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MISSING

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The Canadian Engineer

ESTABLISHED 1893

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A reader is anxious to secure copies of the Canadian Engineer for December 6, 1907 and January 3, 908. Perhaps some of our subscribers can accommodate him. There is three months' extension of subscription in it.

TORONTO, CANADA, MARCH 6th, 1908.

CONTENTS OF THIS ISSUE.

DOMINION SURVEYORS.

The criticism of the amendments to the Dominion Survey Act by the President of the Ontario Land Surveyors' Association should lead to a more careful consideration of the measure, and, it is to be hoped, to some better understanding among the various Provincial Land Surveyors' Associations.

Any change in the Dominion Act to make it more easy for surveyors from the colonies to practise in Canada should have been preceded by a clause encouraging the formation of a body, membership in which would entitle a member to practise surveying in all the territories and Provinces of Canada.

The present arrangement, or want of arrangement, which requires a Dominion land surveyor or a Provincial surveyor, moving into another Province, to take a full examination, looks like what is often called a "hold-up."

The only excuse that can be offered for the continuation of this provincialism is that each Province has its own method of making surveys, in some according to well-defined systems; in others, according to methods that do not lend themselves to examination. A man with the mathematical training and experience which makes him capable of doing survey work in one locality does not by moving lose that knowledge. If he shows himself familiar with the Survey Act for the new Province he should be allowed to follow his profession as a surveyor. The new Association of Dominion Land Surveyors have a splendid opportunity to show their usefulness, broad-mindedness and public spirit by conducting a campaign which has for its object reciprocity between the Provinces in land surveyors. This rearrangement should take place before any encouragement is given to surveyors from other parts of the Empire.

If surveyors from other British possessions are allowed partial examinations, so should our Provincial surveyors. Nothing is to be gained by allowing outsiders privileges Canadians do not possess. Nothing is to be gained by making it appear that other countries require a higher standard than does Canada. Already some of the Provincial Boards require a higher standard than do our Dominion Board. Let Provincial Boards agree on a standard and then arrange that those measuring to those requirements may practice in any Province in the Dominion. The land surveyors are the pioneers in a country's expansion. May they be the pioneers among the close corporations to leave provincialism and become national.

PROFESSIONAL ETHICS.

"Do as you would be done by" is a familiar phrase, and states a doctrine we all profess to live by, but when it is the other fellow who does it, how hard it is for us to believe he is acting according to this rule. It is one thing to persuade ourselves we did right, but it is an entirely different matter to persuade us that someone else acted fairly.

We may prepare codes of professional ethics; we may prepare long essays on professional responsibility; we may even legislate where and when a man may practise his profession, but it will all come to naught

unless each member of the profession does what he knows to be fair, right, and honorable. There are so many ways of keeping the letter and disregarding the spirit of the law that man is bumping his head against a stone wall when he attempts to raise the standard of his vocation professionally by legislation.

It is true in most professions, and we suppose it happens now and then in engineering, that men of high standing and unusual ability appear to depart from the paths of professional rectitude; and then how quickly we pass judgment, sometimes not waiting to learn the whole of the facts. A word in jest, a whispered word, a glance, and the doubt is sown. We will never raise the standard of the profession by arriving at conclusions, having studied but half the facts.

Unfortunately, there are engineers who forget their responsibility and betray their trust. Such men should not expect mercy. With their methods we have no sympathy. Nor would we defend the man who knowingly sails close to the wind, who uses his position to gain information, which he retails to friends, who uses his employer's time for his private gain.

But who shall be judge? Perhaps it would be better for each of us to make sure our own skirts are clean and allow our fellow-practitioner to do the same.

PUBLIC ACCOUNTS OF ONTARIO.

The statements of the Provincial Treasurer, although it shows a large increase in expenditure for 1907, also shows a substantial balance. The total receipts for the year amounted to $8,320,419.19, and out of this $606,173.58 was carried forward as a balance.

The Province aided railways to the extent of $144,860.68; for repairs and maintenance of Parliament Buildings, $95,336.40; appropriated and expended on colonization roads, $316,906.30. For fire and forest ranging some $107,000 was expended, nearly $52,000 more than for 1906.

The Hydro-Electric Power Commission received $40,524.21; of this, $14,448.42 was for salaries.

In the improvement of our inland waterways $16,841.06 was expended.

Among the receipts for the year the T. and N.O. Railway contributed $235,090.69; woods and forests, $1,219,051.32, while mining lands and royalties yielded $1,462,248.69.

"CANADIAN WOODWORKER."

"We desire to produce a paper which shall be indispensable not only to the manufacturers of all kinds of woodwork, but also to the thousands of machine workers employed in their establishments." It is in these words Biggar-Wilson Company indicate the field they purpose entering and the class of journal they will produce in the new publication, "Canadian Woodworker," the first number of which is being distributed.

The subjects discussed are live subjects with the woodworker, and are treated in a manner that will hold the interest of the reader, and not repel him with theoretical discussions that are of interest to but a few. The men who are interested in timber and lumber, the men who work in the mill, the factory or at the bench, the men who design as well as those who execute work in wood, will find interesting information of practical value on every page of "Canadian Woodworker."

WHAT'S NEW?

There is nothing new. Everybody is waiting, confident that with the spring something good will open. We have not met a discouraged man. Perhaps it is the bracing air or the optimism born of years of prosperity.

We think, however, the hope is well founded. Now and then comes word of location parties being sent out on revision, of new offices being opened for canal extension work, of municipal improvements planned for the coming season, of new power schemes, all of which indicate activity in construction work this spring.

THE TORONTO ELECTRIC LIGHT COMPANY.

The twenty-fourth annual meeting of the Toronto Electric Light Company was of more than usual interest, not only to the shareholders because of the satisfactory financial report, but to the general public, and particularly engineers, because of the historical information and data contained in the president's address and in a report to the directors by Mr. W. A. Martin.

The financial statement shows that from 1884, with an authorized capital of $200,000, and a paid up capital of $175,400, the company has grown until in 1907 it had an authorized capital of $4,000,000, and a paid-up capital of $3,385,477.29 on which it paid dividends at the rate of 8 per cent.

The president's address is plainly meant to be educative, if not political. It is evidently meant to be a strong plea for private ownership of lighting plants. The first table submitted gives the contract prices with the City of Toronto for street lighting.

Year.	Amount of Contract.
1884	$226.30 per light per annum
1886	200,75 per light per annum
1891	108.59 per light per annum
1896	74.83 per light per annum
1901	74.83 per light per annum
1906	69.35 per light per annum

While making such reductions as shown in the above table the company take some credit for the reduction in the price of gas, a reduction caused, so it is suggested, by competition. The table showing the reduction in the price of gas is as follows:

Year.	Price of Gas per thousand feet.
1882	$1.75 net
1884	1.60 net
1885	1.50 net
1890	1.12½ net
1893	1.05 net
1896	.90 net
1903	.80 net
1906	.75 net

But we doubt if any argument based on these facts alone will have much weight, as there were other factors than the competition of the Electric Light Company at work. As to the price of gas, it was coming down in price long before the Electric Light Company was organized.

In 1870 the price was $3.00 per thousand
In 1871 the price was 2.66 per thousand
In 1877 the price was 2.50 per thousand
In 1879 the price was 2.00 per thousand

From this one will see the reduction in the price of gas in the nine years before the Electric Light Company entered the field was greater than in any nine years since.

A third table gave the rates charged in the American cities and one Canadian city, namely, Montreal:

Light per K.W. Hour.	Small Users. cents.	Medium Users. cents.	Large Users cents.
Average	12.2	8.9	6
Toronto Rates—			
Small commercial	12.0	8.0	6 to 4
House lighting	8.0	...	..
Power Rates—			
Average	10.2	6.6	5.2
Toronto Rates	8	4	2.66

They did not publish the following figures, however, which would have been much easier to secure and just as interesting and just as fair.

Orillia, 8 cents.
Sudbury, 15 cents less 33⅓ and 10 per cent. off=9 cents.
Pembroke, 8 cents net.
Renfrew, 10 cents, 12 per cent. off.
Mattawa, 13 cents, 15 per cent. off.
Ottawa, 12 cents, 40 per cent. off.
Thessalon, 8 cents net.
Beaton, 7 cents net.

The concluding sentences of Mr. Martin's report give the result of his investigation. He says:

"On the basis of the showing of Glasgow and Detroit, and the price to be paid to the Hydro-Electric Commission for power, as given above, the average cost to the City of Toronto per K.W. hour (delivered to customers) would be 5 4-5 cents, while the average price received by the Toronto Electric Light Company during 1907 per K.W. hour (delivered to customers) was 5 2-5 cents.

"I have given the City proposition the benefit of many doubts, and am of opinion that their schedule of prices must average considerably higher than 6 cents, unless they are to operate at a loss and make the deficiency up out of the general taxes. As you are aware, our prices can and will very shortly be reduced, so that our company need not fear the competition of a City plant if it is operated on a commercial basis.

"I have had the figures and findings in the above estimate carefully gone over by an electrical expert and an expert accountant."

THE BLACKFRIARS BRIDGE.

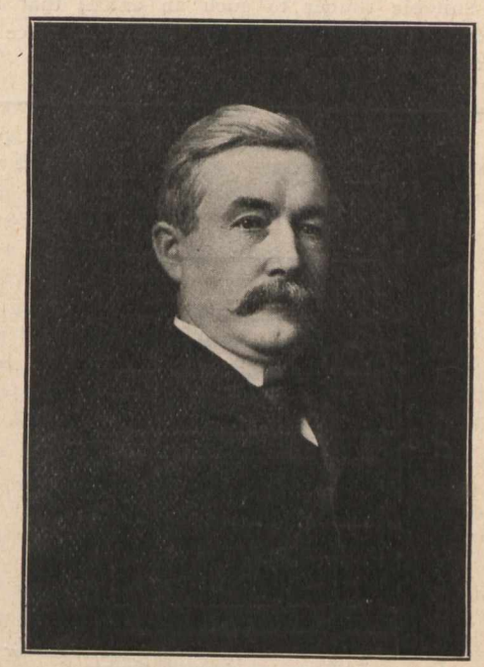
(From Our Own Correspondent.)

I mentioned briefly in my last notes that a serious and fatal accident had occurred in London in connection with the important widening works now being carried out at Blackfriars Bridge, as a portion of the scheme of tramway extension by the London County Council. A very protracted enquiry has since taken place, and fuller details of the catastrophe are now available. The full story summarised is as follows: In order to widen the bridge the piers on the west side were being extended to a length of thirty feet. As the foundations had to be laid in the bed of the river, caissons had to be sunk, one at each pier, each weighing about 230 tons. The lowering of these caissons was carried out from a pile staging, the sides of which were connected at the top by two sets of transverse girders, whilst at each of the four corners of the staging an hydraulic jack rested, the object of these being, of course, to carry evenly between them the weight of the caisson to be lowered. Three caissons had been lowered, and work was being carried out upon the fourth, when the unfortunate accident occurred. Each stage of the operations lowered the caisson some thirteen inches, and the evidence fairly conclusively showed that the cause of the accident lay in the defective working of one of the jacks, which had the effect of upsetting the equilibrium of the caisson, and by transferring all the weight upon the other jacks caused the collapse of the staging. The theory of the engineers connected with the works—and it is generally accepted—is that the fall of the caisson was due to want of uniform action between the jacks, probably due to injury to one of the taps, which resulted in the emptying of the jack and consequent lowering of the caissons at that particular point in advance of the other jacks. In coming to the decision that there were no flaws or defects structurally in the staging or appliances, the jury were guided by the evidence that the same apparatus had previously been used in lowering the other three caissons. In the circumstances, a verdict of death due to accidental causes was returned, with a few suggestions as to providing for a more perfect and simultaneous control of the four jacks used in such operations in the future.

GENERAL MANAGER C. P. R. EASTERN LINES.

The recent important change in Canadian Pacific management brings to public notice the man who, in Eastern Canada, will have the working out of the new arrangement.

James W. Leonard, who was on March 1st appointed general manager of Canadian Pacific eastern lines, is no novice in the handling of large propositions, in dealing with difficult situations. In 1872 Mr. Leonard entered railway service, and his successive promotions are a splendid example of the opportunities within reach of Canadians in their own country. From 1872 to August, 1877, he was telegraph operator and agent of the Midland Railway of Canada; August, 1877, to December, 1878, agent of the Victoria Railway; December, 1878, to March, 1880, assistant manager of the same road; March to June, 1880, assistant to general superintendent of the Credit Valley Railway; June, 1880, to November, 1883, general passenger agent of the same road; November, 1883, to May, 1884, master of transportation of the Ontario and Quebec Railway; May, 1884, to March 17, 1900, superintendent of the Canadian Pacific at Montreal; March 19, 1890, to March, 1893, superintendent of lines east of Montreal, same road; March 1, 1893, to May, 1901, superintendent of the Ontario and Quebec Division; from May, 1901, to December, 1903, superintendent of the Western Division, with headquarters at Winnipeg.



Mr. J. W. Leonard.

In 1903 Mr. Leonard came East, and was appointed manager of construction east of Fort William. In October, 1905, he returned to the operating department as assistant general manager of Eastern lines.

A man of great executive ability, business aptitude and a tireless worker, even greater success is sure to come in future years. The upward climb was not always easy, there were doubtless discouraging pauses, but advancement could not be denied to one who devoted his whole energies to the successful management of railways.

ARCHITECTS' BILL.

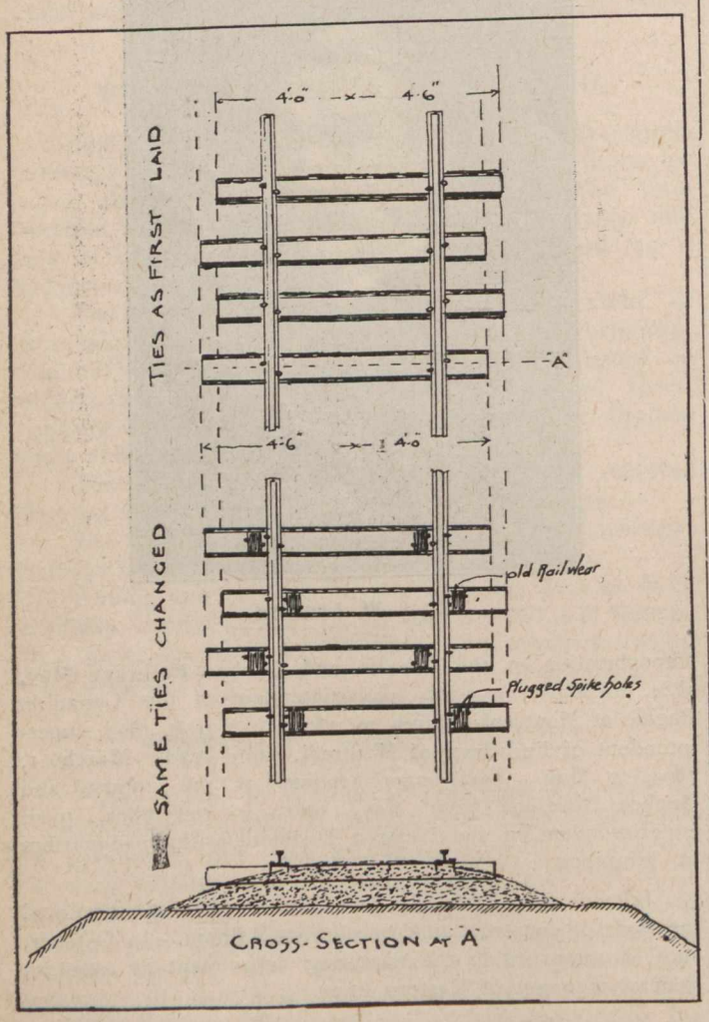
In Private Bills Committee to-day was considered a bill for the incorporation of the Institute of Architects of Canada, which will be amended so as to prevent the body in question, forming itself into a close corporation to the possible detriment of those who do not belong thereto.

CORRESPONDENCE

[This department is a meeting-place for ideas. If you have any suggestions as to new methods or successful methods, let us hear from you. You may not be accustomed to write for publication, but do not hesitate. It is ideas we want. Your suggestion will help another. Ed.]

RAILWAY TIES.

Sir,—The item of ties in railway construction, and subsequent maintenance, is well known to be one of considerable expense, and the large increase of railway mileage in Canada of recent years has drawn upon the supply of available suitable timber to such an extent that ties are now difficult to obtain, and only then at a price two to three times what it was twenty-five years ago.



Any method of using ties which will add to the period of their usefulness in the track must be the means of saving money. It is some years since the writer first proposed a change in the ordinary system, as described below, but has not known of its having been anywhere adopted, even for experiment. On enquiry from different men in the tie business, and from one particularly, who is now purchasing a very large quantity, he learns that a tie 8 feet 6 inches long may be had for practically the same price as one of the ordinary length, 8 feet.

The life of a common tie—mixed tamarac, spruce, and jack pine—is about seven years, and one-seventh of all the ties in a road have to be renewed every year. If only one-tenth of them require to be renewed, and we take a road two hundred miles long, with three thousand ties per mile, as an illustration, it means a saving of nearly $9,000 per annum at the present price of ties.

Ties are first rendered unsafe in track from being "rail-worn" and "spike-killed," especially in northern districts, where the frost causes heaving of track, and rendering necessary the common skimming, and before the body of the tie has decayed they have to be taken out because of the wear under and alongside the base of rail.

It is herein suggested that after five years' use the rail be given a new bearing. The tie may be safely left in track for another five years.

The extra six inches in length will answer for a 60-pound rail, generally used in constructing colonization roads and branch lines, but for a 72 or 80-pound rail seven to eight inches extra length of tie would be needed.

Of course, in the older and high standard roads, where tie-plates and a superior quality of tie are used, this plan may not be suitable or advisable, but for our new roads in the northern and north-western parts of Canada the method shown in the diagram, the writer feels confident, would be the means of saving a large amount of money in material alone, to say nothing of the labor cost, reduced in changing ties.

H. W. D. Armstrong, M. C.S.C.E.

Saskatoon, Feb. 25, 1908.

CANADIAN SOCIETY OF CIVIL ENGINEERS.

Sir,—In a recent issue you conclude some very good remarks on the Canadian Society of Civil Engineers, by an invitation for individual members of the Society to express their views. This is my excuse for now addressing you.

I may preface my remarks by saying that I am one of the older members of the society, that what ever criticisms I make are not intended unkindly towards any one, and that some of those who may come under such criticism are among my most intimate friends.

The remark I always feel inclined to make at the conclusion of each annual meeting, is that the society is seeking to do what it will never succeed in permanently accomplishing, a thing, which by the very constitution of the Canadian engineer, and by the nature of the country he works in, is impossible. But in trying to do it the society is fatally injuring itself. I refer to the tacit assumption, on the part of a very small number of the society, resident in Montreal, that they can run the whole body of Canadian engineers in Canada.

The society is founded on democratic principles, but practically it is governed by a handful of men in Montreal, and this will always be the case as long as there is only one society for the whole of Canada. It is the necessary tendency of centralization.

An effort has been made to check this tendency, by drawing the council from all parts of the Dominion. Another effort has been made by providing for branch societies. But it is vain, as long as there is a head office which exercises a jurisdiction, or seeks to exercise it, over the whole profession in Canada, that head office must be established in one city, and a small resident coterie will inevitably form which will seek to dominate the society and the profession.

There should be a separate and independent society for each province, affiliated with each other, it may be, but self-supporting and self-governing. It is impossible that a few men in Montreal or Toronto, or their nominees, for they are practically self-propagating, can keep in touch with the claims of individual engineers all over these wide extending provinces. But that ought to be the chief use and purpose of the society. To protect and assist the individual engineer is what the individual engineer wants. For instance, it is not at all an uncommon thing for an engineer to be cheated, cut

of many months of hard-earned pay. Here then is one way that a society could, and should be, of real service to its members, by keeping track of doubtful and "N. G." companies or employers, as commercial men do with their customers, and enabling an engineer to learn something about the company or firm he was about to work for.

Another way might be, by seeking legislation, making the claim of an engineer a lien upon the charter of a defaulting company, enforcible by the sale of the charter, instead of his claim, as at present, ranking below that of the laboring man. There are many other ways, no doubt, in which his society might really and tangibly help the individual engineer. Can you tell me what practical good, nine out of ten of the working engineers of Canada, to-day, obtain out of their connection with the Canadian Society of Civil Engineers,—except a copy of the transactions each year, and that would be better filled by his purchasing one of the many standard volumes on the subjects he was interested in. As matters now stand the ambition of the socitey seems to be to get in an array of papers to read at their meetings, to accumulate a lot of books at the head office, and to establish luxurious and costly quarters in Montreal. For whose benefit is all this done?

I have no desire to speak disrespectfully of the papers which are read—many of them are excellent in their way,—but I think most of the working engineers in the country will agree, that they are of little practical value to them, and that their absence would be more than filled by the purchase of one, of the many excellent books, on his subjects, as it was needed, as to the books at the head office, they are essentially for the benefit, or amusement, of those few men in Montreal who have the honor of running the society. The comfortable quarters on Dorchester Street come under much the same category.

To support these features of the society there are several well-paid men in Montreal, and a handsome surplus in the bank, so handsome indeed that a movement is now on foot to donate $500 to the Plains of Abraham scheme.

In my opinion, the objects of the society should be principally to aid and protect the engineers of Canada and the reading and discussing of papers only a secondary thing. The first-mentioned object will never be properly accomplished under the present centralized system, and I am sure the vast majority of engineers in Canada will never exert any real influence in the conduct of the society, as long as it is governed from a city which is practically out of their reach and touch. Under the present system the society becomes a society for the few rather than for the many, and the many in such cases, are invariably exploited for the benefit of the few.

The evil is radical, and is inherent in the idea, that in this vast country, and its widely separated centres, there may be but one engineering society, and that the main object of that must be to read and publish papers.

So strongly has this worship of centralization taken hold of some of the members of the society that, within recent years a move has been made to bring into the society all the engineers in the country, viz.; the Electrical, the Mechanical, the Mining, and all others, and make one great centralized institution; and to a certain extent it is being done. The principle of centralization may suit those engineers who live in Montreal or in near-by towns, and who think that they profit by the amenities of the head office, but I believe it will never fit in with the practical wants of the greater number of Canadian engineers.

Hoping that this subject may be further discussed in your columns,

I beg to subscribe myself,

Civil Engineer.

Ottawa, February 21st, 1908.

SEWER VENTILATION.

Sir,—On page 129 of your 21st February issue, letter signed "Inspector" asks what will Board of Health say re sewer ventilation problem as outlined on page 105 of your 7th of February issue? it being there suggested that the main trap be omitted from all house drains so that soil pipes may ventilate the sewer, etc.

Plumbing and drainage By-law No. 4,330 regulates this matter, it provides (see page 5, sec. 5) that the main trap may be dispensed with when house drain is of iron, thus using the soil pipe as a sewer ventilator, exactly as advocated in the article referred to above.

The use of tile pipe inside walls of a dwelling house is prohibited almost universally outside of Toronto, but here the antiquated custom still holds good.

Now a well-laid, properly connected and covered in tile drain is very little inferior to an iron drain, that is from a sanitary point of view, so that if the main trap is optional on the one, it certainly should also be so on the other, but the question of trap or no trap has always been a good debatable subject amongst sanitary men, and arguments are easily obtainable either way, from personal observation not only here but in other centres of population, I believe that were all soil pipes open from sewer up, very much better results in sewer ventilation would be obtained than where each house drain is trapped, but do not favor the drastic adoption in a city like ours where conditions vary and where low and tall buildings are side by side, some trapped, others not, and in many cases the termination of soil pipe in the low house is far below windows in the tall house.

The matter of defective plumbing allowing sewer gas to escape in the house when drain is minus main trap, is not a good argument in favor of the trap, but reflects upon the competency of those responsible for the installment of the work; were greater supervision exercised before granting licenses and some reasonable care taken to conserve the interest of the innocent property holder by insisting that each applicant for plumbing license, in addition to being properly qualified, should furnish bonds similar to many cities in the States. Sewer gas would not be so frequently heard of, and defective plumbing reduced to a minimum.

Yours,

"Sanitas."

February 28th, 1908.

The sections of the City of Toronto By-law No. 4,330 referred to by "Sanitas," in the above letter reads as follows:—

(1) Between the house and the public sewer or drain there shall be placed a ventilation hand-hole cleaning-trap of approved description and make, except in the case of subsection (5) of this section provided for.

(5) If the house is drained by a continuous iron soil pipe from the outer connection with the house drain at least three feet outside the wall to the opening above the roof, as hereinbefore provided, the trap and the fresh air inlet may be dispensed with.—Editor.

RAILWAY SURVEY OVER THE HEIGHT OF LAND.

Sir,—I shall endeavor to give you a few of our experiences while engaged in the work of location on the National Transcontinental Railway in the hope that it may prove of interest to some of the readers of the Canadian Engineer.

In June, 1906, with two guides and a week's provision in a large Hudson Bay canoe, we left Nepigon and started up the famous Nepigon River route to join one of the parties engaged on first location for the Transcontinental. The party was known to be working somewhere in the vicinity of the Height of Land, at the point where the Red Paint River rises. We had a fine trip, the weather being warm and dry.

The second day out we reached Lake Nepigon, which empties into the Nepigon River, over a beautiful little cascade, called Virgin Falls, at the foot of which many a beautiful trout has yielded itself to the persuasion of the tourist's fly.

After paddling a day and a half up the lake we reached the mouth of the Red Paint River, a large river—several hundred feet wide here—up which we were to paddle until we reached its very source.

We had secured half a dozen gull eggs from a rocky island, about half a mile out from the mouth of the Red Paint, and these, together with some trout secured from some Indians, formed a very welcome addition to our food supply, especially as we had left our bread in Nepigon.

