread typhoid.

This journal asked over and over again—appealed to both the chairman and secretary of the Board of Health—for a copy of the report, but always the one reply: "The only copy is in the hands of the printers, and they are very busy just now, as Parliament is in session."

All for the sake of saving a Government official the trouble of making a second typewritten copy, all for the sake of a theatrical display, momentarily sprung, with "dry-as-dust" pomp of blue book incarnation, Lindsay can wait and Lindsay may suffer, and all the other towns in Ontario which are holding up the question of water purification awaiting Lindsay's verdict, can also wait and suffer.

If this were the only case of effete energy displayed by the Board, one might pass on; but its very constitution entailing quarterly reunions of heterogeneous units in order to wind up the machine, deserves more than passing criticism.

WILL SLOW SAND FILTRATION GIVE WAY TO DISINFECTING METHODS?

The successful application of methods of disinfecting polluted water supplies would appear to point to **rapid methods of filtration.**

In this issue we take the liberty of bringing before our readers a short review (from The Surveyor and Municipal and County Engineer), of eight different examples of hypochlorite sterilization of water.

To the eight the temporary disinfection of the ozone plant at Lindsay by hypochlorite might also be added.

Our English contemporary, which is always "up-to-date" in municipal hygiene, concludes; "Enough has been said to domonstrate how this new process is coming into use on a very large scale. The methods of application are at present crude, and the agent commonly used, viz., chloride of lime, in the form of bleaching powder, is not without its drawbacks, but these will rapidly receive the attention they deserve, and sterilization by means of hypochlorite will undoubtedly form one of the ordinarily accepted methods of water purification."

The question is: **If this prophecy is correct, is slow sand filtration the best method of removing turbidity?**

The chief claim (apart from suitability to varying degrees of turbidity in water), which has been advanced in favor of slow sand filtration in preference to mechanical filtration, has been the superior efficiency of the former in removing bacteria.

It would now appear that the question of efficient removal of bacteria may be left to an agent apart from either process.

Just how may this new agent affect the two processes?

Allen Hazen, in "The Filtration of Public Water Supplies," states as a conclusion, "Mechanical filters have been largely used in the United States; but the bacterial efficiencies secured with them, under proper conditions, and with enough coagulant, have been such as to warrant the belief that they also will serve to greatly diminish the danger of infection,

although they have not shown themselves equal in this respect to slow sand filters."

Again he says; "The main point is that disease germs shall not be present in our drinking-water. If they cannot be kept out, we must take them out afterwards; it does not matter much how this is done, so long as the work is thorough."

Hazen at the time when he published the above work, evidently did not contemplate any method apart from filtration for the removal of bacteria, and was content to compare the average results of slow sand and rapid filtration, without reference to disinfection. In our issue of last week we published a paper read by E. Bernard Phelps, on the disinfection of sewage and water, in which he stated with reference to water supplies; "The two great fields which are open to water disinfection are the treatment of a very slightly or only occasionally polluted supply by disinfection alone, and the treatment of a more seriously polluted supply by the present methods at highly increased rates and by subsequent disinfection. In the latter case disinfection will be found a valuable adjunct to overload mechanical filters. The limiting rates of operation on slow sand filters are determined largely by the organic content of the water, and by consequent economy in the expensive cleaning processes. The limiting rates in mechanical filters, on the contrary, are practically determined by the necessity for obtaining bacterial purification. Therefore, it is especially with reference to this latter type that disinfection will be found important."

At once, it will be apparent that the conclusions of Hazen in 1908, are very different from those of Phelps in 1910.

The conclusions of Phelps based upon absolute data and evidence, which was not in existence in 1908, require that the water purification engineer and chemist face new conditions with re-consideration.

The temptation to install mechanical filters has always existed in the fact that water can be filtered at rates from fifty to one hundred times the rates possible in slow sand filters. Efficiency at these rapid rates requires the use of a coagulant. Further, such rapid filters can be easily housed and protected from weather conditions.

The temptation on the other hand to install slow sand filters has always existed in the fact of a somewhat higher bacterial removal, and that, generally, no coagulant is required.

Otherwise mechanical filters have been considered more suited to very turbid waters and slow sand filters to less turbid waters.

It is, generally, conceded, that in some phase or another every water requires some variation in treatment; but the fact remains, that most waters can be successfully depleted of color, odor, and suspended matter by rapid filtration; that is, a water can be easily, economically and within small space made acceptable to the palate and eye. It is further apparent that an easy and economical method is at hand of destroying disease germs.

The retarding influence on the adoption of methods of disinfecting water will certainly be found in popular prejudice to the addition of chemicals to drinking water. No matter how infinitesimal the amount of chemical used, people will at first imagine harmful results and believe that they taste it. This objection was at first raised to the use of a coagulant, such as sulphate of alumina, and only time and practical evidence of no ill effects can be relied upon as an argument against prejudice.

EIGHT EXAMPLES OF HYPOCHLORITE STERILIZATION OF WATER.*

Nashville.—The water supply of Nashville is derived from the Cumberland River, the water being of a turbid character and of an unsatisfactory bacterial quality. The water is stored in a reservoir holding three and a-half days' supply, and is treated with sulphate of alumina as a coagulant, but since August, 1909, hypochlorite of lime has been added in order to improve the bacterial quality of the water. The reservoir is divided into two basins of equal capacity. The coagulant is added to the water as it enters the first basin, and the hypochlorite of lime is added as the water passes over a wier into the second basin. An allowance of 0.1 grain of hypochlorite of lime per gallon is the amount which is generally used. Dr. William Litterer, reporting upon a number of examinations made in January, 1910, states that the intake sample showed a bacterial content at room temperature of 6,800, and at incubator temperature 6,100 per cubic centimetre. Of twenty-five samples for b. coli 92 per cent. were positive. A sample from the reservoir after treatment showed the bacterial content at room temperature to be 110, and at incubator temperature to be 80; no coli were present in twenty-five samples taken. The percentage of bacterial removal as judged by a sample taken from a hydrant was 98.4 per cent.

In this case the hypochlorite of lime contained about 36 per cent. of chlorine. It is mixed in a tank holding about 1,000 gallons by means of a vertical shaft and wooden agitating blades. The bottom of the tank is cone-shape, and from it a 1½-in. pipe is connected to a small pump. The liquid is drawn from the botom of the tank and is returned into it over the top, so as to stir thoroughly the hypochlorite of lime. The pump is worked by a 2 horse-power motor.

The expense of installing this plant was about $400, and the working expenses are about $6 a day. The cost of the hypochlorite of lime is $1.5 per 100 lbs.; the cost per 1,000,000 gallons of water treated is $1.05 for the hypochlorite treatment. The water consumption from the year 1909 was about 14,000,000 gallone per diem.

Minneapolis.—A 20,000,000-gallon hypochlorite water sterilizing plant has been installed at the city of Minneapolis. Sterilizaiton was first adopted on February 25th, 1910, in order to deal with a severe outbreak of typhoid. The successful results have caused the city to continue the use of the method for the present.

The water supply is derived from the Mississippi River, whence it is pumped to a reservoir of 97,000,000 gallons' capacity. The river, during recent years, has been badly polluted with the sewage, owing to the growth of the cities upon its banks. There had been previous outbreaks of typhoid fever, and it had been proposed to obtain a supply from a lake 18 miles distant. But, upon the advice of Mr. Rudolph Hering it was decided to continue the use of the Mississippi River water, but to treat it by mechanical filtration in conjunction with sterilization by hypochlorite.

In February, the typhoid death rate was four times the normal for the year; thus, in January, 1909, there was one death from typhoid against eleven deaths in 1910. In February, 1909, there was one death from typhoid against thirty-one in 1910. In face of this state of affairs the city

*From the Surveyor and Municipal and County Engineer.

engineer was authorized to construct a 20,000,000-gallon capacity emergency sterilization plant at the public station. Mr. J. A. Jensen, of the Waterworks Department, Minneapolis, describes the plant as follows:—

"The plant consists of a 400-gallons mixing tank, equipped with a vertical shaft and revolving arm having steel paddles which form a stirring rake. Three baffles are placed on the inside of the tank to prevent the water from swirling as one mass. The shaft has a 3 to 1 bevel gear and a 12-in. pulley on the horizontal shaft. The mixing tank is set on framework above two solution tanks 9.5 ft. in diameter, 10 ft. high, each having a working capacity of 4,800 gallons. These tanks are connected with a 3-in. by-pass pipe having a branch running to two regulating weir boxes. Each tank has a water supply connection and a drain. The weir boxes are 4 ft. long by 3 ft. in width, and 20 in. deep. Each box has a supply weir and an overflow weir, and is adjustable by raising or lowering the overflow end by a ratchet on a 1-in. threaded rod, by which the adjustable end is suspended. A receiving funnel is placed at each supply weir, and forms the collector for a 2-in. delivery pipe leading to the sluiceways. The supply weir is made of a ¼-in. brass plate and is 12-in. long. As the supply for one pump is drawn through two sluiceways its delivery pipe is branched to divide the solution as nearly as possible. At the point of delivery the pipe ends n two capped branches, each 18-in. long, drilled with twenty-four ½-in. holes. The power is supplied by a 10-horse-power engine in the screen-house, ordinarily made use of in the periodical removal of sand from the pump wells.

"The operation of the plant and laboratory is in the charge of Dr. J. Frank Corbett, city bacteriologist, and his assistants. In a series of experiments it was determined that the water would require from ¼ to ½ grain of hypochlorite per gallon. This is higher than the amounts generally used elsewhere, but as the disinfection of the distribution system had to be made as soon as possible, and as the spring floods were at hand, these amounts were necessary to begin with. The operation began with ¼ grain per gallon, mixed to form 0.5 per cent. solution. At the rate of pumping this requires 8.7 gallons of the solution to be delivered by each weir with a pointer at zero at water level. By raising this the weir was calibrated for each division for future use. Both solution tanks were also calibrated for each 0.1 ft. of depth and supplied with indicating gauges which, by timing, show the rate of flow when desired. This serves as a check on the weirs. On account of the change in head when the tanks are drawn down the delivery is kept constant by maintaining the uniform head of the weir. This is obtained by keeping the level of the solution always up to the crest of the overflow.

"The mixing is done at intervals in about 10-lb. charges. The outlets from the mixing tank are so placed that most of the insoluble portions remain to be blown out at intervals. While one tank is in service the other is being mixed and tested for available chlorine. Each tank has a capacity for about eight hours of service.

"The proportions will be varied when the distributing system has been thoroughly disinfected until the minimum quantity is determined."

Montreal.—The purification of the water supply by means of hypochlorite has been adopted at Montreal owing to a severe epidemic of typhoid fever which occurred during the winter of 1910, and which followed similar winter epidemics during past years.

The population of Montreal is about 400,000; the water supply is pumped from the St. Lawrence river, and has practically no storage. The larger part of the city is supplied by a municipal waterworks, and the rest, including a number of outlying towns, is supplied by the Montreal Water and Power Company.

The Montreal Company's sterilization plant was put into operation on January 18, 1910. The plant consists of two wooden dissolving tanks, 4 ft. diameter and 3 ft. deep, placed over two solution tanks. The two solution tanks are of wood, 7 ft. 8 in. in diameter and 7 ft. 6 in. deep, having an effective capaity of 2,400 gallons. There is one orifice box through which the solution flows, which is supplied with a float valve in order to keep a continuous head over the orice. There are twelve 1-in. perforated pipes connected to the 2-in. feed pipe, which pipes act as distributors of the chemical solution. The chemical is passed through a 1-in. mesh screen into the dissolving tanks, where it is mixed with sufficient water to form a paste. The chemical in this state is well stirred; then water is turned on and the solution is allowed to pass through the overflow of the dissolving tanks into the solution tanks. It is then stirred hourly by means of a piece of perforated boiler plate mounted at right angles to an iron rod. This produces a violent churning action which thoroughly mixes the solution. At the beginning 6 lb. of bleaching powder per 1,000,000 imperial gallons was used, but later the amount was increased to 9 lb. Good results were secured with a small amount, but the larger quantity was used owing to the rapid variations in the quantity of the water.

The cost of installing the plant was $688 for the building, and $440 for the apparatus. The cost of treatment per 1,000,000 imperial gallons is: Labor $.215, bleaching powder $.10, light and heat $.015.

The Montreal City plant was finished on February 8, 1910; it resembles the plant installed by the Montreal Water and Power Company, and works in the same manner. This plant treats 40,000,000 gallons per day, the cost per 1,000,000 gallons all told being $.36, including labor chemical, light and heat; the cost of the building and plant was $5,770.

Harrisburg, Pennsylvania.—The water supply of Harrisburg is derived from the Susquehanna River. The water being turbid at times, sulphate of alumina has been used as a coagulant, which was applied both in the sedimenttion and coagulating basins, or was sometimes omitted in the latter, according to the condition of the water. In July, 1909, experiments were made in order to test the efficiency of hypochlorite of lime used in connection with the coagulant. The hypochlorite was used during eight days in August, twenty-one days in September, and from September 25th to the end of the year it was used continually with good results. The powder is mixed in tanks provided for the coagulant, and a one-half per cent. solution is used. The chloride of lime used contains an average of 32 per cent. of available chlorine, the strength varying a little from time to time. The solution is kept to a constant density by agitation with compressed air forced hrough perforated galvanized pipes at the bottom of the tank, and it is delivered by gravitation through galvanized-iron pipes to the solution pump, whence it is forced to an orifice box. At the orifice box it is measured so as to give the amount desired, and it is then carried to the intake well and applied to the water there immediately before going through the pump.

The application of hypochlorite is always used in conjunction with the sulphate of alumina, but the latter has been reduced very considerably, it only being used to remove the turbidity and color. "The application of a dose of from .05 to 1 grain per gallon to the water as it comes into the pump well from the river reduces the bacteria to so small a number that the future treatment from a bacterial stand-

point is amply taken care of by the amount of alumina necessary to remove color and turbidity. From experience gained in the short time it has been used .07 grain per gallon seems to give results that are perfectly satisfactory. In fact, this amount has taken care of water containing as high as 80,000 bacteria per cubic centimetre."

In December the river has been unusually low for a long period, and the water level then rose slightly, with the result that several months accumulation of filth that had collected was washed down without any great dilution. As the water could not be purified by the coagulant alone, together with filtration, hypochlorite was added, and it was found that the addition of hypochlorite got over the difficulty. The bacteria in the river water ranged from 945 to 4,450 during the first thirteen days of December. On the worst day the total bacterial content was 85,250, but after having been subjected to sulphate of alumina, hypochlorite and sedimentation the bacteria were reduced to 7,500, and after filtration to 120.

The available chlorine in the solution during the month averaged slightly over 32 per cent., the amount representing .387 parts per 1,000,000 of available chlorine, or about 9.86 lb. of powder per 1,000,000 gallons treated. The action of the hypochlorite was found to be almost instantaneous. The sample of water taken from just beyond the pump after the water had pased through about 15 ft. of pipe showed a very small number of bacteria. No taste or odor was noticed, excepting at one time when as much as .1 grain per gallon of hypochlorite was used, but it was believed that this came from the algæ in the reservoir. Since this time nothing higher than .075 grain per gallon has been used. The use or hypochlorite is therfore proved to be the best known means for getting rid of the bacteria, and has given great relief to the management of the plant. It also enables the filters to be run at a faster rate.

For the year 1909 the bacterial contents of the river averaged 5,763, and of the filtered water 17, giving a removal of 99.68 per cent. Mr. Kennedy, superintendent of the Harrisburg Waterworks, states that the bacteria in the river water averaged 23,117 per cubic centimetre, and only 6 in the filtered water in January, while in February the river water contained 9,015, and the filtered water three bacteria per cubic centimetre, and he further states that these are remarkable averages when it is considered that in these months all the shortcomings of mechanical filters are present. In other words, the coagulation plus mechanical filtration is greatly assisted by the use of the sterilizing agent, for the reason that the mechanical filters are not sufficient to ensure the removal of the bacteria at the worst seasons.

Quincy, Illinois.—Sterilization by means of hypochlorite of lime was adopted at Quincy because the analysis of the water began to indicate a falling off in the efficiency of the mechanical filtration plant in the removal of bateria.

The water at Quincy is treated with sulphate of iron and lime as a preliminary to filtration, and the method adopted was to add the hypochlorite after the chemical precipitation had taken place, but before filtration. No attempt was made as has been done elsewhere to reduce the amount of the coagulant when adding the hypochlorite.

The plant first used consisted of an old oil barrel in which the bleaching powder was mixed and dissolved, and whence the solution was conducted by means of a ½-in. pipe governed by a valve. Owing to the varying head of the liquid in the barrel it was found very difficult to regulate the delivery, and so much attention was required that other arrangements had to be made. It seems also quite possible that this crude method of adding the sterilizing agent to the water was to some extent the cause of the trouble which was experienced at the outset, when owing to complaints received from customers as to the taste of the water supplied, the quantity of hypochlorite was reduced and its use was even discontinued for some days.

The plant used after the first trials consisted of a wooden tank holding about 100 gallons filled to a depth of 1 ft. The bleaching powder solution was prepared in this tank and was mixed with the water as it flowed through a main 100 ft. long and 20 in. diameter on its way to the filters.

(Continued on page 688).

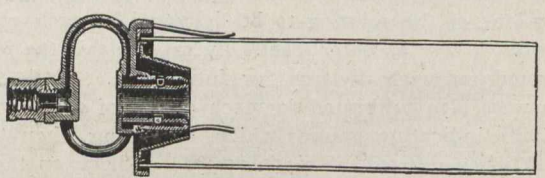
SOME METHODS OF MEASURING LIGHT.

(Continued from last week).

The official standard which long held sway in England was that of the Standard Sperm Candle. This standard has now been replaced with that of the 10-candle Pentane lamp. It has been proven many times by photometrists that the Sperm candle is a very variable and far from convenient standard. The trouble given by the unevenness of burning with its consequent results in an unevenness illuminosity, the sensitiveness of the flames to draught, the effect of barometric and thermometric changes are quickly shown by the varying length of the flame, and the attention which has to be given to the candles prevents close attention being given to the reading of the disc. It is well known that much greater accuracy in the readings of the disc box can be made when the eye is unaffected with outside sources of light.

The 10-candle Pentane lamp as a standard of light has to a greater extent minimized the aforesaid difficulties.

This standard is constant when used under normal conditions, and gives a clear, steady, white light, equal to 10 candles. The flame is shielded from draughts by a metal shield, and owing to its chimney, has a more stable flame than that of the candles. The flame can be raised or lowered with great ease by the operator without moving his position. The length of the flame can be discerned with the aid of a revolving mirror. The mirror reflects the length and shape



10 CANDLE PENTANE LAMP

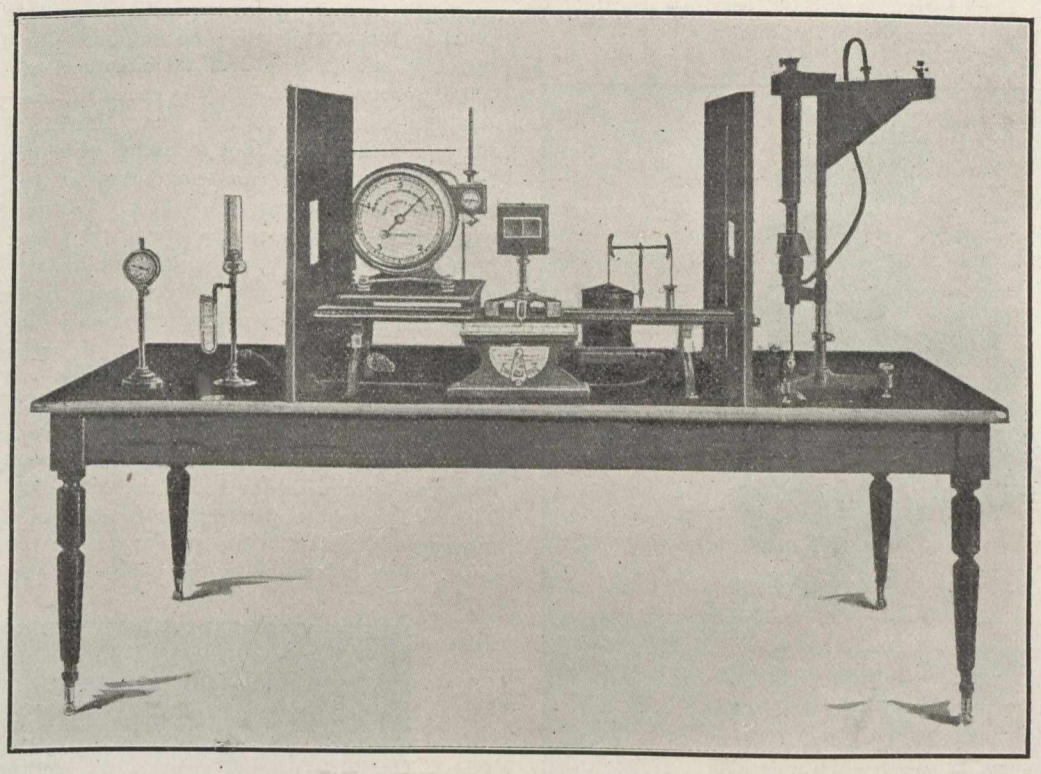
of the flame to the operator, and this arrangement prevents any extraneous light reaching the eye of the operator.