That night we camped on the first portage of the Red Paint River, and for three days we paddled and portaged, while the stream became smaller and smaller, until by noon of the third day, after crossing a small lake, we entered a little creek, not much wider than the canoe, and pulled up alongside a wharf of poles. We had arrived at the Height of Land supply depot, called a cache, from which parties in the neighborhood drew their supplies.

We stopped here the remainder of the day, and the following morning crossed the Height of Land portage and launched our canoe on Hudson Bay waters.

The United States Steel Company now have this portage and the surrounding country staked off in iron claims, and last summer did considerable development work on them. At noon of the same day we reached our destination, for the party was camped only a short distance down Johnson Creek.

I remained with the party for sixteen successive months, and during that time not one moose or cariboo was slaughtered by the party. This statement would seem to contradict some articles which appeared in the daily press a short time ago, to the effect that Government survey parties were unlawfully butchering these animals and should be dealt with accordingly. The fact remains, however, and other parties were much like our own.

The summer of 1906 was very dry and warm, making life most comfortable and the work most enjoyable. From June to September we missed only three half days—outside of days required to move camp—from line work, and those were on account of rain. The result of this dry, hot weather, however, was much forest fire. One such fire we shall long remember. It happened in September, when we were camped on the Kash-aga-wig-ama River. The fire worked down from the north against a strong south wind, and by the middle of the afternoon was burning fiercely about half a mile from camp, and things began to assume a more serious aspect. Before us was a creek, 100 feet wide, with about three feet of water and ten feet of mud in the bottom of it. The fire was running down both sides of it, and all around us was nothing but bush, and yet more bush. The chief gave the "All out!" signal, and set everyone to work with an axe to clear away a space of bush about fifty feet wide around the tents. But before this was completed the fire worked around behind the camp, and the wind was soon showering the tents with sparks and burning debris. Immediately a water brigade was organized to wet down the tents and put out small fires, while the others completed the clearing and fought the big fire. For a time things looked very serious, but by midnight everything was fairly quiet, and, after a watch having been set, we rolled into our blankets, glad of the chance to rest.

About three weeks later we began revising location. Our maximum degree of curvature was a four degree curve, and tangents not less than ten chains long between curves. No reverse or compound curves were run in the 150 miles we covered. The grades easterly from Lake Nepigon are, on the whole, long and easy, but the waters flowing into the lake form deep gullies, which makes some heavy work necessary just north of the lake.

Westward, in the Tunnel Lake region, the country is very rough and rocky, with several small lakes dropped in here and there to make things interesting. The country here requires more curvature and heavier grades, though at the worst the heaviest grade going east is only a 4 per cent., and going west a 6 per cent. These will allow the hauling of heavy trains at a good average rate of speed, so that the country will own, when completed, one of the finest transcontinental lines on the continent. Considerable of the road is located over shallow muskeg, which, when properly ballasted, is considered to make one of the finest roadbeds. There is plenty of fine ballast in this section. At convenient points along the line are situated large hills and ridges of the finest gravel ballast, which, from their form and peculiar shapes, seem due to glacial effect. In many places a short spur or siding would give a steam shovel a bank with a face of thirty or forty feet.

Our revision completed in December of 1906, we were ordered to run final location over the next section west. This meant a move cross country of some ninety miles with snowshoes, dog teams, and toboggans. It took three weeks to make the move, including Christmas week. Christmas Day we were on the trail, as other days, enjoying cold pork and bread, with hot tea, for dinner. This move was made in exceptionally good time, when it is considered that trail had to be cut through the thick bush for nearly the whole of the distance. We had good tents, and plenty of what there was to eat, so we had "no kick coming." With much rejoicing we completed and tied on our final location on the 30th September last, and then the whole party was called out for the winter. Not a man in the party but had been in the bush for seven or eight months, several for a year or more, and one man had been on the party for thirty-two months. This alone speaks well for the chief and the general management of the outfit. But, one and all, we were longing for the fleshpots of Egypt, so that, a week later, when we started for the front, everyone was willing, and trying to do two men's work.

There were only a few scattered articles for second trip on the portages. Canoes, blankets, and dunnage—nearly everything went in one trip. The last twelve-mile stretch of the river into Nepigon was made in just two hours. This is not bad when one considers that the loaded canoes, holding four or five cramped men, who had been paddling for three days, and working like Trojans on the portages, had been paddling all morning against a head wind. Only those who have spent some time in the bush can appreciate the feelings of those boys when they got to the track. "The track" seems to be the synonym for whatever each holds to be his own greatest happiness, for it leads to the East, and to the West, into their own individual worlds. Yet, now that they have been out but for a short time, it is much too long, and I can safely say that, one and all, they are impatiently waiting for that far-off call to bring them back to the bush, which is their home, for such is the lure of the wild.

E. R. G.

Norwich, Ont.

MAGNESIA IN CEMENT.

Sir,—Could some of your readers furnish me with a statement giving the per cent. of magnesia in our Canadian cements. I am anxious to find a cement with the least possible per cent. of magnesia. Yours, A. G.

Hamilton, February 17th, 1908.

SOCIETY NOTES.

Institute of Electrical Engineers of Britain.

Before a meeting of this Institution held in the hall of the Institution of Civil Engineers, Mr. J. S. Peck read a paper dealing with Protective Devices for High-tension Transmission Systems.

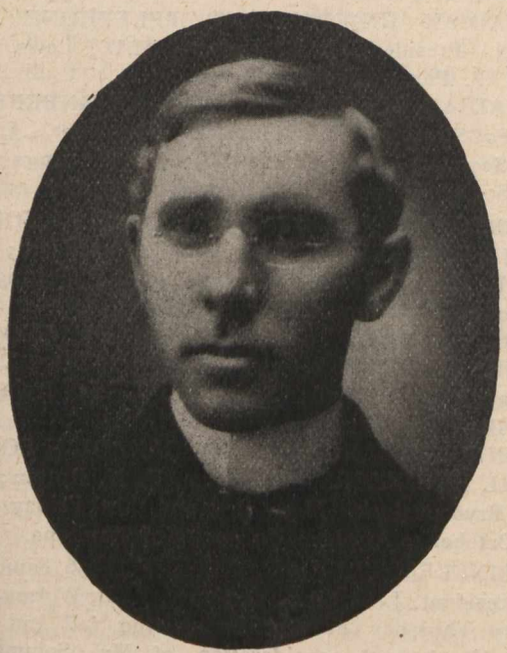
The author said that comparatively little had been done in this country in developing such apparatus owing to the fact that there were very few systems in England working at pressures above 11,000 volts, further, that most of our transmission systems were laid underground, and that severe thunderstorms were of very rare occurrence. In America, where exceptionally high voltages were employed over very long distances, protective devices had been carried to a very high degree of perfection. There were, however, many points, both theoretical and practical, still in dispute, and as it was probable that overhead transmission with high voltages would come into extensive use in England in the near future the mat-

ter was one of importance to British engineers. Static disturbances might be produced in a number of different ways, their distinguishing feature being their oscillatory nature and extreme suddenness of action. The most severe strains were obviously those due to lightning, which operated in three ways, by static induction, magnetic induction, and by direct stroke. Two main dangers to electrical apparatus on transmission systems were concentration of potential on the end windings and excessive voltage between wire and ground. To prevent trouble from the first-named cause the end windings might be insulated, which was expensive, or steps might be taken to ensure that the windings should not be subjected to abrupt change of potential. To prevent high voltage to earth the lightning arrester was employed. These arresters usually consisted of an air-gap in series with a current-limiting and an arc-suppressing device. Four types of arrester were in general use—the horn, the multi-gap, the water-jet, and the electrolytic.

Toronto Branch Canadian Society of Civil Engineers.

At the regular meeting on February 27th, 1908, in the Engineers' Club, Mr. Charles H. Mitchell, chairman of the Toronto Branch delivered his inaugural address. The address in condensed form is given below:—

Gentlemen,—I wish to congratulate the Society and especially the Toronto Branch upon the election of Dr. Galbraith, of Toronto, to the presidency of the Canadian Society of Civil Engineers. The election of our distinguished fellow



Mr. Charles H. Mitchell.

citizen to this honorable position is a distinct advantage to the Toronto members of this branch, and will undoubtedly result in an increased interest and in widened influence of the Society, especially with three other members of the Society's council, also resident in Toronto.

As you are all aware, a circular letter has been sent to all members of the Toronto Branch of the Society explaining its organization and condition, times of meeting, etc.* This, I hope, has had the desired result of making all the members of the various grades resident within the limit of fifty miles from Toronto, acquainted not only with the existence of the branch, but with its functions and aims. As explained therein, all grades of members of the Society within the named radius automatically become members of the branch without further election or payment of fees, and are thus entitled to all its local privileges, the parent Society remitting a portion of the paid-up fees for the maintenance of the branch.

The aims of local branches of the Canadian Society have so frequently been set forth in the Society Proceedings that they need not be repeated at length. The value of a local centre of engineering thought, however, cannot be overestimated by our members, and it is to be hoped that besides the three local branches already formed at Winnipeg, Toronto and Quebec, others at important points in the Dominion will be inaugurated so as to provide the Society with widely separated centres of influence. Such a policy could not be justly criticized as impairing the usefulness and influence of the Society as a whole on account of decentralization, but so long as the central organization holds a strong control over the whole Society's affairs, the formation of local eddies, if I may use the illustration, cannot but contribute in strength to the far-reaching influence of the great pool itself with its ever widening circles. The opinion has been advanced that separate local engineering societies are likely to be of greater mutual advantage to engineers resident in a large centre other than the headquarters city. The friends of this opinion have in mind the various local city and state societies in the neighboring Republic independent of the great national parent Society. Whatever successes such segregation may have attained—and it is doubtful that they are greater than would have resulted with local branches of the main organization—it would, in my opinion, not meet with similar success in Canada on account of our comparatively scattered and sparse membership. Had the branch idea been further developed at an earlier date, it is doubtful whether a separate local engineering association would have been organized in the Maritimes Provinces, for nearly all members of that body are also members of the Canadian Society of Civil Engineers.

For the interchange locally, of ideas and opinions on engineering matters, the functions of a branch of the parent body are especially adapted. Contrary to ths usual order of things in such organizations, there are numerous papers available on various interesting subjects which have been prepared for the parent Society, and which it is intended may be read before the branch simultaneously with headquarters. The discussion on the papers at the branch has the same weight as that at Montreal, and doubtless will bring out many valuable points for incorporation into the published proceedings. As to papers, the Society has justly ruled that they must be prepared and read primarily before the central body. This rule should indirectly have the good result of inducing members of branches to prepare papers and original material for the Society's proceedings on account of the opportunity of the writers to read them at branch meetings if they cannot arrange to do so at Montreal.

Possibly the greatest value of the branch is in its relation to matters professional, especially in furnishing a means of mutual support among its members, in the fostering of a special esprit de corps and interdependence entirely in sympathy with the main Society. The branch should be not merely a reflection of the thought and conceptions of the Society, but in such matters should, when occasion arises, take the initiative and lay before the parent Society any matters of live issue upon which it has formed an opinion. In this manner the branch becomes a potent adjunct to the Society as a whole, while affording a local strength to its members.

In the relations of the Toronto Branch with its sister organizations in the city, we are particularly fortunate. By a re-arrangement with the Engineers' Club, we are enabled at a nominal rental to use its Club Rooms on equal terms with its members, and at the same time to increase the yearly expenditure on our library. A recent addition to the library consists of the Proceedings of the Institution of Civil Engineers (London) for thirty years—120 volumes; these will be available on our shelves in a few days. With our sister, or perhaps I should say "cousin" branch of the American Institute of Electrical Engineers, meeting here also, we hope to work harmoniously to the end, that its members and those of the Engineers' Club will appreciate the value of our parent Society in professional matters. The suggestion has been thrown out that now, since the electrical section of the Canadian Society is well established, electrical engineers should more readily support our own national society than a foreign one; whatever may be said in this respect, we hope at any rate to obtain an ever increasing membership on the electrical side of our Society.

*Circular letter below.

Apart from the presentation of papers, there are many matters in the introduction of which the Toronto Branch might, and should take, the initiative. If I may suggest subjects along this line, I would first introduce the questions of increasing the influence and bettering the Society in its broadest sense. As a result of discussion at the annual meeting of the Society last month, all members are asked for suggestions to the Council to this end, and, I hope, the Toronto members will take the opportunity to respond. Viewing the question in its most material form, permit me to urge the increase of membership of all grades, especially from this locality, during the present year.

Of the questions outside our Society affairs, there are several subjects which are live matters for discussion and suggestion from the engineering profession looking toward the stability, development and expension of our country, for I consider it the prerogative of our Society to draw to the attention of our legislators all questions of common interest, and we are led to believe that our legislators are looking to our body for just such assistance.

The subject of industrial technical education is fast coming to the front in our national life. In its bearing on the education of our artizans and mechanics to produce an adequate expansion of our manufacturing interests, this subject is of the utmost importance, especially at this time. The present upbuilding of a labor adjusting policy by our legislators, and the consequent accommodation of the employer and employee to the new conditions demand, above all things, an intelligent and skillful workman. A new form of industrial education which will accomplish for the artizan what, for instance, our present schools and institutes of agriculture have done for the farmer of Ontario, must before long be evolved if Canada is to become in reality what is prophesied of her, a manufacturing as well as an agricultural nation, the engineers of the country should early place themselves in line for this advance.

The Society cannot afford to remain passive on the great question of Forestry as affecting our country from sea to sea, and the members of our Society, especially those of this branch in older Ontario, it seems to me, should interest themselves to prevent undue deforesting, and to secure a definite policy of reforesting. Along with this momentous question goes that of water supply for our river and lake systems, and without enlarging on its importance let me urge that our Society impress upon our Governments the advisability of commencing at an early date some systematic river gauging, a stocktaking as it were, of typical well-located streams, so that after some years we may be in possession of valuable data on one of our greatest assets.

The appointment by the Society last year, of a committee regarding the materials employed in structural steel work and steel rails, has brought out some valuable information, but much, very much, remains to be investigated along this line which will be of vital interest and value to the public. As each winter period passes with its roll of railway accidents due to defective rails, and more recently with the discovery that there are many still unknown elements entering into structural work, as witness the Quebec Bridge catastrophe, it is incumbent on us to forward any effort to learn more of the behavior of steel under stress.

I hope that the members of the Toronto Branch of our Society will reflect on these several subjects which are to-day so actively before us, and will, before the year is out, furnish the Society in some form with their views.

During the evening a lengthy discussion took place as to whether engineers engaged by Governments or Government commissions should enter into competition with consulting engineers resident in the province. It was decided to draw the attention of the parent Society to what some members of the Toronto Branch considered an instance of unwarranted competition.

On a motion by Mr. S. Gagne, seconded by Mr. A. Macallum, it was decided that the parent Society be requested to memoralize the Government, suggesting that an experienced railway engineer be appointed to one of the vacancies on the enlarged Railway Commission.

Applied Science Undergraduates Society.

On February 26th Mr. J. Murphy, consulting engineer of the Department of Railways and Canals and of the Railway Commission, read an interesting paper on "Ice Troubles in the Hydraulic Power Plants" before the Applied Science Undergraduates Society of McGill University. He told of the conditions under which frazil ice forms and the great trouble and expense it gives every year to the power houses before the surface ice was taken. Mr. Murphy had made many attempts to overcome the ice troubles with little success till Dr. Howard Barnes' book on "The Formation of Frazil and Anchor Ice" put him on a new track, and he tried protecting all the exposed parts of the grates from the cold air, and heating the turbines with steam or electricity to raise their temperature the fraction of a degree above the freezing point necessary to prevent the particles of ice from adhering to them. This plan proved very successful, and he showed that for a very insignificant outlay the increased efficiency and the saving in the cost of operating was very great.

ENGINEERING SOCIETIES.

CANADIAN RAILWAY CLUB.—President, W. D. Robb, G.T.R.; secretary, James Powell, P.O. Box 7, St. Lambert, near Montreal, P.Q.

CANADIAN STREET RAILWAY ASSOCIATION.—President, E. A. Evans, Quebec; secretary, Acton Burrows, 157 Bay Street, Toronto.

CANADIAN INDEPENDENT TELEPHONE ASSOCIATION.—President, J. F. Demers, M.D., Levis, Que.; secretary, F. Page Wilson, Toronto.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—413 Dorchester Street West, Montreal. President, J. Galbraith; Secretary, Prof. C. H. McLeod. Meetings will be held at Society Rooms each Thursday until May 1st, 1908.

QUEBEC BRANCH OF THE CANADIAN SOCIETY OF CIVIL ENGINEERS.—Chairman, E. A. Hoare; Secretary, P. E. Parent, Po. O. Box 115, Quebec. Meetings held twice a month at Room 40, City Hall.

TORONTO BRANCH OF THE CANADIAN SOCIETY OF CIVIL ENGINEERS.—96 King Street West, Toronto. Chairman, C. H. Mitchell; Secretary, T. C. Irving, Jr., Traders Bank Building.

WINNIPEG BRANCH OF THE CANADIAN SOCIETY OF CIVIL ENGINEERS.—Chairman, H. N. Ruttan; Secretary, E. Brydone Jack. Meets first and third Friday of each month, October to April, in University of Manitoba.

ENGINEERS' CLUB OF TORONTO.—96 King Street West. President, J. G. Sing; secretary, R. B. Wolsey. Meeting every Thursday evening during the fall and winter month. March 12th consideration of Mr. Sommerville's amendment to admit "Associate Members."

CANADIAN ELECTRICAL ASSOCIATION.—President, R. S. Kelsch, Montreal; secreary, T. S. Young, Canadian Electrical News, Toronto.

CANADIAN MINING INSTITUTE.—413 Dorchester Street West, Montreal. President, Frederick Keffer, Greenwood, B.C.; secretary, H. Mortimer-Lamb.

NOVA SCOTIA SOCIETY OF ENGINEERS, HALIFAX.—President, R. McColl; Secretary, S. Fenn, Bedford Row, Halifax, N.S.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, TORONTO BRANCH.—W. G. Chase, secretary, Confederation Life Building, Toronto.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—29 West 39th Street, New York. President, H. L. Holman; secretary, Calvin W. Rice.

The Ohio Blower Co., Cleveland, Ohio, has completed arrangements with the Standard Engineering Co., Toronto, Ont., under which the latter Company will act as exclusive licensees and manufacturers of the "Swartwout" helico-centrifugal steam and oil separators, cast-iron exhaust heads, gravity closing ventilators, etc., for the Dominion of Canada.

THE RAILWAY COMMISSION *—ITS CONSTITUTION, JURISDICTION, AND WORK.

Dr. James Mills.

The Railway Commission is composed of three matter-of-fact, hardworking men, assisted by a hardworking staff.

As a Commission, we are under obligation to do everything that can fairly and reasonably be done to secure for the people of this country prompt, good, and reasonably cheap transportation—to keep the golden stream of commerce flowing swiftly and benignly past their doors; but, in our efforts to meet the wishes of the people in this respect, we must be careful not to issue orders which will result in serious injury to our transportation companies; for anything that would destroy the credit of any of our leading railway companies or otherwise seriously cripple them would be a calamity—would do incalculable damage to the whole country. Hence, metaphorically, if not very elegantly, I may say that, in our zeal, we must not kill the goose that lays the golden eggs.

The distinctive title of the Commission is "The Board of Railway Commissioners for Canada"; and throughout the Railway Act it is usually referred to as "the Board." The general scope of the Act may be briefly stated under six heads.—

1st. The Constitution, Procedure, Jurisdiction, and General Powers of the Board.

2nd. The Incorporation of Railway Companies.

3rd. The Construction of Railway Companies.

4th. The Operation of Railways.

5th. The Traffic on Railways, including passenger fares and freight rates.

6th. Penalties for specific sins of omission and commission—some 46 in number, varying in amount from $2 to $5,000 each.

The Commission is a court of record, with very wide jurisdiction in matters pertaining to railways and railway companies; it has all the powers, rights, and privileges which are vested in a superior court—and powers much greater than the powers of any other court in the Dominion. The findings of the Board on questions of fact within its jurisdiction are binding and conclusive; every decision or order of the Board is final; the Board is not bound by the findings or judgments of other courts; and no order, decision, or proceeding of the Board can be questioned or reviewed, restrained or removed by prohibition, injunction, certiorari, or any other process or proceeding in any court.

There is a right of appeal from the Board to the Supreme Court of Canada on questions of jurisdiction, and the Board may allow appeals to the same court on questions of law; but the only body which can of itself rescind or vary any order, decision, rule, or regulation of the Board is the Governor-in-Council.

The Board may review, change, alter, vary, or rescind its own orders and decisions as often as it thinks proper; and it can do of its own motion anything it can do upon complaint or application.

Doubtless, the reason for giving such extensive powers to the Commission was the hope that through it, by direct, simple, and informal proceedings, shippers and others having dealings with railway companies, express companies, and telephone companies, might have their disputes settled and get substantial justice without expensive litigation and the possibility of appeals carried from court to court; and the greatness of the power bestowed, has imposed upon the Commission the obligation to exercise due care, deliberation, and caution in everything it does or refuses to do.

The Interstate Commerce Commission.

The great Interstate Commerce Commission of the United States has been in existence for about twenty years. It was at first composed of five Commissioners, who were paid $7,500 a year each; but recently two additional Commissioners were appointed, and the salary was increased to $10,000 a year each.

The Commission elects its own chairman, aiming to get a man who is a good organizer possessed of first-class executive ability. Mr. Knapp, the present chairman, has been on the Commission for about sixteen years, and has been chairman for ten years. He was chairman when there were five Commissioners, and has been chairman since the number of Commissioners was increased to seven. He has taken part in the work of both Commissions; and regarding the number of Commissioners he says that he might hesitate as between three and five, but would rather have five than seven. He is convinced that, other things being equal, five men on a Commission will do more and better work than seven; and he thinks that when there is need (as there may occasionally be), the Commission should select and send out special men, specialists, experts, if you will, to do special work, rather than have an unduly large number of men on the Commission.

Concerning Experts.

One of the members of the English Railway and Canal Commission, is, I understand, a practical railway man; but they have no railway experts on the Interstate Commerce Commission of the United States; and when asked about the advisability of having such men on the Commission, Chairman Knapp said no—he had not favored the appointment of experts of any kind; he wanted men of a different type; and he asked me whether the crystalized opinion of the country regarding the judiciary was that we should have expert politicians on the bench to try cases, expert bankers to try banking cases, expert railway men to try railway cases, or expert business men to try cases growing out of business transactions.

And as there has been some talk in this country about the need of railway experts on our Commission, it is proper that we should consider the question and see whether there really is such a need. May I ask what you mean by a railway expert—do you mean an expert in railway construction, an expert in the operation of railways, or an expert in traffic and rate-making? And suppose you could find an available man who has had a broad and thorough training in all these branches of railway work, what about his work on the Commission? Would it be to solve all railway problems and settle all railway questions for the Commission? No Commisisoner would be allowed to do so on a Commission of competent men. He could simply furnish information, give the results of his experience, and express his opinion on the points at issue, that is, do just what is done for our Commission, every week, equally well, and at much less expense by railway experts employed for the purpose—engineers, operating men, and traffic experts—men who devote their whole time and their undivided attention to the special work of their respective departments, and are not distracted, as Commissioners are, by all kinds of problems; men also whom you can send anywhere, at any time, to make personal examination of railway terminals and railway equipment, or investigation of railway management and the books of railway companies—men, in a word, who can do for the Commission many necessary and important things which a Commissioner cannot consistently do.

My own opinion is that a man should not be excluded from a Railway Commission because he happens to be an expert, whether he is a farmer, a fruit grower, a business man, a journalist, a professor, a politician, a lawyer, or a railway man, provided that, above everything else, he is clearly and manifestly a man without bias, resulting either from temperament or from training, a broad-minded man, of ability, education, clear-cut individuality, persistent industry, and undoubted capacity for work, a judicial mind, sound common sense, unfailing courage, and incorruptible integrity—a man who cannot be, directly or indirectly, influenced by personal favors, society connections, or club associations, and can always be counted on to stand firmly and strong for justice or fair play, without regard to popular favour or personal advantage.

* Extracts from an address delivered before the Canadian Club, Ottawa.

Interstate Commerce Commissioners—Help for Each.

Each member of the Interstate Commerce Commission of the United States has constantly at his disposal a first-class stenographer at $1,200 a year, a private secretary at $2,000 a year, and a law clerk at $2,500 a year. The Commission has a staff of something over 300; it spent about $850,000 last year; and it has applied for an appropriation of $1,000,000 for the year on which it has just entered.

The Commission has divided the country into as many districts as there are Commissioners; and all ordinary railway correspondence and informal complaints from any district go at once to the Commissioner who represents that district, to be disposed of by him with or without consultation with the chairman or other Commissioners. All formal complaints filed for hearing are sent to the secretary, who has them summarized on paper of uniform size, folded, and numbered; and on Monday morning of each week, just before the weekly meeting of the Commission, these formal applications are shuffled like a pack of cards by a committee of three; and the first drawn is allotted to Commissioner A, the second to Commissioner B, the third to Commissioner C, and so on to the end of the list; then back to A, and round in a circle till all are distributed. Next week, the committee will commence its distribution at the point where it left off this week; and when an application is allotted to a Commissioner, he is responsible for it till it is finally disposed of. In this way, there is a fair and complete division of labor; each Commissioner is fully occupied all the time; and in case there is undue delay in disposing of an application, it is known who is responsible.