The fact that the flame is larger and longer than that of the candle flames will go to prove that it is much less susceptible to air currents. It is, however, open to discussion whether any kind of flame is suitable as a standard of light. All flames are liable to variation, due to the different surrounding circumstances, such as temperature, pressure, condition of air in regard to water vapor, and the purity of the substance used. Knowing that all flames are subject to variation it would be most desirable that an electric standard capable of giving a constant candle power be used as a standard of light. With this in view experiments have been made with electric glow lamps as a standard of light, but unfortunately the results have not been satisfactory. The electric glow lamp is useful as a secondary standard, but it is necessary to constantly check its candle power against the 10-candle Pentane lamp.

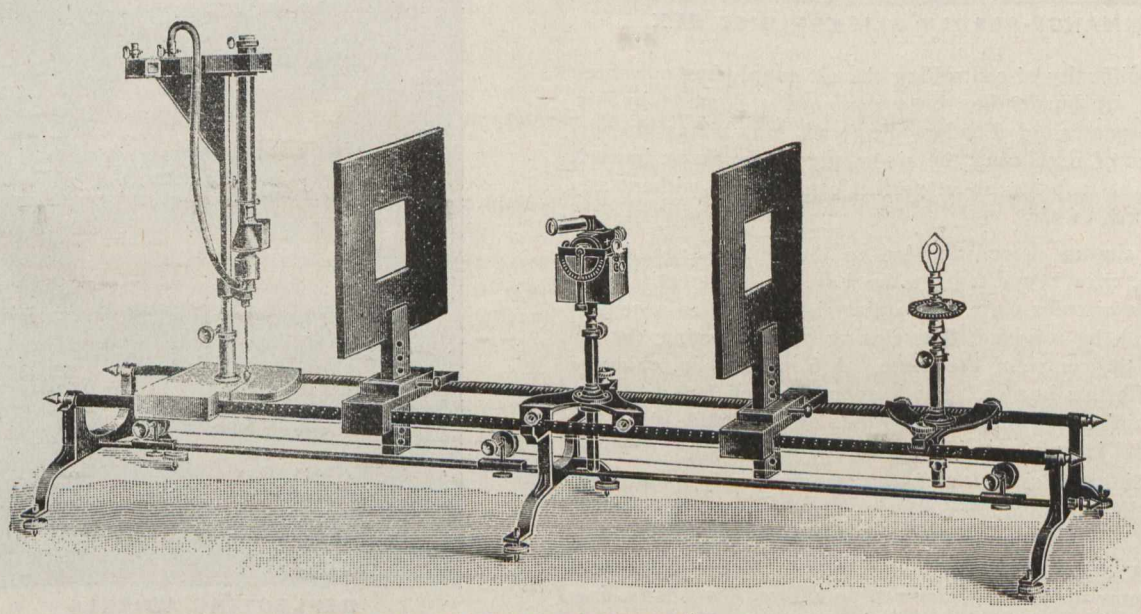
However, given a well-ventilated photometer room, and the temperature of 60° to 70° Fahr., the Pentane lamp may

be said to be an accurate and constant standard of light. The only uncontrollable element is the variation in the barometric conditions, and for this a correction is made, in cases where the light under test is an electric lamp, which is supposed to be unaffected with barometric variations.

The gas under test is burned in a specially constructed burner. The burners used are usually those of the Argand type. This burner is constructed for testing gas of a certain candle power, this candle power being 16. The inventor claims that when the gas is around 16 candles, and the gas passing at the rate of 5 cu. ft. per hour, the burner gives true efficiency. But the gas made on all works varies in quality, and it is impossible to make gas of a specified candle power. The variation in the quality of the gas tested in this burner has been partially allowed for by Mr. Sugg. He recommends that for gas of 16 candle power or over, a 6 in. x 1⅞ in. chimney be used, and for gas of lower candle power a 6 in. x ⅝ in. chimney. The reason for using different-sized chimneys with this burner is due to the fact that gases of varying quality require varying volumes of air for combustion, and the changing of the chimney had the effect of decreasing or increasing the air supply to the flames. This arrangement for controlling the air supply, although helping to some extent, does not have the desired effect of regulating the approximate amount of air to bring out the maximum candle power. It will be self-evident that to obtain maximum light from the combustion of an illuminating gas, the agents taking part in that combustion must be



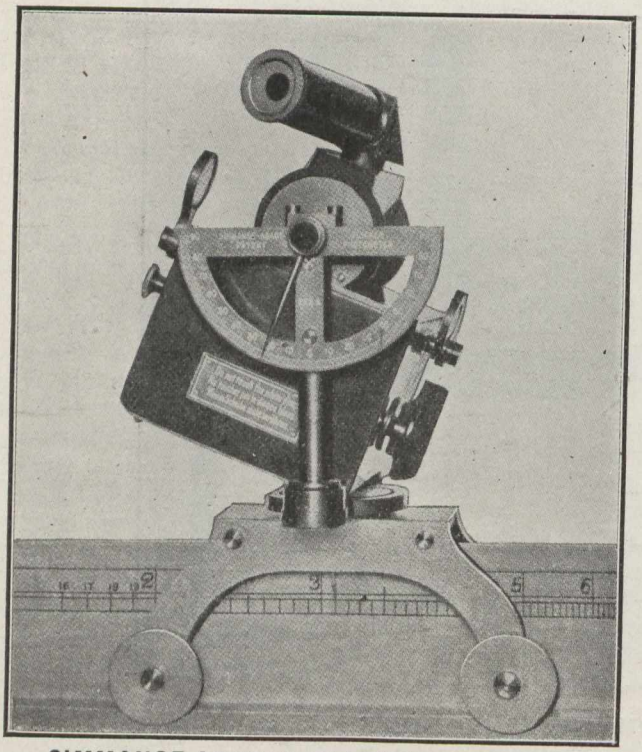
PHOTOMETER



PHOTOMETER FOR INCANDESCENT LAMPS

under control. As combustion is a purely chemical process, it is apparent that true efficiency can only be obtained when that process is controlled.

As will be noticed, no provision (other than changing chimneys) has been made for regulating the proper volume of air necessary for combustion. This variation in the volume of air passing to the flame may be caused by reason of the great or small volume of flame in the chimney, the temperature of combustion, and to a very great extent the quality and chemical composition of the gas.



SIMMANCE-ABADLY FLICKER DISC BOX

This difficulty of controlling the air supply has now been overcome. A burner has been designed and made by Mr. Chas. Carpenter, of London, England, which has the desired effect of regulating the air supply to the flame in such quantities as to bring about perfect combustion, without any undue excess of air.

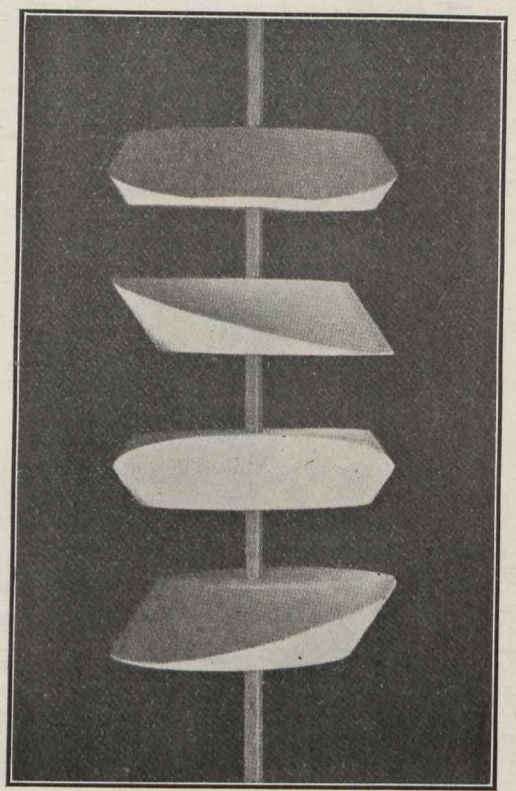
It is similar in construction to the No. 1 Argand, the main difference being that at the base of the steatite ring is placed a circular plate. The plate is screwed to a central rod and can be revolved, thus closing off or opening the air supply to the centre of the flame. A 6 in. x 5/8 in. chimney is used with this burner. The burner has been found to give a true illuminating value of all kinds of gas, while the London Argand is only suitable for gas of one quality.

The different qualities of gas, as previously mentioned, requires different volumes of air to support combustion. Coal gas of a stated candle power requires more air than pure water gas of the same candle power. These differences in the volume of air necessary can be allowed for when using the No. 2 burner. There is no difficulty in obtaining enough air for combustion; the danger lies in obtaining too much. With an excess of air the flame becomes diluted and shortened, with the result that the true illuminating value of the flame is not obtained.

It will be interesting to note that up to the present time about eighty gas companies in England have been given permission to use this burner in preference to any other standard test burner.

In the latest design of photometers the gas is burned in a No. 2 Metropolitan burner, and the standard lamp is the 10-candle Pentane. This photometer is being supplied by the makers, Messrs. Alexander Wright & Co., to many gas companies in England. It embodies all the vital conditions set forth in the regulations for gas testing in England.

The photometrical work, which is done on a gas works, is chiefly that of obtaining the candle power of the gas supplied to the consumer. The standard gas burner is placed opposite and in line with the standard of light. The disc box is moved until equality is obtained, and the candle power read off directly from the bar. Correction must be made for rate of flow of gas if in excess or slower than the specified rate, corrections for temperature of gas, and barometric pressure must also be allowed for. Testing for candle power when the lights are on the horizontal plane, and with lights of a similar color, is not a difficult matter, but when it becomes necessary to test and compare lights giving various tints, and at varying angles, it becomes somewhat more complicated. The difference in color of various lights is due to their variable spectral compositions. We all know the difference between gas light and day light. The difference is most marked, and the gas light looks yellow compared with the sun's light. However, if we compare an incandescent gas light with day light, the difference is not so great. This is due to the spectral composition of the light from an incandescent lamp being similar to the composition of day light. The difference in the composition of gases becomes more noticeable when one attempts to compare their intensity.



REFLECTING WHEELS

Great difficulty is found when testing an incandescent lamp against a Pentane standard when using the ordinary disc box. For comparing different colored lights, a special disc box has been invented. By using what is known as a Simmance Abadly Flicker disc box, the difficulties due to the different tints of light are overcome. The disc box is fitted

on the inside with a reflecting wheel. This reflecting wheel is revolved by means of a spring motor and upon this wheel falls the light from the standard and the lamp under test. The rays of light strike the sides of the wheel alternately and with a rapidity which is determined with the operator.

It will be noticed a small telescopic arrangement enables the operator to watch the revolving wheel. When the lights striking the disc box are unequal in intensity, the operator will notice a "flickering" on the reflecting wheel; the disc box is then moved until the "flicker" ceases and at this point the intensity of the lights falling upon the disc box are equal.

The distance between the centre of the disc box to the standard lamp and the lamp under test are then squared, the quotient obtained from the division of the one number by the other, multiplied by the power of the standard of light, gives the candle power of the lamp under test.

The speed of the reflecting wheel can be regulated at will; for very powerful lights, a high movement is necessary, but for lower candle powers, a slower movement is desirable. Lights up to a candle power of 1,600 candles may be tested with an accuracy of about two candles. Incandescent lamps or electric lights can be tested against the Pentane lamp or any other reliable standard.

It is necessary to remember when comparing lamps that some lamps send more light downwards than upwards, others more upward than downwards, and the true value of the lamp depends upon its sheding its light in the direction it is most required. For lighting factories, public buildings and large inside areas, it is necessary to throw light sideways and downwards. For street lighting, a lamp is desired to send the greater part of its light sideways and not in a centralized area under the lamp alone.

As I have already mentioned, the light from different lamps is thrown in different directions, and it is necessary when comparing the efficiencies of various lamps to calculate their candle power on a common basis. To bring about this comparison the candle power of various lamps is usually expressed as the "mean spherical candle power" or the "mean hemispherical candle power." These expressions may be explained by imagining a light enclosed in a sphere or hemisphere, set at a radius of one foot from the source of the light.

In any fair comparison of different lights, it is necessary to consider not only the light that is sent out horizontally, but the total light shed in all directions, which is proportional to the mean spherical candle power. It must, however, be borne in mind that the light rays thrown upwards are in some cases useless, and in those cases the true efficiency of the lamp should be calculated on the mean hemispherical basis.

The rays of light which would, under some circumstances, be useless when thrown upwards, can, with the judicious arrangement of reflectors be made to fall downwards or sideways and thus become a valuable lighting factor.

To measure the amount of light thrown in different directions and at different angles, the flicker disc box is most suitable. It will be noticed the disc box is fitted with a quadrant graduated in degrees, and the box is capable of receiving light from 90 degrees above to 90 degrees below the horizontal.

A photometer suitable for testing incandescent burners and lamps, is one fitted with a flicker disc box and an electric glow lamp, which acts as a secondary standard—the primary standard is the Pentane lamp. The procedure of testing would be as follows: Having standardized the secondary standard, the sighting disc box must be turned until the lamp to be tested shows a speck of light upon the cross lines of the screen cover (the lens being turned up vertically). Read off the angle on the quadrant and re-adjust the box at half the angle indicated (i.e., if the light is actually at 40 degrees the box must be turned to 20 degrees, thus presenting the same angle to both lights). During this operation the box must be kept stationary at the same point on the bar.

Turn down the sighting lens and screen cover and start the motor revolving the reflecting wheel. The Pentane lamp can now be masked and by bringing up the secondary standard the balance of intensity may be made. The two distances are then required, the one divided by the other, and the quotient multiplied by the ascertained power of the secondary standard.

The inequality of the distribution of light from different lamps will be better understood by referring to the following figures:—

Description of Lamp.	Direction of Rays Straight up.	Candle Power.
With		20
Upright Welsbach Burner	67½ deg. above hor.	32
Without shade	45 " " "	50
	22½ " " "	75
	Horizontal	63
	22½ deg. below hor.	40
	45 " " "	22
	67½ " " "	15
	Straight down	0
Mean Spherical Candle Power of this Burner		47.75

Description of Lamp.	Direction of Rays	
	Horizontal	58
With Lamp	22½ deg below hor.	75
Upright Welsbach	45 " " "	65
Mantle with	67½ " " "	27
Reflector	90 " " "	0
Mean Hemispherical Candle Power		60.29

Description of Lamp.	Direction of Rays above Horizontal	Candle Power.
Inverted burner with	Horizontal	40
Clear Globe and	15 deg. below hor.	43
Reflector	30 " " "	43
	45 " " "	48
	60 " " "	40
	75 " " "	42
	90 " " "	
Mean Hemispherical Candle Power		43.046

Description of Lamp.	Direction of Rays Horizontal.	Can. Power.
	15 deg. below hor.	410
Humphrey Lamp	30 " " "	330
with four burners	45 " " "	350
clear globe, with	60 " " "	355
reflector	75 " " "	188
	90 " " "	185
Mean Hemispherical Candle Power of this lamp being		150

320.28.

The above tests are made with gas having a net calorific value of about 600 B.T.U., and a pressure of 2.5 inches head of water.

It will be noticed, by comparing the first two tables, the effect of using reflectors. The light ray from all lamps are, in the majority of cases, thrown in an upward direction, where, in the greater number of cases it is less needful. The upward light can be intercepted and reflected in the direction it is most required. The type of reflectors and globes have all to do with good effective lighting, and a few hours spent in choosing suitable materials for the particular kind of lighting to be done would amply repay anyone who has anything to do with inside or outside illumination.

Surrounding circumstances must also be given due consideration. The problems of absorption and omission of surfaces upon which the light falls must be reckoned with, and each particular case should be considered by itself.

DISCUSSION ON THE REPORT OF THE COMMITTEE ON THE ILLUMINATING POWER AND CALORIFIC VALUE OF GASES MADE IN CANADA.

President: This report has been prepared for the consideration of the Association, and Mr. Keillor or myself will be very glad to answer any questions regarding the methods of making these tests or any other information you may desire.

Mr. Burnett (Toronto): What were the proportions?

President: The mixture taken was 25 per cent. water gas and 75 per cent. coal gas. This is as it should be in large cities anyway.

Mr. Burnett (Torono). I do not agree with you; think it should be reversed.

Mr. Dunderdale (Winnipeg): What type of burner were these tests made with?

President: These tests were all made with the standard Argand burner.

Mr. Dunderdale (Winnipeg): No. 1?

President: Yes.

J. S. Morris, Sec. and Gen. Mang. M. L. H. &.P. Co. Mont. Past Pres. Can. Gas Assoc.

Mr. Dunderdale (Winnipeg): Why were these tests not all taken with the No. 1 burner as the Government regulations call for?

Mr. Hewitt (Toronto): These tests were all made with the standard Argand burner, and have been made as thorough and accurate as possible.

Mr. Keillor (Hamilton): I infer that what Mr. Dunderdale calls the No. 1 burner is the standard Argand burner, used by the Government inspectors throughout the Dominion for testing the candle power of the gas. In any case it was the standard Argand burner that was used when making these tests. In the report it is termed the 16-candle Sugg standard, which is the same thing. I should explain that for comparative purposes a similar number of tests were made with what is now known as the No. 2 South Metropolitan burner—a burner virtually the same as the present Government standard, but differing in respect that the South Metropolitan is scientifically designed with an arrangement for adjusting the air supply so that it is possible to test accurately any candle power gas from ten to twenty candles more or less. This burner was invented by Mr. Charles Carpenter, of London, England, I believe in collaboration with the late Sir George Livesey, a number of years ago, previous to the time these gentlemen applied for and were successful in securing a reduction in the candle power of gas supplied in London. It is a fact that the standard Argand burner now used by the Government in Canada is made for testing 16-candle gas. In other words, if you make straight 16-candle gas and test it by this burner it would be quite correct, but, on the other hand, if the gas is 18, 19 or 20 candles, and you test it with this burner, the results would be incorrect, because there is nothing in the old type burner to enable you to regulate the air supply, which, as you know, with the Argand burner has everything to do with getting the highest efficiency out of the gas. The same remarks apply to gases lower than 16 candles. It is true that when making tests of candle-power gas higher than 16, the regulations state you should use a 1⅞-inch diameter chimney. But at best the change in the chimney merely lessens the margin of error; it does not eliminate it.

Mr. Dunderdale (Winnipeg): The Government here to-day will recognize nothing but one burner; that is, the one in use at the present time—the standard Argand. In my estimation, what we require is a Canadian standard. For instance, the new Old Country standard, if it will meet the requirements in this country.