Over 50 per cent. of the cases formally adjudicated by the Interstate Commission are, I understand, heard by one Commissioner, a considerable number by two, and a much smaller number by three. When a Commissioner hears a case, he reports upon it as soon as possible, giving his findings, his conclusions with his reasons therefor, and an expression of his opinion as to the action which should be taken. This opinion or judgment is at once printed; a copy of it in galley form is sent to each Commissioner; and as soon as possible thereafter it is brought to the attention of the Commission at a weekly meeting, when it is carefully considered and freely discussed as to the findings, the law, the conclusions, the form, the composition, and the punctuation; and all such judgments, when finally approved, are promptly printed and distributed in pamphlet form—each case in a separate pamphlet. When two or three Commissioners hear a case, in the absence of the chairman, the chair is taken and the case reported upon by the Commissioner who is senior in time of appointment.

Work of the Interstate Commerce Commission.

The Interstate Commerce Commission has nothing to do with the physical side of railways, that is, with the matter of railway construction and railway operation; it has large powers of investigation; it collects and tabulates statistics regarding railways, railway accidents, etc.; and it is dealing with the method of keeping railway accounts; but it devotes the greater part of its time and attention to the question of rates, discrimination, rebates, over-charges, refunds, etc.; and all its decisions and orders are subject to appeal to the State Courts and to the Supreme Court of the United States.

Work of the Canadian Railway Commission.

The work of the Canadian Commission is broader, heavier, and equally difficult, including railway construction and the operation of railways, as well as the question of railway rates, rate-making, discrimination, etc., not to speak of telephone and express company rates and management. The things requiring constant attention under the heads of railway construction and railway operations are very numerous.

Under the head of railway construction we have the location and inspection of new lines of railway; the taking and using of lands of other companies and of private individuals; the construction of branch lines, spurs, or sidings; the crossing of one railway by another; highway crossings; farm crossings; the carrying of telegraph, telephone, electric light, and electric power wires over the right of way and tracks of railway companies; the construction of sewers and the laying of water-pipes under railways; the fences, gates, and cattle-guards required in railway construction; the location, character, and suitability of railway stations; especially the widespread and urgent demand for additional crossings over railways in the towns and villages of the West; the everlasting question as to the protection required at highway and street crossings in cities, towns, villages, and rural municipalities throughout the Dominion, and the divison of the cost involved in such protection as may be ordered—all this and much more under the head of construction.

1st. Furthermore, no railway company in any part of Canada can construct a branch, spur, or siding, which will cross or run along any street or highway, or touch any property other than that of the railway company, without an order from the Railway Commission.

2nd. No company or any individual in any part of Canada can carry a telgraph wire, a telephone wire, an electric light wire, or an electric power wire over the right of way and track of a railway company, without an order from the Railway Commission.

3rd. No city, town, village, or rural municipality in any part of Canada can construct a sewer or lay a water pipe of any size or description under a railway, without an order from the Railway Commission.

Further, I desire to offer a few words of comment under this head. First, I would call your attention to the fact that we have, as intimated above, a constant demand for crossings through long railway yards which divide many of the towns and villages in the Western Provinces. The inconvenience and loss of time resulting from the lack of such crossings, are so great that the people are very determined and persistent in their appeals for relief; and we are at a loss what to do, because crossings through railway yards are usually dangerous and always interfere more or less with the operation of trains; and the cost of building bridges or constructing subways, unless it is equitably divided among those who are interested and reasonably able to pay, is out of the question. Second, I need not remind you of the loud and frequent complaints from all parts of the older Provinces, about the lack of proper protection at street and highway crossings. These complaints are constant; and, again, we are at a loss, in very many cases, because of the greatness of the cost involved.

These problems demand solution; and it is manifest that the cost of installing and operating gates, building bridges, and constructing subways, in order to secure reasonably necessary crossings through long railway yards, and provide the protection required at street and highway crossings, throughout the Dominion, would be a very oppressive burden upon the strongest of our railway companies and would almost bankrupt the weaker ones; therefore, I think the time has come when Parliament should deal with these questions by special legislation, as has been done in the State of New York and in some of the other States across the line—fixing the terms as to where, when, and under what conditions crossings shall be made or protection ordered, and providing for a fair and reasonable distribution of the cost. Wherever these questions have been dealt with in the United States, the cost has been imposed, in different proportions, upon the Railway Company, the Municipality or Municipalities, and the State.

Operation of Railways.

Under the head of the operation of railways we have the question of the accommodation necessary for receiving, carrying, and delivering traffic; the rules for the running of trains; the handling of trains in transit; the handling of trains in yards; interswitching between railway companies; the protection of property; the protection, safety, accommodation, and comfort of the public and of the employees of the company; the safety appliances required on engines and cars; the condition of rolling stock; car shortage and car distribution; complaints about unreasonable delays in transportation; precautions at railway crossings; obstruction of highway traffic; passenger train connections; transportation

of dangerous commodities; the packing of frogs and care of switches in railway yards; and the investigation of accidents to the public and to railway employees.

The Board has given a great deal of time and attention to the investigation of accidents on our lines of railway and in railway yards throughout the Dominion; and all the while the number of such accidents has been rapidly increasing—from various causes, especially, I think, the following: the congestion of railway traffic for some time past; an increase in the breakage of steel rails, possibly from defects in structure and may be from the use of much heavier engines and cars; the lack of discipline and due sense of responsibility among railway men; and the employment of inferior and inexperienced men and boys in responsible positions. The Board has been looking sharply after the railway companies regarding the arrangement and condition of their yards, the location and condition of switches, the use of necessary yard lights, the condition of their rolling stock, and the use of safety appliances on their cars and engines; it has also done what it fairly and reasonably can in directing the attention of Attorneys-General to cases which seem to call for careful consideration and possible action, with a view to the protection of the travelling public and the employees of the railway companies; and action has been taken in a considerable number of cases, but with very meagre results, because, under present conditions, the public mind, as represented by the average jury, seems strongly opposed to the punishment of men for negligence or recklessness in the managemnt of railway yards, the handling of cars, or the running of trains, even when the results are fatal, the offences wholly inexcusable, and the evidence most clear and convincing.

Traffic.

Under the head of traffic the question is whether, with the telephone and express companies to look after and the great amount of work to be done under the heads of railway construction and operation, the Commission can give due attention to the larger and much more difficult questions which arise in the traffic department—questions as to passenger fares and freight rates, freight classification, discrimination, rebates, over-charges, refunds, etc.; and my answer is that we have been able to give a good deal of attention to the settlement of questions and the solution of problems regarding railway rates throughout the Dominion—work which has removed many grievances and saved the country very many thousands of dollars. If I had time, I would be glad to state the results accruing from a large number of orders issued for the reduction, adjustment, and regulation of passenger fares and freight rates; but I can merely refer to a few of the most important orders, without going into details.

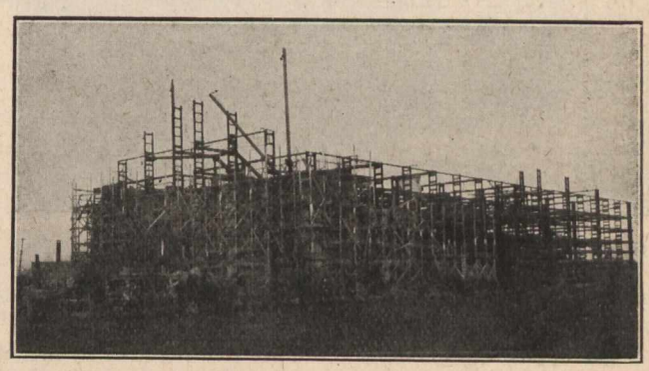
REINFORCED CONCRETE IN THE BUILDING OF A CEMENT PLANT.

The plant, which is now being built at Longue Pointe, near Montreal, Canada, for the Vulcan Portland Cement Company, is of fireproof construction throughout. The buildings comprise a stone house, coal mill, cement mill, kiln building and clinker storage building, all of which are of steel framed construction; the remainder, namely, a stock house, two packing houses, six lime stone bins, a machine shop, transformer house and office building, are all of reinforced concrete.

Description of Stock House.

The out-to-out dimensions are:—Width, 180 feet, length, (exclusive of packing houses), 245 feet 3 inches, and the height from ground to eaves is about 35 feet. At each end there is a packing house 108 feet wide and 30 feet long. The stock house is divided by a 10-foot wide gallery into two equal portions, each of which is subdivided into 8 bins about 30 feet long and 49 feet wide, centre to centre of columns. The walls and columns are of reinforced concrete and the floor of plain concrete resting on an earth filling. The roof has a pitch of 6 inches to the foot, and is constructed of steel trusses on 15-inch centres, steel purlins, wooden sheathing and composition roofing. It has a monitor extending the full length of the building. All interior walls are carried up to the same height as the side walls, while the gable walls extend 12 inches above the roof and form parapets. The stock house has a capacity of about 240,000 barrels, and will be used for the storage and seasoning of cement in bulk.

The system of reinforcement adopted for this building represents a radical departure from the usual practise of reinforced concrete construction. The column and beam reinforcement and the ties connecting the columns on opposite sides of the bins are all of structural steel shapes with riveted connections. These members were manufactured in a structural shop, shipped to the job, and when erected formed a self-sustaining steel skeleton frame of great rigidity and of ample strength to support the wooden forms and scaffolding, as well as the plant for handling and distributing the concrete.



Structural Steel Reinforcing Frame of Stock House, showing Derricks for Handling Forms and Concrete. Vulcan Portland Cement Company, Montreal.

The walls are of ribbed construction with 10-inch slabs throughout the building, except in the gable walls where they are 11 inches thick. The spacing of the ribs increases from the bottom up so that the bending moment on the slabs are approximately the same for all panels. The wall slabs are reinforced with ¾-inch diameter rods placed vertically near the outside face of walls, and with ½-inch vertical rods placed opposite all beams near the inner face. The beam reinforcement in all but the partition walls consist of a T-section made of two steel angles of which the long legs are placed vertically, and the short legs are riveted together back to back and turned towards the bin. They vary in section from 6 x 4 x ⅝-inch to 3 x 2½ x ⅜-inch, and are protected with from 1-inch to 1½-inch of concrete or mortar on all sides, making the width of beam 14 inches in most cases. The depth of beam outside the slab is constant, and is equal to 18 inches for all except the gable walls.

At the columns, the beams are reinforced with 4¾-inch diameter rods, 6 feet long, placed near the inner face of wall. From 24 to 60 ⅜-inch diameter stirrups were used in the beams; one half of the number was of U-shape, with the ends of the legs bent to hook into 7-16-inch hole punched in the vertical legs of the angles; the other half consisted of single rods, which were hooked into holes in the horizontal legs of the angles.

These stirrups were provided to augment the shearing resistance of the beams, to furnish the necessary mechanical bond between the angles and the concrete, and finally to prevent the concrete scaling off the outside of the angles.

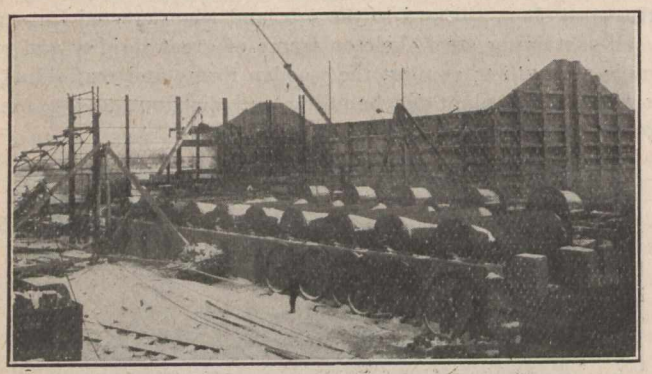
The intermediate columns, which also act as girders, are reinforced with 4 L's, 6 x 4 x 7-16-inch arranged in double T-section, with the long legs perpendicular to the plan of web and the short legs of the outside pair turning away from the centre line of column.

This was done to give the beam reinforcing angles direct bearing on the outside column flange, and to admit of simple connections. All other columns have 4 L's, 6 x 4 x ⅜-inch arranged in substantially the same manner.

The columns have riveted base plates provided with holes for four 1⅛-inch anchor bolts, which were concreted into the footings. To permit of a slight inaccuracy in the setting out

of the foundation bolts, they were encased in 2-inch iron tubes, which were later filled with liquid cement grout. Column binders of ⅜-inch diameter rods spaced 18 inches on centres were used throughout.

The partition walls and columns are symmetrical with respect to a plane through the centre. The beams consist of two steel channels, one on each side of the slab with the backs facing the bins; they are riveted to the columns and are tied together by means of through bolts, and filled with concrete. The channels are spaced at the same elevation as t' e corresponding outside and gallery wall-beams, to which they connect by means of bent plate straps.



Stock House near Completion, showing part of the Steel Work for Cement Mill. Vulcan Portland Cement Company, Montreal.

The opposite walls of each bin are tied together by means of steel channel ties riveted to large gusset plates on the intermediate columns. There are two sets of these connecting the partition walls, each set consisting of two ties which are trussed in a vertical plane to prevent sagging. The columns in the outside and gallery walls are connected by one set consisting of three ties of which the bottom one is flush with the bin floor, and the two upper ones are resting on the corresponding partition ties. In addition to these, the gable walls are stiffened with horizontal and vertical diagonal ties, anchored back into the outside and gallery wall columns.

A condition of the design was that the gallery be the last to be filled and the first to be emptied, and for his reason no ties were provided between opposite gallery columns, but light channel braces were introduced for erection purposes.

The columns are supported on spread reinforced concrete footings, proportioned according to the loads. These are carried 6 feet below the surface of the ground, and rest on a layer of blue clay overlying the bed rock. Opposite gallery columns have combined footings, all others are single.

The concrete in the footings was proportioned of one part cement, 3 parts sand and five parts stone broken to 2-inch size or smaller. The remainder of the concrete, except in the floors, consisted of a mixture of 1 cement, 2 sand and 4 parts broken stone of a maximum size of ¾-inch.

The aggregate used consisted of a fair quality of lime stone which was quarried and crushed on the job. It contained a large proportion of dust which formed into clay on coming in contact with water; for this reason all stone, except for footings and floors, was screened.

Outside of the structural steel, plain round rods were used for reinforcement throughout. All connections were riveted, pneumatic hammers being used for most of the work. All steel which was to be embedded in concrete was left unpainted. The ties and the outside faces of partition channels were given two coats of paint in the shop. The structural steel was manufactured by the Structural Steel Company of Montreal, P.Q., and was delivered at the site complete within six weeks after placing of the order.

Design:—

The adoption of the form of construction described above was prompted by the peculiar character of the building, as well as by local and labor conditions.

The cement pressure on the four sides of a bin produces bending moments, shear and direct tension in every beam and wall. Had rod reinforcement been used, the connections, in order to transmit these stresses, would necessitate a large amount of blacksmith work and bending.

Apart from the great expense which this would incur, it was considered doubtful whether connections of sufficient strength could have been effected, as the strength of bent rods, or hooks, is at the best an extremely uncertain item, especially when the work has to be performed in the field with unskilled labor.

It was also realized that the high walls, without any intermediate floors, would render the erection and alignment of forms extremely difficult and expensive without some stiff skeleton frame on which to support these.

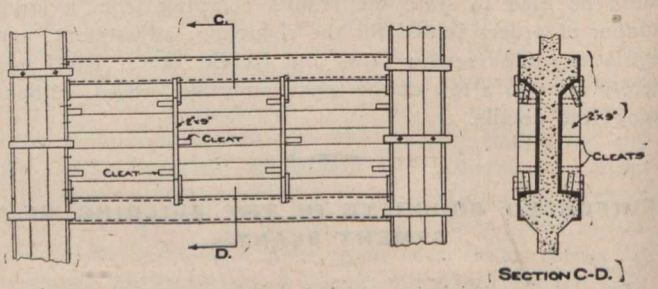
That the design decided upon met these various conditions admirably was fully substantiated during the construction of the building.

Very few data are available relating to the lateral pressure of cement. It has been observed that it assumes a curved surface, whose maximum slope occurs under the point of discharge and grows comparatively flat further out. This indicates that the lateral pressure would vary, according to the distance from the discharge spout.

For the purpose of determining the pressure on the walls, a constant angle of repose of 15° was assumed, and the weight of the cement was taken at 100 lbs. per cubic foot. The pressures were obtained by inserting these values in Rankin's formula for surcharged walls.

Experiments have shown that the pressure is greatest immediately after the cement has come to rest, indicating that in large bins, requiring several days to be filled, the pressure would be less than given by the above formula. For this reason it was deemed permissible to increase the working stresses on the steel and on the concrete somewhat beyond the values usually adapted.

The beams in the outside gallery and gable walls were figured as T-beams. The partition wall beams were not designed on the principle of reinforced concrete, but were treated as lattice girders with the steel channels acting as chords, and the through bolts and the concrete filling as web members. In addition to the lateral pressure, the walls, columns and footings were figured for vertical loads composed of the live load on the roof, the weight of the structure and friction loads. The latter were based on an assumed coefficient of friction of 0.55 for the plain walls and a somewhat higher value for those having ribs in contact with the cement. The partial continuity of slabs, beams and columns, was taken into consideration in the calculations.



Forms for Partition Walls. Vulcan Portland Cement Company, Montreal.

Construction:—

The forms for the concrete were made in a temporary carpenter shed erected for this purpose close to the stock house, and equipped with motor-driven saw and other necessary tools.

The reinforcing rods were ordered to length from the mill, and the little cutting required was done with a 1⅛-inch rod shear. The stirrups and column binders were bent cold by a simple lever contrivance attached to a bench and operated by one man.

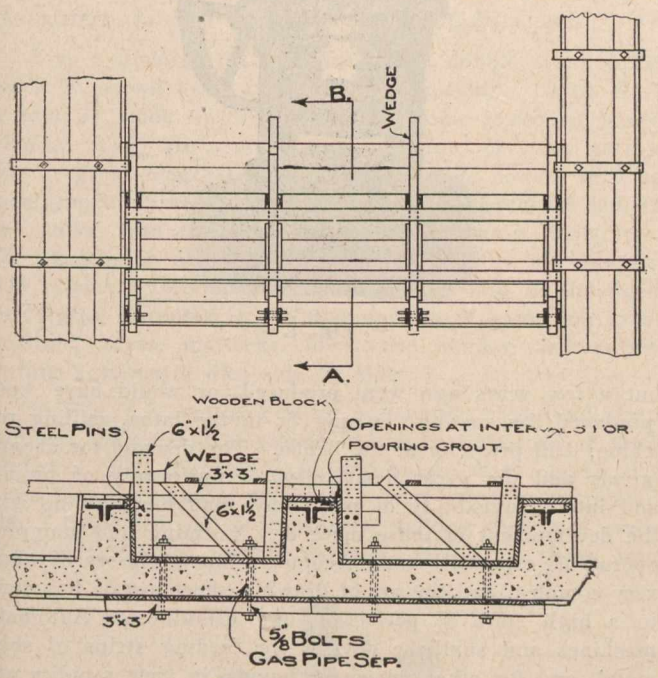
Forms were at first provided for one complete quarter section of the building, and it was the intention to re-use these till the job was completed. On account of weather conditions, it was afterwards decided to provide some additional

forms and start operations at the other end of the structure. As a result of this, the first set of forms was actually used only three times.

The wall forms, typical cross-sections of which are shown, were made up on the ground into sections, each covering one entire wall panel, between adjacent beams and columns, including the corresponding column sides; the front and back of the columns were covered by separate sections.

The principal lumber used was 1½-inch tongued and grooved hemlock, dressed one side. The sides of columns and beams were battered ⅜-inch to the foot to permit easy removal of the forms. All surfaces in contact with concrete were oiled.

Two guy derricks operating abreast on top of the steel frame, one on each side of the gallery, handled the forms as well as the concreting on three-fourths of the building. The



SECTION A-B.

Forms for Outside Wall, arranged so that the Lower Sections can be Removed First.

remainder was built with a hoisting tower and one stiff-legged derrick, put up as a last resort in order to complete the work before the severe frost set in.

The form sections for the outside face of wall were generally erected complete to the top and supported on the steel frame before any concreting was done. The reinforcing rods were then placed and held in position by means of wooden strips nailed to the outside forms, and provided with notches or holes for the rods. The inside forms were then erected section by section as the concreting progressed, and were held in position by pipe separators and bolts passing through the outside forms. The wooden spacers for the reinforcing rods were removed before the concreting reached them. The concrete was mixed with two mixers mounted on trucks and located on each side of the building between two successive positions of the derricks. Two 14 cubic feet contractors' tipping buckets operated by the guy derricks transferred the concrete from the mixer hoppers to the walls. When a section within the reach of the booms was completed, including the moving of forms, the derricks were moved forward.

The instructions issued to the field force provided that the maximum dump of the concrete should not exceed one panel height, and further, that construction joints would be permitted only at the centre line of beams and columns.

Concreting was permitted whenever the temperature was above + 15° F. When below + 40° F. the stone, sand and water were heated and steam discharged into the mixer. All fresh concrete less than 12 hours old was protected from freezing.

The packing houses are built of a light steel frame construction on concrete foundation walls. They have roofs similar to the stock house, but the walls are formed of "Trussit Metal" clipped to the steel girts and plastered both sides with cement.

The principal quantities involved, exclusive of packing houses, are:—Concrete, not including floors, 3,570 cubic yards; fabricated steel, not including roof, 510 tons; steel rods, 103 tons.

Work on the footings was started September 2nd, and concreting of walls was completed November 28th, 1907. All steel was inspected at the mills, and each carload of cement at the job was sampled and tested in accordance with the specifications of the Canadian Society of Civil Engineers. All the work was carried out by W. S. Barstow & Company, Engineers; the writer having charge of the concrete work for that concern.

REFORESTRY AND OUR TIMBER RESOURCES.

Need for Conservation on National and Economic Grounds.

By H. Capewell.

This Dominion, and this Province in particular, has received the heritage of an almost illimitable supply of timber. This would have been preserved in perpetuity had the governments adopted a careful policy, which would have conserved for future generations our forest resources. Now, what are the conditions to-day? They are the same in New Brunswick, Nova Scotia, Quebec, Ontario, the North-West Provinces, and British Columbia. The woods and forests have been administered with an insane prodigality, and in no Province has such ruthless, reckless, and, I might say, criminal waste obtained in respect to the forests than in this beloved Ontario of ours.

Irrespective of our political predilections, we know that when the present Government was in opposition in this Province, it was a matter of the commonest adverse criticism, that the then Government was meeting its current expenses and living upon the proceeds of the sale of timber lands, or, as it was said, living upon its capital account. That criticism was just and true; and what has the Honorable Minister of Crown Lands done that would relieve him of the charge of inconsistency in this regard? The Minister is compelled to admit that the policy in regard to woods and forests is the same to-day as it was in the days of Mowat, Gibson, Hardy, and Davis.

Impotency and Neglect.

Is reforestation feasible, and can it be made a paying undertaking? I answer emphatically, yes; and I base my opinion upon evidence which I have been able to procure. The annual revenue for the past few years for the Woods and Forests Branch of the Crown Lands Department has been, in round figures, $2,000,000. This is derived from sale of timber limits, timber dues, and ground rents. How much of this sum has the Government spent each year upon the forests of this Province? It is a sum equal to about 7 per cent. of the revenue, and even this 7 per cent. represents all the charges on this branch of every kind. I am bold enough to say to-night that if the Government did its duty to the lumbering industries of this Province, and to the forests from which the industry derives its supply, a sum at least equivalent to 75 per cent. of the revenue would be spent upon reforestation to perpetuate that industry. We have in this Province a Bureau of Forestry, which has been in existence upwards of ten years. In reading the various reports of the Bureau, I am reluctantly forced to the conclusion that, with the exception of the past two or three years, it has been impotent, making but little progress in the achievement of its purposes. I do not wish to be understood as reflecting in any way upon the ability or zeal of Mr. Southworth, but I would rather lay a charge of passive indifference against the late and present Governments, each of which must admit responsibility.

Reforestation has been, is now, and can be successfully accomplished if scientifically and intelligently undertaken. Before pointing to what has been demonstrated in this re-

gard to other countries, I wish to call your attention to the urgent need of saving the extinction of the forest entirely.

With One Generation.

The Deputy Minister of Crown Lands, in a speech at Ottawa in February of last year, said that he estimated that there still remained within the borders of this Province 25 billion feet of pine timber, ten billion feet on licensed lands, and fifteen billion feet on unlicensed lands. Now, what I am about to state, using the Deputy Minister's estimate as a basis on pine, will also apply to all other classes of lumber, as it would be too tedious to specify each by itself. For the purpose of my reasoning let us assume that all the different kinds of lumber are disappearing with the same alarming rapidity as is the pine. Were one disposed to separately classify them, it would be an impossible task, as the figures are not available.

In 1906 there were cut over 700,000,000 feet of pine timber within the Province, and I submit that I am within the bounds of fair reasoning in stating that it will take but thirty to thirty-five years (and this is dealing generously with the figures) for the lumbering industry in this Province to come to an end for ever. Never in the history of man from its very beginnings has there been such a devastation, such an insane prodigality as in the administration of the forestry and timber resources of this Province.

We have frequently heard during the past few years complaints respecting the high price of lumber. No doubt prices have appreciated, and from what I have said it does not require a Solomon to see what we do not know what high prices mean. Fifty years ago Ontario white pine was worth 5½ cents per cubic foot; to-day it is worth 60 cents. He would be a bold man, indeed, who would prophesy what it would be twenty years hence.

Just a Question of Money.