Mr. Keillor (Hamilton): It is true at present the Government here will recognize only one burner for testing gas, viz., the standard Argand. We cannot use another until the Government give their consent. One of the objects of this report was to bring before you a number of comparative tests of the candle power and heating value of gases tested with the old and new types of test-burners and the Junker calorimeter. When the members get time to compare these they will see a very wide difference. So far as the idea of adopting a Canadian standard is concerned, it is our intention to endeavor to do this. Personally, I think the Government officials will co-operate with the Gas Association in an endeavor to get this accomplished, because we can prove to their satisfaction that the present test-burner is obsolete and incorrect. It is out intention also to ask the Government to amend the Act so that gas companies, if they wish to, can make lower candle-power gas—this low candle-power gas to be tested by the No. 2 Metropolitan burner instead of the old Sugg standard. We wish also to draw the attention of the Government to the fact that better and more accurate results all round will be obtained by the use of the Metropolitan burner. In this connection I was interested to learn by Mr. Philpott's paper yesterday that over eighty different companies had adopted this burner in England. Some of these companies are now distributing gas of about 13 candle power, tested by the No. 2 Metropolitan burner, the calorific value of which is between 450 and 460 B.T.U's.

Mr. Philip (Berlin): It might appear to anyone not a gas man that the reason we want the standard changed is to benefit ourselves, but in Berlin we have a municipally-owned gas plant. Toronto has practically the same, and there are a number of municipal gas plants, and if we can better gas for the purpose required more economically, the benefit accrued directly to the public.

This paper has been very interesting, and I move a hearty vote of thanks to those who got the data together and made this report.

Mr. Dunderdale (Winnipeg): Before putting that motion, Mr. President, I would like to know whether any person

can give me a scale of depreciation in candle power of gas put in a holder when the temperature is 50 below zero?

President: I think you have got us there.

Mr. Dunderdale (Winnipeg): I would like to know the decrease in illuminating power.

President: We put gas in the holders at 60, and it goes at times to 10 and 12 below zero, or worse, but do not know how far.

Mr. Wallace (Quebec): There is a paper being prepared by a man connected with the American Gas Association, which will be copied with the proceedings of their convention. I will look it up and send it to you, Mr. Dunderdale.

Mr. Keillor (Hamilton): Do you find abnormal condensation in the holder drips?

Mr. Dunderdale (Winnipeg): Quite a bit.

Mr. Coate (Ottawa). I quite agree with Mr. Philip. This paper deserves our best appreciation and thanks, and I am sure we are all gratified and pleased with the result, and I take pleasure in seconding the vote of thanks to Messrs. Hewitt and Keillor.

The motion being put to a vote was carried unanimously.

Mr. Keillor (Hamilton): I thank you very much, gentlemen, for your kind acceptance of this report. So far as I am concerned it has been a labor of much interest and love.

Mr. Hewitt (President): I thank you, gentlemen. The interest you have displayed amply repays for the cost and trouble taken.

DISCUSSION ON MR. R. A. FRASER'S PAPER, "GAS ENGINE DEVELOPMENT."

President.—I am sure we have all listened with a great deal of interest to Mr. Fraser's paper. What suggested itself to my mind while Mr. Fraser was reading was, that in view of its efficiency and apparent economy, especially in towns where natural gas is available, it is strange that gas engines are not more generally used, for I think I understood Mr. Fraser to say these engines reach their highest point of efficiency running on natural gas, while it is also capable of taking an important place in manufacturing centres where industrial gas is used. This has been an education to me. We must be very ignorant of these facts in Montreal, for I don't think we have six gas engines on our gas list in that city of about half a million population. It seems to be replaced there by comparatively cheap electric power. I don't know how it is in other cities. I should like to hear a discussion on it.

Mr. Hewitt (Toronto).—Mr. Fraser has given us a splendid paper and pointed out many important things which we had scarcely realized. Away back in the early days the Consumers' Gas Company, of Toronto, bought and installed in Toronto, what was then considered a good type of the Otto Engine already referred to, made by the Doty Company, of Toronto. There were two reasons why these engines were not fully successful, 1st, because of many imperfections in the engine, and 2nd, insufficient knowledge on the part of the people who tried to run them.

I have watched with much interest the later development and improvement of the gas engine. In Philadelphia, the W. G. I. Co. has about 1,500 gas engines working. They have an expert whose duty it is to inspect and look after engines regularly—see that they are properly attended to and kept working. When a consumer wants to buy an engine and has not got the money to pay for it, the company will install the engine and provide easy terms of payment. They are not themselves manufacturers of engines, but believe this is good business. They surely are on the line that will succeed.

We have something like 200 gas engines on our lines in Toronto, and as an illustration of the economy of this class of power we took 23 gas engines, secured the statistics from the people who were using them, and it was shown that the annual saving as compared with electricity was $60 per h.p. per annum. This was on the basis of a 10-hour day, and the actual number of working days in a year. These figures were taken just to get at the facts, not to boost the sale of gas engines at all.

I think this paper has come before us at an opportune time, and we are deeply indebted to Mr. Fraser for the very careful manner in which he has prepared it. I have never heard a better paper.

Mr. Dion.—What are the electric rates in Toronto? They must be excessive.

Mr. Hewitt (Toronto).—The rates are as low as 1½c. and as high as 20c.

Mr. Dion (Ottawa).—I cannot imagine even if you produced electric power at less cost, how could you save $60 a year?

Mr. Hewitt (Toronto).—These are figures furnished by the consumers themselves, not by our company.

JOHN KEILLOR,
Supt. and Mgr. Hamilton Gas Light Co., Ltd., Sec.-Treas. Can. Gas Assn.

Mr. Dion (Ottawa).—I do not know what the rates for electric power in Toronto are, but I have some idea. But take in our own city, where it is sold in small quantities, ½ and 3 h.p., with a maximum rate of $25 per h.p. per year, you cannot save $60 per h.p. there. (Laughter.) There are other places where the power is as cheap, not many, I suppose, some are a little higher. We are interested in Ottawa in both gas and electricity.

The writer of the paper said that one reason why electric power was used so much was on account of the aggressive policy of the electric companies. That may account for it to some extent, but the little or no attention required by an electric motor after you pull the lever, in my opinion, is not one of the least reasons for the popularity of electricity.

The writer referred to producer gas: now while it costs very little to install a motor, the initial cost of a producer gas plant is extremely high. If producer gas is to compete the first cost has got to be reduced considerably.

There was another point touched on, but this has no bearing on the subject—that was gasoline engines. The writer stated it would take one pint of gasoline per h.p. per hour. Is that right, Mr. Fraser?

Mr. Fraser (Toronto).—That is correct.

Mr. Wallace (Quebec).—I would just like to refer to one point touched on, that is the non-aggressiveness of the gas companies; I just wish, Mr. Hewitt, they had some of our customers in Quebec to deal with—you have got to be pretty aggressive to satisfy and hold them.

I quite concur in what Mr. Hewitt said a few moments ago about ignorance of how to handle and run gas engines. It was my duty at one time to look after the repairs of some of them, and we looked on the gas engine as a "plague," and when we saw a person coming to have his engine repaired we would sneak out of the shop. However, I wish to congratulate Mr. Fraser on this excellent paper. The gas engine to-day is not a toy, but a mechanical machine, which, if intelligently handled and advertised, will furnish a broad field for increased consumption.

Mr. Coate (London, Eng.)—I should like to add a word on this subject. Mr. Keillor, Mr. Dunderdale and myself have had some experience in the handling of gas engines in England, Australia, and New Zealand, but during the 18 years I was in Ottawa I was not able to get a single gas engine in. Of course gas was $1.10, in comparison with water-power electricity. Unless you can get the price of gas down to the level they have it in Toronto it is pretty hard to sell them.

I was much impressed with the remarks of Mr. Hewitt, and surprised to know they have so many gas engines in Toronto, for I did not think there was so many in the Dominion. But as Mr. Wallace remarked, there is a great field if properly developed, and if you can get the gas down below the dollar mark (I know I will never be able to do it). I heard the other day that gas was to be put in the holder at 25c. per 1,000 ft. I hope it is true, but, like the Scotchman, "I hae mi doots." (Laughter.)

I want to thank Mr. Fraser personally for the very interesting paper he has given us, and may I just say in conclusion, I was reminded while he was reading it of the story told of an eminent professor in the Old Country who was lecturing on "Expansion by Heat," when a humorously-inclined student in the back of the hall stood up and asked the lecturer if that was the reason the days were longer in warm weather than in cold? (Loud laughter.)

Mr. Carter (Guelph).—I would like to mention something which has come under my notice in Manchester, where they are making electric power cheaper there than we are. In one plant they have 10,000 h.p. all in small units—I think you will agree with me they are making some headway there. Their power is generated by steam, surely we ought to be able to equal or go one better when we have water power.

We have two plants in Guelph furnishing gas at $1 against electricity at 3c.

Mr. Dion (Ottawa).—It is a strong talking-point that with a motor you only have to move a lever and there is no further trouble.

The 200 gas engines in Toronto are only the ones supplied by the Consumers' Gas Company, not taking into account those running otherwise, but without seeing the figures and knowing something of the returns, I cannot understand how $60 a year could be saved.

Mr. Carter (Guelph).—Are these definite figures, or are they just agents' talk? You agents are very clever, and I take off my hat to you—but can we get at any definite figures in regard to the comparative cost of producer gas, or are we electric people off our bases?

President.—Mr. Philip, of Berlin, could have given this information if he had been here.

Mr. Keillor (Hamilton).—I am sorry I cannot throw any light on the comparative cost figures as Mr. Philip could. We know there is a great deal of difference in the cost of both gas and electricity in Canada to what there is in the Old Country. In some of the towns in England the price of gas is only half what it is in Canada—in some places they charge 40 to 45c. per 1,000 feet for manufactured gas, and 4 and 5c. per kilowatt for electricity, whereas, in this country electricity is sold as low as ¾ and 1c. per kilowatt, and gas at $1, 75c. or less, as the case may be.

Take the case Mr. Wallace referred to, at our own works, where we have a coal hopper run by a gas engine. This runs only intermittently, and we find it very economical, but if it were running constantly, say, 10 or 12 hours a day, then it might be cheaper to use electricity at 1c. per kilowatt.

I should like to ask Mr. Fraser what kind of gas he has in mind when he put the consumption at 15 to 18 cubic feet of gas per h.p. per hour? Also the number of BTU's? I think you mentioned 630, Mr. Fraser.

Mr. Fraser (Toronto).—I had reference to illuminating gas, of 630 BTU's.

Mr. Keillor (Hamilton).—I would like to know whether you can give us any information as to how a reduction in the BTU's would effect the consumption. The Association has the subject of lowering the BTU's of the gas under consideration. Of course we know you can use producer gas as low as 150 BTU's, but would a reduction to say 500 BTU effect materially the consumption?

Mr. Fraser (Toronto).—Take in the case of gasoline, it runs about 850 to 900 BTU's, and in practice we have found that 50 or 60 lbs. compression is about all you can carry safely, but in the case of illuminating gas, 630 BTU, you can increase the compression up to 150 lbs. per square inch, so the matter of compression enters into the question of consumption. The consumption is about in proportion to the BTU's. It might be possible to increase the compression without increasing the consumption.

Mr. Wallace (Quebec).—I would like to challenge the statement made by Mr. Keillor, that where power is on all day long, electricity would be cheaper than gas; I am not prepared to admit that electricity can beat gas at any stage, or under any circumstances as prices go to-day.

Mr. Hewitt (Toronto).—Is it not a fact that with the price of gas at $1 and electricity at 2c. they would be about equal?

Mr. Keillor (Hamilton).—Whether electricity would be cheaper than gas in any particular case depends entirely upon the price of the gas and electricity. I should say that $1 gas would easily beat electricity from 2c. kilowatt up, but at ¾c. to 1c. it is a tough competitor, that is for continuous use for 10 to 12 hours a day. On the other hand, for intermittent use, gas would certainly be cheaper than electricity under almost any circumstances.

Mr. Buskard (Hamilton).—My experience has been that gas engines on continuous use are cheaper than electricity. I have 28 of them in Hamilton from 4 to 20 h.p. under the same conditions that I have used electric power, and it costs only half the price of electricity.

Mr. Coates (Ottawa).—There was a reference to making bread by gas power in Mr. Fraser's paper, I would like to have that repeated, please.

Mr. Fraser (Toronto).—The point I wanted to make was that there was an advantage in operating a dough mixer, for instance, by power, over hand-operated machines, and better results are obtained. If you take a certain quantity of flour, you get more bread when it is mixed in a power machine than when mixed by hand—get more loaves from the same quantity of flour.

Mr. Carter (Guelph).—The real point is the comparative cost between gas and electricity for intermittent use, as I understand it.

Mr. Fraser (Toronto).—Yes, the mixer would probably only be running about fifteen minutes to mix an ordinary batch of bread run by a gas engine, and you get a better quality of bread, more of it, as well as saving labor. The same thing applies to the making of ice cream. There is no question about it, ice cream made by power motion is very much superior to the same article made by a hand-operated machine.

Mr. Dion (Ottawa).—I can quite understand that, because ice cream is sold by bulk, but cannot see what difference it would make in bread, that is sold by weight.

Mr. Carter (Guelph).—It takes in more water.

Mr. Dion (Ottawa).—I would like to ask Mr. Hewitt whether the figures given by Mr. Hewitt were simply for the gas consumed or whether they include cost of attendance?

Mr. Hewitt (Toronto).—The point I intended to bring out was that the gas companies must undertake the care and maintenance of these engines—see that they are given proper attention and kept in perfect condition. The operation is nothing if they are kept in proper working order.

Mr. Dion (Ottawa).—Your figures do not include attendance?

Mr. Fraser (Toronto).—No.

Mr. E. H. Gurney (Toronto).—In our plant we riddle our sand in the foundry by gas power, and although we make our own electricity we have decreased the cost considerably by using gas. I think if the advantages were brought before foundrymen in the proper way there would be a good field for gas engines.

Mr. Keillor (Hamilton).—That is a good, practical illustration.

Mr. Buskard (Hamilton).—I have had a good deal of experience since 1896 with gas engines, and would like to say that it is the most economical power you can use except water, providing you have a perfect mixer and a perfect sparker on your engine, you will have very little trouble with your engine, and it will cost you very little for operation or repairs.? I run my engines for $4 a month on natural gas, and although I have 20 engines working in Hamilton, I have only spent $5 for repairs in ten years. I make my own mixers and sparkers and they never miss fire from one year to the other. Don't blame the engine if you have trouble with starting it and running it—blame the designer. The mixer now generally used on the small gas engines is not a mixer proper, as the index valve has to be so regulated as to do the work of the mixer, which, when not set within the fraction of an inch, necessitates the turning of the crank, and I may add with great difficulty before the engine can be started, and in many cases with such difficulty and repetition that the operator is exhausted. This should not be—a man is not a horse.

The sparker used also caused a lot of unnecessary trouble, the make and break spark causing the points to hammer together, the result being that carbon or other foreign matter accumulating in the cylinder becomes packed onto the points, which in turn become carbonized, thereby greatly decreasing the efficiency of the sparker.

The compression valve now in use on the side of the cylinder and which is supposed to regulate the compression, is in my estimation a detriment, and acts directly to the disadvantage of the mixer, as for instance the operation of the crank causes the piston to create an influx of gas and air in a fixed proportion through the mixer, then, again, when the piston is in the act of passing the valve, whose purpose it is to relieve the compression, I find that the piston at this point has a tendency rather to draw a further quantity of air into the cylinder, which offsets the required proportion of gas and air, and the result is that when the piston returns it forces this proportion of gas and air out through the cylinder valve and a uniform quantity and proportion of gas and air cannot be maintained.

A gas engine should be, and can be, so constructed that any person with ordinary knowledge should be thoroughly capable of properly caring for it. The mixer should be as perfect as the generating properties of the steam boiler, for the mixer is, in effect, the boiler of the gas engine. It should, and is, possible to regulate the compression at from one pound upwards to its limit without undue exertion on the part of the operator in starting the engine.

By having a perfect mixer which will draw the charge to the full length of the stroke, and discharge the excess gases through the exhaust valve to the limit of compression, the energy required to start the engine is greatly decreased.

The sparker should be made so that the least friction possible would be created while in action, and so that one spring will not pull against the other, and constructed of such material as not to be effected by the heat, it should also be self-cleaning, with short contacts and throw the arc in a similar manner to that of the lightning flash, and work in perfect order for at least two years.

The gas valve should be so constructed that when the engine is turned over it would be possible to obtain the proper proportions of gas without regulating the index valve to within the fraction of an inch.

The engine builders of to-day do not seem to realize that in the lighting system a perfect mixer is to be found, and that the principles upon which it works should be applied to the gas engine if the best results are to be obtained. There should be a standard rule as to the sizes of valves in their relation to the h.p. of the engine. By having large valves made of hard steel and not of the same metal as the seat of the valve, I have found these valves will seat themselves and run for years. The ones we see to-day on most of the engines are like egg shells. (Laughter.)

Mr. Keillor (Hamilton).—Do you consume 16 to 18 feet of gas per horse-power?

Mr. Buskard (Hamilton).—Less than that, I only use 8 to 9 feet. I run on 68c. a day on artificial gas.

Mr. Hewitt (Toronto).—You get better results than any person I ever heard of.

Mr. Buskard (Hamilton).—Why cannot you do it if you have got a perfect mixer and sparker? Gas engine manufacturers often follow some other person's ideas and do not use their own brains.

Another thing about them is, they over-rate their engines. There are engines in Hamilton to-day sold for 6 h.p. and will only show 3 h.p. I know a man who sold one for 15 h.p. which would only develop 8 h.p.

President.—The discussion this paper has evoked I am sure must be very gratifying to Mr. Fraser. Like Mr. Coate, I was not aware there were 200 gas engines in Toronto. I did not think there were so many in the Dominion. I am also surprised at the statement made regarding saving $60 a year. I would like to sell electric power in Toronto. (Laughter.)

Mr. Philip (Berlin).—At the present time we are tied up for power in Berlin—our gas engines are overloaded, but, of course, the town does not want to put in any more in view of the Niagara power, which will be available shortly. During the month of April our steam generators burned $1,400 worth of coal and only produced one-third of the power we made on $500 worth of coal with producer gas. There may be some plants more economical than this one. These are high speed engines, running against five-pound back pressure, which effect the economy somewhat. We have producers made by the R. D. Woods Co. The last time the fire was

out was the 2nd of January this year, and they had not been out up till then since two years ago last March. They run 24 hours a day all the time. You can shut them off. Our holders will run the plant four minutes—that is the limit. Now, that is pretty reliable, running night and day all through. It is no imagination—we have nothing else to make "juice" and keep the power on.

Then, take with illuminating gas, if you are running on a fixed quality (though in Berlin we are "running pretty close to the wind," sometimes) your engines will run uniformly with just as little trouble as a water-wheel—your troubles are very slight. Our ignition troubles are easily overcome. We change our igniters in forty seconds—these are little tricks the boys find out for themselves.

Now, as far as hydro-electric power goes, I am afraid it will never be satisfactory—there is nothing like having the control of the power at your own door. Take the T. Eaton Co., Toronto; I suppose their power costs them as high, or higher, than any concern in Canada, perhaps three times as high, but it is worth that much to them to be under their own control—no shutting down everything there in a thunderstorm, but when we are dependent on Niagara power, Toronto, London, and possibly Windsor, it will not only be local storms, but the power will be affected by storms over an area of 150 miles, and the troubles will be manifold. We all know what trouble there is in our own plants, now, with big motors jumping on and off, and you can imagine what it will be when everyone is trying to get on at once after an electric storm—there will be lots of fun.

I am sorry, Mr. President, I did not hear this paper, but I will write the author my criticism later on.

Mr. Wallace (Quebec).—I would like to ask whether any of the members have had experience with gas of a uniform quality and different specification, and whether it makes any difference?

Mr. Philip (Berlin).—If your engine does not run on coal gas and give the maximum economy, and you change over to water gas, you will get rapid back-firing, and the compression will be doubled; it will he hard to get proper ignition. Your compression should be lower and your hydrogen higher, the same as in producer gas.

Our producer will run from 80 to 140 compression. It varies sometimes, running 125 to 130 BTU, but that may be excessive, then we have troubles with the ignition, back-firing and blowing out the manifold. That does not affect the working of the engines, but does affect the motives—for it is like the Battle of Paardeburg. (Laughter.)

COLLAPSED WATER TANK.

On the 13th of June, shortly before the noon-hour, the five-storey building occupied by the Herald Publishing Co., on St. James St., Montreal, was almost totally wrecked, the front walls and portion of the floors alone remaining intact.

The water tank, weighing about 60 tons, for use in connection with the water sprinkler system for fire protection, crushed through the building, wrecked it, and following the collapse of the tank fire broke out causing further destruction.

The cause of the collapse of the tank is not yet definitely known. Civic authorities have called in Messrs. Ross and Hogarth, W. J. Hutcheson, and J. A. Jamieson, from Montreal, to make a thorough investigation of the wreckage with a view to ascertaining the reasons for the destruction of the building.

At the coroner's inquest, Mr. J. S. Archibald, of Saxe & Archibald, architects, gave technical evidence of the situation of the tank and its supports. He produced the plans of the building made at the time of the entry of the "Herald" into the building, and explained the situation of the tank to the coroner.

Its capacity was 12,000 gallons, U. S. measure, and its weight would be 60 tons. Of this weight 40 tons rested on the centre wall, which witness described as a good brick wall, and 20 on the east wall. There were two steel girders twelve feet apart and running from wall to wall. The legs of the tank rested on these girders.

Witness mentioned that they were well within the limits of weight allowed by the city. The centre wall, which bore

Showing the Clean Cut Through Floor

two-thirds of the whole weight, was a strong, well-built twelve-inch wall, and was a couple of inches thicker than the other wall.

On Friday, October 4, 1907, Mr. Archibald examined the building and found everything all right, and so reported. Then again in June of last year a slight fire occurred on the back of the "Herald" building. At that time, for his own satisfaction, he examined everything again, and the tank and roof were in proper shape. The only warning ever given the "Herald" was to keep the outside steel work properly painted, so that the weather might not work its way in.

The steel work was good. If it had not been, it would not have stood for five years, it would have gone the very day after it was put up. The examination which he had made of the building sine the disaster had convinced him that it was not the fall of the tank which had caused the catastrophe, and if so the tank would not have fallen in a

place 50 feet southward of that which it had occupied on the roof. He felt sure that something had occurred in the building to cause the collapse of the wall and then the tank had come down. If the tank had fallen first it would have gone down due west. The civic by-laws allowed a weight of 46,800, the margin of safety being 16 per cent. in this case.

A Page of Costs

ACTUAL, ESTIMATED, AND CONTRACTED.

COST OF PUMPING WATER, OTTAWA.

The cost of pumping 1,000 imperial gallons as shown by the present system of accounting, is as follows:—

Maintenance and repairs	0.810	per 1,000 I. gals
Salaries:		
Pump and Press House	0.190	"
Management	0.190	"
Collection	0.150	"
Fire Alarm	0.013	"
Miscellaneous	0.005	"
Interest and Sinking Fund	1.840	"
	3.198	"

The average daily consumption of water during 1909 was 15,360,900 imperial gallons, an increase of 979,080 imperial gallons per day over 1908.

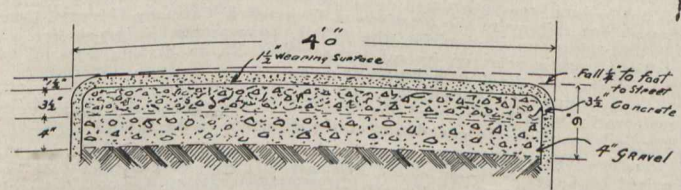
The population increased from 80,248 in 1908, to 83,360 in 1909, and the daily consumption per capita from 179 in 1908, to 184 imperial gallons in 1909.

COST OF SNOW CLEANING, OTTAWA.

After each snow storm 15,153 miles of sidewalk was cleaned. For the winter 1908-9 it cost $16,582.81, or an average of cost of $109.14 per mile. The lowest cost per mile for the winter was $58.85, the highest, $210.95.

COST OF LAYING 596 LINEAL FEET OF 4-FOOT CONCRETE SIDEWALK.

The data is obtained from work done in a suburb of Toronto, one short street (both sides), being taken as a representative stretch.



Specifications:—5 in. cinders; 4 in. foundation (1 cement, 8 gravel); 1¼ in. surface (1 cement, 2 sand).

Costs:

Cinders, 15 loads at $3	$45.00
Cement, 155 bags or 39 barrels (approx.), at $1.65	64.35
Delivery, 39 barrels, at 15c.	5.85
Gravel, 36 cu. yds., at $1.35	38.60
Labor, 390 single hours, at 25c.	97.50
Machinery, depreciation and repair and interest	5.00
Moving	2.00
Machinery, gasoline 4 gals.	.64
coal 400 lbs.	1.30
Teaming, 2 days, at $5	10.00
Incidentals, wear and tear, etc.	3.00
Men's carfare	3.00
Total	$276.24

Labor was made as follows:—

19	men,	9	hours each	171 hours
18	"	8	"	144 "
15	"	5	"	75 "
				390 "

Two machines were used, one ½ yard mixer, steam driven, for foundation, and one small mixer, gasoline driven, for topping.

Total length of 4-ft. walk, 596 ft.; total cost, $276.24; cost per lineal foot, 46.3 cts.; cost per sq. ft., 11.5 cts.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

Copies of these orders may be secured from the Canadian Engineer for a small fee.

10802—June 4—Authorizing the C.N.R. to open for the carriage of traffic that portion of its railway from Rosetown to Kindersley, distance of 54 miles.

10803—June 8—Authorizing C.P.R. to construct an additional track across Alberni Street, Moosomin, being parallel to the main line of railway and 26 feet south-west thereto.

10804—June 7—Authorizing the Hydro-Electric Power Commission to carry its transmission line across wires of Bell Telephone Company at Lot 108, Township Thorold, County Welland, Province Ontario.

10805—June 6—Authorizing the Tillsonburg, Lake Erie, and Pacific Railway Company to construct branch or spur lines in town of Ingersoll, to the premises of the Ingersoll Packing Company, and to a point on Victoria Street, west of Wonham Street. The work to be done within 8 months from this date; temporary station to be constructed on corner of Carnegie and Thames Streets; compensation to be given for injury to property by spur; no movement of cars or engines permitted across Thames Street unless man goes ahead to warn public, west of said street not to exceed 4 miles per hour. Authorizing Tillsonburg, Lake Erie, and Pacific Railway Company to take certain lands; compensation to be given to land-owners. Application re Interswitching at Ingersoll reserved, pending report by Chief Engineer and Chief Operating Officer.

10806—June 8—Relieving Pere Marquette Railroad Company from furnishing further protection at first crossing of the highway by its railway west of Blenheim, Ont.

10807—June 7—Relieving the Windsor, Essex & Lake Shore Railway Company from further protection at the crossing by its railway at Gosfield South, Essex County, Ont.

10808—June 7—Ordering diversion of the highway four miles east of Tilbury Station by the Michigan Central Railroad Company.

10809—June 7—Approving of the location of the proposed new C.P.R. station at Cartier, Ont.

10810—June 7—Authorizing the G.T.R. to construct branch line from a point on its line east of Milton, Ont., into the premises of P. L. Robertson Manufacturing Company, Township of Trafalgar, County Halton, Ont. Work to be done in three months from date.

10811—June 8—Approving of location of new G.T.R. station at Malton, Ont.

10812—June 8—Approving of location of the piers in the International bridge of the M.C.R., Front Street, Niagara Falls.

10813—June 8—Ordering C.N.R. to construct cattle pen and loading chute at Ashville, Man. Application of W. E. Keefer, Ashville, Man.

10814—June 9—Authorizing the C.P.R. to alter, etc., the bridge by which Notre Dame Street, East, is carried over its tracks at its Place Viger Station yard; and to carry the said street over the new location of its tracks.

10815—June 9—Approving of C.N.O.R. line from east end of proposed viaduct near Wright Street, station 330, to a point on the west side of the river; and authorizing the C.N.O.R. to construct a bridge over the Port Hope Creek, Township of Hope, County of Durham, Ont.

10816—June 9—Authorizing C.N.O.R. to construct its line across public road between Lots 2 and 3, Concession "A," in Trenton, Ont.

10817—June 7—Making Toronto Street Railway Company and the Toronto & York Radial Railway Company parties to the application re separation of grades at C.P.R. crossings over Yonge Street and Avenue Road.

10818—June 7—Dismissing the application of the corporation of the town of Ferris, Nipissing District, for order directing G.T.R. to construct crossing where its railway intersects a proposed deviation of road allowance between Concession 3, 4 and 5, Lot No. 29, in the 4th Concession.

10819—June 6—Refusing the application of village of Morningtown for a subway. The C.P.R. to widen approaches to 22 feet; raise the hollow on north approach at least 5 feet; cover clay approaches on both sides with 6 inches of gravel; and work to be completed within 20 days from date.

10820—June 13—Authorizing the G.T.R. to construct branch line from a point on its railway west of Brock Street, Toronto, south-easterly across Brock Street to the premises of the Gall Lumber Company.

10821—June 9—Authorizing the Atlantic, Quebec, and Western Railway Company to construct its railway across the King's High Road at mileage 62⅛, being crossing No. 7, in the municipality of Cape Cove.

10822—June 9—Authorizing the Atlantic, Quebec and Western Railway Company to construct its railway across the King's High Road at mileage 62⅛, be ingcrossing No. 7, in the municipality of Cape Cove.

10823—June 9—Being crossing No. 3, mileage 58, municipality of Cape Cove, King's High Road.

10824—June 9—Being crossing No. 5, mileage 60½, municipality of Cape Cove, concession road.

10825—June 9—Being crossing No. 2, mileage 56, municipality of Cape Cove, concession road.

10826—June 9—Being crossing No. 1, mileage 55½, municipality of Cape Cove, King's High Road.

10827—Being crossing No. 1, mileage 64½, municipality of Perce, County Gaspe, concession road.

10828—June 9—Being crossing No. 2, mileage 65, municipality of Perce, County Gaspe, range road.

10829—June 9—Being crossing No. 2, mileage 98½, municipality of Douglas West, County of Gaspe. Over by-road leading to beach.

10830—June 9—Authorizing the Atlantic, Quebec and Western Railway Company to construct its railway over road crossing No. 1, mileage 79, municipality of Malabie No. 2, County Gaspe.

10831—June 9—Over range road at mile 92½, being crossing No. 5, municipality of Douglastown, County Gaspe.

10832—June 9—Over concession road at mile 77⅛, being crossing No. 3, municipality of Malabie No. 1, County Gaspe.

10833—June 9—Over King's Road at mile 77, being crossing No. 2, municipality of Malabie No. 1, County Gaspe.

10834—June 9—Over King's High Road at mile 89¼, being crossing No. 3, municipality of Douglastown, County Gaspe.

10835—June 9—Over concession road at mile 81⅛, being crossing No. 2, municipality of Malabie No. 2, County Gaspe.

10836—June 9—Over concession road at mile 90¾, being crossing No. 4, municipality of Douglastown, County Gaspe.

10837—June 9—Over main road on Barachois Sand Bar at mile 73¾, being crossing No. 1, municipality of Malabie No. 1, County Gaspe.

10838—June 9—Over King's High Road, mileage 61½, being crossing No. 6, municipality of Cape Cove.

10839—June 9—Authorizing the Atlantic, Quebec, and Western Railway Company to construct its railway across a concession road at mile 63¾, being crossing No. 8 in the municipality of Cape Cove, County Gaspe, Que.

10840—June 7—Authorizing the C.N.O.R. to construct its line of railway across the public road between Lots 13 and 14, Concession 1, Township of Cramahe, County Northumberland Ontario,

10841—June 7—Authorizing the Chatham, Wallaceburg, and Lake Erie Railway Company to construct a branch line 3½ miles long from a point on the main line of the railway, opposite the Blind Line of the 4th Concession, Township of Dover East, County Kent, terminating at a point at or near the corner of the Winter Line and the road between the 3rd and 4th Concessions, in said township.

10842-3-4—June 9—Dismissing application of the Department of Public Works of Province of Ontario, for authority to construct a crossing over the track of the C.P.R. (Soo Branch), by the Sudbury Soo Trunk Wagon Road at Lot 8, Concession 11, Township Dennison, Ont.; at Lot 7, Concession 11, Township Dennison, Ont.; and at New Algoma Mills Station, or mill location, in the Township of Long, Ontario.

10845—June 1—Directing the Canadian and Dominion Express Companies to file with the Board before the 1st of August, 1910, a rate of $1.50 per one hundred lbs., from Providence to Toronto, on oysters.

10846—June 10—Approving location and detail plans of the proposed new station of the C.P.R. at Erskine, Alta.

10847-8—June 9—Authorizing the C.P.R. to construct the following bridges:—No. 90.09, over the Magpie River, White River Section, Lake Superior Division; No. 61.64 on the Lac du Bonnet Section, Central Division.

10849—June 10—Approving plan of a concrete canopy to be constructed along the west side of the Quaker Oats Company's new warehouse, Peterboro, Ontario.

10850—June 10—Relieving the Boston & Maine Railway from further protection at the crossing by its railway at Tyler Street, Ayers' Cliff, Quebec.

10851—June 10—Authorizing the Atlantic, Quebec, and Western Railway Company to construct its railway over a bye-road of the York Lumber Company at mile 99¼, being crossing No. 3, municipality of Douglas West, County Gaspe, Quebec.

10852—June 9—Authorizing the Atlantic, Quebec and Western Railway Company to construct its railway across the main back road at mile 86¼ being crossing No. 1, municipality of Douglastown, County Gaspe, Quebec.

10853 to 10856 Inc.—June 9—Authorizing the Atlantic, Quebec, and Western Railway Company to construct its railway across the King's High Road at mile 93¾, crossing No. 6, municipality of Douglastown; at mile 96¾, crossing No. 1, municipality of Douglas West; across the by-road leading to the beach at mile 100, crossing No. 4, municipality of Douglas West; across the side road, under a pine trestle, crossing No. 6, municipality of Grand River; across the side road to the beach under its steel trestle over Breche a Mannon, crossing No. 8, municipality of Grand River; across the King's High Road on the Douglastown Sand Bar at mile 95¼, crossing No. 8, municipality of Douglastown; across the King's High Road, at mile 94⅞, crossing No. 7, municipality of Douglastown; across the King's High Road at mile 50¼, crossing No. 2, municipality of Grand River; across the side road to the beach under its steel trestle over Breche a Mannon, crossing No. 7, municipality of Grand River; across the King's High Road at mile 89⅛, crossing No. 2, municipality of Douglastown; across the King's High Road at mile 52¾, crossing No. 5, municipality of Grand River; across the Concession Road at mile 50¾, crossing No. 3, municipality of Grand River; and across the King's High Road at mile 49½, crossing No. 1, municipality of Grand River, all in the County of Gaspe, Province of Quebec.

10866—June 10—Approving revised location of the C.N.O.R. Company's line of railway through the town of Cobourg, from mile 172.58 to mile 173.9 Ontario.

10867—June 10—Amending Order No. 10330, dated April 22nd, 1910, relieving the C.P.R. from providing further protection at the crossing where its railway crosses the highway known as Chemin Frederick, mile 21.86, Concession Road between Lots 466 and 504, Parish of St. Felis de Valois, Elizabeth Township, County Joliette, Quebec, by striking out the figures "21.86" in the fifth line of the recital to the Order, and substituting therefor the figures "13.42."

10868-9—June 10—Authorizing the C.N.O.R. to construct its railway across the public road between Lots 30 and 31, Concession A, Township of Haldimand; and to construct its spur line to ballast pit across the Kingston Road between Concessions "A" and "B," Township of Brighton, Ontario.

10870—June 10—Authorizing the C.P.R. to construct bridge No. 20.64 over the North River on the Georgian Bay and Seaboard Railway.

10871—June 9—Authorizing the Bell Telephone Company to construct its aerial wires across the track of the G.T.R. at public crossing 1¾ miles east of Jeannett's Creek Station, Ont.

10872—June 10—Authorizing the Hydro-Electric Power Commission of Ontario to erect transmission line across the telegraph wires of the C.P.R. at Lot 5, Concession 9, Township of West Flamboro, County Wentworth, Ontario.

10873—June 10—Authorizing Wm. J. Aikens, to lay a gas pipe under the track of the G.T.R. where the same crosses Onondaga Road at a point 1¾ miles west of Onondaga, Ont.

10874—June 10—Authorizing the corporation of the city of Fort William, Ontario, to lay a sewer under the track of the C.N.R. where the same crosses Francis Street, Fort William, Ont.

10875—June 10—Authorizing Wm. J. Aikens to lay a gas pipe under the track of the G.T.R. where the same crosses Onondaga Road, near the village of Cainsville, Ontario.

10876—June 10—Authorizing the C.P.R. to construct an industrial spur to the premises of Messrs. J. D. Clark and Company, Winnipeg, Man.

10877—June 10—Authorizing the C.P.R. to construct an industrial spur to the premises of the Yale, Columbia Lumber Company, Nelson, B.C.

10878—June 13—Authorizing the Nipissing Power Company to erect its transmission lines across the track of the G.T.R. at Callander, Ont.

10879—June 13—Authorizing the corporation of the city of Toronto, to lay a water pipe under the track of the C.P.R. where the same crosses St. Clarens Avenue, Toronto, Ont.

10880—June 13—Directing that the C.N.R. carry out the provisions of Order No. 8445, dated the 13th of October, 1910, within sixty days from the date hereof, and in the event of its failure to carry out the terms of the Order within the time limited, it shall be liable to a penalty of $25 per day for every day thereafter that the work remains uncompleted.

10881—June 13—Authorizing the M.C.R. to reconstruct bridge over Bear Creek on the St. Clair Division of its line of railway.

10882—June 14—Authorizing the Water Commissioners for the city of London, Ontario, to lay a water main under the track of the G.T.R. where the same crosses the public highway, known as Wellington Street, London, Ont.

10883—June 14—Directing that the time within which the C.P.R. was required by Order No. 10321, dated April 12th, 1910, to install an electric bell at the crossing of the highway at mile 81.28, Township Markham, be extended until the 15th day of July, 1910.

10884—June 14—Directing that the time within which the C.P.R. was required by Order No. 10147, dated April 12th, 1910, to install an electric bell at the crossing of Queen Street, Streetsville, be extended until the 15th of July, 1910.

10885—June 14—Directing that the time within which the C.P.R. was required by Order No. 10142, dated April 12th, 1910, to install an electric bell at the crossing of Thomas Street, in the village of Streetsville, be extended until the 15th of July, 1910.

10886—June 14—Directing that the time within which the C.P.R. was required by Order No. 10156, dated April 12th, 1910, to install an electric bell at Manvers' Road, Pontypool, be extended until the 15th of July, 1910.

10887—June 14—Authorizing the C.P.R. to construct Bridge No. 62.4 over the Nipigon River, Nipigon Section, Lake Superior Division.

10888—June 13—Authorizing the C.P.R. to open for the carriage of traffic the diversion of the Arcola Section, Pipestone Extension of its line of railway from mile 0.00 to mile 2.8, Manitoba.

10889—June 13—Approving location of the G.T.P. Branch Lines Company's Tofield-Calgary Branch from the south line of Section 23, Township 36, Range 23, west 4th Meridian, to the south line of Section 4, Township 35, Range 23, west 4th Meridian, District of North Alberta.

10890—June 13—Approving location of the G.T.P. Branch Lines Company's Tofield-Calgary Branch from the south line of Section 4, Township 35, Range 23, to Section 21, Township 29, Range 24, west 4th Meridian, District of South Alberta, mile 110.719 to mile 150.