The present forest reserves comprise 5,800,000 acres of land, which the Government has in its wisdom set aside for the reforestation of pine timber. These figures omit the Algonquin Park Reserve, as it seems to be the intention to reserve it as a game preserve rather than for timber purposes. As against this 5,800,000 acres, the Government sold 1,116,800 acres of timber lands within the period 1897-1903. It is easily seen, then, allowing time for the natural growth on the forest reserves—which takes from thirty to forty years—that the consumption is many times more than the production. Candidly, we may say that the sales of timber berths have not been made with the least regard to what could be prudently sold. How much money was required to carry on the expenses of Government alone determined this policy of devastation and inexcusable extravagance.

What has been done in the reforestation of countries where it has been successfully carried out? In Germany and Prussia reforestation has been practised for upwards of 100 years. In Saxony, careful statistics have been preserved, and the undertaking is conducted upon the soundest business principles. During the years 1884-1890 the gross revenue was $6.67 per acre, the expenditure $2.30 per acre, the net revenue $4.37 per acre; and, as there were only 430,000 acres under reforestation, the figures show a net revenue of nearly $1,900,000. It has been pointed out that there could well be spared 40,000,000 acres from the domain of this Province for the purposes of reforestation.

The situation in the United States, so far as the existence of the lumber industry is concerned, is about the same as in Canada. In a circular issued by the United States Forest Service the conclusion is arrived at that the standing timber will be exhausted, after allowing for the natural growth, in thirty-three years.

It is an imperative obligation to hand down to the future generations some of the blessings which we ourselves enjoy; and, therefore, that reforestation and the conservation of our timber resources, is a duty that falls upon each of us, so far as lies in our power to fulfil.

POWER PRESSES AND THEIR USES.

In few of the industrial arts has there been such progress in recent years as in that of working sheet metals into commercial articles. Some years ago the operations of cutting, blanking, and forming were exceedingly simple, but the requirements of sheet metal workers have had the effect of focusing many minds on the developing of the original and primitive methods used in such work to the special needs of various lines of manufacture. A very large number of articles are now made from sheet metal which

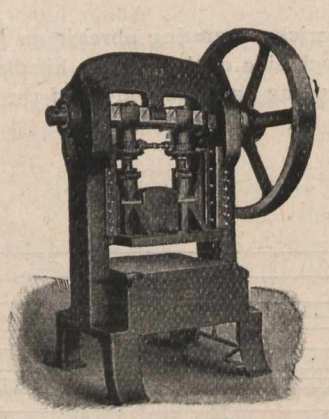


Fig. 1.

but a few years ago were produced, or would have been produced, by casting, forging or in the lathe, milling machine, drill press, or at the bench. The demand for cheaper goods and the great desirability of uniformity of product and interchangeability of parts have had much to do with the development of these methods. Forming and stamping operations especially have become, in many classes of work, very complex, and the art of drawing sheet metals has come to a high state of perfection and usefulness. Automatic machines and auxiliary devices for feeding strips of sheet metal, and for other purposes, having in view rapidity and economy of production, have been invented and brought into service. Many types of presses have come into existence in response to the demands of various classes of work.

It is our purpose in this article to illustrate and briefly describe a few of the machines which are used in the fashioning of most of the sheet metal articles which pass through our hands every day. In regard to designation, presses may be properly divided by two methods; First, as to the work which they have been designed to perform, as punching, stamping, drawing, blanking, embossing, riveting, wiring, forming, broaching, trimming, bending and forging presses. Second, as to their construction, as

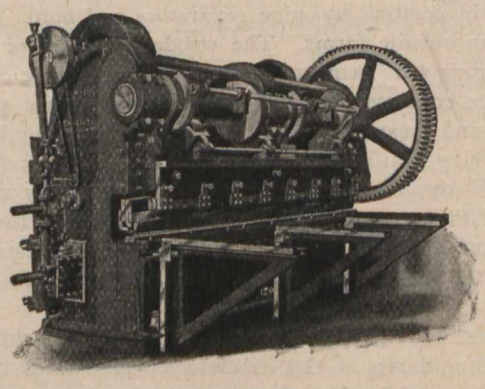


Fig. 2.

single-action, double-action, triple-action, double crank, cam, knuckle-joint, toggle, drop presses, etc. This latter method may be subdivided with regard to the frame, whether straight-sided or over-hanging, upright or inclinable, or whether made of one casting or built up in sections. Users generally designate presses by the first method, while builders employ the second.

The subject of double crank presses is a large one. They are a type of press of which there are more modifications than any other. One American manufacturer, viz., the E. W. Bliss Co., of Brooklyn, N.Y., U.S.A., makes over 150 different types and sizes, weighing from 2,500 to 100,000 pounds. They are particularly adapted for work requiring dies of a large area, and are frequently made with beds having distances as great as 8 or 10 feet between the uprights. Fig. 1 illustrates one of the medium size presses of this class. This kind of press is used in the manufacture of sheet iron and steel goods, such as vapor stoves, steel ranges, shingles, paneled ceilings and sidings for buildings, cornice work, stoveboards, armature disks, segments, and for operating gangs of punches for water pipes, gas meters, kitchen boilers, mower knife-bars, etc.

Fig. 2 illustrates a modification of double crank press which is known as a gang punching machine. This class of tool is made in sizes varying from 20,000 to 75,000 pounds. They are especially adapted for operating narrow dies of great length requiring considerable power, such as gang punching dies for marginal holes in sheets for boilers and tanks, also for corrugating and forming tools, etc. The illustration shows the machine driven by an independent engine. Double crank presses may also be arranged for forging purposes in the manufacture of hammers, axes, pickaxes, adzes, mattocks, hoes, and similar articles requiring a series of dies side by side.

In Fig. 3 is shown a Stiles automatic friction roll drop hammer, extensively employed in the manufacture of drop forgings. This hammer is so well known to the trade that a description is hardly necessary. It is sometimes supplied with a large bed and four poppets, making the press available for stamping tinware, copper, brass, or sheet iron

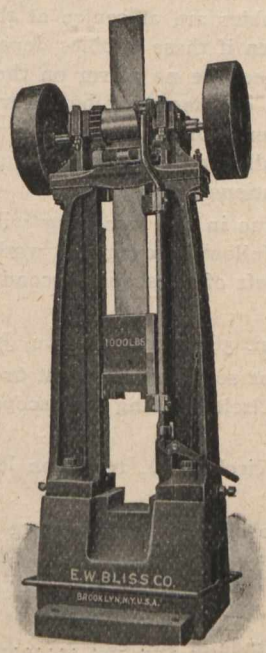


Fig. 3.

goods. It is also built with six poppets, adapting it for the manufacture of silver and plated forks, spoons, ladles, etc. This drop is regularly built with a geared lifter, as in the illustration, or with a gearless lifter when preferred. Drop hammers of this type are made with hammers weighing from 60 to 3,000 pounds.

An important part in the manufacture of sheet metal goods is the question of dies. The construction of the dies is one that requires the greatest care and experience. In view of the foregoing consideration we cannot help but wonder when the limit in the working of sheet metals will have been reached. The art is yet in its infancy, and we still constantly see the rapid growth of this wonderful industry, which has practically every day a new field in which to develop and expand.

ASTRONOMICAL BEARINGS BY SUN OBSERVATIONS.

D. D. James, B.A.Sc.

An accurate method—easy to understand—easy to apply.

This observation consists of the measurement of a vertical angle and a horizontal angle, therefore, the transit must be equipped with a vertical circle and a sensitive level attached to the telescope.

The other levels of the transit ought to have the sensitiveness of one bubble division to thirty seconds of arc.

For the calculations a table of logarithmic functions given for every ten minutes and a copy of the Canadian Almanac are required.

For the benefit of those readers who are not specialists an explanation of refraction and declination is in order.

Refraction—This is the amount by which we reduce the observed angular elevation of the sun or a star above the horizontal to obtain the true angular elevation.

It is called "r" and r can be taken as 58″ (seconds) multiplied by cotangent of observed angular elevation.

Or r can be found on page 35 of the Canadian Almanac, 1908, for any angle to be connected. We call the angle of elevation, less the refraction, by the symbol "h."

Declination—This is the angular distance of the sun's centre north or south of the equator, and is given for every day of the year in the Canadian Almanac.

It is given practically for noon, longitude 75°, or fifth meridian time. For intermediate moments and other meridian time correction must be made. For example, if it is 2 p.m. we must make 2/24 of the change to the next noon declination. If we use 6th meridian time 1/24 of the change to the next noon declination must be allowed. If both these alterations come in we must allow 3/24 of the change. Or supposing it is 10 a.m. and 7th meridian time. This is the same moment as noon 5th meridian time and no correction is necessary.

Further 90° plus a south declination or 90° minus a north declination is given the sympol P for polar distance.

Latitude—Before treating the subject proper another necessary quantity must be dealt with, viz., the latitude.

For Manitoba and the North-West the latitude is given for every north boundary of any row of sections, and can be found in the Manual of Instructions to Dominion Land Surveyors. In the East a few latitudes are given, pages 38 to 40 of the Canadian Almanac.

If the observation is within estimating distance of a place of known latitude we may reckon every .6080 feet of nothing equivalent to 1′ (minute) of latitude.

As a final resort we may observe the latitude as follows:

Somewhat before noon the instrument is set, and the increasing angles of elevation of the sun watched until a somewhat stationary maximum angle is obtained after the noting of which, there is a decrease in elevation of the sun.

This maximum angle corrected for refraction is designated h and we have from astronomy

Latitude=90°—h—declination of sun, if south, as for winter, or

Latitude=90°—h+declination of sun, if north, as for summer.

Angles to the Centre of the Sun.

In the foregoing it has been assumed that we measure an angle of elevation directly to the centre of the sun. This is possible by means of the Davis solar screen, or by a piece of white cardboard or ground glass attached by wire two or three inches from the eye end of the telescope and at right angles to its axis.

When the eye piece is pulled farther out from its usual place, it will project on the screen, as on the ground glass of a camera, an image of the sun with the cross hairs showing

on the image. One can then judge quite nicely, when the cross hairs bisect the sun, either vertically, horizontally or both combined.

With eye away from the eye piece and head in a natural position one is at ease, and can watch his side bubble at the same time. If the sun be so high as to involve the horizontal rim of the instrument a prism eye piece can be employed to turn the direction of the rays at right angles to the telescope.

Without the solar screen a colored glass attached to the eye piece to deaden the brightness of the sun must be used.

Here the sight may be taken to the upper or lower edge of the sun, and the angular semi-diameter of the sun, given on page 33 of the Canadian Almanac, is subtracted or added to the observed angle of elevation after the refraction correction is applied.

Again, if there be no horizontal cross hair in the instrument, two angles of elevation may be observed, one with the upper portion of the sun tangent to two cross hairs, the other with the lower portion of the sun tangent to the very same cross hairs, only that the instrument has been transited meanwhile. The average of the resulting angles is then corrected for refraction and used as before.

While on the subject of measuring two angles of elevation the advantage of a reversion level to telescope may be noted. Therewith, having absolutely no previous adjustments of the instrument, or note of the index error of the vertical circle, the very best results may be attained, when two angles of elevation are taken.

The only thing we depend on is the reliability of the reversion level, which we have, say, tested for all time.

Suppose the first angle of elevation to have been taken with the vertical circle to the right of the telescope.

Then take the second angle of elevation circle to the left of the telescope. In each case have the horizontal bubbles at centre, when the sight is on the sun, even if these bubbles should not be in adjustment; and in each case determine the corresponding index error, when the then upper side of the reversion vial has its bubble centred. Remember to determine each index error with side bubble centred, regardless of the adjustment or lack of adjustment of side bubble or cross hairs.

Operations and Formula for Calculating Azimuth.

To come to the subject proper, everyone knows that the higher the sun is, the nearer it is to due south, or the higher the sun the farther it is from the north of us. Higher mathematics or astronomy gives the following formula, in which A is the azimuth, or horizontal angular distance between plumb lines, one suspended from the centre of the sun, the other, we imagine, to be suspended due north of us. This unknown angle A is thus found by calculation—

$$\text{Tan } \tfrac{1}{2} A = \sqrt{\frac{\sin (s-h) \sin (s-L)}{\cos s \quad \cos (s-P)}}$$

The known quantities are h, L, and P, s being simply

$$\frac{h+L+P}{2}$$

The finding of L and P, the latitude and polar distance has been already explained.

The measurement of h, the corrected elevation of the sun, is our particular business in the field. We get the best results between an hour after sunrise and two hours before noon. If we could leave the instrument as pointed at the sun and sit down and calculate A then the astronomic north could be laid off. But instrumental and other difficulties demand that we at the same time measure a horizontal angle from the centre of the sun to a reference mark or to our centre line.

The operations in the field then consist of—

(1) The setting up of the instrument on the line of which the bearing is required.

(2) The clamping of horizontal and vertical movements so that the intersection of the cross hairs lies at the centre of the sun or so that certain cross hairs are tangent to the sun's disc.

(3) The reading of the vernier of the vertical circle.

(4 The reading of the vernier of the horizontal circle.

(5) The freeing of the circles and the reading of the vernier of the horizontal circle with the cross hairs set on the line sight.

With regard to (2)—If we use the solar, disc, as previously explained, we get an observation to the centre of the sun, and can make a complete calculation therefrom. But if we use tangent cross hairs we must double the operations (2) to (5). Suppose we go through the five with the vertical circle to left of telescope, and use the upper portion of the sun. Then we must repeat the operations (2) to (5) with vertical circle to right of telescope and use the lower portion of the sun. Then the resulting vertical angles averaged give a vertical angle to the centre of the sun, also the resulting horizontal angles give us a horizontal angle to the centre of the sun.

The use of the solar disc does not always excuse the taking of a second set of angles. The two sets are better taken to give complete freedom from instrumental errors of adjustment.

But with the case of the use of the solar disc, one set can be calculated out independently of the other. When there is no one to check the calculations it is very valuable to have two sets of complete calculations. A very serious divergence in the results would show errors, and a smaller divergence gives a hint as to instrumental adjustments and accuracy of handling the instrument.

One should, during the operation called (2), insure that the horizontal bubbles are at centre at the moment the sun is "spotted." Even if these bubbles depart from centre subsequently, there need be no alarm on the same principle as after the use of a clinometer or hand level the delicate part of the work is over. Of course in determining index errors the bubbles are all carefully centred, but this can be done after all the operations are complete.

Anything vague in the foregoing will perhaps be made apparent in the following example worked out first with vertical circle to left of telescope—second with vertical circle to right.

Time 8.20 a.m. 5th meridian time, July 9th, 1907.

(1) Instrument set up on tangent 61+38 to 106+34.

(3) Vertical circle reading (telescope pointed to centre of sun) 35° 12′.

Index error (circle left), reversion level bubble centred, +03.

Vertical angle of elevation to centre of sun, 35° 15′.

Refraction correction (always subtracted) for 35° 15′ —01′ 20″.

True angular altitude of sun call	h= 35° 13′ 40″
Latitude of set up call	L= 44° 04′ 36″
Polar distance call	P= 67° 31′ 54″
2 S	=146° 50′ 10″
S	= 73° 25′ 05″
log cos S or	73° 25′ 05″= 9.455430
log cos (S—P) or	5° 53′ 11″= 9.997704
log cos S, cos (S—P)	=19.453134
log sin (S—h) or	38° 11′ 25″= 9.791180
log sin (S—L) or	29° 20′ 29″= 9.690207
log sin (s—h), sin (S—L)	=19.481387
log cos S, cos (S—P)	=19.453134

$$\log \frac{\sin (s-h), \sin (S-L)}{\cos S, \cos (S-P)} = 0.028253$$

$$\log \frac{\sin (s-h), \sin (S-L)}{\cos S, \cos (S-P)} = 0.014126 = \log \tan 45°$$

55′ 54″—log tan ½ A.

So A=45° 55′ 54″ + 2=91° 51′ 48″.

Or 91° 51′ 48″=angular distance from morning sun to astronomic north.

But 79° 44′ 00″ was measured from morning sun to tangent to the southward.

171° 35′ 48″ the addition of the two gives the angular distance from astronomic north to our tangent.

But 171° 35′ 48″ from north is (180° less 171° 35′ 38″) S. 8° 24′ 12″ E.

Second series with circle to right, instrument in same place, (3) vertical circle reading.... 37° 38′ 30″

Index error circle right, other side of reversion bubble now in use . . .. —05— 15″

Vertical angle of elevation to centre of sun..... 37° 33′ 15″

Refraction correction for 37° 33′ ..... 1′ 15″

True angular altitude of sun ..... h= 37° 32′ 00″

Latitude . . . .L= 44° 04′ 36″

Polar distance . . ..P= 67° 31′ 54″

2S=149° 08′ 30″

S= 74° 34′ 15″

cos S or . . .. 74° 34′ 15″= 9.424960

cos (S—P) or . . .. 7° 02′ 21″= 9.996714

19.421674

log sin (S—h) or . ..... 37° 02′ 15″= 9.779840

log sin (S—L) or . ..... 30° 29′ 39″= 9.705393

log sin (S—h), sin (S—L) . . ..=19.485233

log cos S, cos (S—P) . . ..=19.421674

$$\log \frac{\sin (S-h), \sin (S-L)}{\cos S \quad \cos (S-P)} = 0.063559$$

$$\log \sqrt{\frac{\sin (S-h) \sin (S-L)}{\cos S \quad \cos (S-P)}} = 0.031779 = \log \tan 47° 05′ 40″ = \log \tan \tfrac{1}{2} A$$

So A=47° 05′ 40″×2=94° 11′ 20″.

94° 11′ 20″=angular distance of morning sun to astronomic north.

But 77° 26′ 30″ was measured from morning sun to tangent to southward.

171° 37′ 50″ the addition of the two gives the angular distance from astronomic north to our tangent.

But 170° 37′ 50″ from north is 8° 22′ 10″ from south, so our observation with circle right gives

S 8° 22′ 10″ E circle right

And we have S 8° 24′ 12″ E circle left.

Average S 8° 23′ E.

REINFORCED CONCRETE BRIDGE.

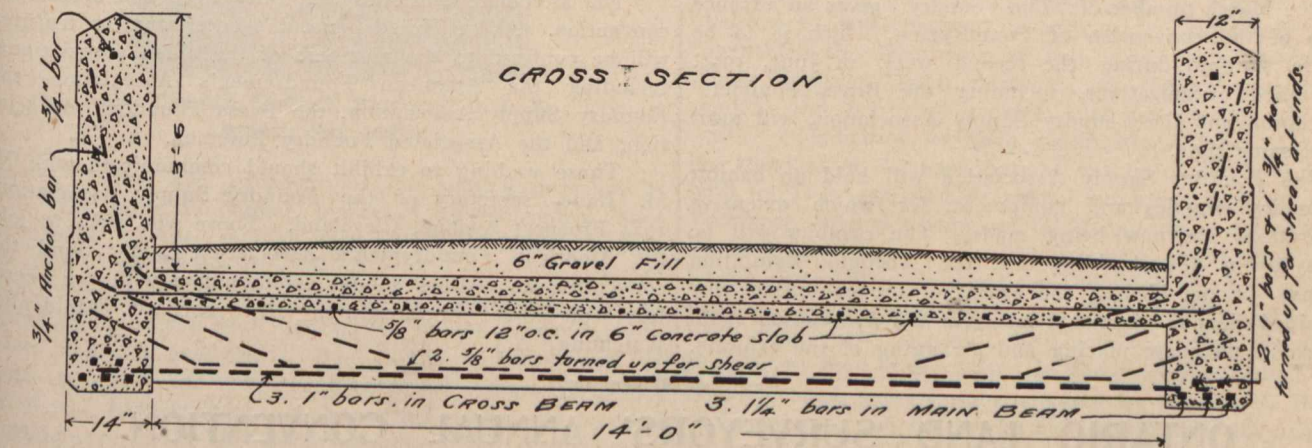
A. F. Wells, B.A.Sc.*

The reinforced concrete bridge shown in the accompanying picture is an example of the adaptability of reinforced concrete to bridge construction. This bridge was designed by The Concrete Engineering and Construction Company, Limited, and built near Woodstock, Ont.

The engineer in charge of the work would not allow the bottom of the beams to project more than 24 in. below the finished surface of roadway, and this would be practically impossible if the ordinary beam bridge were used, while for a similar reason an arch was out of the question, aside from the fact that for this span an arch would be more expensive.

The bridge was designed to carry an eight-ton traction engine. On account of the many uncertainties in reinforced concrete design and construction and in the resultant stresses from such a load an exact theoretical design was not attempted. The approximate design outlined below proved to be safe and economical, although the cost of centering was greater than for an ordinary beam bridge.

The plan and cross section of bridge shown give a fairly complete idea of the design. In designing the floor slab it was assumed that one set of wheels of the engine was in the centre of the floor slab between cross beams, and that the gravel fill distributed this load of four tons over a width of nine feet. This would be equivalent to a uniformly distributed load of 16,000 pounds on an area of 63 square feet or 254 pounds per square foot. This live load together with the weight of concrete slab and gravel fill gave a total load of 375 pounds per square foot, while the clear span was seven feet. The slab was then designed in the ordinary way for bending moment, which necessitated a 6-in. slab reinforced by ⅝-in. bars, 12-in. on centres. There is always some uncertainty in designing such a slab for shear. If there were no gravel fill the shear, directly under a wheel, as it passed off a cross beam would be very great, since the load would be concentrated on a narrow strip of the slab, but when a gravel fill is used the load may be distributed over as great a width as necessary by varying the depth of fill. In this case the greatest concentrated load would be one wheel of the engine or 4,000 pounds. Allowing a safe shearing stress of 50



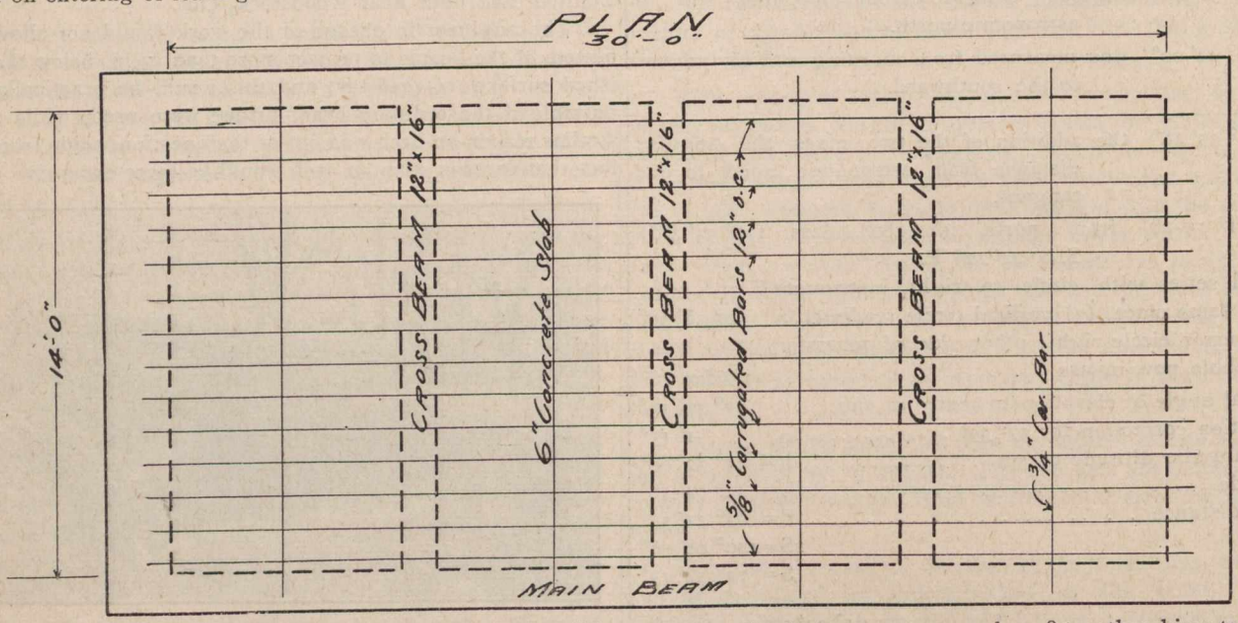
*Wells and Raymond, Stair Building, Toronto, Ont.

pounds per square inch in concrete, as is the usual custom 80 square inches of concrete would be necessary. Since the slab is 6 inches thick the load must be distributed over a width of $\frac{80}{6} = 13.3$ inches, which would be accomplished by a 6-in. gravel fill. This gravel fill is also advisable for the reason that it makes a continuous roadway over the bridge with no jar on entering or leaving.

The main beams were designed to carry the entire weight of the bridge, and also a concentrated load of 8 tons at the centre. The engine load would not be concentrated at the centre, but this assumption would be on the safe side.

The specifications called for Johnson corrugated steel bars throughout, and concrete composed of one part of cement to four parts gravel.

The contract price for the superstructure, and abutments containing 75 cubic yards of concrete, was $1,075.



The cross beams were designed for the greatest possible load, i.e., when one pair of wheels is directly over the beam. This would be almost equivalent to a concentrated load of 4 tons at centre of beam or a uniformly distributed load of 8 tons. This load with weight of gravel fill, concrete slab and beam, required a beam as shown on plan and section.

These beams did not supply enough concrete to take up all shearing stresses and accordingly some of the main tension bars were turned up towards the ends of beams to provide for these stresses. Also ⅝-in. bars were placed at the ends of beams running up into the main beams to act as anchors, and as additional shear members in both beams.

After the forms were removed an 8-ton threshing traction engine was run across the bridge several times, without the slightest deflection.

This type of bridge is not advisable where an ordinary beam bridge is possible, since it is more costly to centre, and some people object to the appearance of the heavy concrete guard rails which are in reality part of the main beams supporting the bridge. However, as stated above, it is an example of the adaptability of reinforced concrete to structural work of this nature.

AMERICAN FOUNDRYMEN'S ASSOCIATION CONVENTION IN TORONTO.