10891—June 13—Approving revision in the grades of the C.P.R. Company's Railway, (a) from mileage 19 to mileage 42 in the Counties of Vaudreuil and Soulanges; (b) from mileage 42 to mileage 60 in the County of Glengarry, and (c) from mileage 60 to mileage 74, County of Stormont, and of the crossings of the highways.

10892—June 13—Authorizing the G.T.R. to change the location of the branch line railway to the premises of Wagstaff & Company, Toronto, Ont.

10893—June 13—Authorizing the G.T.R. to construct a branch line of railway from a point on its railway south of Elmira Station, Ontario, to the premises of the Elmira Furniture Company.

10894—June 13—Authorizing the C.P.R. to operate its trains temporarily upon the rails of the National Transcontinental Railway near Theriault, pending the completion of the diversion of the C.P.R.

10895—June 13—Directing that the time within which the C.P.R. was required by Order No. 9497, dated February 8th, 1910, to construct spur between Mary and Christine Streets, at Westfort, Ontario, be extended until the 31st of August, 1910.

10896-7—June 13—Authorizing the C.P.R. to cross with its Lansdowne Avenue spur under the wires of the Bell Telephone Company and the Toronto Electric Light Company at two different points in Toronto, Ont.

10898—June 15—Approving the location of the C.N.R. Company's line through Townships 29-26, Ranges 19-23, west of 4th Meridian, Alberta, mile 171.66 to 212.83.

10899—June 14—Directing that within 90 days from the date of this Order the C.P.R. shall install a Whyte Signal Electric Bell at the crossing of John Street, Almonte, Ont.

10900—June 13—Directing that within thirty days from the date of this Order the C.N.R. extend its platform at Harris Station, and make it 225 feet long; the Railway Company to be liable to a penalty of $25 a day for every day after the said thirty days have expired, that the work remains uncompleted.

10901—June 13—Authorizing the C.P.R. to construct an industrial spur, within three months from the date of this Order, to the premises of the Calgary Gas Company, Calgary.

10902—June 14—Authorizing the G.T.R. to construct an industrial spur, within three months from the date of this Order, to the premises of Lever Bros., Ltd., Toronto, Ont.

10903—June 13—Approving location of a portion of the Fort William Terminal Railway and Bridge Company's line of railway from a point between Rebecca Street and Vickers Street, on main line of said company at mile 0 to a point in Lot 5, Concession 7, on Island No. 1, Fort William, at mile 1.08.

10904—June 13—Authorizing the C.N.R. to divert and cross by means of an overhead crossing, Cavan Street, Port Hope, Ont.

10905—June 14—Granting leave to the G.T.R. to construct its railway across the public road between Lot 93, in 1st Concession, and Lot 93, in 2nd Concession of Township Tay; said highway to be carried over the railway by means of an overhead bridge.

10906—June 15—Authorizing the Hamilton Gas Light Company to lay a gas main across the Mary Street Bridge which passes over the track of the G.T.R., Hamilton, Ont.

10907—June 14—Authorizing the Hamilton Gas Light Company to lay a gas main under the track of the G.T.R. where the same crosses Ferguson Avenue, Hamilton, Ontario.

10908—June 15—Authorizing the Calgary Power Company, Limited, to erect a high tension transmission line across the track of the main line of the C.P.R. at mile 49, Laggan Section.

10909—June 15—Directing that the time within which the C.P.R. was required by Order No. 10507, dated May 3rd, 1910, to erect gates at the crossing of its railway, near Matthew Pork Factory, Hull, be extended until the 2nd of September, 1910.

10910-11—June 15—Relieving the Pere Marquette Road from providing further protection at the following crossings:—2nd highway 1½ miles west of Kingsville, Ont.; highway 2 miles north of Watson, County Lambton.

10912—June 15—Relieving the W. E. & L. S. R. Railway Company from providing further protection at the crossing of the cut-off road by said railway, near Essex, Ont.

10913-14—June 15—Extending, until the 27th of August, 1910, the time within which an electric bell was to be installed at the crossing of 1st public road west of Britannia Station, as required by Order No. 10376, dated April 28th, 1910; and at the crossing of the 1st public road west of Stittsville Station, as required by Order No. 10377, dated April 28th, 1910.

10915—June 14—Approving plans of the C.P.R. showing the changes proposed at Bridge No. 73.93, on the Nipigon Section, Lake Superior Division.

10916—June 15—Authorizing the C.P.R. to construct an industrial spur to the premises of the City Planing Mills, Calgary.

10917—June 16—Approving by-law of the Michigan Central Railway authorizing C. F. Daly, vice-president, in respect of passenger and freight traffic, and O. W. Ruggles, central passenger agent, in respect of passenger traffic, and W. C. Rowley, general freight agent, in respect of freight traffic, to prepare and issue tariffs of tolls to be charged in respect of the railway owned and operated by the M.C.R.

THE INSULATION AND PROTECTION OF UNDERGROUND STEAM PIPES.

The centralization of steam generating plants and the resulting economies to be gained thereby have been largely made possible by the perfection of underground pipe insulating systems which afford a means of conduction with a very small loss of heat. Furthermore, the economical utilization of exhaust steam delivered from a central power plant installation for heating purposes in a group of buildings can only be successively achieved when the transmission pipes are so insulated as to prevent any material loss by radiation. The accompanying cuts show details of the system of pipe supports and covering as manufactured by the Portland Stone Ware Company, of Portland, Maine, and Boston, Mass.

There are two methods of supporting the pipes, one entirely independent of the sectional covering, for large heavy pipe, or when the ground is not firm; the other for smaller piping which can be supported by the conduit itself without damage. In the former method there is absolutely no danger of cracking the conduit should there be any movement vertically by settlement or horizontally by expansion and contraction.

The conduit itself is so thoroughly vitrified, salt glazed as to make it absolutely impervious to any water, acids or other injurious substances from the outside, while the innumerable air cells in the structure make it an excellent insulator itself.

The pipes may be covered with sectional insulation of any approved material or the conduit may be filled with loose insulating material.

The following tests conducted by Mr. George H. Barrus, Consulting Engineer, on 600 feet of six-inch black iron pipe protected and insulated with Portland Sectional Conduit, show the high efficiency of insulation secured in this system.

REPORT OF TEST SHOWING THE INSULATING EFFICIENCY OF PORTLAND SECTIONAL CONDUIT INSTALLED AT PHILLIPS AND ABBOT ACADEMIES, ANDOVER, MASS.

Dimensions.

Outside diameter of pipe	6.68 in.
Outside circumference of pipe	1.75 ft.
Length of pipe end to end	608 "
Area of pipe surface enclosed in conduit	1,064 sq. ft.
Area of surface of elbows and connecting pipes at inlet and outlet covered with hair felt	6 " "
Total area of pipe radiating surface	1,070 " "

Data of Tests.

	High Pressure.	Low Pressure.	
Date	Aug. 11,	Aug. 12, 1905.	
Duration of test	5	5	hrs.
Total weight of water drawn off	529.25	243.5	lbs.
Weight of water drawn off per hour	105.85	48.7	"
Water drawn off per square foot of pipe surface per pipe	0.0989	0.0454	"
Moisture in the entering steam	0.3%	0.3%	
Steam condensed per square foot of surface per hour, corrected for moisture	0.0987	0.0451	"
Average pressure above atmosphere	83	6	"
Average temperature of steam corresponding to pressure	325.8	229.7	deg.
Average temperature of water drawn off	306.4	222.6	"
Difference in temperature between steam within the pipe and assumed external temperature of 70 degrees	255.8	159.7	"

Results in British Thermal Units.

Heat units corresponding to steam condensed per hour, reckoned from temperature of water drawn off, being the heat loss per hour by radiation	95,455.0	46,663.0	
Heat units lost per degree difference of temperature within and without per square foot of pipe surface	0.349	0.273	
Heat units lost by bare pipe per degree difference of temperature per square foot of surface per hour, based on previous experiments on pipes in still air	3.1	2.1	
Efficiency of covering or percentage of loss by bare pipe saved in insulation	88.7	87.	

In this particular instance it was possible to dispense with four independent steam generating plants and concentrate them all in one. This has shown a big economy in operation, and furthermore the line of steam piping is designed with the view of future extension to any new buildings which may be erected. This will cause a very material saving in the initial cost of the heating systems of these buildings.

RAILWAY EARNINGS; STOCK QUOTATIONS.

Figures for the Past Week and from Beginning of Year, with Comparisons and Stock Prices.

The following table gives the latest traffic returns it is possible to obtain at the time of going to press:—

Road	Wk. Ended	1910	Previous Week	1909
C. P. R.	June 21	$1,926,000	$1,902,000	$1,481,000
G. T. R.	June 21	931,844	891,252	826,865
C. N. R.	June 21	299,600	290,400	184,500
Halifax Elec.	June 21	4,539	4,049	4,164

Figures showing the earnings of Canadian roads since January 1st, this year and last, are appended:—

Road.	Mileage.	Jan. 1st to	1910.	1909.
C. P. R.	10,236	June 21st	$41,247,000	$34,430,000
G. T. R.	3,536	June 21st	20,305,524	17,024,497
C. N. R.	3,180	June 21st	5,583,300	34,892,400
Halifax Elec.	13.3	June 14th	90,071	79,486

Stock quotations on Toronto, Montreal and London exchanges, and other information relative to the companies listed in the above tables are appended. The par value of all shares is $100.

Co.	Capital 000's omitted.	Price June 24 1909.	Price June 16 1910.	Price June 23 1910.	Sales last week.
C. P. R.	150,000	-181¾	.....	.....	176
Mtrl. St.	18,000	218-217¾	244-243	243½-243	130
Tor. St.	8,000	-123¾	118½	118½	156
Hal. Elec.	1,400	115-112	124-123	124-121¾	...

CANADIAN NORTHERN RAILWAY EARNINGS

For May Show Half-Million Increase Over Preceding Year —Eleven Months' Increase Nearly Three Millions.

The Canadian Northern Railway earnings for May and for eleven months ending May 31st, compare as follows:—

May.	1910	1909	Inc.
Gross Earnings	$1,224,900	$720,100	$504,800
Expenses	856,300	537,200	319,100
Net Earnings	368,600	182,900	185,700
11 mos. ending May 31.	11,592,600	8,863,900	2,728,700
	8,258,500	6,301,000	1,957,500
	3,334,100	2,562,900	771,200

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

(Continued from page 685.)

10918—June 15—Relieving the Pere Marquette Road from providing further protection at the crossing of the highway by its railway at the 1st crossing east of Merlin Station, Ont.

10919—June 16—Authorizing the Kaministiquia Power Company to erect power line across the track of the C.P.R. on Yonge Street, Fort William, Ont.

10920—June 16—Authorizing the V. V. & E. Railway and Navigation Company to construct bridge over Park Drive, Vancouver, B.C.

10921—June 16—Authorizing the C.N.O.R. to construct its line of railway under Ontario Street, Port Hope, said street being carried over the line of railway by means of an overhead bridge.

10922—June 16—Certifying that the error in the book of reference accompanying the plan and profile filed with the application of the C.P.R. for authority to construct branch lines in the Township of North Oxford, Ingersoll, approved by Order No. 10805, dated June 6th, 1910, to show the title of lot belonging to Mrs. Wilson to wit, .22 acres instead of .15 acres, has been corrected accordingly.

10923—June 16—Certifying that the error in the book of reference accompanying the plan and profile filed with the application of the C.P.R. for approval of the revised location of its line of railway between Ingersoll and Code Junction, and approved by Order No. 10323, dated April 23rd, 1910, to make it show the property of A. McKee and T. Tav to be in Concession 4 instead of Concession 2, as set forth in book of reference, has been corrected accordingly.

10924—June 16—Directing that the M.C.R. divert and construct the road surface along the north side of the track at the crossing of the 2nd highway east of Yarmouth, so as to cross the track at right angles.

10925—June 17—Directing that the time within which the C.P.R. was required by Order No. 10614, dated the 12th and 12th of May, 1910, to file plans of the subway to be constructed at crossing of Main Street, Kenora, be extended for a period of thirty days from the date of this Order.

10926—June 13—Approving the G. N. W. Telegraph Company's tolls for the transmission of telegraph messages between points in Canada, east of and including Windsor, Ont., North Bay, Ont., and the line of the Temiskaming & Northern Ontario Railway, included in the company's tariff of telegraph tolls, C.R.C. No. 9, dated July, 1909, and extending, until November 1st, 1910, the time for the approval of the company's tolls between points in Canada west of North Bay, also to and from points west of North Bay from and to points east thereof, and east of and including Windsor, Ont., also included in said tariff.

10927—June 13—Approving the C.P.R. Telegraph Company's tolls for transmission of telegraph messages between points in Canada east of and including Sudubry, Ont., and Windsor, Ont., included in the company's said tariffs of telegraph tolls, C.R.C. No. 5, dated January 1st, 1910, and extending until the 1st of November, 1910, the time within for the approval of the company's tolls between points in Canada west of and including Sudbury, Ontario, to and from points west of Sudbury, and to points east thereof, and east of and including Windsor, Ont., also included in said tariff.

10928—June 13—Extending until November 1st, 1910, the time for the approval of the C.N.R. Telegraph Company's tolls for transmission of telegraph messages between points in Canada.

10929—June 13—Approving the N. A. Telegraph Company's tariff of telegram tolls between points in Canada, C.R.C. No. 1, and directing that said tolls, together with copy of this Order be published in at least two consecutive weekly issues of the Canada Gazette.

10930—June 13—Extending until November 1st, 1910, the time for the approval of the White Pass & Yukon Route Telegraph System's tolls for transmission of telegraph messages between points in Canada.

10931—June 13—Extending until November 1st, 1910, the time for the approval of the G.T.P. Telegraph Company's tolls for the transmission of telegraph messages between points in Canada.

10932—June 10—Directing that within 30 days from date of this Order the G.T.R. shall install a Whyte Signal Electric Bell at the crossing of highway known as Pierce's Crossing, 1½ miles west of the Parish of Melbourne, County Richmond, Ont.

10933—June 17—Directing the C.P.R. to provide and construct a suitable farm crossing where its line of railway intersects the farm of Zenon Sabourin, of Cadaret, Ont.

10934—June 18—Dismissing application of E. B. Neely, Humboldt, Sask., on behalf of Alb. J. Ecker and C. L. Schmidt, complaining that the lands of the complainants in Sections 20-37-22 are injuriously affected by the construction by C.N.R. of its off-take water pipe along its right-of-way from the company's round-house and yards eastward to the said Section 20.

10935—June 18—Approving amended location of the V. V. & E. Railway & Navigation Company's line of railway from west line of Township 26, to east line of New Westminster District, Province of British Columbia.

10936—June 17—Granting leave to the Vancouver-Nanaimo Coal Company to cross the line of railway of the Esquimalt & Nanaimo Railway Company with its line of railway leading from its coal mine situate on Section 11, Mountain District, Vancouver Island, B.C., to tide water on Exit Passage.

10937—June 18—Approving location and detail plans of the G.T.R. Company's new station at Ste. Martine, Que.

10938—June 18—Approving the location and detail plans of the G.T.R Company's proposed new station at Lacadie, Que.

10930—June 20—Approving location of the G.T.R. Company's new station and proposed remodelling of siding at St. Agapit, Que.

10940—June 20—Approving location of the road connecting the road allowance on the North Boundary of Section 4, Townhip 13, Range 20, west Principal Meridian, with the road allowance on the East Boundary thereof; and authorizing the C.P.R. to construct an additional track across the road allowance between Section 9, Township 13, Range 30, west Principal Meridian, and Section 4, Township 13, Range 30, west Principal Meridian, on main line of its railway at Fleming, Sask.

10941—June 20—Authorizing the C.P.R. to construct an additional track at Fleming, Sask., across the road allowance between Section 4, Township 13, Range 30, west Principal Meridian, and Section 3, Township 13, Range 30, west Principal Meridian.

10942—June 18—Approving the location of the C.P.R. Company's station at Barnet, B.C.

10943—June 18—Approving the location of the C.P.R. Company's station at Franktown, Ontario.

10944—June 18—Authorizing the C.P.R. to divert the highway from the north side to the south side of the Waltham Branch of its line of railway in Lot 28, Range 9, Township Clarendon, Que.

10045—June 18—Authorizing the C.P.R. to construct bridge No. 27.3 over Sheep Creek, on MacLeod Section Western Division of its line of railway.

10946—June 17—Authorizing the C.N.R. to open for the carriage of traffic that portion of its line of railway from Russell to Calder, a distance of 41 miles.

10047-8—June 18—Approving location of the C.N.R. Company's station grounds at Bowmanville, Ontario, and at Kendall, Ontario.

10949 to 10954 Inc.—June 18—Approving location of the C.N.R. Company's station grounds at Colobrne, Ont., Cherrywood, Ont., Oshawa, Ont., Grafton, Ont., Brooklin, Ont., and at Osaca, Ont.

10955—June 18—Authorizing Geo. Heggie, of Enderby, B.C., to lay a water pipe under the track of the Shuswap and Okanagan Branch of the C.P.R. at mile 28.

10956—June 18—Authorizing the corporation of city of Fort William to lay a sewer under the tracks of the C.N.R. where the same crosses Amelia Street, Fort William, Ontario.

10957—June 18—Authorizing the St. Lawrence Pressed Brick & Terra Cotta Company, Limited, to lay a drain under the track of the G.T.R. where the same crosses the public road of St. Philippe, at Laprairie, Que.

10958—June 17—Authorizing the C.P.R. to construct a branch line of railway across Norman Avenue, Toronto.

10959—June 20—Authorizing the C.P.R. to construct an industrial spur to the premises of the John Deere Plow Co., Ltd., Saskatoon, Sask.

ENGINEERING SOCIETIES.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—413 Dorchester Street West, Montreal. President, Col. H. N. Ruttan; Secretary, Professor C. H. McLeod.

Chairman, L. A. Vallee; Secretary, Hugh O'Donnell, P.O. Box 115, Quebec. Meetings held twice a month at Room 40, City Hall.

TORONTO BRANCH—

96 King Street West, Toronto. Chairman, A. W. Campbell; Secretary, P. Gillespie, Engineering Building, Toronto University, Toronto. Meets last Thursday of the month.

MANITOBA BRANCH—

Chairman, J. E. Schwitzer; Secretary, E. Brydone Jack. Meets first and third Fridays of each month, October to April, in University of Manitoba, Winnipeg.

VANCOUVER BRANCH—

Chairman, Geo. H. Webster; Secretary, H. K. Dutcher, 40-41 Flack Block, Vancouver. Meets in Engineering Department, University

OTTAWA BRANCH—

Chairman, W. J. Stewart, Ottawa; S. J. Chapleau, Resident Engineer's Office, Department of Public Works.

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ONTARIO MUNICIPAL ASSOCIATION.—President, Mr. George Geddes, Mayor, St. Thomas, Ont.; Secretary-Treasurer, Mr. K. W. McKay, County Clerk, St. Thomas, Ontario.

UNION OF ALBERTA MUNICIPALITIES.—President, H. H. Gaetz, Red Deer, Alta.; Secretary-Treasurer, John T. Hall, Medicine Hat, Alta.

THE UNION OF CANADIAN MUNICIPALITIES.—President, W. Sanford Evans, Mayor of Winnipeg; Hon. Secretary-Treasurer, W. D. Lighthall, K.C., ex-Mayor of Westmount.

THE UNION OF NEW BRUNSWICK MUNICIPALITIES.—President, Mayor Reilly, Moncton; Hon. Secretary-Treasurer, J. W. McCready, City Clerk, Fredericton.

UNION OF NOVA SCOTIA MUNICIPALITIES.—President, Mr. A. E. McMahon, Warden, King's Co., Kentville, N.S.; Secretary, A. Roberts, Bridgewater, N.S.

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CANADIAN FORESTRY ASSOCIATION.—President, Thomas Southworth, Toronto; Secretary, James Lawler, 11 Queen's Park, Toronto.