The March number of "The Foundry" gives an advance notice of the convention of Foundrymen, which is to be held in Toronto during the second week in June, 1908. The allied organizations, including the Brass Founders' Association and the Foundry Supply Association, will meet at the same time.

The Foundry Supply Association will hold an exhibit of foundry supplies and equipment, for which extensive preparations are now being made. The exhibits will be displayed in the buildings at the Toronto Exhibition Grounds. Some idea of the extent of the exhibition may be gained from the fact that last year the Association spent $12,000 in the mere placing and arranging of the exhibits.

Dr. Moldenke estimates that fully 2,000 will attend the convention. As at Philadelphia, the entertainment features will be confined to the members of the allied associations, including the American Foundrymen's Association, the Foundry Supply Association, the Brass Founders' Association, and the Associated Foundry Foremen.

Those wishing to exhibit should communicate with H. M. Lane, secretary of the Foundry Supply Association, 1924 Prospect Avenue, Cleveland. Those who wish to join the American Foundrymen's Association and attend the convention as visitors should communicate with the secretary of that organization, Dr. Richard Moldenke, Watchung, N.J.

ONTARIO LAND SURVEYORS' ANNUAL CONVENTION.

The fifteenth annual convention of the Ontario Land Surveyors was held in Toronto, February 25th, 26th and 27th. Reports from the various committees and officials show the Association to be in a flourishing condition.

The meetings were presided over by the President, Mr. Thomas Fawcett, of Niagara Falls. Mr. Fawcett was born in Yorkshire, England, on the 28th of October, 1848, and came to Canada when a lad of nine years. After completing the work in the Ontario Public Schools he attended Albert College, Belleville. In 1873 he entered the office of Hermon & Bolton, land surveyors, of Listowel, Ont., serving under articles with this firm for three years, and in 1876 was one of the first candidates to be admitted as a Dominion land surveyor. The year following Mr. Fawcett was admitted as a Dominion topographical surveyor. aLter, he became a member of the Ontario Land Surveyors' Association.

Mr. Fawcett's most important work has been in connection with the survey of base lines, standard meridians, and exploratory surveys for the Dominion Government in what was a few years ago the North-West Territories. One of his most difficult trips was from Kenora to the head waters of the Albany River, and thence tracing out the boundary beween Ontario and Keewatin.

In 1897 Mr. Fawcett became first Gold Commissioner to the Yukon, and was there in that capacity and that of Director of Surveys during the two years of the "great stampede" to the Klondike. In 1899 he resigned from these positions, and since has been engaged on contract work

for the Ontario and Dominion Governments and for the Clergue Company at the Soo.

On the afternoon of the first day the President's address was delivered.

Mr. Fawcett said in part: The past year has been one of success and profit for the majority of the members of our Society, many of whom are unable, because of the urgency of their work, to attend the annual meeting, even at this time of the year, when the demand for surveys and engineering work is not so great as during other parts of the year. For those who during the past season were engaged on Government, mineral, and other surveys in the wilds of our own Province, the difficulties were by no means trivial; conditions arising which at times were very discouraging—excessive rains, dissatisfied and unreasonable employees, broken agreements, and desertions from the party at times when great injury and loss would be the outcome, all have a tendency to place the surveyor on the anxious seat. But victory over such obstacles brings a feeling of satisfaction not otherwise experienced once the task is accomplished. We trust that the change in industrial conditions which has recently overtaken our country in common with that of other nations will not prove to be an unmitigated evil, but that those most affected will become more reasonable in their demands and take some little interest in the welfare of those they are employed to

Mr. Thomas Fawcett, President O. L. S. Association, 1907-8.

assist. Those who attended our last annual meeting, or who have read the annual report of that meeting, have knowledge of the several memorials submitted on that occasion —one to the Hon. Minister of Lands, Forests and Mines, setting forth the necessity of increasing the remuneration for the work undertaken by the surveyor, both under contract and salary, due to the increased cost of labor, supplies, and camp equipages. The majority, if not all of you, have learned that the memorial not only received consideration from the Department, but the recommendations set forth in the memorial were adopted with one single exception, thus proving the readiness of the Ministers of the Crown to remedy any defects in the departmental economy brought to their attention. I am sure we do not fail as an Association, deeply interested in this matter, to appreciate this immediate response to our request on the part of the Honorable Minister, and also the support of the Director of Surveys and the Deputy Minister, who are so closely in touch with the survey work that they could appreciate the justice of the request, and bring the matter more fully before the Minister than could be set forth in a memorial. Another memorial to the Hon. Sir Wilfrid Laurier, Premier of Canada, set forth the urgent necessity of undertaking a geodetic and trigonometrical survey of the Dominion, and that the primary work should be undertaken by the Federal Government at an early date. The reply to the memorial in a letter from the Hon. Frank Oliver, Minister of the Interior, stated that the question had been carefully considered by a departmental conference, convened at the instance of the Minister of Militia and Defence, and that the conference had submitted a report now before the Government. This reply bore date of 27th March, 1907. Preliminary work towards such an undertaking has been carried on to a limited extent by the Astronomical Branch of the Department of the Interior, we have been informed by our former President, Dr. Klotz. But much greater activity towards this important work will have to be displayed before any benefit be derived by the Provinces. If the work was fairly started and points in the primary triangulation permanently marked, I am confident that the progressive Provincial Governments would lose no time in carrying on the work to completion by arranging for the secondary triangulation, leveling and establishing permanent marks on the ground and sectional maps on such a scale that they be of utility to surveyors, engineers, municipalities, joint stock and insurance companies, and in all public works, supplying information which at present is only obtained through expensive preliminary and exploratory surveys, which are indispensable in all road construction, railways and other roads, waterways and irrigation ditches, drainage and all similar undertakings before any estimate of the cost or idea of the best locations can be formed. Such maps as are constructed in connection with a completed geodetic survey would take the place of these preliminary and exploratory surveys, so that roads could be located, schemes for municipal drainage adopted, and a close estimate of the cost of all such undertakings arrived at by competent persons from the simple examination of the maps. A question of more than passing interest to our Association has arisen through recent legislation by the Dominion Parliament amending, or rather changing the Act in regard to the qualification of Dominion Land Surveyor, the new Act providing that surveyors in certain of His Majesty's dominions, other than Canada, may become qualified as Dominion land surveyors without passing any examination except that portion of the Dominion Lands Act relating to the survey and division of lands, and the manual of survey issued by the Surveyor-General of the Dominion for the guidance of surveyors, employed in the survey of Dominion lands. When the Dominion Lands Act came into operation in 1872, all the surveyors who at that time were qualified to make surveys in any of the Provinces which constituted the Dominion at that date, were named ex-officio Dominion land surveyors; all the subsequent Dominion land surveyors became such by passing the prescribed examination for such qualification. Since that date the standard of the examinations has gradually been raised both for Dominion and Provincial surveyors in most of the Provinces, so that a standard fairly uniform in the ordinary mathematical subjects entering into the examination given by the several Provinces and the Dominion has been adopted in so far as the examinations are similar. For a time there was reciprocity between the Dominion and Provincial Boards, so that examinations in those subjects which covered the same ground were accepted by the several Boards of Examiners, and those who had passed full examinations before the one board were not re-examined in the same subjects by the other. After a short trial this arrangement came to an end, and surveyors from the Provinces were required to pass the full examination before the Dominion Board of Examiners to become qualified to survey Dominion lands, and those who had passed the Dominion Board has to pass the full examination before the Provincial Boards before they became qualified to make surveys in the Provinces. There was no particular hardship or grievance in this, as the candidates usually presented themselves for the two examinations while the subjects were still fresh in their minds; and the examining boards had the right to terminate the reciprocal arrangement if they considered the examinations were not similar in their requirements and so long as all were admitted on the same terms. Truly, there are several subjects relating to engineering and surveying

prescribed in the Revised Statutes of Ontario in which candidates for the Ontario examination are examined that are not included in the list of subjects for D.L.S., and the several Acts are entirely different, thus necessitating separate examinations in these particular subjects, but the new Dominion Act, while it purports to re-establish the reciprocal status to a certain degree, states in a footnote that these advantages will only apply to sister colonies, such as Australia, New Zealand, Cape Colony, etc., "Where the standard of the examinations is very high." We do not believe that the standard of examinations for land surveyors is higher in any country than it is in the Provinces of Canada, and especially in the Province of Ontario, where three-fourths at least of the candidates who come before the board for examination are university graduates, and those who are not have to acquire an education in many respects equivalent to that obtained by the university graduates. It seems reversing the order of affairs where immigrants from foreign countries are granted privileges not accessible to the loyal citizens of Canada. That there was any necessity for such a change in the Act we do not believe. There certainly is no scarcity of surveyors, any more than a scarcity of doctors or lawyers, that they should have to be imported from foreign countries and constituted such by Act of Parliament. Few of us had heard anything about the change until it had passed through the Commons and become law. The Board of Examiners have some discretion in the matter, and, as all the gentlemen on the present Dominion Board of Examiners are men who stand at the very top of the profession, educationally, they will undoubtedly use that discretion in debarring any from qualifying who do not possess the mental equipment necessary for the work. I regret to have to report the death of six of our active members since last annual meeting, viz., Messrs. Augustine McDonald, Chatham, Ont.; Milton C. Schofield, Guelph, Ont.; John McLatchie, of Nelson, B.C.; John Davis, of Alton, Ont.; R. H. Squire, of Brantford, Ont.; and E. S. Steel, of Sault Ste. Marie, Ont.

Mr. A. J. Van Nostrand, President O. L. S. Association, 1908-9.

Tuesday evening in Massey Hall Commander Robert Evans Peary gave his lecture, "Nearest the Pole." Commander Peary told a graphic story of his splendid fight against the greatest natural objects in the world in search of that point on the earth's surface which has so far eluded so many heroic searchers. The lecture was illustrated with beautiful lantern slides, but before these were put on the screen the lecturer explained the geography of the Polar Sea, and pointed out on the map his route from his departure from New York in July, 1905, to his arrival there again Christmas Eve, 1906. On April 21st, shortly before noon he had stopped at 87 degrees 6 minutes, north latitude, the nearest point to the pole reached by any man.

Every Arctic expedition had to follow the same routine. In the summer it would have to work its way as far north as possible by boat. In September it would be frozen in, and intervening time before the long night set in in October would have to be spent in securing game for the winter's meat supply. Early in February the sledge journeys could be begun, but the parties would have to be back near the land by June before the big ice fields began to break up. In the first stages, when the cold was severe, snow huts were used in the camps, but tents were used in April when the weather was warmer; that is, about 30 or 35 below zero.

The greatest obstacle he had met in his journey over the ice was a huge snowstorm, which kept them in camp six days. In that time the party of eight had drifted seventy miles to the eastward, cutting them off from their bases of supplies, and leaving them to get as far as they could on half rations. The day the highest point was reached was Peary's bluest day, the predominant feeling, he explained, being one of intense disappointment. Then began the painful trip southward, in which the sufferings were terrible, and death was missed by a hairsbreadth.

The dogs, he added, made possible the journeys. Automobiles, he said, would be altogether impracticable. The result of his expedition had been to simplify by 50 per cent. the work of reaching the pole. He had learned that in his next journey he would have to arrange his course so as to allow for the eastward drift of the ice.

On Wednesday evening a banquet was held at McConkey's. The attendance was large, and the speeches bright, though brief. President Fawcett presided, and on his right sat Dr. G. Kennedy, James Bain, G. B. Kirkpatrick, and J. F. Whitson; on the left, Thomas Southworth, R. F. Stupart, and T. Hogg.

After "The King" had been honored "The "Empire" was proposed and responded to by Mr. James Bain, who looked upon Canadian Confederation as one of the greatest steps in Empire-building. The strength of the Empire would depend largely upon how far the strong would lend a helping hand to weaker fellow-countrymen.

The toast of "Canada" was responded to by Mr. Stupart and Major Howard.

"The Province of Ontario" had for sponsors Dr. Kennedy, who spoke of Ontario as the Premier Province. Mr. Southworth told how that in 1907 eighty-two thousand people had settled in Ontario, and of this number seventy-seven per cent. were English-speaking people. Ontario was to be congratulated that her recent arrivals were of a class so easy to assimilate.

In responding to the toast, "Our Sister Societies," Mr. A. B. Barry, of the Engineers' Club, Toronto, referred to the possibility of a Scientific Club Building for Toronto, and the advantages to be gained by professional men from such a club. Mr. Hogg spoke for the Engineering Society, and Mr. Selby for the Dominion Land Surveyors.

Mr. G. Kirkpatrick and Mr. W. Chipman, in replying to the toast of "The Veterans," both referred to the kindly relations and brotherly feeling that existed among professional men that was not noticeable in the early days of the Land Surveyors' Association. Mr. E. A. James, editor of the "Canadian Engineer," responded to the toast of "The Press."

For 1908-9 the following officers were elected: President, A. J. Van Nostrand, Toronto; vice-president, Lewis Bolton, Listowel; secretary, Capt. Gamble, Toronto. The following council was nominated: Messrs. Kirkpatrick, Hutcheon, Wilkie, Selby, Whitson, and Fitzgerald.

Among those attending were: H. Gamble, J. F. Whitson, H. Sewell, W. A. MacLean, G. B. Kirkpatrick, H. W. Selby, A. J. Van Nostrand, C. J. Murphy, W. A. Browne, A. T. Ward, L. B. Stewart, S. James, D. D. James, A. P. Walker, C. E. Brush, L. V. Rorke, E. P. Bowman, A. Wells, of Toronto; Thomas Fawcett, Niagara Falls; J. W. Fitzgerald, Peterboro'; H. K. McEvoy, St. Mary's; A. G. Ardagh, Barrie; P. Gibson, W. S. Gibson, Willowdale; W. Smith, Lindsay; H. Bowman, Berlin; A. S. Code, Alvinston; L. Bolton, Listowel; E. W. Wilkie, Carleton Place; E. D. Bolton, Listowel; J. Warren, Walkerton; W. E. McMullen, St. John, N.B.; J. J. Newman, Windsor; J. Hutcheon, Guelph; T. D. Green, K. D. McCaw, Welland; F. J. Ure, Woodstock; G. Ross, Welland; Thos. H. Dunn, Winchester; G. S. Abrey, Toronto Junction; Jas. J. McKay, Hamilton; S. B. Code, Smith's Falls.

THE MULHOUSE CENTRAL STATION STEAM TURBINE PLANT.

By Frank C. Perkins.

One of the most successful steam turbine installations for electric light and power service in which an alternating current generator is directly coupled to a horizontal shaft Zoelly steam turbine is that in the central power station of Mulhouse, in Alsace. The first unit installed in this plant, as noted in illustration (Fig. 1), has a capacity of 2,200 horse-power, and operates at a speed of 1,500 revolutions per minute. The successful operation of this unit resulted in the installation of another turbo-alternator of the same capacity. The electrical generators were constructed by the Siemens Schuckert-Werk, of Berlin, and supply three-phase alternating current of 6,300 volts pressure.

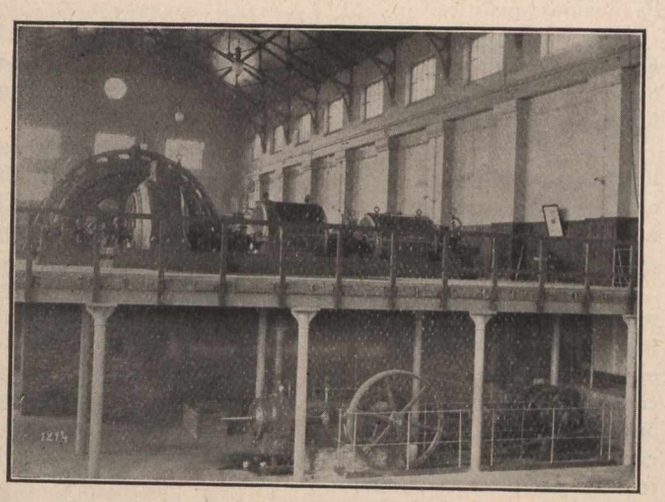


Fig. 1.

In Switzerland the Zoelly steam turbine is constructed at Zurich by Escher, Wyss & Cie., the well-known Swiss hydraulic turbine manufacturers, while in Germany the Zoelly turbine is constructed by the Vereinigte Maschinenfabrik Augsburg Und Maschinen bargesellschaft Nurnberg, A.-G. The steam turbine has come into extensive use in central station practice, being particularly desirable in extending older plants, having reciprocating engine sets in operation, and having a limited amount of space available for installing additional power units.

The Zoelly steam turbine of ten stages is divided into two groups of five each, arranged in two cases with a bearing between them as shown in Fig. 2. The steam is admitted through a regulating valve passing in to the first guide apparatus, acquiring kinetic energy as it is partially expanded, and is directed to the running wheel at the proper angle. This wheel absorbs the energy of the first expansion, and the steam then passed through the second guide while a second expansion takes place, the second running wheel absorbing the additional energy corresponding to the second expansion. In like manner, the steam passed through and on to all the guides and wheels to the exhaust pipe.

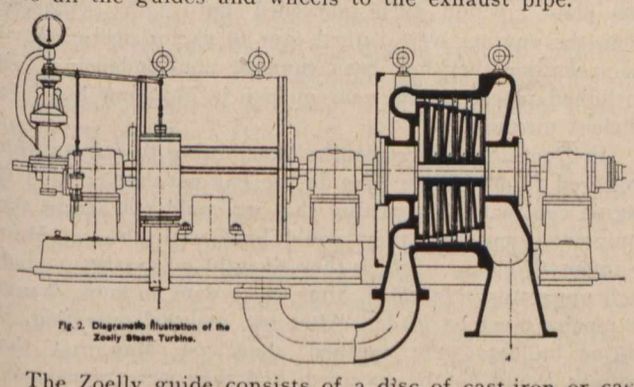


Fig 2. Diagramatic Illustration of the Zoelly Steam Turbine.

The Zoelly guide consists of a disc of cast-iron or cast-steel divided along its horizontal diameter. It is made in one piece with the distributing ring, and the vanes are fixed in the recesses by means of rings. The disc is of cast-iron in the low pressure part, and the nickel steel blades are cast in. The turbine wheel discs are made of steel, forged in one piece, and these wheels are turned and polished all over. The wheels are thickened near the centre, and a T-shape recess is provided at the periphery of each disc, one side of which is formed by a ring, which is fastened to the disc, the blades and distance pieces being fitted in this T slot, nickel steel being used in their construction.

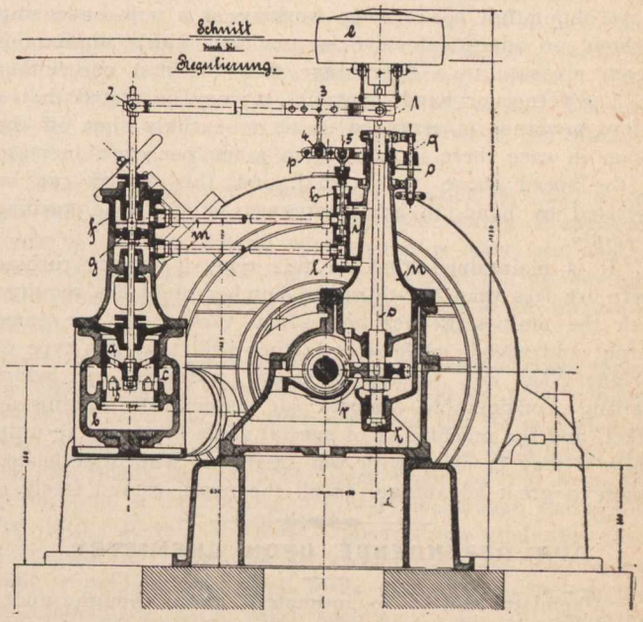


Fig. 3.

The turbine casings are divided into two parts horizontally, the upper half of the guide being fastened to the corresponding half of the casing. Hollow brasses for water cooling are provided for the bearings, mounted on the bedplate and not influenced seriously by heat from the turbine, as the temperature of the oil leaving the bearings is not increased by more than twenty degrees C. It is held that a normal heating of the bearings is, therefore, out of the question, and they are well lubricated by oil under pressure which flows from the bearing to a central reservoir, where it is cooled and filtered, the circulation being effected by a pump driven through worm gearing from the turbine shaft, a second emergency steam-driven pump being also provided.

The Zoelly steam turbine governor, seen in Fig. 3, consists of an automatic regulator operating in the "servomotor, or "relay" principle. There are pendulum weights connected to a lever and controlling a small distributing valve, which connects the pressure pipe to either of two other pipes, and so admitting oil under pressure to one end or the other of a cylinder, and causing a piston to open or close the regulating valve, to which it is directly connected. The oil from the other side of the piston returns to the distributing valve, and thence to the reservoir through a pipe provided for the purpose. The lever is fixed to the main steam valve-rod, and the action of the piston returns the small valve to its normal position, preventing plunging, and leaving the governor ready to cope with any other change of load. It is held that accurate and practically instantaneous regulation is obtained with this regulator, the governor being such that the speed variation does not exceed three per cent. with a sudden variation on load of one hundred per cent.

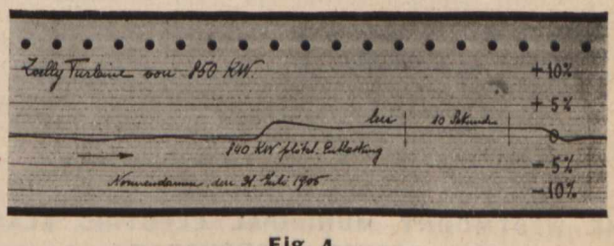


Fig. 4.

A tachograph speed diagram, seen in Fig. 4, taken from a one thousand kilowatt Zoelly steam turbo-alternator showed that when a load of eight hundred and forty kilowatts was suddenly cut out, the maximum variation in speed was only 2.6 per cent., and in seven seconds speed was constant. In order to change the speed from normal five per cent. either up or down, a speed adjuster is fixed to the governor which can be operated at will, either from the switchboard

by a small electric motor, or it may be worked by hand, this device being extremely useful when two electrical generators are coupled in parallel.

In order to take care of an ordinary over-load as well as to obtain full power when working as a non-condensing turbine, an additional valve is provided, which admits full steam pressure to a later stage than the first one, either by a governor or hand control. It may be stated that a safety governor is arranged so as to entirely shut off the steam in case there is more than a ten per cent. increase of the speed above the normal, and this device can be operated by hand in an emergency to stop the turbine instantly.

It is maintained that in this type of steam turbine there are less than one-third the number of blades required with the multi-stage reaction steam turbine of the same output and speed, while it is further held that this type of turbine does not require extensive warming up before starting, considerable changes of temperature having no effect, and the machine is of special value as a reserve unit, while it may be used with wet steam or with superheated steam to great advantage, as all the parts expand freely.

OUR DEPENDENCE UPON CHEMISTRY.

"Chemistry enters so intimately, even though unobtrusively, into every phase of modern life and thought that it is, perhaps, impossible to present in any adequate degree the real dependence of the community upon the work of chemists, past and present." So says Mr. Arthur D. Little, chemical engineer, of Boston. "Industrial revolutions," he continues, "are seldom chronicled, and more rarely celebrated, though their influence upon the welfare of mankind may be as profound as that of other revolutions, the records of which are traced in blood. It can no longer be said, as it was said to the father of chemistry as he passed out to execution, 'The Republic has no need of chemists.' If we were to take away what chemists have contributed the whole structure of modern society would break down at once. Every commercial transaction in the civilized world is based upon the chemist's certificate as to the fineness of the gold which forms our ultimate measure of values. Faith may remove mountains, but modern society relies on dynamite. Without explosives our great engineering works must cease, and the Panama Canal, no less than modern warfare, becomes impossible.

"Prices rise and fall with the variations in the gold supply as the barometer responds to the changing pressure of the atmosphere, so that to the cyanide and chlorination processes, which has so greatly increased the world's supply of gold, must be ascribed a potent influence on market prices everywhere. With the development of the steel industry have come great fortunes and greater corporations, bringing with them social benefits and social problems hitherto unknown. This industry rests pre-eminently upon the work of chemists, as its greatest master has been quick to testify, and is to-day at every point under the strictest chemical control. The Bessemer process alone was estimated by Abraham S. Hewitt to add, directly and indirectly, $,2000,000,000 yearly to the world's wealth. Of this vast sum Bessemer himself retained in all about ten million dollars, or one-half of one per cent. of his contribution to the community in a single year. And this is characteristic generally of the rewards which come to chemists. They are not taken from the common fund; no man is poorer for them; their recipient has made others richer in those rare cases in which he has become rich himself."

THE WESTMOUNT MUNICIPAL ELECTRIC PLANT AND REFUSE DESTRUCTOR.*

In the summer of 1904 we were instructed by your engineer, Mr. F. L. Fellowes, to prepare for him a report dealing with the capital and operating costs of a lighting plant for the town of Westmount. This we did, basing the report upon the fact that we felt we could conservatively figure upon obtaining one thousand customers in that municipality.

Your engineer, using our figures as a basis for the electric lighting equipment, supplemented them by estimates of his own on a destructor plant, and reported upon the combined proposition, which, being approved by council, bonds were issued for $225,000 to cover the capital cost of the two plants.

The reasons which led to the initiating of this enterprise were as follows:—

1st. The garbage question had become acute in your town, as no dumping space could be provided either within your own boundaries or those of neighboring municipalities.

2nd. It was recognized, in view of the above, that this garbage would have to be burned so as to effectually destroy its noxious qualities.

3rd. It was also recognized from the experience with English destructors that municipal garbage had a distinct heat value, which could be applied to the raising of steam for power purposes.

4th. It was recognized that the existing rates for lighting and power in Westmount were altogether too high, and could be reduced by a municipal lighting plant, which would utilize the heat value of the garbage for steam-raising in an electric plant.