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CANADIAN RAILWAY CLUB.—President, H. H. Vaughan; Secretary, James Powell, P.O. Box 7, St. Lambert, near Montreal, P.Q.

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CENTRAL RAILWAY AND ENGINEERING CLUB.—Toronto, President, J. Duguid; Secretary, C. L. Worth, 409 Union Station. Meets third Tuesday each month except June, July, August.

DOMINION LAND SURVEYORS.—President, Thos. Fawcett, Niagara Falls; Secretary-Treasurer, A. W. Ashton, Ottawa.

EDMONTON ENGINEERING SOCIETY.—President, Dr. Martin Murphy; Secretary, B. F. Mitchell, City Engineer's Office, Edmonton, Alberta.

ENGINEERING SOCIETY, TORONTO UNIVERSITY.—President, A. D. Campbell; Corresponding Secretary, A. H. Munroe.

ENGINEER'S CLUB OF TORONTO.—96 King Street West. President, C. M. Canniff; Secretary, R. B. Wolsey. Meeting every Thursday evening during the fall and winter months.

INSTITUTION OF ELECTRICAL ENGINEERS.—President, Dr. G. Kapp; Secretary, P. F. Rowell, 92 Victoria Street, London, S.W.; Hon. Secretary-Treasurer for Canada, Lawford Grant, Power Building, Montreal, Que.

INSTITUTION OF MINING AND METALLURGY.—President, Edgar Taylor; Secretary, C. McDermid, London, England. Canadian Members of Council:—Prof. F. D. Adams, J. B. Porter, H. E. T. Haultain, and W. H. Miller, and Messrs. W. H. Trewartha-James and J. B. Tyrrell.

MANITOBA LAND SURVEYORS.—President, George McPhillips; Secretary-Treasurer, C. G. Chataway, Winnipeg, Man.

NOVA SCOTIA MINING SOCIETY.—President, T. J. Brown, Sydney Mines, C.B.; Secretary, A. A. Hayward.

NOVA SCOTIA SOCIETY OF ENGINEERS, HALIFAX.—President, S. Fenn; Secretary, J. Lorne Allan, 15 Victoria Road, Halifax, N.S.

ONTARIO PROVINCIAL GOOD ROADS ASSOCIATION.—President, W. H. Pugsley, Richmond Hill, Ont.; Secretary, J. E. Farewell, Whitby, Ont.

ONTARIO LAND SURVEYORS' ASSOCIATION.—President, H. W. Selby; Secretary, Killaly Gamble, 703 Temple Building, Toronto.

ROYAL ARCHITECTURAL INSTITUTE OF CANADA.—President, F. S. Baker, F.R.I.B.A., Toronto, Ont.; Hon. Secretary, Alcide Chausse, No. 5 Beaver Hall Square, Montreal, Que.

ROYAL ASTRONOMICAL SOCIETY.—President, Prof. Alfred T. de Lury, Toronto; Secretary, J. R. Collins, Toronto.

UNDERGRADUATE SOCIETY OF APPLIED SCIENCE, McGILL UNIVERSITY.—President, H. P. Ray; Secretary, J. P. McRae.

WESTERN CANADA RAILWAY CLUB.—President, Grant Hall; Secretary, W. H. Rosevear, 199 Chestnut Street, Winnipeg, Man. Second Monday, except June, July and August, at Winnipeg.

AMERICAN TECHNICAL SOCIETIES.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS (TORONTO BRANCH).—W. H. Eisenbeis, Secretary, 1207 Traders' Bank Building.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—President, John P. Canty, Fitchburg, Mass.; Secretary, T. F. Patterson, Boston & Maine Railway, Concord, N.H.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION.—President, L. C. Fritch, Chief Engineer, Chicago G. W. Railway; Secretary, E. H. Fritch, 962-3 Monadnock Block, Chicago, Ill.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—Secretary, C. W. Hunt, 220 West 57th Street, New York, N.Y. First and third Wednesday, except July and August, at New York.

AMERICAN SOCIETY OF ENGINEERING-CONTRACTORS.—President, George W. Jackson, contractor, Chicago; Secretary, Daniel J. Hauer, Park Row Building, New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—29 West 39th Street, New York. President, Jesse M. Smith; Secretary, Calvin W. Rice.

WESTERN SOCIETY OF ENGINEERS.—1735 Monadnock Block, Chicago, Ill. J. W. Alvord, President; J. H. Warder, Secretary.

COMING MEETINGS.

CANADIAN ELECTRICAL ASSOCIATION.—July 6-7-8. Annual convention at Royal Muskoka Hotel, Muskoka Lakes, Ont. Secretary, T. S. Young, Confederation Life Building, Toronto, Ont.

AMERICAN SOCIETY FOR TESTING MATERIALS.—June 28-July 2. Annual meeting at Atlantic City, N.J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

THE ROYAL ARCHITECTURAL INSTITUTE OF CANADA.—August 24-27. Annual meeting at Winnipeg, Man. Alcide Chausse, Hon. Secretary, 5 Beaver Hall Square, Montreal, Que.

UNITED STATES GOOD ROADS' ASSOCIATION.—July 28-29-30-31, 1910, Niagara Falls, N.Y. President, Arthur C. Jackson.

THE AMERICAN PEAT SOCIETY will meet at Ottawa, Ont., July 25-26-27, 1910. Secretary and Treasurer, Julius Boodollo, Kingsbridge, New York City.

NEW ENGLAND WATER WORKS ASSOCIATION.—September 21-23. Annual meeting, Rochester, N.Y. Willard Kent, Secretary, Narragansett Pier, R.I.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.—October 11-16. Seventeenth annual convention, Erie, Pa. Prescott Folwell, Secretary, 239 W. 39th Street, New York, N.Y.

NATIONAL MUNICIPAL LEAGUE.—November 14-18. Annual meeting, Buffalo, N.Y. Clinton Rogers Woodruff, Secretary, North American Building, Philadelphia, Pa.

UNION OF CANADIAN MUNICIPALITIES.—August 31st to September 2nd. Tenth annual convention, Toronto, Ont. Secretary, W. D. Lighthall, K.C., Westmount, Que.; Assistant Secretary, G. S. Wilson, 107 St. James Street, Montreal, Que.

TORONTO, CANADA, JUNE 30, 1910.

CONTENTS OF THIS ISSUE.

EIGHT EXAMPLES OF HYPOCHLORITE STERILIZATION OF WATER.*

(Continued from page 674).

The amount of hypochlorite first added to the water was 0.25 grains per gallon, but after complaints were received from the consumers the quantity was reduced to 0.14 grains per gallon and sometimes to less. The addition of from 0.14 to 0.25 grains per gallon of hypochlorite made from April 14 to April 27, 1909, produced a water from which 99.7 of the bacteria had been removed. Owing to complaints the treatment was discontinued from April 28th to May 3rd, with the result that the bacterial content per c.c. of water rose from 15 to 493, the per cent. removal being 77.5. From May 4th to June 9th the water was treated with 0.14 grains per gallon of hypochlorite, and the per cent. removal of bacteria was 96.1. It should be observed, however, that the number of bacteria in the raw river water had risen from 2,193 to 3,986 per c.c., and that the number per c.c. in the treated water was 154. From June 11th to 23rd the water was not treated with hypochlorite, and the result at first sight was very remarkable, seeing that the bacterial count per c.c. in the filtered water rose from 154 to 2,038. This shows very clearly that the water needed further treatment, but it does not by any means show that the previous treatment of 0.14 grains per gallon would have given a good result, for the reason that during this period the bacterial content per c.c. of river rose from 3,986 to 63,443, and it is probable that as the hypochlorite would have been added before filtration that the effect would have been to some extent neutralized by the organic matters in suspension. Also it is clear that a great deal of purification was effected by the coagulants and by the filters, and it is impossible to tell exactly how much of the work was done by the sterilizing agent. However, bearing these facts in mind and judging from the general results, it appears that when the water was treated with hypochlorite even in such small quantities as those used, a considerable improvement was effected. Thus between April 6 and November 8, 1909, the plant was operated during six different periods without hypochlorite and the maximum removal of bacteria was 98.4 per cent. and the minimum 72.6 per cent., the average for the six periods being 87.7 per cent. The bacterial content per c.c. being 276,493, 2,038, 1,265,942 and 96 respectively on the average for the six periods

There were also nine periods during which the water was treated with hydrochlorite varying in amount from 0.035 to 0.25 grains per gallon, with a maximum removal of 99.7 per cent. and a minimum of 95.8 per cent., the average removal for the nine periods being 97.7 per cent. or 10 per cent. higher than in the case of the samples which were not treated with hydrochlorite. The bacterial contents per c.c. on the average for the nine periods were respectively 15, 154, 36, 853, 265, 139, 22, 64, 72.

There are indications that as the solution was applied with greater skill so the results improved. Thus, in November, 1909, with the river water containing 4,337 bacteria per c.c., a removal of 98.3 per cent. was effected with a .10 grain per gallon treatment, while earlier when the river water contained only 3,996 bacteria per c.c., 0.14 grains per gallon only effected a removal of 96.1 per cent. Hence it is clear that comparative results can only be judged when the means of application are up to the same standard of efficiency, and when the preliminary removal of organic matter is the same in both cases.

Hartford, Connecticut.—The experiments with hypochlorite of lime at Hartford, Connecticut, have already been mentioned in these pages. The water of the Connecticut River has been treated, and Prof. Newlands has stated that when one part per million or more of available chlorine is used the removal of bacteria from this particular water is always greater than 99.5 per cent., and that the colon bacillus is not found in water so treated. The object of these experiments was to ascertain the possibility of using the river water for the town supply, in the event of the exisiting supply from the surface gathering grounds failing, a thing which was considered very likely to occur.

New Jersey.—It will also be remembered that in our issue of September 24th, 1909, the sterilization of the New Jersey water was described. The daily supply being 40,000,000 gallons is sterilized at a cost of 14 cents per 1,000,000 gallons. A ½ per cent. solution of bleaching powder (5 lb. of dry bleaching powder to 1,000 lb. of water) is the sterilizing agent. One part of this solution is then added to 10,000 parts of water, or, in other words, 5 lb. of bleaching powder is added to every 1,000,000 gallons of water. The bleaching powder used has about 35 per cent. of available chlorine, so that the amount of available chlorine used is about 0.2 parts per 1,000,000, or very much less than the amount once considered necessary at most places. Out of 455 tests made during a period of sixty-two days the total number of bacteria averaged 15 per c.c. in the treated water, and only once was B. Coli isolated.

The sterilizing agent is mixed and stored in tanks and discharged through orifices under a constant head, the supply being regulated in proportion to the flow of water in the aqueduct into which the solution is discharged.

Toronto.—The treatment of the water drawn from Lake Ontario with hypochlorite of lime was dealt with in these pages in a recent issue. It has been adopted in order to purify the sewage polluted lake water in the face of a typhoid epidemic.

Enough has been said to demonstrate how this new process is coming into use on a very large scale. The methods of application are at present somewhat crude, and the agent commonly used—viz., chloride of lime in the form of bleaching powder—is not without its drawbacks, but these will rapidly receive the attention they deserve, and sterilization by means of hypochlorite will undoubtedly form one of the ordinarily accepted methods of water purification.

ELEMENTARY ELECTRICAL ENGINEERING.

L. W. Gill, M.Sc.

CHAPTER IV.

DIRECT CURRENT APPARATUS AND SYSTEMS.

This series of articles will be continued for some months. They will be of particular interest to the student of electrical work and the civil engineer anxious to secure some knowledge of the simpler electrical problems.

Up to this point it has been assumed that the magnetic flux which passes to and from the armature is caused by a current flowing in coils of wire placed on the poles, but nothing has been stated as to how this current is obtained. If the poles were permanent magnets, there would be no need of these coils and current; and it may be here noted that the magnetic flux in the first generator which was constructed by Faraday was obtained from a horseshoe magnet. Generators with permanent magnets

are built at the present time, but they are necessarily small, and are known as "magnetos." They are used to ring bells, and in connection with gas and oil engines to ignite the charge. They are not constructed in large sizes, because the flux density cannot be made sufficiently high, which makes the machine too large and expensive. The next step was to obtain a current from some independent source, such as a battery. This method is still used in special cases, but very rarely. Any machine which receives its exciting current from an independent

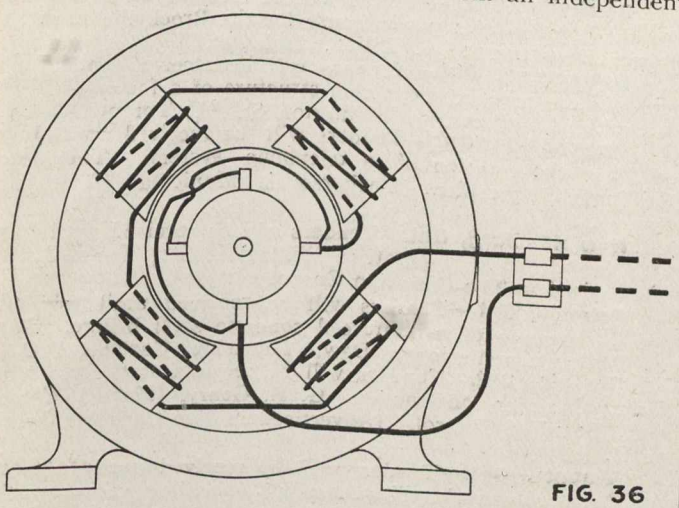


FIG. 36

source of power is said to be "separately excited." The modern direct current generator supplies its own exciting m.m.f., and, as this may be provided by various arrangements of exciting coils, it is usual to designate a generator by its system of excitation.

Referring to Fig. 32, it will be noted that the circuit formed by the exciting coils is connected directly to the main terminals of the generator. It is thus in parallel with the external circuit, and is, therefore, known as a "shunt" circuit. All the earlier forms of self-excited generators were of this type, and are known as "shunt-wound," or simply "shunt" machines. As will be seen later, these terms apply to motors as well as generators.

When a generator of this kind is started from rest there is no current in the shunt circuit. There will, however, always be a sufficient amount of residual magnetism to generate a small e.m.f. when the machine is started, and this e.m.f. will cause a small current to flow through the shunt circuit. This current will increase the flux passing into the armature, resulting in an increase of e.m.f. and a consequent increase of exciting current. This process of "building-up" will continue until the magnetic circuit begins to get saturated, or at least until the permeability begins to diminish, when a point of equilibrium is reached. This point may be raised or lowered by varying the resistance of the shunt circuit. If the resistance of this circuit is diminished, for example, there will be an increase of exciting current, and a consequent increase of flux and e.m.f. The building-up process will thus continue until equilibrium is again established. In Fig. 32 a rheostat or variable resistance is shown connected in series with the shunt circuit. By means of this rheostat the resistance of the shunt circuit may be varied, and the e.m.f. of the generator raised or lowered as desired. When the resistance of the rheostat is all cut out, the e.m.f. of the generator obviously cannot be increased any further. It may be here noted that when a generator of any kind is being put into commission, the external circuit should be open. If the external circuit is closed, the generator may refuse to build up.

If the resistance of the armature circuit of a generator is represented by Ra, and a current, represented by Ia, is flowing through it, the fall or loss of potential on account of the resistance is RaIa, according to Ohm's law. If the e.m.f. generated in the armature is represented by Ea, and the difference of potential or voltage between the terminals by E, then

$$E = Ea - Ia\,Ra \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (15)$$

From this equation it is obvious that the voltage between the terminals of the generator will diminish as Ia increases. This means that the terminal voltage diminishes as the load increases, and rises again as the load decreases, the amount of the variation depending on the value of Ra. If the armature resistance were zero, the terminal voltage would be constant for all values of Ia; i.e., under all conditions of load. In the actual machine the value of Ra, although usually small, is never zero, and consequently the terminal voltage always decreases as the load increases. It is possible to maintain it at a constant value by suitably adjusting the rheostat, but this would require the constant attention of an attendant. Since it is desirable to have constant voltage for most kinds of work, the shunt generator is in most cases not a suitable type of machine for general purposes. For this reason there are very few of these machines in use at the present time.

In the second system of excitation the exciting coils are connected directly in series with the external circuit as shown. in Fig. 36. Machines which are excited by this system are kqnown as "series" machines. From the figure it is obvious that the exciting current is identical with the current in the external circuit. The magnetic flux and e.m.f. will, therefore, increase with the load, irrespective of the resistance of the armature circuit. If the permeability of the magnetic circuits remained constant, the flux and the generated e.m.f. would increase proportionately with the current. A generator of this type is, therefore, unsuitable for general work, and is used only in special cases.

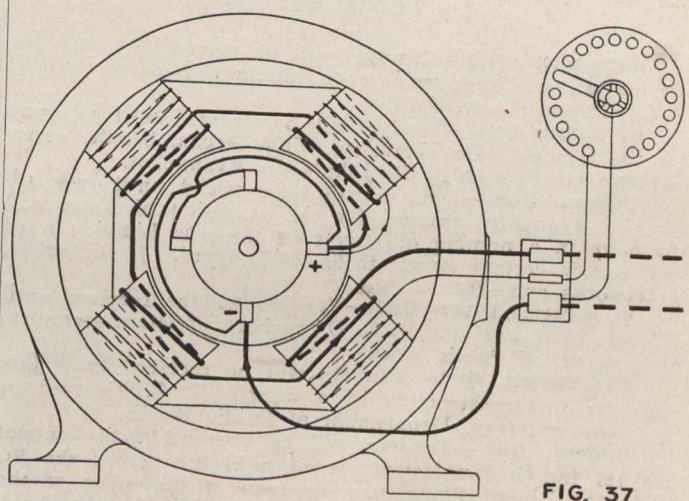


FIG. 37

The system of excitation which is in general use at the present time is a combination of the shunt and series systems. Since with increase of load the terminal voltage diminishes with the shunt system and increases with the series system, it will be obvious that a combination of the two systems may be arranged which will either maintain the terminal voltage constant or increase it a small amount in proportion as the load increases. Generators provided with this combination system are known as

(Continued on page 694).

CONSTRUCTION NEWS SECTION

Readers will confer a great favor by sending in news items from time to time. We are particularly eager to get notes regarding engineering work in hand and projected, contracts awarded, changes in staffs, etc. Printed forms for the purpose will be furnished upon application.

TENDERS PENDING.

In addition to those in this issue.

Further information may be had from the issues of the Canadian Engineer referred to.

Place of Work.	Tenders Close.	Issue of.	Page.
Girvin, Sask., telephone line	July 15.	May 20.	514
Lennox Island, P.E.I., wharf construction	June 27.	June 3.	569
Levis, Que., wharf	July 5.	June 10.	596
Little Tancook Island, N. S., breakwater	July 4.	June 10.	596
Calgary, Alta., electrical plant supplies	July 12.	June 16.	54
Hampton, N.S., breakwater	July 4.	June 16.	626
New Richmond, Que., wharf extension	July 11.	June 16.	626
Moose Jaw, Sask., drainage works	July 18.	June 23.	56
Swift Current, Sask., sewer tile	July 12.	June 23.	56
Swift Current, Sask., cast-iron water mains	July 12.	June 23.	54
Berlin, Ont., railroad grading	July 15.	June 23.	54
Swift Current, Sask., hydrants, valves, etc.	July 15.	June 23.	54
Victoria, B.C., steel tugboat	July 4.	June 23.	659
Winnipeg, Man., line-disconnecting switches	July 4.	June 23.	659
Toronto, Ont., new fire hall	July 12.	June 23.	659
Ottawa, Ont., bridge	July 4.	June 23.	658
North Bay, Ont., sidewalks	July 2.	June 23.	658
Sorel, Que., breakwater	July 18.	June 23.	658

TENDERS.

Antigonish, N.S.—Tenders will be received at once for the plastering of the new Science building. J. A. McDonald, 46 Barrington Street, Halifax.