After the presentation of your engineer's report it was realized that destruction of garbage and reduction of lighting rates could be obtained by the installation of a plant for one thousand customers, which it was estimated could be constructed within the amount of the bond issue, and that once in commercial operation the lighting department would carry its own operating costs and fixed charges under reduced rates for lighting.

A contract was thereupon entered into between your municipality and our firm, in which it was specified that we should act during the construction period as designing and supervising engineers of the combined plants, and after the construction had been completed that we should, for the period of one year, act as managers with a view to obtaining business, arranging an accounting and record system, appoint and train a staff, and, in fact, establish the department on a sound commercial basis, and demonstrate that our preliminary report could be substantiated.

As construction was completed by the end of December, 1906, when the arc lighting plant was completed and put into operation, the year 1907 has been devoted entirely to management.

Ground was broken on the site of the plant about 20th September, 1905, current being furnished to a few customers about the middle of April, 1906, thus enabling us to secure many customers, whose contracts expired on May 1st. This speed in construction was due very largely to the mild winter with which we were favored. Owing to the fact that the engines were not ready, the engine contractor installed, at his own expense, a temporary unit, which ran until about the 1st June, when the first permanent engine was erected. The plant erection then proceeded until 18th September, when the engines were turned over to us for operation. In the meantime they had been running non-condensing, with unclothed pipes, and in consequence in anything but in an efficient manner.

In December, three months later, owing to defects which appeared from time to time in the engines, we notified the engine contractors in writing that we could not accept their equipment, and that they would have until the 1st March to make all changes which they thought necessary to render their apparatus acceptable, after which date no more changes or repairs must be made. After two months' operation, the engine builders were notified about 1st May that their engines would not be accepted, and they were requested to carry out the terms of their contract and remove the present engines. This they agreed to do, and an arrangement was entered into whereby new engines of similar type were to be supplied, but with all the improvements which had been shown to be necessary, all under an additional penalty of $50 per day by the 1st November, 1907. So far only one new engine is installed, the other two being in the station

* Being extracts from the report of Ross & Holgate, Consulting Engineers to the Council of Westmount, Q.

ready for erection. From the operation of the single engine at present running, it would appear probable that the engine builders have at last been able to meet our requirements. Before, however, acceptance can be made several months of practical operation will have to be given.

As the engines have caused practically the only serious trouble which we have experienced with the plant since it started, we beg to draw attention to the arrangements made with the contractors in the original contract to safeguard your interests. These are, briefly, as follows:—

1st. A saving of about $6,000 was made to the municipality by the acceptance of this tender, which was the lowest by that amount.

2nd. The contractors agreed if, after one year's trial, their engines were not satisfactory to the municipality, they would replace them with one of the best types of English engines, entirely at their own expense.

3rd. They agreed that, after the expiration of the first year and for one year thereafter, if our firm requested them to replace any broken or wornout parts they would do so.

4th. They accepted a penalty of $50 per day to have the engines installed by March 15th, 1906.

We may say that the troubles and expenses in connection with these engines have been shouldered by the contractor and by ourselves, as the first mentioned installed at their own expense a temporary plant, and have since made all repairs and replacements entirely without charge to the municipality.

At a meeting of the Light Committee and ourselves, together with the contractors, in May, 1907, the contractors made the following offers:—

1st. To replace the engines, which we claimed to be unsatisfactory, with those of the English maker, as per terms of their contract; or,

2nd To replace the first engines with others of their own make, with added improvements, and to replace the 50 kw. engine with one of 125 kw., all without extra charge; and further, to still carry forward their contract as regards the replacement by English engines from the time of the installation of the new units. In other words, to consider the new installation as being under the exact terms of the old contract extended for the intervening period.

This latter alternative was recommended by ourselves, approved by the Light Committee, and accepted.

As a great amount of misunderstanding exists regarding this matter, tending to shake the confidence of the public in your lighting plant, the above rather long explanation is submitted, and, as it is supported at all points by documentary evidence, it is to be hoped that further reference thereto will be unnecessary.

It is anticipated that the three new engines will be installed and in complete operating order about March 1st. In this connection, we may state that from our experience of this year it will be unnecessary for you to order another engine, as was anticipated might be required to meet the increased loads for next winter, as at present you have an entire spare equipment in your station, and, therefore, will be able to cope with any loads obtainable this year.

The last large installation was that of your arc lighting equipment, which went into operation on the completion of your contract with the Montreal Light, Heat and Power Company on December 15th, 1906.

In dealing with the whole question, the matter of ultimate efficiency of the plant was kept in mind rather than the minimizing of capital costs, in order that your plant might operate with the best efficiency and maintain its efficiency and capacity over a long period. In this connection it might be noted that, whereas we only estimated in our original report upon obtaining one thousand customers, your plant has a capacity in both station and street equipment for 2,000 customers, so that the only expenditure necessary to supply this number of customers will be for the house meters, transformers and house connections. The wisdom of this has been demonstrated by the fact that at the end of the operating period of one year you have already about 1,300 customers, and by the end of this year you should have 1,600 customers.

In August, 1906, we obtained a contract for the operation of the motor of the Notre Dame de Grace Pumping Station, to extend for five years, by which we were enabled to sell about 100 horse-power. As it could not have been anticipated that a motor load of this size could have been obtained in Westmount, our small generator unit, which was intended to handle only the small lighting and small motor load during the day, was found to be too small. The new unit of 125 kw., however, which is at present operating, is entirely adequate to handle this load.

The justification for this motor contract is found in the fact that garbage has to be destroyed during twenty-four hours of the day, during winter time at least, and that if some load of this kind were not obtained during daylight hours steam from the boilers would have to be wasted to the air.

It should be noted that during the construction period we began with no customers and worked up to 500 billed, averaging 250; that the revenues from the Notre Dame de Grace pump were not obtained until the end of August, and that practically no payments were made by the town for arc lighting to the Light and Power Department during the year 1906. It will, therefore, appear fairly creditable that, in spite of the operation of a temporary and incomplete plant, running under small loads and with customers few in number, the results were such as to pay all operating expenses apart from fixed charges during the construction period. The fixed charges during construction period are, of course, chargeable to capital cost, as in every case an allowance has to be made to carry fixed charges and possible losses in operating expenses during the construction, and is rightly considered as chargeable to capital cost of plant and establishing the business.

During the operating year of 1907 all capital charges, including interest on bonds, sinking fund and depreciation are, of course, added to the operating costs, consisting of wages, coal, and salaries, etc., to establish the total yearly costs of operating the plant. This, you will note, has been done in the schedules.

About May 1st, 1906, an office was secured on St. Catharine Street, in a good location, wherein all business is transacted, all customers' accounts paid, and all complaints lodged. It was deemed advisable that this, the only revenue earning department of your town, should be established as a business concern, with an office apart from the town hall, which was inaccessible to customers, and thus place it entirely on its own feet as a business proposition. We submit that the wisdom of this decision cannot be gainsaid, and we would regret exceedingly should any action be taken tending to remove this department to the town hall, where it would be inaccessible to the citizens of Westmount, and be more subject to influences which have always tended to limit the efficiency of a productive undertaking when carried on by a municipality.

We would point out that the records in the department office are complete up to the time when money is banked; after that, the disposal of the funds is not in the hands of the Light and Power Department, and, therefore, no records from month to month can be kept. We believe that all cheques should be made out by the Lighting Department and submitted to the proper authorities for signature, so that in that department a record may be had of the exact state of the business, and every expenditure made, whether on operating costs or fixed charges, such as bonds, interest, etc., be recorded so that a balance can be obtained in the books of the Lighting Department at any time apart from those of the town. We feel that there is a possibility under present arrangements of profits earned by the Lighting Department straying into other channels, or at least not being banked and allowed to draw interest on behalf of the department which earns it, and we, therefore, submit this matter of a complete book-keeping system within the department itself for your consideration as the best means of obtaining satisfactory reports and of tracing all leaks.

As a considerable amount of discussion has arisen relative to the increased capital costs of the plant as actually

constructed over that estimated upon, we give the estimated and actual capital costs of the lighting plant below:—

Actual cost of plant, as constructed (without land)	$198,218 24
Estimated cost from preliminary report (without land)	129,883 60
Increase of cost over estimate	$68,334 64

The broad reasons for this increase are as follows:—

1st. The increased capacity of plant, which has been nearly doubled. This increase was determined upon after an actual canvass had been made of the customers available and is being justified by the fact that the number of customers is already 1,300, and will be over 1,600 before the end of the year. If this increase had not been made, additional new plant would have to be ordered and put in operation this summer. In other words, our canvass showed the increased plant to be justified.

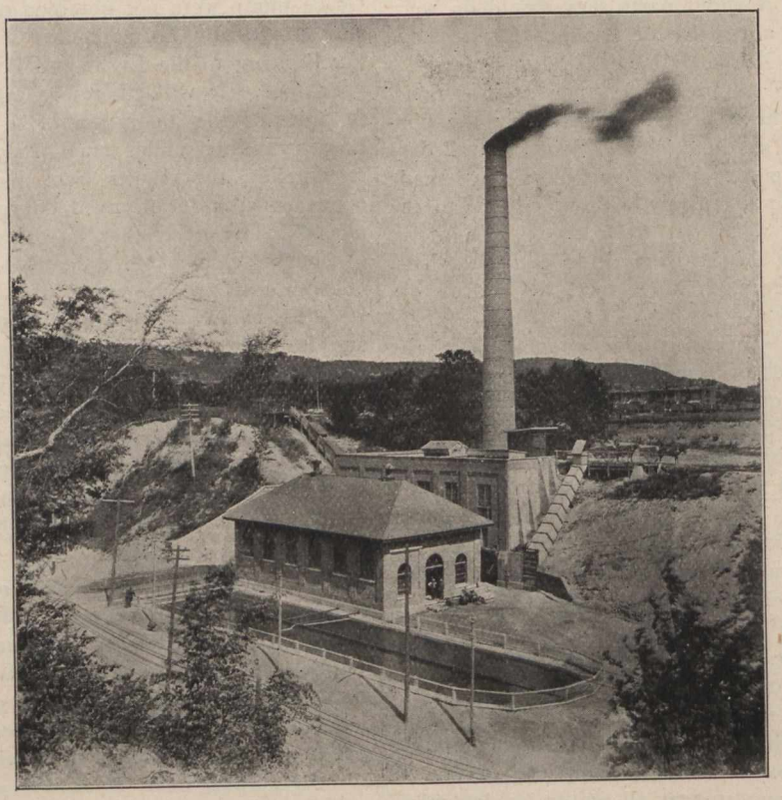
2nd. The superior efficiency of the plant installed over that contemplated, due to using compound condensing engines instead of simple non-condensing, etc. This change will make a saving of at least $5,000 a year in coal.

3rd. The increased cost of labor and material from August, 1904, when the estimate was made, up to completion of the plant in 1907. To illustrate, copper was then selling at 16 cents per pound; we have had to pay as high as 28 cents per pound, averaging over 23 cents, making a total increase of about $8,000 in this one item. Poles increased 20 per cent. in the same time, and other general material advanced in price from 10 to 20 per cent., and labor about 20 per cent. On the other hand, it is fair to state the engines were purchased at $6,000 less than their market value. The destructor and boilers were also below market value and below our estimates.

4th. Additional items not contemplated. A very large increased capital expenditure has been made, due to the site chosen for the destructor and electric lighting station. This expenditure was made on excavations, retaining walls, cooling pond, roads, etc. This capital expenditure has been compensated for by the ideal situation of the plant as regards handling of garbage, ashes, coal, and water, and the returns will show in the operating expenses. Special lines to Notre Dame de Grace are also included, as well as preliminary advertising, materials in stock, insurance during construction, and auxiliary apparatus for coal and water handling.

5th. Three hundred additional customers over the 1,000 estimated upon have been secured and connected, involving an additional outlay of about $10,000 for house meters, transformers, house connections, and secondary wiring.

We beg to point out in this connection that in spite of this increased capital cost, which was warranted in view of the canvass of the town referred to above, which showed a broader market than originally anticipated, your department has carried the increased fixed charges on this additional amount, but on an average during the year 1907 of only 800 customers billed. But had this increased capital expenditure not been made originally, you would be faced by an immediate increase to your plant. This will not be necessary during this year as it is now of ample capacity to carry over the maximum loads of next winter, and possibly the winter after.



Westmount Power Station.

During the year 1906, which was the construction period, the revenues and costs were as follows:—

Net revenues earned	$12,067 72
Total operating costs, plus heat-value of refuse.	12,060 52
Profit for year, as per Table III	$ 7 20

In this case all fixed charges have been included in capital costs, as the revenues earned cover only eight months, during which construction was proceeding.

The facts deducible from the above are that during the construction period your department earned sufficient to pay all operating costs, with practically no revenue from arc lighting, and the customers during the year increasing from nothing up to about 500 billed, averaging probably 250 for eight months. This we submit as a fairly creditable performance with a plant operating under adverse conditions while construction was going forward.

As regards revenues and operating costs for 1907, you will see from the tables that these reached the following figures:—

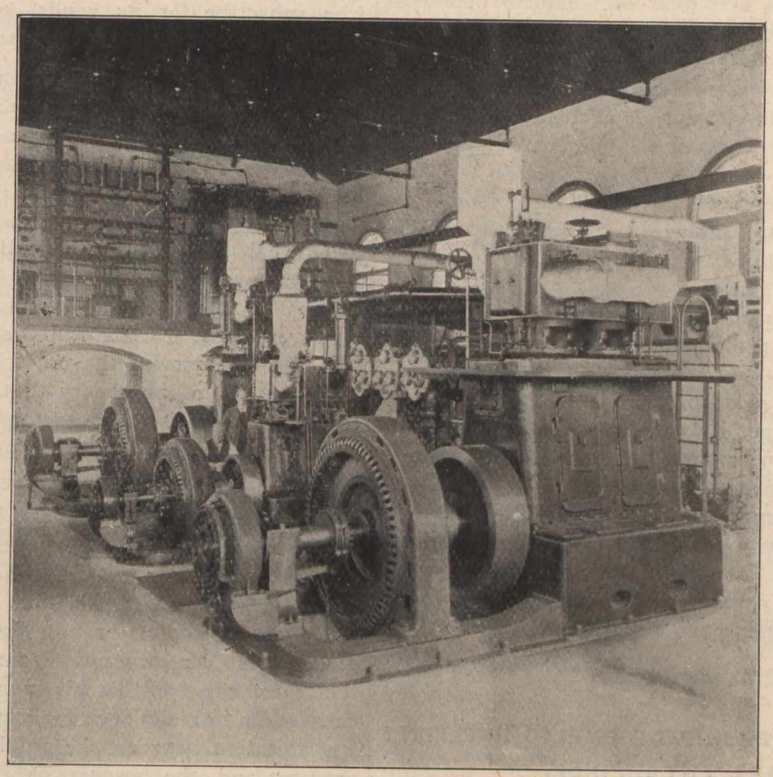
Revenues earned during 1907	$47,666 31
Total operating costs, plus interest, sinking fund and depreciation, and bad debts	47,491 76
Net profit for year over operating and fixed charges	$ 174 55

This result indicates that during 1907, your first year of real operating, your department earned sufficient to pay not only all operating costs, but all fixed charges, including depreciation. This was accomplished with an average of about 800 customers billed throughout the year. At the present time there are about 1,300 customers secured, which is about 500 more customers for 1908 than the average throughout 1907. It will be seen from the tables that the average revenue per incandescent customer is $40 per year; therefore, this number of customers means an additional revenue of $20,000. The increased expenses are only those for coal, lamps, and fixed charges on house connections, meters, etc., totalling not over $5,000. This indicates that during the present year, without obtaining a single additional customer for incandescent lighting, you cannot fail to show a profit over and above all charges of $15,000.

Destructor Plant.

Your destructor plant commenced operation about the middle of April, 1906, and has been successfully destroying all the town's refuse ever since commencement of operation, about 3,500 tons being dealt with during the first eight months ending December 31st, 1906, and about 8,000 tons during the year 1907. Complete records as to the amount of garbage destroyed may be obtained from your Health Department, of which the destructor really forms a part. It should be noted, however, that the electric plant operates the destructor for the Health Deparment, and pays the latter for the heat-value of the refuse destroyed; this is indicated in the tables attached.

No difficulties have been found in the operation of this plant, and it does its work in a thoroughly efficient manner. As indicated in your engineer's original report, this is not an earning department, but a direct charge on the Health Department.



Westmount Power Station.

Inasmuch as it may confidently be anticipated that you will obtain at least 300 additional customers during this year, this will add to your profits $4,500, making at total anticipated profit for this year over and above all charges of about $20,000.

In addition to the above it may be interesting to know just what savings have been made to the citizens of the town of Westmount owing to the installation of the municipal plant during its first year of operation. It may be remembered that the old rate of yearly contract with the M. L. H. and P. Co. was 14.25 cents per kilowatt hour, while the present rate both with the above Company and the town is 10 cents, the difference representing the saving to the customers of the plant and to those who are still customers of the M. L H. and P. Co., and to which should be added the profits made from this year's operation, as below:—

Saving to 1,000 customers of municipal plant....	$15,560 00
Saving to 800 customers of the M. L. H. and P. Co.	12,500 00
Reduction in the cost of arc lighting.....	2,550 00
Net profit on operation of lighting station.....	174 55
Total saving for 1907 to the town and those citizens using electric light....	$30,784 00

The total cost for destroying your garbage has been as follows:—

For 1906, as per Table IX.....	$1,615 40
For 1907, as per Table XII.....	6,055 50
Making a total of	$7,670 90

The cost for 1906 does not include fixed charges; that for 1907 includes these. This amount of $7,670 90 should be charged in the books of the town to the Health Department

In this report you will notice that we have made no mention whatever of the land upon which the refuse destructor and electric plant is built, as we had nothing whatever to do with its purchase, and as we understand it is not yet paid for. We consider that about 100 per cent. more land has been acquired than is actually needed and we think that it is not fair that this excess should be charged to this department.

We desire to record with pleasure the very business-like way in which your Council and Light Committee has handled the business in connection with the construction and operation of this plant, and we also desire to testify our pride in the results obtained with their assistance.

Your staff is capable and honest, and perfectly competent to handle the department without additional assistance.

We have, however, to note with regret the recent rise of certain influences in your Council, which, if allowed to maintain or increase their ascendancy, will, in our opinion, seriously impair the usefulness and efficiency of the enterprise. This is the only danger to your enterprise which can be foreseen, and which should be carefully guarded against.

In conclusion, we beg to draw attention to the following facts:—

1st. You have a plant which is nearly double that originally estimated upon for an increase in capital outlay of only about 50 per cent. over estimates.

2nd. That your plant as actually installed is a much more efficient one than contemplated in the original report, thus decreasing operating costs.

3rd. The number of customers actually obtained is 33 per cent. in excess of those estimated upon.

4th. That during the construction period your department paid out of its earnings all its operating costs.

5th. That during the first year of complete operation your department has paid all operating costs and fixed charges.

6th. That during the present year, without obtaining a single additional customer, your department cannot fail to make a profit over all operating and fixed charges of $15,000.

7th. During the current year, with addition of only 300 customers, which you can hardly fail to secure, your department will show a profit of about $20,000 over all operating costs and fixed charges.

8th. That the saving to the corporation and citizens by the installation of this plant amounts to $30,000 per year, entirely apart from the profits indicated above.

9th. That your demands for the next year, and possibly two years, can be met by your present plant without additions, except those necessary for house connections, meters, transformers, and secondary wiring.

10th. That this, your only revenue-producing department, should be treated as a business proposition, and kept completely separate from other departments.

11th. That your only chance of failure or decreased efficiency lies entirely outside the department itself.

THE MUNICIPAL OWNERSHIP OF PUBLIC UTILITIES VS. PRIVATE ENTERPRISE.

Mr. W. McLea Walbank, in his presidential address delivered before the Canadian Society of Civil Engineers, discussed the question of municipal ownership. First, however, he reviewed briefly the events of the year that were of particular interest to members of the society, and then said:—

The Institute of English Bankers a short time ago attributed the widespread depression that existed in England at the time, to the engagement in municipal trading. They pointed out "That it had been productive of many evils, such as the elimination of personal initiative and enterprise, evasion of the natural laws of commerce, the creation of a favored class of labor. It has brought corruption in politics, and practically eliminated in many directions any further attempts to engage in private industry."

The country has been after the corporations recently to such an extent that we have become unnerved, tired of leading such a life, and seek rest. The losses in credit and value of money during the past year have been untold. Even those that have safety deposit boxes full of securities, through lack of credit are unable to obtain money to carry on their work, so necessary at this time of the year to give employment to those who will otherwise feel the pinch of hunger.

The recent panic was not a rich man's panic, not even an industrial panic; it was a financial panic, which every man, woman, and child is bound to feel the effects of. We have been attempting too big a business with too small a capital. As long as there was confidence and its resulting credit, a small amount of money accomplished wonders, but destroy that confidence, replace it with distrust, and a large amount of money accomplishes but little. There is not sufficient money in this country to carry on business if actual cash must pass from hand to hand. A short time since our industrial conditions were all that could be desired; but a spirit of unrest and discontent has appeared. The working classes are arrayed against capital. The professional agitator is seeking new recruits, and political interest knows no law but to succeed. Votes are gained, business may suffer, may even go to the dogs, but who cares? Corporations can be taxed; that is to say what they are there for. I do not wish to be understood as saying that corporations are not in a measure responsible for this state of affairs. When we read of great railroads giving secret rebates, enriching the recipients and suppressing competition in the interests of individuals, of the enormous amounts of cash and bonds in the hands of insurance companies, of how large companies are promoted and their capital inflated by their organizers giving large bonuses of common stock to those who subscribe for its bonds—is it any wonder that labor rebels and becomes arrayed against capital?

Is their condemnation of wealth, trusts, and corporations justifiable? Have they forgotten that it is from these sources that the people at large have derived hospitals, colleges, museums, special chairs of learning, and other beneficent uses too numerous to mention? I think that a close examination of most gas, electric, and public utility companies will reveal the fact that the public and taxpayers in general derive more benefit than do the ordinary shareholders, whose money has made these possible. To those engaged in the management of electric and gas plants, it seems impossible that the clamour for the municipal ownership of these utilities, based on the theory that municipalities can produce these commodities as cheap, or nearly as cheap, as the corporations, can be founded on fact.

You must realize that self-interest and the interest in getting returns on investments, point towards the economical management of large enterprises, and while we may not be beyond reproach or criticism, many of the so-called evils are the result of unwise legislation. Ill-advised efforts are made by governing bodies through legislative assemblies, to secure advantages over corporations that can only result in causing the investor to feel that his interests are being attacked, and causes him to resist such legislation, the result being a feverish agitation between the would-be perfector of civic government and the owners of corporate properties, without either party reaching a satisfactory conclusion.

If so-called reformers would only take the trouble to investigate carefully both sides of the problem, many of the supposed evils would disappear, and all they would have left to work upon would be the substitution of civic or political management in lieu of industrial management. The civic politician sees an easy road to office through catering to and fanning the flame of public discontent, to which "yellow journalism" has given birth. He sees votes and therefore shouts for municipal ownership indiscriminately. He never loses an opportunity in season and out of season of pointing out how wretchedly our companies are managed, and how extortionate are the tolls that are extracted from the public, compared with the rates that might be expected if Mr. Alderman had the management. He sees great possibilities of extending his patronage by an increased list of employees, and the expending of vast sums of money, while the average citizen thinks he sees a favorable opportunity to obtain a necessary commodity at a greatly reduced cost. Were a referendum taken, I have no hesitation in saying that the majority of citizens, unless they were property-owners whose lands would have to pay the cost in taxes, would vote for free gas, free electric light, free telephones, free street railway service, free groceries, free coal, free newspapers—in short, all the necessaries of life free of cost.

In pointing out the fallacy of municipal ownership, Mr. M. J. Francisco, an engineer who has devoted a great deal of thought and study to the question, in his work on the subject says:

"The whole foundation of municipal ownership is based upon the assumption that inexperienced hired employees of a city who have not a dollar at risk, and in many cases have been given the position as a reward for helping some political aspirant to office, can and will run the plant and manage the business more successfully than the members of a private corporation, notwithstanding the latter may have nearly all their property invested in the enterprise, and a failure means ruin to them. Is it not reasonable to suppose that men under such conditions will give closer attention to business and investigate every branch and detail of its work? It is a well-established axiom that the more a man has at risk the closer attention he gives to details.

"It is well-known that municipal ownership is purely and simply a political move to secure votes for some aspirant for office, and that it is used for this purpose regardless of any other question. Parties have publicly announced that they are using it as a plank upon which to stand while they gather in the votes.

"It has become a well-established principle with both parties that civic government is the lawful spoil of the victorious party. It is for the purpose of getting the votes of the laboring class that lower rates of taxation, with shorter hours and higher wages, are promised, but these are forgotten as soon as the election is passed, as was shown in Detroit and other places.

"When the advocates of municipal ownership find themselves unable to disprove the facts disclosed under municipal management in this country, they immediately fall back upon Glasgow and the wonders achieved there by municipal ownership. The conditions are not the same in Glasgow as they are found in the United States. The government is entirely different, and the political situation that exists in this country is not found there. Wages there are less than half those paid in this country. Conductors on street cars are paid 93 cents per day for the first year, and $1.04 the third year, while conductors on street cars in New York are paid $2 the first year and $2.25 after that. The average wages for the railroad men in Glasgow are 78 cents per day, while in New York they are $1.88. Here we have a difference of more than 100 per cent. in wages alone.