St. John's Que.—Tenders will be received until July 31st for the removal of a cemetery. Eug. Archambeault, secretary-treasurer parish of St. John's the Evangelist.

Quebec, Que.—Tenders will be received until July 4th for the trenching required for the extension of water and drainage in a number of streets in the new Limoiou ward and also in certain streets in St. Malo Ward. J. Gallagher, waterworks engineer.

St. Charles River, Que.—Tenders will be received until July 5th for dredging. R. C. Desrochers, assistant secretary, Department of Public Works.

Natashquan, Que.—Tenders will be received until July 19th for the construction of a wharf. R. C. Desrochers, assistant secretary, Department of Public Works.

Quebec, Que.—Tenders will be received until September 1st for the superstructure of a bridge across the St. Lawrence River. Plans may be seen at the office of the Quebec Bridge Board of Engineers, Canadian Express Building, Montreal, and at the Department of Railways and Canals. Ottawa. L. K. Jones, secretary, Department of Railways and Canals, Ottawa.

Toronto, Ont.—Tenders will be received until July 4th for the enlargement of Howard School, alterations to Pape Avenue school, midsummer repairs, iron stairs for sundry schools, also for science apparatus and supplies, flags and expressage. W. C. Wilkinson, secretary treasurer, Board of Education.

Brockville, Ont.—Tenders will be received until July 6th for the erection of a power house for the Brockville Light & Power Department. B. Dillon, Architect.

Georgetown, Ont.—Tenders will be received until June 30th for the reinforced concrete structure of a factory. Bond & Smith, Architects, 19 Wellington St. W., Toronto.

Egmondville, Ont.—Tenders will be received until July 9th, for the erection of a telephone system. Thos. G. Shillinglaw, president Tuckersmith Municipal Telephone System.

New Hamburg, Ont.—Tenders will be received until July 18th for electrical apparatus. William Millar, Town Clerk. (Advertised in The Canadian Engineer).

Petrolea, Ont.—Tenders will be received until July 4th for the erection of a reinforced concrete steel bridge. Geo. N. Boyle, Commissioner, Dawn Township, Garville, P.O.

Toronto, Ont.—Tenders will be received until July 26th for trunk sewer construction. G. R. Geary, (Mayor), Chairman, Board of Control. (Advertised in The Canadian Engineer).

Toronto, Ont.—Tenders will be received until July 9th for the marble work, tiling, roofing, including copper work, conductors, prism lights and slating, etc., plumbing, heating, ventilation, electric wiring, plastering, painting and glazing iron staircases and wrought iron work, in connection with the reconstruction of the west wing of the Parliament buildings. J. C. Reaume, Minister of Public Works, Ontario.

Toronto, Ont.—Tenders will be received until July 12th for heating palm house in Allan Gardens. G. R. Geary, (Mayor), Chairman, Board of Control.

Fergus, Ont.—Tenders will be received until July 13th for the construction of a post-office. R. C. Desrochers, assistant secretary, Department of Public Works, Ottawa.

Elora, Ont.—Tenders will be received until July 13th for the construction of a post-office. R. C. Desrochers, assistant secretary, Department of Public Works, Ottawa.

Fort William, Ont.—Tenders will be received until July 15th for the construction of piers, abutments and pedestals for bridge. Plans may be seen at the office of the Engineer of Bridges, Montreal, and Division Engineer, Toronto. Frank Lee, Division Engineer, Winnipeg.

Winnipeg, Man.—Tenders will be received until July 7th for fittings, examining warehouse. R. C. Desrochers, assistant secretary, Department of Public Works.

Winnipeg, Man.—Tenders will be received until June 30th for supplying 400 cords of tamarac wood for Normal school and 12 cords for Training school. R. Fletcher, Deputy Minister of Education.

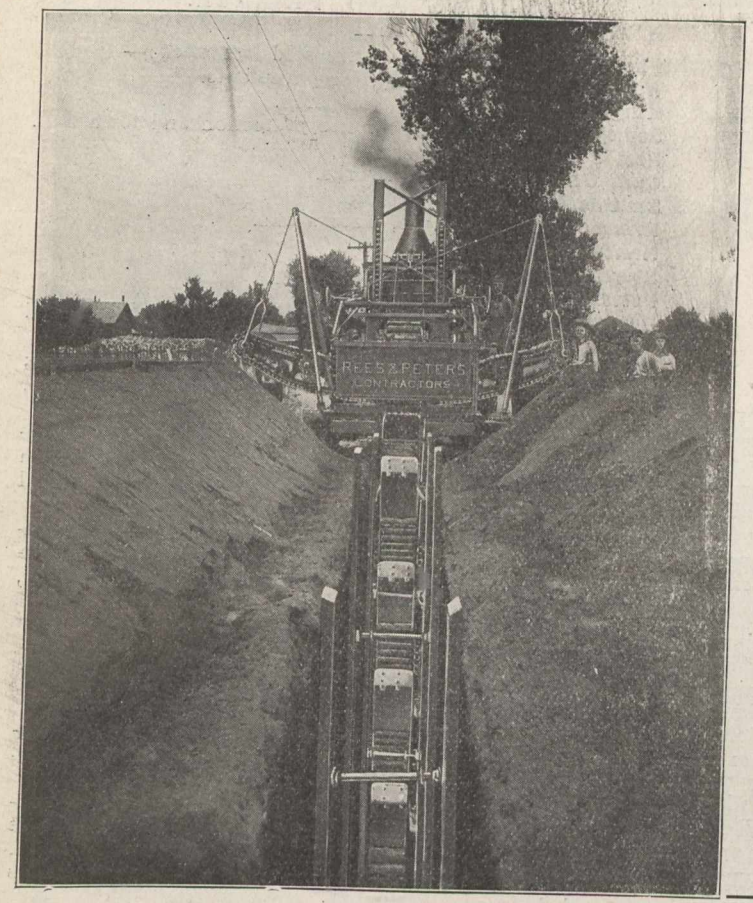
Winnipeg, Man.—Tenders will be received until June 30th for the erection of a reinforced concrete building for Gowans-Kent Western, Limited. Jas. Chisholm & Son, Architects, 310 Enderton Building.

Winnipeg, Man.—Tenders will be received until July 4th for the construction of the superstructure of the La Pas Bridge, on the Hudson Bay Railway. The bridge will be composed of a swing span of 262 feet and four fixed beams of 147 feet each. Plans may be seen at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, or at the office of the Chief Engineer of the Hudson Bay Railway at Winnipeg, Man. L. K. Jones, secretary, Department of Railways and Canals, Ottawa.

Winnipeg, Man.—Tenders will be received until June 30th for fittings, examining warehouse. R. C. Desrochers, assecretary, Board of Control.

Winnipeg, Man.—Tenders will be received until July 4th, for supply of 500 tons of bituminous slack coal. M. Peterson, Secretary, Board of Control.

Foam Lake, Sask.—Tenders will be received until June 30th for the construction of approximately 13,000 square feet



Parsons Excavator-Carlsbad, N.M.

of concrete sidewalks. F. T. McArthur, engineer, town hall, Yorkton, Sask.

File Hills, Sask.—Tenders will be received until July 16th for boarding school. J. D. McLean, Secretary, Department of Indian Affairs, Ottawa.

Yorkton, Sask.—Tenders will be received until July 12th for sewer construction. F. T. McArthur, Town Engineer.

Edmonton, Ala.—Tenders will be received until July 20th for the erection of substructure of bridge over the Saskatchewan River. Plans may be seen at offices of A. L. Hertzberg, Division Engineer, C.P.R., Toronto; C. N. Monsarrat, Engineer of Bridges, Montreal; N. E. Brooks, Division Engineer, Calgary, Alta.; H. Rindal, Division Engineer, Vancouver, B.C.; J. E. Schwitzer, Assistant Chief Engineer, C.P.R., Winnipeg, Man.

Ladysmith, B.C.—Tenders will be received until July 4th for the building of a public hospital. Wm. J. Forbes Robertson, A.R.A.I.C., Chairman, Hospital Building Committee.

Vancouver, B.C.—Tenders will be received until July 6th for clearing part of D. L. 272, North Vancouver, containing about 57 acres. R. V. Winch & Co., Ltd., Winch Building.

CONTRACTS AWARDED.

Fraserville, Que.—Contract for the construction of the armoury was awarded to Phillippe Dumont, of Riviere duLoup Station.

Quebec, Que.—A. Leofred, consulting engineer, has been given a contract for waterworks and sewer construction at Chaudiere Curve, near the Quebec bridge. The waterworks plant is intended to supply the town as well as the following railways:—I.C.R., G.T.R., Transcontinental, Delaware and Hudson, Quebec Central, C.P.R., N.Y.C., C.N.R., and all roads crossing the Quebec bridge. The following bids were received:—

F. Sullivan, Montreal	$260,000
J. Bertram, Montreal	255,000
B. Castigan, Ottawa	245,000

Mr. A. Leofred, who was commissioned to prepare the plans, took the contract for $250,000, and guaranteed completion within two years.

Berlin, Ont.—Bowman and Connor, consulting engineers, have awarded contracts for concrete bridges, as follows:—Kelly's bridge, 12 ft., flat top, J. H. and R. Beatty, Fergus, $289.25; McInnis' bridge, 12 ft., flat top, J. H. and R. Beatty, $271.45; Mickle's bridge, 12 ft., concrete arch, J. H. and R. Beatty, $554.60; Harper's bridge, 14 ft., flat top, J. H. and R. Beatty, $337.50; Four Mills' bridge, 40-ft. arch, J. Galvin, $1,690; other tenders for this were:—J. H. and R. Beatty, $1,723; J. D. Callaghan, $1,967; J. Larydon, $1,839; Fraser and Clement, $1,779. Colquhoun' bridge, 24-ft. arch, $376, Simmons Bros.; Moorefield bridge, (abutments only), M. Clemens, Berlin, $1,649; floor and steel beams, Hamilton Bridge Works Company, $669; other tenders: Hunter Bridge Company, $690; Petrolea Bridge Company, $840; R. McMannus, $875; A. Hill & Company, $775; J. Lichty, $872. Patterson bridge, $808.55, J. H. and R. Beatty.

Cornwall, Ont.—For the construction of five reinforced concrete bridges, Chisholm & Quinn, of St. Andrews West, Ont., were awarded a contract by the Township of Cornwall. Following is a list of the tenders:—Chisholm & Quinn, St. Andrews West, Ont., $5,400; Chisholm & McLean, Glen Water, Ont., $5,500; McCoy & Wilford, Lindsay, Ont., $6,930; Merpaw & McDonald, of St. Andrews, tendered at $14 a cubic yard, for reinforced concrete.

Smith's Falls, Ont.—F. Dolan & Son, of Belleville, Ont., was awarded a contract for the construction of 40,000 square feet of concrete walks at 14½ cents a square foot, and crossings at 16½ cents. Other tenders were; H. A. Pruner, Ottawa, walks, 15¼ cents; crossings, 25 cents; H Winstanley, Morrisburg, Ont., 14¼ cents for walks, and 19 cents for crossings.

Pilot Mound, Man.—A. E. Dobson, of Manitou, was given the contract to lay 1,500 yards of granolithic walks.

New Westminster, B.C.—The Hassam Paving Company, of British Columbia, were awarded the contract for paving on Second Street. A list of the tenders follows:—Hassam Paving Company, of Britsh Columbia, $62,100; Granatoid Paving Company, Chicago, $65,690; Warren Bitulithic Construction Company, $66,903. The Pacific Construction Company were given a contract for laying concrete sidewalks at $13,750. J. W. B. Blackman is the city engineer.

Vancouver, B.C.—The contract for grading the Portland Canal Short Line Railway has been let to Solomon Cameron.

RAILWAYS—STEAM AND ELECTRIC.

Halifax, N.S.—Negotiations which have been in progress for some time for the building of the Halifax & Eastern Railway, have resulted in a definite conclusion, and the contract for building the road from Dartmouth to Guysboro', with Country Harbor and Sunny Brae branches, was formally executed on Monday. J. B. Bartram, of Toronto; Thomas B. Fogg, of Toledo; and Segmund Hirch, of Toledo, are named as the incorporators of the Halifax & Eastern Railway Company.

Hamilton, Ont.—A plan has been filed with the city clerk by the Toronto, Niagara & Western Railway, respecting an entrance into the city. The map shows the line beginning just where the radial tracks turn to enter Burlington along Regent Street. Beginning at this point, the Toronto Company proposes running as directly as possible to the north shore of the bay, and following near the water's edge to Carroll's point, crossing over from there and tunnelling under the Grand Trunk and C.P.R. tracks, just before the Desjardins Canal is reached. The canal will be bridged over and the line then goes south and west of the C.P.R. tracks, apparently connecting with the T., H. & B. tracks, probably half a mile from the corner of Locke and Hunter Streets.

Winnipeg, Man.—The Canadian Northern Railway is reported to have decided to fence all its lines in Alberta.

Winnipeg, Man.—The construction of the main line of the Canadian Northern from Edmonton to Yellowhead Pass will be commenced at once. The contract for the first section, from Edmonton to Pembina River, seventy miles, has been awarded to McMillan Bros., who are now on the scene, preparing to start work. The Canadian Northern will make extensive improvements on the main line between Winnipeg and Edmonton this summer. The road will be thoroughly ballast and relaid with eighty-pound steel in place of the sixty-pound rails now in use.

Stettler, Alta.—The Canadian Northern Railway will shortly commence the construction of a line from Stettler to the Brazean coal fields.

Victoria, B.C.—R. Marole, vice-president of the E. & N. Railway, a subsidiary company of the C.P.R., is reported to have announced the construction of a branch to Cowichan Lake.

Victoria, B.C.—Two survey parties have been sent out by the British Columbia Electric Railway to locate a line to Saanich.

LIGHT, HEAT AND POWER.

Kingston, Ont.—The Seymour Power & Electric Company have offered to supply this city with power at $25 per horse-power.

Vancouver, B.C.—Plans have been announced by the Vancouver Power Company, a subsidiary organization of the British Columbia Electric Railway Company, regarding the development of 100,000 horse-power of electrical energy. The source of the power is located in Chilliwack Lake and Jones' Lake, both lying in the Chilliwack district some distance east of Chilliwack, and connected by the Vedder River and other streams flowing from those storage reservoirs with rapid descents to the Fraser River

BY-LAWS AND FINANCE.

The following debentures were sold last week:—

Windsor, Ont.—$69,108.45, for pavements.
Kingsville, Ont.—$5,000, for parks.
Sedley, Sask.—$10,000, for fire protection and town hall.
Peel County, Ont.—$100,000.
Galt, Ont.—$5,000, waterworks.
Smith's Falls, Ont.—$30,660.
Inverness, N.S.—$1,500, waterworks.
Hanover, Ont.—$6,680.
Lloydminster, Sask.—$15,000.
Peterboro County, Ont.—$17,000, bridges.

Brampton, Ont.—An $11,000 by-law will be introduced for the purpose of improving the River Etobicoke.

Welland, Ont.—By-laws carried were:—Sewer, $30,000; electric railway franchise. Those defeated were:—$60,000, waterworks extensions; $5,000, electric fire alarm.

Edmonton, Alta.—Five by-laws were carried, as follows:—$175,000, for a public hospital; $75,000 for exhibition grounds; $25,000 for a library site, a franchise to the radial railway, and a franchise for the gas plant.

South Vancouver, B.C.—Until July 13th, tenders are invited for $200,000 road debentures, $170,000 school debentures, and $30,000 sidewalks debentures, by G. H. Peake, C.M.C., Hillcrest P.O., B.C.

SEWERS, SEWAGE AND WATERWORKS.

Quebec, Que.—In our "Contracts Awarded" column appear particulars of a contract let for the installation of a $250,000 waterworks and sewerage system at Chaudiere, Que.

Montreal, Que.—In a report on the Montreal water supply, Herring and Fuller, of New York, state that the best available supply is to be secured from the centre of the St. Lawrence River. The installation of a filtration plant is recommended.

St. Thomas, Ont.—A special meeting of the Water Commissioners asked Engineer Bell to make plans and specifications for a pure water reservoir of reinforced concrete, with a capacity of about 800,000 gallons and to ask for tenders. This is a part of the $40,000 scheme and will be gone on with immediately.

Wallaceburg, Ont.—Plans for waterworks are being discussed.

Kamloops, B.C.—H. K. Dutcher, consulting engineer, of Vancouver, has reported on the water supply problem here.

Stewart, B.C.—A $20,000 sewerage system is being talked of.

MISCELLANEOUS.

Toronto, Ont.—The Works Committee favored widening St. Clair Avenue, Danforth Avenue, and Anderson Street.

Winnipeg, Man.—St. Andrew's Locks will be officially opened on July 14th.

Winnipeg, Man.—A permit was issued this week for a $330.000 technical school.

Calgary, Alta.—The Street Commissioners may spend $10,000 on street paving plant.

New Westminster, B.C.—The British Columbia Packers' Association are reported to be planning the erection of a $40,000 cold storage plant.

Vancouver, B.C.—A. J. Bird, architect has prepared plans for a five storey steel frame structure to be erected for S. McClay, at a cost of $70,000.

Vancouver, B.C.—The widening of Pender Street at a cost of $170.000, the construction of creosoted block pavement on Richards Street, forty-four feet wide from Georgia Street to Robson Street at a cost of $13,423, the grading and rocking of Fifteenth Avenue from Woodland Drive to Knight Road, to cost $4,735, and the grading of Eton Street from Templeton Drive to Nanaimo Street, to cost $985, were passed.

PERSONAL.

Readers are invited to forward notes of staff changes and new appointments for publication in this column.

Mr. J. J. Scully, who had charge of the double-tracking work on the C.P.R. between Fort William and Winnipeg, has been appointed general superintendent of the new Saskatchewan division. Mr. T. Martin, formerly assistant engineer at Moose Jaw, will be division engineer of the new division, while Mr. H. B. Sims, resident engineer, will be assistant division engineer.

Mr. A. O. Graydon, M. Can. Soc. C.E., for 19 years city engineer of London, Ontario, has tendered his resignation, on account of ill-health. Mr. Graydon will probably be retained as consulting engineer.

Mr. S. R. Crerar was appointed lecturer in surveying, and Mr. W. W. Gray and J. J. Traill, lecturers in mechanical engineering, by the Board of Governors of Toronto University.

Mr. John Dudgeon, of the Lubecker Machine & Excavating Company, of 30 Great St. Helens, London, is making a trip in Canada. Mr. Dudegon arrived in Montreal to-day, and he can be addressed care of The Canadian Engineer, 62 Church Street, Toronto, Ont.

Mr. C. T. Anderson, has been appointed manager of the Chicago office of the C. W. Hunt Company, New York, builders of coal handling, conveying and hoisting machinery.

Dr. J. A. Amyot, director of the laboratory of the Provincial Board of Health of Ontario, was appointed by the Board of Governors of Toronto University, to be Professor of Hygiene at the University, to succeed Dr. Wm. Oldright, who resigned earlier in the year. Dr. Amyot has been Associate Professor of Hygiene for some time. His promotion will not interfere with his duties for the Provincial Board of Health.

ELEMENTARY ELECTRICAL ENGINEERING

(Continued from page 689).

"compound-wound" or "compound" machines. This system of excitation is shown in Fig. 37. In commercial work the amount of series excitation is sufficient in practically all cases to raise the terminal voltage a small amount as the load increases. For example, a generator for lighting purposes which will give a terminal voltage of 115 at no load will usually give 125 at full load. The percentage increase of terminal voltage between no load and full load is usually referred to as the amount of compounding, and depends on the class of service for which the generator is designed. Generators which supply power for railway service are usually compounded more than those which are used for lighting service.

The object of increasing the terminal voltage of a generator in proportion to the increase of load is to compensate for the loss of voltage in the external circuit or transmission line. It was noted above that for most kinds of work it is desirable to have a constant voltage at the point where the power is being used. To secure this condition the terminal voltage of the generator must increase as the load increases. If R represents the resistance of the transmission line between the generator and the point where the power is being used and I the current flowing in the line, the loss of voltage in this line will be RI; and if the voltage at the point of power consumption is represented by E, the terminal voltage of the generator must be equal to E + RI. In this connection it may be noted that nearly all apparatus which uses electric power is designed to operate at a constant voltage. A little consideration will show that this is necessary, for every generator, with practically no exception, supplies power for various purposes, and its voltage could not be varied to suit any particular piece of apparatus without interfering with other apparatus taking power from the same system.

Example.—The e.m.f. of a certain generator is 240 volts, and the resistance of its armature is .05 ohm. (a) To determine its terminal voltage and the voltage at the end of a line to which it is delivering 200 amperes, the resistance of the line (two wires) being .03 ohm. If the voltage at the end of the line (i.e., at the point where the power is being used) remains constant, to determine the generated e.m.f. when a current of 300 amperes is delivered to the same line.

(a) Loss of potential in the armature = 200 × .05 = 10 volts.
Terminal voltage = 240 — 10 = 230 volts.
Loss of potential in line = 200 × .03 = 6 volts.
Voltage at end of line = 230 — 6 = 224 volts.

(b) Loss of potential in line = 300 × .03 = 9 volts.
Loss of potential in armature = 300 × .05 = 15 volts.
Generated e.m.f. = 224 + 9 + 15 = 248 volts.

SPECIFICATIONS FOR MACADAM ROADWAY FOR THE APPROACHES TO THE RICHMOND ROAD VIADUCT, OTTAWA, ONT.

Work—

1. The work is to consist of the construction of a limestone macadam roadway on the approaches to the Richmond Road Viaduct.

Subgrade.

2. The subgrade is to be brought up to within twelve (12) inches of the top of the finished roadway and must be thoroughly and uniformly compacted so that there will be no soft spots. The subgrade must conform in shape to the camber of the finished roadway.

Foundation.

3. Upon the subgrade prepared as above, a course of limestone spalls eight (8) inches in thickness is to be laid. The stone must be of approved quality and no particle of stone shall be more than six (6) inches, and not more than five (5) per cent. of the stone shall be less than two (2) inches in length or breadth. The stone is to be placed by hand and roughly broken with sledges, then rolled until thoroughly consolidated so as to form a compact layer of stone eight (8) inches thick. The surface must conform to the camber of the finished roadway.

2-Inch Course.

4. Upon the foundation course is to be laid a course of good, hard, rough limestone, no particle of which is to be more than two (2) inches or less than three-quarters (¾) of an inch in length or breadth. This course is to be thoroughly rolled so as to form a compact layer four (4) inches in thickness when rolling is completed and must conform to the camber of the finished roadway.

Limestone Blinding.

5. After the above course of two (2) inch stone is completed a thin layer of approved limestone not to exceed five-eighth inches in largest dimension is to be evenly spread over the whole surface and thoroughly rolled in. The surface is to be dampened sufficiently to bind well under the roller. Rolling must be continued until the surface presents a smooth compact appearance and is free from lumps and hollows.

Camber.

6. The roadway is to have a fall of six (6) inches from the crown to the gutter.

MARKET CONDITIONS.

Montreal, June 29th, 1910.

Reports from the United States indicate that the consumption of finished steel products is unusually heavy for this time of the year. Mills, however, have now an exceptionally large capacity, so that they are able to produce probably one-quarter more than can be sold to the home market. Consequently the export market is beginning to attract some attention. The effect on prices, of this lack of demand, is naturally not of an encouraging nature to producers.

It would seem that the most important contract known of at the moment is in connection with the Panama Canal. Next to this, the attention of the trade is turned towards Canada, whence it is expected that an order for 60,000 tons of bridge material will shortly be forthcoming. The material is stated to be for the Montreal Bridge, by which is meant, no doubt, the Lachine Bridge, of the C.P.R. As has already been announced in these columns, it is the intention of the C.P.R. to double track this bridge, and to build additional piers, and widen out the existing piers. In fact, the contract for this work has already been given out. The reports from the United States would make it appear that considerable competition has developed for the material required, and that the prices will be unusually low. This situation will naturally be welcomed by the C.P.R. Activity in the steel building trade has developed throughout the country, and numerous small orders for commercial structures are being placed.

In the pig-iron market, the feature is the excessive capacity of blast furnaces. A large amount of smelting is going on, and there are heavy shipments on contracts, and a fair percentage of new business. At the same time, there is more than enough metal to go around, the result being that the tendency of prices continues downwards, although the claim is made that profits are practically wiped out at present prices.

Reports from the other side of the Atlantic say that trade there is very much the same as in the United States. In fact, the situation in the United States would seem to be the most important influence in the markets on the other side. Home consumption in the United Kingdom is fairly encouraging, but Germany has not been buying freely, and exports are light all round. The situation is no more than steady, and the market, generally, lacks character. Prices are not showing any marked tendency to go lower, particularly, as they are said to have gone far enough in that direction.

The local market is somewhat dispirited over the failure of the American market to respond in the manner so generally anticipated a while ago. So far as the consumption within Canada is concerned, however, very few complaints are heard. The volume of trade is very fair and prices are being maintained at recent levels. This applies not only to pig-iron, but to finished and semi-finished steel products. The trade is not a little interested in the peaceful solution of the question of the title between the recently organized Dominion Steel Corporation, Limited, and the Steel Company, of Canada, Limited. The markets are still holding very steady, and the trade generally is not looking for much alteration for some time to come.

The market holds steady at recent prices:—

Antimony.—The market is steady at 8c. to 8¼c.

Bar Iron and Steel.—The market promises to advance shortly. Bar iron, $1.90 per 100 pounds; best refined horseshoe, $2.15; forged iron, $2.05; mild steel, $1.90; sleigh shoe steel, $1.90 for 1 x ⅜-base; tire steel, $2.00 for 1 x ⅜-base; toe calk steel, $2.40; machine steel, iron finish, $1.95; imported, $2.20

Building Paper.—Tar paper, 7, 10, or 16 ounces, $1.80 per 100 pounds; felt paper, $2.75 per 100 pounds; tar sheathing, 40c. per roll of 400 square feet; dry sheathing, No. 1, 30 to 40c. per roll of 400 square feet; tarred year will be the largest in the history of the country. Prices on foreign fibre, 55c. per roll; dry fibre, 45c. (See Roofing; also Tar and Pitch). (164).

Cement.—Canadian cement is quotable, as follows, in car lots, f.o.b., Montreal:—$1.30 to $1.40 per 350-lb. bbl., in 4 cotton bags, adding 10c. for each bag. Good bags re-purchased at 10c. each. Paper bags cost 2¼ cents extra, or 10c. per bbl. weight.

Chain.—The market has advanced again, being now per 100 lbs., as follows:—¼-in., $5.30; 5-16-in., $4.70; ⅜-in., $3.90; 7-16-in., $3.65; ½-in., $3.55; 9-16-in., $3.45; ⅝-in., $3.40; ¾-in., $3.35; ⅞-in., $3.35; 1-in., $3.35.

Coal and Coke.—Anthracite, egg, stove or chestnut coal, $6.75 per ton, net; furnace coal, $6.50, net. Bituminous or soft coal:- Run of mine, Nova Scotia coal, carload lots, basis, Montreal, $3.85 to $4 per ton; cannel coal, $9 per ton; coke, single ton, $5; large lots, special rates, approximately $4 f.o.b., cars, Montreal

Copper.—Prices are strong at 13¾ to 14c.

Explosives and Accessories.—Dynamite, 50-lb. cases, 40 per cent. proof, 15c. in single case lots, Montreal. Blasting powder, 25-lb. kegs, $2.25 per keg. Special quotations on large lots of dynamite and powder. Detonator caps, case lots, containing 10,000, 75c. per 100; broken lots, $1; electric blasting apparatus:—Batteries, 1 to 10 holes, $15; 1 to 20 holes, $25; 1 to 30 holes, $35; 1 to 40 holes, $50. Wire, leading, 1c. per foot; connecting, 50c. per lb. Fuses, platinum, single strength, per 100 fuses:—4-ft. wires, $3; 6-ft. wires, $3.54; 8-ft. wires, $4.08; 10-ft. wires, $5.

Galvanized Iron.—The market is steady. Prices, basis, 28-gauge, are:—Queen's Head, $4.10; Colborne Crown, $3.85; Apollo, 10¾ oz., $4.05. Add 25c. to above figures for less than case lots; 26-gauge is 25c. less than 28-gauge, American 28-gauge and English 26 are equivalents as are American 10¾ oz., and English 28-gauge.

Galvanized Pipe.—(See Pipe, Wrought and Galvanized).

Iron.—First boats are now arriving at Montreal, and importers are quoting prices, ex-wharf, about $1 per ton under prices ex-store. Following are the prices, on cars, ex-wharf, Montreal:—No. 1 Summerlee, $20.50 to $20.75 per ton; selected Summerlee, $20 to $20.25; soft Summerlee, $19.50 to $19.75; Carron, special, $20 to $20.50; soft, $19.50 to $20; Clarence, $17.25 to $17.50; Cleveland, $17.25 to $17.50 per ton.

Laths.—See Lumber, etc.

Lead.—Prices are easier, at $3.35 to $3.45.

Lead Wool.—$10.50 per hundred, $200 per ton, f.o.b., factory.

Lumber, Etc.—Prices on lumber are for car lots, to contractors, at mill points, carrying a freight of $1.50. Red pine, mill culls out, $18 to $22 per 1,000 feet; white pine, mill culls, $16 to $17. Spruce, 1-in by 4-in. and up, $15 to $17 per 1,000 ft.; mill culls, $12 to $14. Hemlock, log run, culls out, $13 to $15. Railway Ties; Standard Railway Ties, hemlock or cedar, 35 to 45c. each, on a 5c. rate to Montreal. Telegraph

Poles: Seven-inch top, cedar poles, 25-ft. poles, $1.35 to $1.50 each; 30-ft., $1.75 to $2; 35-ft., $2.75 to $3.25 each, at manufacturers' points, with 5c. freight rate to Montreal. **Laths:** Quotations per 1,000 laths, at points carring $1.50 freight rate to Montreal, $2 to $3. **Shingles:** Cedar shingles, same conditions as laths, X. $1.50; XX, 2.50; XXX, $3.

Nails.—Demand for nails is better and prices are firmer, $2.40 per keg for cut, and $2.35 for wire, base prices. Wire roofing nails, 5c. lb.

Paints.—Roof, barn and fence paint, 90c. per gallon; girder, bridge, and structural paint for steel or iron—shop or field—$1.20 per gallon, in barrels; liquid red lead in gallon cans, $1.75 per gallon.

Pipe.Cast Iron.—The market shows a steady tone although demand is on the dull side. Prices are firm, and approximately as follows:—$32 for 6 and 8-inch pipe and larger, $33 for 3-inch and 4-inch at the foundry. Pipe, specials, $3 per 100 pounds. Gas pipe is quoted at about $1 more than the above.

Pipe.—Wrought and Galvanized.—Demand is about the same, and the tone is firm, though prices are steady, moderate-sized lots being: ¼-inch, $5.50 with 63 per cent. off for black, and 48 per cent off for galvanized; ⅜-inch, $5.50, with 59 per cent. off for black and 44 per cent. off for galvanized; ½-inch, $8.50, with 69 per cent. off for black, and 59 per cent. off for galvanized. The discount on the following is 71½ per cent. off for black, and 61½ per cent. off for galvanized; ¾-inch, $11.50; 1-inch, $16.50; 1¼-inch, $22.50; 1½-inch, $27; 2-inch, $36; 2½-inch, $57.50; 3-inch, $75.50; 3½-inch. $95; 4-inch, $108.

Plates and Sheets.—Steel.—The market is steady. Quotations are: $2.20 for 3-16; $2.30 for ⅛, and $2.10 for ¼ and thicker; 12-gauge being $2.30, 14-gauge, $2.15; and 16-gauge, $2.10.

Rails.—Quotations on steel rails are necessarily only approximate and depend upon specification, quantity and delivery required. A range of rails, per gross ton of 2,240 lbs., f.o.b. mill. Re-laying rails are quoted at $27 to $29 per ton, according to condition of rail and location.

Railway Ties.—See lumber, etc.

Roofing.—Ready roofing, two-ply, 70c. per roll; three-ply, 95c. per roll of 100 square feet. Roofing tin caps, 6c. lb.; wire roofing nails, 5c. lb (See Building Paper; Tar and Pitch; Nails, Roofing)

Rope.—Prices are steady, at 9c. per lb. for sisal, and 10½c. for Manila. Wire rope, crucible steel, six-strands, nineteen wires; ¼-in., $2.75; 5-16, $3.75; ⅜, $4.75; ½, $5.25; ⅝, $6.25; ¾, $8; ⅞, $10; 1-in., $12 per 100 feet.

Spikes.—Railway spikes are firmer at $2.45 per 100 pounds, base of 5⅝ x 9-16. Ship spikes are steady at $2.85 per 100 pounds, base of ⅝ x 10 inch, and ⅝ x 12-inch.

Steel Shafting.—Prices are steady at the list, less 25 per cent. Demand is on the dull side.

Telegraph Poles.—See lumber, etc.

Tar and Pitch.—Coal tar, $3.50 per barrel of 40 gallons, weighing about 500 pounds; roofing pitch, No. 1, 70c. per 100 pounds; and No. 2, 55c. per 100 pounds; pine tar, $8.50 per barrel of 40 gallons, and $4.75 per half barrel; refined coal tar. $4.50 per barrel; pine pitch, $4 per barrel of 18 to 200 pound. (See building paper, also roofing).

Tin.—Prices are firm, at $34 to $34.50.

Zinc.—The tone is easy, at 5¾ to 6c.

CAMP SUPPLIES.

Beans.—Prime pea beans, $2 to $2.25 per bushel.

Butter.—Fresh made creamery, 25 to 26c.

Canned Goods.—Per Dozen.—Corn, 80 to 85; peas, $1.05 to $1.15; beans, 85c.; tomatoes, 85 to 90c.; peaches, 2s, $1.65, and 3s, $2.65; pears, 2s, $1.60, and 3s, $2.30; salmon, best brands, 1-lb. talls, $1.87½, and flats, $2.02½; cheaper grades, 95c. to $1.65.

Cheese.—The market ranges from 11c. to 11½c., covering all Canadian makes.

Coffee.—Mocha, 20 to 25c.; Santos, 15 to 18c.; Rio, 10 to 12c.

Dried Fruits.—Currants, Filiatras, 5¾ to 6¼c.; choice, 8 to 9c.; dates, 4 to 5c.; raisins, Valentias 5 to 6¼c.; California, seeded, 7½ to 9c.; Evaporated apples, prime, 8 to 8½c.

Eggs.—New laid, 20 to 22c.

Flour.—Manitoba, 1st patents, $5.60 per barrel; 2nd patents, $5.10; strong bakers, $4.90.

Molasses and Syrup.—Molasses, New Orleans, 27 to 28c.; Barbadoes, 40 to 45c.; Porto Rico, 40 to 43c.; syrup, barrels, 3½c.; 2-lb. tins, 2 dozen to case, $2.50 per case.

Potatoes.—Per 90 lbs., good quality, 45 to 50c.

Rice and Tapioca.—Rice, grade B., in 100-lb. bags, $2.75 to $2.80; C.C., $2.65. Tapioca, medium pearl, 5½ to 6c.

Rolled Oats.—Oatmeal, $2.20 per bag; rolled oats, $2, bags.

Sugar.—Granulated, bags, $5.05; yellow, $4.65 to $5. Barrels 5c. above bag prices.

Tea.—Japans, 20 to 38c.; Ceylons, 20 to 40c.; Ceylon, greens, 19 to 25c.; China, green, 20 to 50c.; low-grades, down to 15c.

Fish.—Salted.—Medium cod $7 per bbl.; herring, $5.25 per bbl.; salmon, $15.50 per bbl., for red, and $14 for pink. Smoked fish.—Bloaters, $1.10 per large box; haddies, 7½c. per lb.; kippered herring, per box, $1.20 to 1.25.

Provisions.—Salt Pork.—$27 to $34 per bbl.; beef, $18 per bbl.; smoked hams, 16 to 20c. per lb.; lard, 16½ to 17½c. for pure, and 12½ to 14c. per lb. for compound.

* * * *

Toronto, June 30th, 1910.

The most noticeable item to-day is in the camp supplies' department. Prices of flour are advanced 25c. per barrel. This is caused by an advance in the Chicago and Winnipeg wheat markets of 7 and 6 cents per bushel respectively, the impelling idea being the drought in the American and Canadian West. This advance may or may not last. Pork and salt meats are easier.

Very marked activity has developed in lumber during the fortnight; large bills of hemlock as well as pine have been sold, and the demand continues. The ingot metals are easy; pig-iron steady under a moderate demand, sheet steel moving briskly.

The following are wholesale prices for Toronto, where not otherwise explained, although for broken quantities higher prices are quoted:

Antimony.—Trade is quiet, market easier at $8.50.

Axes.—Standard makes, double bitted, $8 to $10; single bitted, per dozen, $7 to $9.

Bar Iron.—$2.00 to $2.10, base, per 100 lbs., from stock to wholesale dealer. Free movement.

Bar Mild Steel.—Per 100 lbs., $2.10 to $2.20.

Boiler Plates.—¼-inch and heavier, $2.20. Boiler heads 25c. per 100 pounds advance on plate. Tank plate, 3-16-inch, $2.40 per 100 pounds.

Boiler Tubes.—Orders continue active. Lap-welded, steel, 1¼-inch, 10c.; 1½-inch, 9c. per 10 foot; 2-inch, $8.50; 2¼-inch, $10; 2½-inch, $10.60; 3-inch, $11 to $11.50; 3½-inch, $18 to $18.50; 4-inch, $19 to $20 per 100 feet.

Building Paper.—Plain, 27c. per roll; tarred, 35c. per roll. Demand is moderate.

Bricks.—In active movement, with very firm tone. Price at some yards $9 to $9.50, at others, $9.50 to $10 for common. Don Valley pressed brick are in request. Red and buff pressed are worth $18 delivered and $17 at works per 1,000.

Broken Stone.—Lime stone, good hard, for roadways or concrete, f.o.b., Schaw station, C.P.R., 75c. until further notice, per ton of 2,000 lbs., 1-inch, 2-inch, or larger, price all the same. Rubble stone, 55c. per ton, Schaw station, and a good deal moving. Broken granite is selling at $3 per ton for good Oshawa.

Cement.—Car lots, $1.75 per barrel, without bags. In 1,000 barrel lots $1.60. In smaller parcels $1.90 is asked by city dealers. Bags, 40c. extra. Demand good.

Coal.—The price of anthracite still remains at $6.50 per ton, net, and pea coal at $5.75; but as the usual monthly advances have been made at the mines, a higher figure may be anticipated in the near future. From these prices a discount of 25 cents per ton can be had on considerable lots. In the United States there is an open market for bituminous coal and a great number of qualities exist. We quote: Youghiogheny lump coal on cars here, $3.75 to $3.80; mine run, $3.65 to $3.70; slack, $2.75 to $2.85; lump coal from other districts, $3.55 to $3.70; mine run 10c. less; slack, $2.60 to $2.70; cannel coal plentiful at $7.50 per ton; cook, Solvey foundry, which is largely used here, quotes at from $5.75 to $6.00; Reynoldsville, $4.90 to $5.10; Connellsville, 72-hour coke, $5.25.

Copper Ingot.—A very large volume of business is being done, but the market is weaker at $13.50 to $13.75. Production goes on at a rapid rate.

Detonator Caps.—75c. to $1 per 100; case lots, 75c. per 100; broken quantities, $1.

Dynamite, per pound 21 to 25c., as to quantity.

Felt Roofing.—The spring trade has opened very well at an unchanged price, which is $1.80 per 100 lbs.

Fire Bricks.—English and Scotch, $30 to $35; American, $25 to $35 per 1,000. Fire clay, $8 to $12 per ton.

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