"Anyone who has travelled over the street railroads in Glasgow knows perfectly well that the whole equipment and accommodations are antiquated and behind the day, while the service furnished there would not be tolerated in any city in the United States. We are also told that the profits or revenue from the street railway in Glasgow is so large that it pays all the expenses of the government, while in fact the roads are not operated for the purpose of producing a revenue to meet current expenses of the municipality. Instead of there being no taxes in Glasgow, they are more burdensome than in this country. Rents are taxed 12½c. on every dollar that a man pays, and the owner of the property has to pay the same amount of tax. Besides this, license taxes are levied. You pay a tax for every servant you employ in the house, also on every horse or carriage; in fact, you cannot turn round without running against the tax collector."

What would become of electric light, telephone, street railway and gas plants, if these undertakings were in the hands of municipal authorities? Would improvements in these enterprises be encouraged or would they remain at a standstill? The whole question seems to me too simple for elaborate discussion. A municipality should not be allowed to tax its citizens for its own benefit, but for the benefit of the whole and not of the few. Administration of justice, the protection of life and property, the police and fire departments, and civic affairs generally, such as the maintenance of roads and sanitary conditions, are things in which all the citizens are interested, and for which all should be called upon to bear their proportionate share of cost. We might go so far as to include water, as this commodity is needed by every person, rich as well as poor, for fire protection and sanitary purposes. It comes therefore fitly under municipal control, and at this stage I might say that if a private company were furnishing the water that is being furnished to-day to the City of Montreal, the citizens would rise up in arms. Would they accept unfiltered St. Lawrence or Ottawa River water for domestic use, receiving as it does the drainage of the towns between Toronto or Ottawa and Montreal, and at a price fully twice as high as it would be were it under private control? My answer is, No.

The waterworks plant is undoubtedly operating at a considerable profit, and the city as a whole it is to be hoped is benefiting financially. On the contrary, were we to take the case of gas or electric light, if it is operated at a profit then the users of the light are paying that profit. If it is run at a loss then the municipality is carrying on a business which is not profitable, to the detriment of the taxpayers who are not using light.

That there are many honest supporters of municipal ownership who have been deceived by the highly-colored but false reports from cities that are experimenting with this question, is undeniable. It is only natural to suppose that municipalities after having made large investments in municipal enterprises should endeavor to justify what they have done. They certainly will be reluctant in throwing the limelight on their errors in acts and conclusions. On the contrary, the tendency will be to suppress the bad and give prominence to the good, which is only to be expected, and this important question really gets serious consideration from owners of property only when the situation becomes acute or puts the taxpayers on the defensive.

The following analogy is taken from "Municipal Ownership":

"Aesop's fable of the fox and his lost tail here finds excellent application. The wily old fellow wished company in his misery, and, we recall, urged all the other foxes to cut off their tails. He gave as many favorable reasons as a proud possessor of a municipal plant can offer a sister municipality in urging her to do likewise. But the assembled foxes remembered that the loss of a tail is easily accomplished; that the troublesome thing is to get it back again. Municipal, like private, funds may be spent at any time—they take flight easily—with less ease one again gets possession of them."

Governments, federal, provincial, or civic, are instituted for the purpose of protection, not production. It would be just as reasonable for either of these bodies to enter any pursuit, such as bakers, grocers, saloon-keepers, or the insurance business, as it is for them to enter the field of public utilities, and

"Just as sure as a nation becomes a commercial producer, competiting against its own citizens, just as sure will the seeds of its own disintegration be sown. There is no finality to municipal enterprise."

The character of a public service is to be judged as much by the extent of the service as by its cost. In other words, it is better to serve double the area and number of inhabitants at a given cost, than it is to serve one-half that number at half the cost.

Recent public reports of Glasgow, Edinburgh, Manchester, Leeds, and Birmingham, show that they are operating a smaller number of lamps than Chicago alone, and very few more than Boston, while the combined population is a million more than Chicago and fully five times that of Boston. If you take Glasgow, Hull, Brighton, Portsmouth, and Swansea, you will find that on December 31st, 1905, the number of municipal telephones was less than 20,000, while the number of private telephones was over 40,000. In 1905 the increase in municipally-operated telephones was 12.05 per cent., and in private telephones 92 per cent.

Exclusive Franchises.

Exclusive franchises are not popular, but the best service at the lowest cost can only be secured in gas, electricity, telephones, or street railways, by one company having exclusive control within given limits. But in such cases, in order to protect the public, exclusive franchises should only be given under some sort of public control.

Mr. Allen R. Foote, Commissioner of the Ohio Board of Commerce, is quoted as follows:

"You want the best obtainable service at the lowest profitable price. It goes without saying that you cannot get that condition by dividing your demand between two or more corporations. The economies of production and distribution are not increased by division, but by concentration. Therefore, the problem properly analyzed does not admit of competition as a factor.

"In the past record of this country, the whole effort has been to regulate public service utilities by competition, and all the complaints that are now being pressed, of discrimination in rates, and rebates, secrecy of accounting and over-capitalization, are the direct and legitimate results of attempting to regulate a business that is a natural monopoly by the principles of competition. Assuming the point of view that a business is a natural monopoly, then, it must be controlled and regulated by principles to control monopolies. That means public regulation."

During the past year the City of Syracuse appointed a special commission to inquire into the lighting question, and their report was handed in on the 3rd of September last. The findings of the committee are adverse to a municipal plant either for gas or electricity, and the following is quoted from their report, which is now a public document:

"The granting of a franchise which results in competition in electric lighting and power service is fraught with many grave contingencies. The inconvenience and annoyance to the public in having duplicate systems of poles and wires in the streets is sufficiently obvious, and it is not necessary to enlarge upon that feature of such a situation. Only most urgent necessity for relief from unsatisfactory service and excessive rates, and the failure of other practicable remedies, would warrant such a step.

"Duplication of electrical distributing systems increases the number of poles and wires in and over our streets, with consequent greater difficulty in contending with fires. The responsibility from accidents from crossed wires and defective construction is not so readily and certainly fixed when numerous independent systems of wires are in the streets.

"The division of the business between competing companies makes it less practicable to compel the use of underground conduits extensively, because competition renders the business less profitable to both companies, or if separate conduits are constructed, the disturbance of the surface of the streets becomes a more serious annoyance to the public.

"As against the possibility that the public might receive at least for a time better rates and service, is the other possibility (not to say probability) of an agreement being arranged between the nominally competing companies which would nullify the effect aimed at through competition. If we may draw deductions from practically all previous experience with such utility corporations, we may conclude that the outcome—should the Niagara Distributing Company actually have entered the local field—would probably have been either an agreement with the Syracuse Lighting Company to divide the business along territorial or other lines, or else a consolidation of the two corporations on some basis to their advantage, rather than to the advantage of the public.

"The division of the business would probably not enhance the grade of service to individual users, nor reduce the rates for power or light. On the other hand, it would naturally have the opposite effect.

"Merging of two companies would result in a larger capitalization, on which the consolidated company would endeavor to pay interest or dividends. It would also naturally desire to recoup itself for reduced returns during the period of competition. We may conclude, therefore, that competition in itself is not to be desired in the electric lighting and power field."

Compensation for Franchises.

You may have noticed in connection with public utility franchises that certain civic rulers, and I may say the Press, have publicly demanded from the companies certain percentages on their gross earnings, to be applied to the making of good roads, etc. Now, if the price for service is based on cost, it matters little to the companies whether they pay the percentage demanded direct to the municipality or not. If the public demand it why cannot the companies pay it, as it would simply be an added expense to cost? If they do not demand it, then the cost, and consequently the selling price, would be so much less. It then becomes a question whether the company is to be a public taxgatherer for the muncipality, or whether the municipality should collect direct from the citizens, which to my mind is the only fair and just way, otherwise you compel a small minority of the citizens using the commodity in question to unfairly contribute to the city's revenue, while the benefits would be reaped by all.

Remedies.

Having reviewed the origin of the agitation for municipal ownership of public utilities, I will endeavour to point out my idea as to the proper remedies, and I would say right here that the remedy does not lie with the companies alone. It lies with the company, the consumer, and the public. There must be some give-and-take from the company, the authorities, and the public, or nothing effective will result. Public companies for their own salvation must endeavour to give the best service at the lowest cost. In my opinion the best results will be obtained by a system of public control. A "Public Service Commission," framed on the lines of the existing Railway Commission at Ottawa, would go a long way to protect the interests of both the company and the user. Reasonable inflation of capital is necesary to off-set the possible loss or questionable profit. Fair treatment for capital invested in corporate enterprises is imperative. Capital is answerable to public opinion, which is oft-times unreasonable and must be led, not disregarded. Rather educate the people in the fact that public corporations should have the same protection in the enjoyment of the rights to their property as is enjoyed by other investors.

Massachusetts, U.S., has had a form of public control of private companies for the past thirteen years that appears to have given fairly good satisfaction. No doubt it also has its imperfections, and at times we hear of corporations and the public not being satisfied with its application in specific cases. On the whole, however, it has been advantageous. The consumers are better and more cheaply served, and employed capital is better protected. Stock-watering has been eliminated and reasonable returns on capital allowed. Badly-framed or viciously-applied laws could do serious damage, but with a real desire on the side of all parties to secure justice for all alike, public control offers a far better solution of all difficulties than does municipal ownership.

As I have stated, public companies must endeavour to give the best service at fair rates, and the most satisfactory results will be obtained by following the lines laid down by the "London Sliding Scale," thus making the consumer a partner in the enterprise by reducing the price as rapidly as is consistent with sound management, and by treating the public as though they were its servants, not its masters. In all intercourse with the consumer or public, be it through the highest official of the company, or its office-boy, it should be the aim of the company to establish good feeling with the customer, even at the sacrifice of personal dignity. When the public appreciate that they are being fairly treated by corporations they will not object to fair returns on the capital invested. ,

So far as I can judge, the concensus of opinion of writers on this subject seems to be that some form of public supervision and control of charge for service by quasi-public corporations, offers the only solution of the problem.

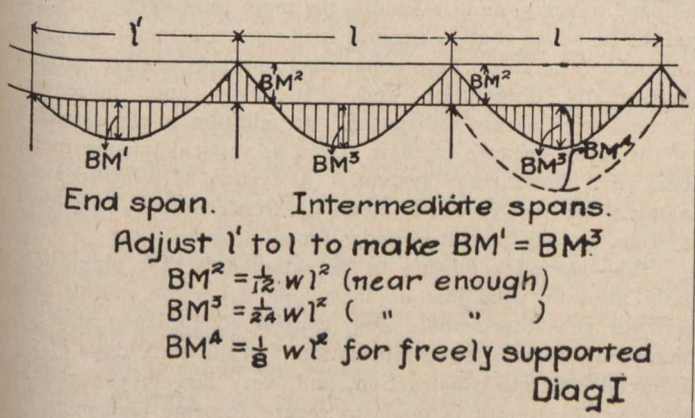
"It preserves individual initiative, does not discourage enterprise nor the combination of private capital. It leaves industrial freedom unharmed, simply controls it in the public interest, enforces the rights of the consumers, while protecting the rights of industrial liberty."

A PRACTICAL SYSTEM OF REINFORCING CONCRETE.*

H. F. Porter, C.E.

When I was asked to address this meeting I did not expect to have the honor of taking sides as it were in a debate on the subject of reinforcing systems. As it happens the preceding speaker has exploited to you the merits of one distinct type which involves the use of rigidly attacked diagonal stirrups to the main reinforcing member. The system which I shall endeavor to explain is based entirely upon the use of plain bars which can always be obtained readily and at the lowest price per pound. Working along this line, we have endeavored to develop a logical, practical, and economical system of reinforcement that would meet at the same time in so far as possible all theoretical and practical demands of an ideal system. How far we have succeeded, I shall leave you to judge. In any event in the large number of installations in which this system has been used we have enjoyed unusual success not alone in keeping down the costs, but, in making possible rapid construction accuracy of work and the realization of a large factor of safety. The exponents of a leading American system of patent bar reinforcement—I refer to the Kahn bar—claim to have developed factors of safety of ten and eleven whereas the building laws have required only a factor of safety of four. With this system of plain bar reinforcement which I shall try to explain to you, factors of safety as large as thirteen have been attained and in every case where failure has resulted, it has been by pulling in two of the horizontal reinforcement and not by failure of the concrete in diagonal tension or compression, Evidently, then, as this is the ideal method of failure, we have in this system provided properly for all of the stresses.

The preceding speaker has explained to you the theory upon which the system of reinforcement using rigidly attached diagonal members is based; and for freely supported rectangular reinforced concrete beams there is no gainsaying that this is a proper and also an economical method. However, in practice, beams of this character are rarely encountered. Instead the majority of beams will be continuous over several supports and being monolithic with the floor slab, will act in every case as T-beams. There is one exception—



the end span—in which at the best only partial fixity of construction can be secured; but, by properly adjusting the length of spans, this weakness of the end spans may be compensated for, allowing the use of the same reinforcement throughout. If the end span cannot be made shorter than the intermediate spans, then it will be necessary to provide for the loss of strength by increasing the amount of steel. For practical purposes it is advisable to preserve uniformity in the amount and kind of reinforcement so that the former method is preferable.

The subject of continuity is one that engrosses the entire engineering world to-day. There is no question whatsoever that concrete in view of its monolithic character, must develop continuity of action, and, it seems, therefore, logical to work on this base in developing a satisfactory method of reinforcement. True, the building laws of practically every city on the American continent prescribe that reinforced concrete members shall be calculated as freely supported—that is, steel shall be provided on the tension side to satisfy the equation 1/8 WL, which those of you who are familiar with the mechanics of engineering will recognize as the value of the bending moment in a freely supported beam for uniformly distributed loading. The plain fact that continuity of stresses is bound to exist is very largely ignored. The new building code of the city of Philadelphia issued in November, 1907, is the first one to require provision for continuity stresses. Yet, it has not, in my opinion, gone far enough in that no allowance is made for continuity, beams being still required to be figured as freely supported. To show you the great difference in the amount of steel necessary, I would ask your attention to the following diagram, which represents approximately the character of the stresses realized in beams continuous over several supports. You will note that to all practical purposes, the bending moment in mid-span may be represented by the equation 1/24 WL, and the bending moment over the support, known commonly as the negative bending moment, by the equation 1/12 WL. Obviously then, to calculate beams as freely supported that in construction are bound to be continuous, is to provide three times as much steel in mid-span as the actual stresses require; and, if along with this error, the negative bending stresses are partially if not wholly ignored, there is uncared for a stress represented by 1/12 WL over the support, and the plain result is if the member is overloaded to its calculated ultimate carrying capacity, parting of the beam over the support is inevitable. Moreover, in practically every failure of a reinforced concrete construction this neglect to provide for continuity stresses has been largely responsible for collapse. This fact has not been sufficiently realized, for, in nearly every case, the cause of the failure has been assigned to premature removal of the centres. On the contrary, premature removal of the forms has not been the cause of the difficulty, but, has only brought to light, defects in design and installation. Like charity, "it covers a multitude of sins." In nearly every case, failure would have been either entirely prevented, or, not nearly so extended, if proper provision had been made for negative bending stresses.

Bearing the foregoing facts in mind, let us proceed to examine practically a typical reinforced concrete layout and to adapt a system of reinforcement to best meet the conditions, which may be summarized as follows:—

(1) That it will provide for all stresses horizontal and inclined.

(2) That it will permit of the use of plain bars without the necessity of shop fabrication.

(3) That it will permit of easy and rapid, and therefore economical, and safe installation.

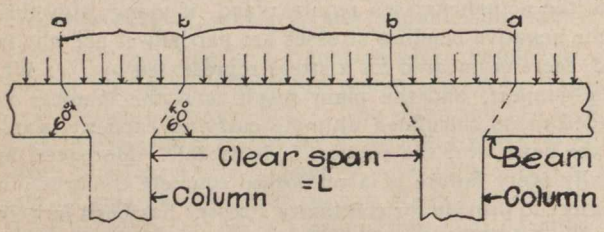
Let us examine the first condition. In all failures of concrete beams wherein only horizontal reinforcement has been provided, the first sign of yielding has been a diagonal crack extending upward and outward at an angle of between 45 and 60° horizontal from the edge of the support. This is commonly known as failure by sheer; correctly speaking, it is failure in diagonal tension, or pulling apart of the concrete along the diagonal line above-mentioned which defines the region where a reversal of tensile stresses from the bottom of the beam to the top ensues. Evidently, this failure can be prevented by providing sufficient diagonal steel normal to plain of separation to care for the stresses, tending to disrupt the beam at this point. How shall we ascertain the amount of these stresses and provide for them to the best advantage practically—this is the issue.

Let us examine for an instant a plain concrete of masonry footing with superimposed column. Now it is a well-known fact that if the footing slopes off from the edge of the column at an angle of approximately 60° with a horizontal, the internal or cohesive strength of the material is sufficient to develop the full bearing value of the footing without danger of cracking. A concrete footing of this design would obviously need no reinforcing. The analogy is close between this case and an earthen embankment. If the solid slopes at the so-called angle of repose of the material, no retaining wall or

*Paper read before the Engineering Society of Faculty of Applied Science.

other means is required to hold the earth in position; so, in a concrete footing, if the slope does not exceed the angle of friction of the material, no reinforcement is required.

Now let us consider the footing and its column inverted. Have we not then the same condition as is realized in every reinforced concrete construction? It is perfectly apparent that the portion of the beam over the support encompassed by the 60° lines is capable of transmitting its load into the support without the assistance of any metal. This reduces the loading on the beam which produces bending in mid-span to the portion between the upper ends of the same 60° lines. We need, therefore, provide reinforcement in the lower side of the beam to care for the bending moment produced by this reduced loading over the clear span between supports. The tendency obviously is for this mid-portion of the beam to slide out of position, even though the horizontal tensile stresses may be adequately provided for. This explains the failure due to diagonal tension of beams in which horizontal reinforcement alone is provided. To counteract this tendency, the simplest plan seems to be to bend up some of the horizontal steel, where it is no longer required to take horizontal tension, and carry it through this plane of diagonal tension normal to it in amount sufficient to take care of the component stress along this plane. This is made clear on



Load "a" to "b" produces no bending
Load "b" to "b" produces bending over span = L only

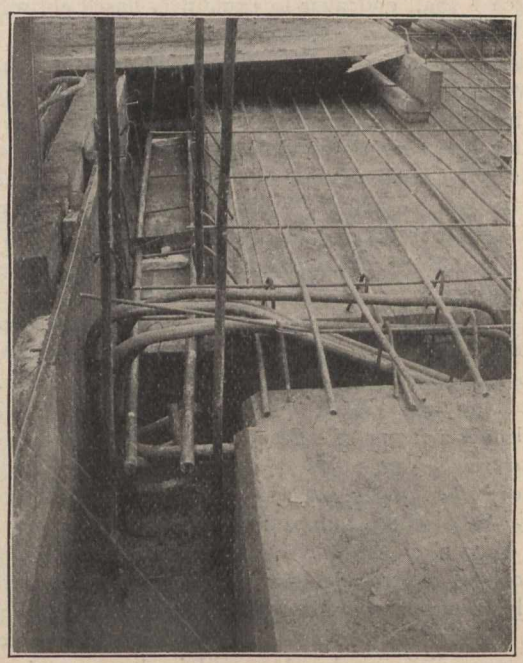
Diag II

the diagram. This diagonal steel must, of course, be anchored securely at either end in order to be effective; at its lower end it is a part of the horizontal steel which very effectively anchors it; at the upper end equally as effective anchorage may be secured by carrying the same bars across the support and down into the adjacent span. As an additional precaution this end may be hooked, a device which somewhat assists the bond. Or, as is our practice, the bar may be carried down into the adjacent span and used there, one span being thus anchored against the other and an absolute tie provided across the support. In a series of spans by using this system of double length bars, in alternation, absolute continuity of the reinforcing is practically insured throughout the construction. This feature not only is an effectual guarantee of safety, but, it increases the carrying capacity considerably. A further advantage afforded is the early removal of forms possible, which is an economical factor not to be made light of.

The similarity between the foregoing method of placing steel in beams and the catirinary curve, which is the form assumed by a loaded cord freely suspended, is apparent; and in fact, if the steel were placed in exactly this position and provision were made for the full development of the steel at every point, the analogy would be perfect. Then the steel would be at all points in correct position to assume all tensile stresses leaving the concrete to act only in compression and to restrict the steel to definite lines of action.

There is, furthermore, an analogy between this method of placing steel and a parabolic bow string truss. Those of you who are familiar with the mechanics of bridge construction will recall the remarkable property possessed by the parabolic bow-string truss in that there is uniform tension throughout the tension chord and uniform compression throughout the compressive chord of the truss. This fact is of marked economic advantage, inasmuch as it permits of the use of the same section of metal throughout. The same advantage obtains by simulating the parabolic truss in designing reinforcement for reinforced concrete.

It will be apparent that if the steel were placed to satisfactorily fulfil the caterinary principle, no further reinforcement in the beam would be needed, which would theoretically be correct. However, in practice we find it advisable to use vertical stirrups throughout the member, although theoretically their presence might be considered superfluous. There are two reasons which justify the use of stirrups in this connection. Firstly—that, inasmuch as T-beams are almost invariably realized in actual construction, economy justifies the use of narrow deep beams which calls for the use of a certain amount of vertical steel to tie the compression flange to the

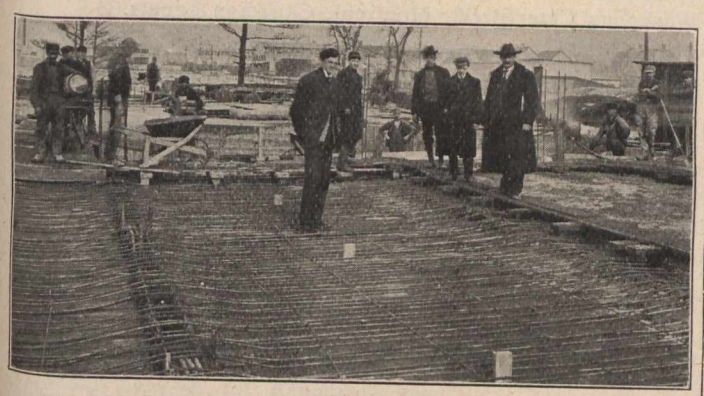


rib. Especially do stirrups become an absolute necessity when in the course of installation it becomes impossible or impracticable to pour the soffit of the beam and the superimposed slab which forms its compression flange at the same time. Stirrups of the proper type and liberally spaced throughout the length of the beam become in this instance an effectual agency in unifying the parts of the beam. Secondly—stirrups are a practical advantage in that they may be utilized to carry, as in a saddle, the main reinforcing bars. It might be added that in general it is a good principle in dealing with concrete to have some steel running in all directions horizontally, diagonally, and vertically; and, moreover, vertical stirrups are indisputably an addition to the strength of the beam because of their action as vertical tension members of a Howe truss system. A system of reinforcement along these lines evidently meets the first criterion of an ideal system, namely, that it provides for all stresses.

The second condition to be satisfied is that plain bars only need be used just as they come from the rolling mill without the intermediate step considered indispensable by many engineers of shop fabrication. In the early days of reinforced concrete construction, and, very largely yet to-day, little or no attempt is made to secure accurate placement of the steel, and as a natural result wide prejudice has been engendered in the minds of engineers against so-called loose bar installations. This problem we believe has been satisfactorily solved in the system now being explained. With the aid of a few simple accessory devices which are made clear on the accompanying illustration, we believe we have made it entirely possible to use plain bars without shop fabrication, without undue expenditure of time and money in the field, and with absolute asurance that all steel will remain in position intended throughout the operation of installation. Moreover, this is accomplished without excessive expense for inspection, and the possibility of mistakes is also largely reduced.

The third criterion follows naturally—certainly a system that satisfies all theoretical conditions, ensures accurate placement of the steel, has the possibility of error reduced to the minimum and that requires less inspection than any other system that has come to the writer's attention, will be easy and rapid, and therefore economical and safe in installation.

The principle followed out in constructing a reinforced concrete floor under this method is, briefly, as follows:—Place each item of the steel in logical order and when once placed and inspected know that it will stay there, then, when sufficient steel has been placed for a day's work in advance, the operation of pouring concrete may be begun and continued without interruption. This method not only ensures correct work, monolithic construction throughout and a better quality of workmanship, but, by eliminating the element confusion in a large measure, greatly increases the effectiveness of the organization, thereby making possible more rapid construction and nedless to say more economical. In a typical instance, for example, in an eight storey factory building in Philadelphia, of approximately 10,000 square feet to a floor, stories were added at the rate of one in every seven to ten days throughout the job, interruptions of weather alone delaying. The cost of the steel in position exceeded very little $40 a ton reckoned from a base of $34 a ton; and the total cost of mixing, hoisting, placing and tamping the concrete averaged under favorable conditions close to forty cents a



cubic yard and never exceeded seventy-five. A twenty-two foot span girder in this building, when tested, to three times its calculated carrying capacity deflected less than three-sixteenths of an inch, which is about half the allowable deflection prescribed by good practice, namely, 1/800 the clear span. The loading was so arranged as to obviate any arching that would defeat the spirit of the test. The slabs in this building, when loaded three times their capacity showed absolutely no indications of deflection. In another building constructed similarly, a floor designed according to the city building law for 120 pounds live load, was loaded up when only thirty days' old to over 600 pounds a square foot and gave no sign of yielding whatsoever.

In conclusion I would say that what has been presented to you in this paper represents the honest attempts of engineers having neither hobbies nor prejudices, but, seeking only to secure with the simplest means at hand, the most practical system of reinforcement. It has been adopted widely in Philadelphia and is being used in the reconstruction of the Bridgeman Brothers' factory, which collapsed last spring. While not by any means ideal, it seems to be in the way of progress, and the results obtained are certainly a justification.

Gentlemen, I thank you for this opportunity and for your warm interest, kind attention and courtesy.

BOOK REVIEWS.

An Introduction to the Study of Electrical Engineering.—By Henry H. Norris, M.E. John Wiley Sons, New York. 8vo., 404 pp.; 179 illustrations. Price, $2.50 net.

The book has been prepared for the use of students entering upon the study of Electrical Engineering for which purpose it is admirably adapted. The introduction contains a review of the principal fields of application of the electric current, arranged under a number of descriptive headings and briefly illustrated by examples and diagrams giving a general survey of its commercial use. The first chapter contains a brief survey of the historical development of electrical engineering, divided into three periods. The first, or period of mystery, comprises the time up to the beginning of the seventeenth century; second the period of scientific preparation between the years 1600 and 1830, and the period of commercial development which continues to the present time. Under these periods a brief history of the discoveries and developments in electricity and magnetism is given with dates of principal discoveries. Two very useful summaries are given of the different periods, with the names of discoverers and dates in order of discovery and application.

Chapter II. treats with the fundamental electric and magnetic quantities. A number of experiments are described and illustrated showing the inter-relation of the fundamental electrical and magnetic quantities, for which definitions are deduced. The fundamental and derived units are described and illustrated by problems and examples in a very clear and concise manner and constitute a valuable section of the book.

Chapter III. gives a brief description of the materials of electrical engineering, their properties and applications. The magnetic materials and their properties are well illustrated by problems and exercises showing the magnetic qualities of iron and steel.

Chapter IV. is on electric circuits, treating briefly the transmission line, distributing and machine circuits, and their characteristics.

Chapter V. treats with magnetic circuits and the different kinds of windings. The laws of magnetic circuits are briefly described and illustrated by examples.

Chapter VI. is on the construction of electric generation, and clearly and briefly describes the essential features of design and construction of alternators and direct current generation.

Chapter VII. describes the operation of generators and their characteristics, which are illustrated by curves taken from actual machines.

Chapter VIII. deals with the construction and operation of transformers, describing briefly the different types of transformers in commercial use with their characteristics and applications.

Chapter IX. contains a brief survey of the construction of the different types of power stations, with examples of construction taken from the latest practice. The operation and generation of power stations is treated, giving load curves, effect of load factors, and corrective action of the storage battery. The chapter ends with a short discussion on power station economics. The next four chapters take up the construction of electric motors, their characteristics and application to commercial uses. Electric lighting and heating, electric measuring instruments and the transmission of intelligence, describing the application and the different methods of transmission.

A noticeable feature of the book is the systematic arrangement and treatment of the material, which has been presented in a clear and logical manner, is well illustrated by cuts, curves and examples taken from modern construction, and representing the most up-to-date equipment and practice.

The book will prove of value to students and others who are entering upon the study of electrical engineering, and the work can be read with interest and advantage by those who desire a knowledge of the construction and application of electrical apparatus.

Specifications and Contracts.—A series of lectures delivered by J. A. L. Waddell, C.E., D.Sc., LL.D., author of "De Pontibus," etc., including examples for practice in specification and contract writing; together with "Notes on the Law of Contracts," by John C. Wait, M.C.E., LL.B., author of "Engineering and Architectural Jurisprudence," etc. New York: Engineering News Book Department. Cloth, 6x9, pp. vi. + 174; $1 net.

The book is divided into five sections. The first, Specifications, forty-eight pages, is devoted to a discussion of the necessity for, and a general outline of what specifications should cover. A few examples are given, not so much as types to be followed as to give an idea of what may be done. Second, Examples for Practice in Specification Writing. This section, although of great value to students, when working under the direction of a competent lecturer, is not of much help to the engineer in practice. The third section, consisting of fifty pages, deals with contracts and the relation of specifications and contracts. This is a practical, authoritative and valuable section, interesting to the contractor and engineer alike. The fourth section devotes forty pages to examples on Contract Writing.. The fifth section is written by Mr. J. C. Wait, and deals with the Law of Contracts. The moment the contractor and the engineer commence discussing "law," just at that moment trouble commences; but this is a chapter that should be welcomed by those interested in contracts. Clearly, yet concisely, Mr. Wait has given the main points to be observed. Altogether, the book is a welcome addition to the literature, which is all too scarce, on specifications and contracts.

How to Read Plans.—By Charles G. Peker. Published by Industrial Publication Co., 16 Thomas Street, New York. Size, 5 x 7, pp. 46 (eight insert plates). Price, 50 cents.

To the mechanic who is not a draughtsman the reading of plans and the working from drawing is frequently a difficult problem. The field engineer, who has gained all his knowledge as a field man, is often at a loss to interpret the symbols and signs on the drawings supplied. To assist those unfamiliar with draughting-room methods this book has been prepared. The author simply explains the meaning of the various lines, plans, views, elevations, sections, scales, blue prints, devices, symbols, etc., to be found on a set of plans. Each subject is taken up and explained and illustrated separately, and then a full, complete set of architect's plans for a frame house is taken up and explained so that the reader will be sure to understand how to read plans. The book is illustrated by forty-three illustrations in the text and eight large, folding plates, giving the full plan of a six-room frame house.

Specifications for Street Roadway Pavements.—By S. Whinery, M.Am. Soc. C.E. Published by the Engineering News Publishing Co., New York. Size, 6 x 9, pp. 56, paper cover. Price, 50 cents.

Specification writing should be reserved for specialists. Specifications by any but specialists are the cause of much unnecessary work and unnecessary clash between engineers and contractors. Mr. Whinery has shown himself a master in this kind of work. An introduction, stating the value of specifications, the necessity of enforcing, and their reasonableness is followed by a complete set of specifications for roadway pavements, clear, concise, and with added footnotes where such appear necessary.

CATALOGUES.

Belt Conveyors.—The Jeffrey Manufacturing Company, Columbus, Ohio, are distributing a booklet illustrating the application of Rubber Belt Conveyors for handling materials of various kinds. Size, 6 x 9.

Spiral Riveted Pipe.—The American Spiral Pipe Works, Chicago, Illinois, are sending out a twenty page illustrated circular showing the varied uses and advantages of Taylor's Spiral Riveted Pipe and Forged Steel Flanges. For the asking any reader may receive a copy of this pamphlet, No. 21, C.E.

Tests of Shaft Bearings.—Bulletin No. 101 issued by the Chapman Double Ball Bearing Company, Toronto, Ont., being a report of tests made at Toronto Exhibition by R. J. Parke, C.E., on loss of power by friction in shaft bearings.

Worthington Multi-Stage Turbine Pumps.—The John McDougall Caledonian Iron Works Company, Montreal, Can., would be pleased to send to any interested reader their Bulletin No. 102. This circular illustrates several recent installations of Worthington multi-stage turbine pumps. Size, 8 x 10.

Gas Power.—The Weber Gas Engine Company, Kansas City, U.S.A., are distributing gratis Brochure No. 55, describing Weber Gas Engines and their prominent features. Size, 4 x 9.

Pulsometer Steam Pump.—Mussens Limited, Montreal, sole agents for Canada, Catalogue No. 16, describes the use, advantages, construction and adaptability of these pumps to difficult work. Size, 7 x 10.

Atlas Preservative.—Navy League Journal for January 1908 contains an article of some length describing experiments with Atlas Preservative E, a composition which when added to feed water precipitates solids and prevents corrosion of boilers. Several of the larger shipping companies of Britain have used it with success. The Hall Engineering Works, 14 Cote Street, Montreal, Canadian agents.

Oil and Steam Separators.—The Ohio Blower Company, Cleveland, Ohio, has upon the press a comprehensive catalogue which bids fair to excel anything in its particular line: that of centrifugal steam and oil separators, cast iron exhaust heads and gravity closing ventilators. Requests which are sent in now will be honored just as soon as the catalogue is ready for distribution.

Corrugated Steel Bars.—The corrugated Steel Bar Company of Canada, manufacturers of the Johnson Corrugated Steel Bar for reinforced concrete, with offices in the Coristine Building, Montreal, send us an exceedingly attractive catalogue of 232 pages. This catalogue contains upwards of eighty full page illustrations of work completed and under construction in which the Corrugated Bar System has been employed. The illustrations are of bridges, abutments, culverts, floors, retaining walls, footings, reservoirs, subways, tunnels, sewers, and other works of construction. In addition a large number of sketches show in detail the most interesting portions of the construction. The last section of this catalogue is devoted to reinforced concrete beams and to a mathematical treatment of the subject. There are also a great many carefully compiled tables for use in designing, making this book highly instructive and full of interest from cover to cover.

PUBLICATIONS RECEIVED.

Water Commissioners Report.—The report for 1907 of City of London Water Commissioners contains a report on test wells bored outside of the city.

Canada's Fertile Northland.—An edited report of the evidence given before a Senate Committee in 1906-7. Fully illustrated and accompanied with maps and published by direction of R. E. Young, D.L.S., Department of Interior, Otttawa.

Maps of Canada's Canals and Railways.—Ten maps showing in some detail the location of canals and railways in Canada, Department of Railways and Canals, Ottawa, Ont.

Consumption of Poles in 1906.—Circular 137 of Forest Service, Washington, gives not only figures indicating the consumption but also that of supply available.

Ohio Highway Department.—The third annual report of this department gives a statement of the road law in the State as well as as the requirements of the State Board Report issued by Sam Houston, Commissioner, Columbus, Ohio.

Preservative Treatment of Cross-Ties.—Circular No. 132 of Forestry Service, Washington. A very valuable bulletin dealing with the seasoning, treating and preservation of hemlock and tamarack ties. Pages, 32. Size, 6 x 9.

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.

LIGHT, HEAT, AND POWER.

Ontario.

ST. CATHARINES.—The City Council has completed the lighting question by granting an extension of time to the Falls Power Company to sign the contract to light the city at $39.50 per arc light, beginning August 1st next. The matter was decided at a special meeting of the Council.

HAMILTON.—The Special Power Committee has appointed T. W. Sothman to draw up the specifications for the proposed municipal street lighting and power plant. His price was $2,000.

TORONTO.—The control of the Electrical Development Company has passed into the hands of Mr. William Mackenzie and his asociates.

British Columbia.

NELSON.—A thorough inspection of the machinery and buildings in connection with the municipal power plant here has been completed by Mr. Cecil B. Smith and his report will be made shortly. He recommends the installation of a second unit, but claims the present building is quite substantial enough.

CRANBROOK.—A large power and hydraulic plant is under construction at Bull River. The power plant when installed will have a capacity of not less than 8,000 horse-power, and will be used for generating electricity, for power and lighting purposes, to be transmitted to every city, town and camp in south-east Kootenay. The hydraulic plant will be the largest in the district. Bull River will be diverted, so as to enable the company to wash the bed of the river, also the old channels.

RAILWAYS—STEAM AND ELECTRIC.

Ontario.

Regarding the work done and payments made to McRae, Chandler & McNeil, contractors for the T. & N. O. Railway, up to January 1st, 1908, the total value of work done was $140,373.60, of which the commission retained ten per cent., or $14,037.36, leaving a balance of $126,336.24. The amount paid to the firm of contractors was $100,553.08, while the amount still due was $2,768.25. The commission is taking over the work, thus cancelling the contract. The Government have as security for the due performance of the contract $10,000 in cash, together with the drawback of ten per cent., $14,037.36. The estimated amount due for work done in January is $23,014.91.

Manitoba.

RESTON.—The C.P.R. have passed estimates for the putting in of the pipe line from Pipestone Creek to this place. Work will begin as soon as the frost is out. The cost will be about $10,000.

WINNIPEG.—The Canadian Northern Railway Company will relay their line between Winnipeg and Port Arthur with 80-pound rails this season. The work will be commenced early in the spring. This section of the line will also be re-ballasted and put in first-class shape for fast and heavy traffic.

British Columbia.

NELSON.—E. F. Busteed, general superintendent of the Western division of the Canadian Pacific, in speaking of railway improvements in this province says that all that will be done is the replacing of many miles of steel by 85-pound rails and filling in of trestle work or the substitution therefor of steel spans.

GRAND FORKS.—The Great Northern Railway is now laying track between Keremeos and Headley City, a distance of 20 miles. The railway contractors have five camps in this short stretch of work, but very slow progress in laying steel is being made, as the Similkameen River has to be bridged three times and much rock and other heavy grading is now confronting the contractors. May 1st is now fixed for the date the rails are supposed to reach Headley City.

TENDERS.

ONTARIO.—Tenders will be received up to March 16, 1908, for the construction of the uncompleted portion of the North Branch and McIntosh Drainage Scheme, in the Township of Roxborough and Cornwall. A. H. McMillan, Reeve, Roxborough.

Quebec.

MONTREAL.—Tenders will be received until 10th March, 1908, for the supply of 35,000 barrels of Portland Cement, for the use of the Quebec Canals. L. K. Jones, Secretary, Department Railways and Canals, Ottawa.

New Brunswick.

HILLSBORO.—Tenders will be received until March 23 for building Mill Creek Mouth Bridge, Albert County. C. H. LaBillois, Department Public Works, Fredericton.

RENFREW.—Tenders will be received until March 13 for the construction of a public building here. F. Gelinas, Secretary Department Public Works, Ottawa.

VICTORIA.—Tenders will be received until March 16 for supplying the following cast-iron water pipe: 33,000 feet, 12-inch; 18,000 feet, 8-inch; 36,500 feet, 6-inch; 25,000 feet, 4-inch. C. H. Topp, city engineer.

Ontario.

CHUTE A BLONDEAU (County of Prescott).—Tenders will be received for the construction of landing pier here until March 18. Fred Gelinas, Secretary Department Public Works, Ottawa.

New Brunswick.

FREDERICTON.—Tenders will be received until March 23 for building Mill Creek Mouth Bridge, Albert County. C. H. LaBillois, Department Public Works, Fredericton.

FREDERICTON.—Tenders will be received at the Department of Public Works, Fredericton, until Monday 23rd day of March, for building the concrete substructure and approaches of Apohaqui Bridge over Kennebecasis River. King's County. C. H. LaBillois, Department Public Works, Fredericton.

Nova Scotia.

HALIFAX.—Tenders will be received until March 13 for alteration to the Post Office Building at Halifax. F. Gelinas, Department Public Works, Ottawa; C. A. Dodwell, Resident Engineer, Halifax.

Manitoba.

WINNIPEG.—Tenders addressed to the Chairman of the Board of Control here for supply of turbine pump of 2,500,000 imperial gallon capacity, with electric motor for City Water Works, will be received until Tuesday, March 24th, 1908. M. Peterson, Secretary, Board of Control, Winnipeg.

WINNIPEG.—Tenders will be received at the Department of Public Works, Ottawa, until Friday, March 20, 1908, inclusively, for the erection of an Examining Warehouse at Winnipeg, Man.

Saskatchewan.

SUMMERBERRY.—Tenders will be received by School District of Summerberry, No. 33, until April 1st, 1908, for the purchase of $10,000 twenty-year six per cent. school debentures. Interest payable annually. Jas. Alex. McCowan, Secretary-Treasurer.

CONTRACTS AWARDED.

Ontario.

TORONTO.—The Board of Control have recommended that the John Inglis Company be given the contract for the new 15,000,000 gallon pumping engine at $147,530, and also the contract for the 6,000,000 gallon engine at $52,700. The Bethelem Steel Company also tendered. Information is being obtained as to the merits of producer gas, and the subject may be brought before the Council.

Alberta.

EDMONTON.—The firm of Phelan and Shirley has secured the contract of grading a forty-mile section on the G.T.P. from near Clover Bar through this city to a point west.

EDMONTON.—The telephone question, which has been under discussion by the Edmonton City Council for the past two months is apparently settled by the awarding of a contract for 1,200 phones of the Strowger system to the Chicago Automatic Machine Company.

British Columbia.

Official announcement of the award of the contract for building one hundred miles of the Grand Trunk Pacific Railway between Prince Rupert and Kitsalas Canyon on the Skeena River, to Messrs. Foley, Welch & Stewart, successors to Messrs. Foley Bros., Larssen & Company, is expected shortly. The schedules in the bids of the various tenderers have been worked out; this company has been found to be the lowest. Its tender will approximate between $6,000,000 and $7,000,000, or an average of $70,000 a mile. Other tenderers included Winston Bros., of Minneapolis, and McArthur Bros., Chicago. The successful firm, it is understood will begin construction work at Prince Rupert and Kitsalas Canyon early in April. Most of the contract will be sublet. June will see grading operations in progress along the entire 100-mile section. The work will prove the heaviest on the entire transcontinental line between the Atlantic and Pacific.

MISCELLANEOUS.

Ontario.

TORONTO.—According to the annual report of City Engineer Rust, which is all but complete, the city has saved $25,000 during the year by day labor.

OWEN SOUND.—The Owen Sound Iron Works have about completed two large tube mills for wet grinding at the Imperial Cement Company's plant. Both mills are five feet in diameter and eighteen feet in length and weigh over eight tons each.

Manitoba.

WINNIPEG.—The Government has decided to connect the automatic telephone system in the legislative building with the manual system, so that it may be used the same as the old Bell system. It is the plan to put in a local exchange in the Parliament Buildings. The first construction work in extending the Government telephones will probably be at Headingly where a number of the farmers will be connected with the city exchange.

PORTAGE LA PRAIRIE.—At a recent meeting the City Council decided to proceed with the proposed auxiliary system of waterworks, according to the plans drawn up by Engineer Chipman, of Toronto. The cost is not to exceed $40,000. The railway companies will be offered a supply of water at 7 cents per 1,000 gallons, based on 100,000 gallons daily each.

Alberta.

EDMONTON.—Nine money by-laws have been carried here, which are as follows:—To provide $42,500 to pay part of cost of traffic deck on C.P.R. bridge; to provide $10,000 to pay city's share of cost of certain cement and plank sidewalks; to provide $49,000 to cover deficit on last debentures sales; to provide $30,000 additional cost of street railway material; to provide $40,000 for improvement and extension of telephone system; to provide $60,000 for improvement and extension of electric lighting and power system; to provide $5,000 extra cost of erection and equipment of Isolation Hospital; to provide $20,000 for fire equipment and additional cost of new fire halls; to provide $130,000 for city's share of street paving and street railway track laying.

STRATHCONA.—The concrete work on the piers of the G.T.P. bridge at Clover Bar is nearing completion. The contractors are rushing the work as quickly as possible. It is expected the piers will be ready for the steel shortly.

British Columbia.

VICTORIA.—The City Council have decided to pave several streets with wooden blocks treated with creosote and placed on a concrete foundation.

NEW WESTMINSTER.—Engineer J. A. L. Waddell, of Kansas City, who is at present in Vancouver, has submitted an estimate of the cost of the proposed Lulu Island steel bridge in this city, which he set at $76,000. The specifications he worked on, however, are not in accordance with the city plans, and he will be asked to submit another estimate

VICTORIA.—Of the total, 1,255,960 to be voted for expenditure upon public works, according to the estimates which are before the Legislature, 778,585 is to be expended upon roads, streets, bridges and wharves. For the Vancouver Island Trunk Road $20,000 is voted towards the construction of the section between Coldstream and Mill Bay on Saanich Inlet. In other portions of the island considerable sums are also to be expended. In Alberni district $10,450 is voted, while in Comox $17,000 is set aside. Cowichan receives $9,000 and Esquimalt $11,000. In Newcastle district $7,000 is voted for the same purpose, while in Nanaimo City $2,700 is set aside. In all, $86,380 is to be voted for roads, streets, bridges and wharves on Vancouver Island. The largest single item is $50,000 in aid of the road in South Vancouver, including Point Grey. Okanagan receives a vote of $38,000. In Skeena district $28,000 is voted, while in Similkameen $26,000 is to be spent. Yale will benefit to the extent of $34,730. Under the caption of works and buildings, the chief items are those providing for the continuance of construction on the court house at Vancouver and Kamloops. One hundred thousand dollars is voted to the former and $47,000 to the latter. For the new insane asylum at New Westminster, which is projected, $60,000 is set aside. Repairs to the capitol buildings to the extent of $2,000, and to Government house to the extent of $4,500, and $4,000 for the Government grounds, are mooted. The sum of $50,000 for surveys throughout the province is to be voted, similar to the amount provided last year. Under the heading votes to hospitals and charities the Royal Jubilee Hospital of this city obtains $15,000.

PERSONAL.

MR. HUGO CRAIG, B.Sc., A.M., Can. Soc. C.E., has been offered the position of City Engineer of Kingston, Ont.

MR. E. METZ, JR., has been placed in charge of the Pittsburg Automatic Vice Company's new branch office in the Dwight Building, Kansas City.

MR. R. D. WILSON, of the Winnipeg City Engineers' department has been appointed first assistant to City Engineer Ruttan.

MR. CELESTIN COUANON from the selling staff of Fenwick Freres & Co., representatives of John F. Allen, in Paris, has been making a month's visit to the Allen works, 370-372 Gerard Avenue, New York City, familiarizing himself with the various types of Allen riveting machines.

ERNEST R. BECKWITH, A.M., Can. Soc. C.E., and Member of the Ontario Association of Architects has resigned his position as City Engineer of Kingston, Ont. Mr. Beckwith has had a large experience in laying out sewerage schemes and sewage disposal works in England, and his chief success in the architectural profession has been the erection of a City Hall costing $350,000.

OBITUARY.

In the death of Judge Killam, Canada loses a leader. His work did not require the controversy of the politician but it did require all the tact, foresight and patience of a successful statesman. As chairman of the Railway Commission he was doing much to cultivate a better understanding between the railways and the people. The late Judge Killam was born at Yarmouth, N.S., in 1849. He graduated with honors from Toronto University, and was called to the Ontario Bar in 1877. He practised for some time in Windsor, and then moved to Manitoba. He became Q.C. in 1884, and represented South Winnipeg in the Legislature from the general elections in 1883 until his elevation to the Manitoba Court of Queen's Bench in 1885.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

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

4371—Feb. 4—Authorizing the C.P.R. to construct a branch line in Red Deer, Alberta, to the premises of the Red Deer Milling and Elevator Company.

4372—Feb. 18—Extending until June 15th, 1908, time within which the G.T.R. shall construct crossing on the farm of Samuel B. Carew, Lot No. 15, in the 3rd Concession of the Township of Emily, Ontario.

4373—Feb. 22—Authorizing the Bell Telephone Company to erect aerial wires over the G.T.R. siding to Standard Chemical Company, south of Longford station, Ontario.

4374—Feb. 7—Ordering Quebec, Montreal & Southern Railway to change the existing derails at and near the junc-point of the Rutland Railroad and G.T.R. at Noyan Junction, P. Q.

4375—Feb. 18—Authorizing Windsor, Essex and Lake Shore Rapid R. R. Company and the Pere Marquette R. R. to operate their trains over the crossing between their respective railways at Pelton, Ontario.

4376—Feb. 21—Authorizing the Canadian Northern Ontario Railway to erect its telegraph wires across the tracks of the Canada Atlantic Railway at Boyne River, Ontario.

4377—Feb. 19—Authorizing the C.P.R. to use 0.116 of an acre of the Canadian Northern Ontario Railway Company's lands for the purpose of diverting the existing highway from Parry Sound to Bala, in Lot 3, Concession 10, Township of Medora, district of Muskoka, Ontario.

4378—Feb. 20—Authorizing C.P.R. to divert the existing highway from Parry Sound to Bala, in Lot 3, Concession 10, of the Township of Medora, district of Muskoka, Ontario, where the said highway crosses the spur of the C.P.R. Sudbury-Kleinburg branch, from mile 123.18 to Lake Joseph.

4379—Feb. 22—Extending for three months from February 22nd, 1908, the time within which the G.T.R. is authorized to take certain lands from the corporation of the city of Toronto for the purpose of a passenger station and yards.

4380—Feb. 21—Authorizing Windsor, Essex & Lake Shore Rapid R. R. to operate its cars across the tracks of the Pere Marquette at a point near Kingsville station, Ontario.

4381—Feb. 17—Authorizing the G.T.R. to take certain lands belonging to George Knill, being part of Lot 5 in the 1st Concession, Township of Blenheim, County of Oxford, Province of Ontario.

4382—Feb. 25—Authorizing the Dominion Car & Foundry Company to construct a sewer under the tracks of the G.T.R. Company at its Lachine Canal bank branch.

4383—Feb. 4—Authorizing the Canadian Northern Ontario Railway to divert the Montreal and Ottawa Road, Township of Clarence, County of Russell, Province of Ontario, at mileage 37.13 from Hawkesbury, Ontario.

4384—Feb. 25—Approving revised location of the G.T.R. from the west line of Section 30, Township 53, Range 9, west to the west line of Section 7, Township 54, Range 13, west of the 5th meridian, district of North Alberta, Province of Alberta, mile 78.109 to mile 103.00.

4385—Feb. 25—Authorizing C.P.R. to reconstruct bridge No. 18.2 on its Brockville, Ontario, section.

NEW INCORPORATIONS.

Cobalt, Ont.—Cobalt Light, Power and Water Company, $10,000. J. R. Gordon, Sudbury; C. C. V. Campbell, C. A. Gilmour, Cobalt.

Owen Sound, Ont.—Sonora Mining Company, $2,500,000. R. A. Thompson, Lynden; E. Morwick, Hamilton; F. W. Barrett, Toronto.

Winnipeg, Man.—Touraine Apartments. $100,000. G. S. Wyman, A. Melville, J. Douglas, South Main Street Development Company, $100,000. N. T. MacMillan, T. H. Gilmour, J. B. Hugg.

Brandon, Man.—Brandon Fire Engine Company, $60,000. J. Burchill, A. H. McEwan, J. Empey.

Dunnville, Ont.—Dunord Gold Mines Company, $500,000. J. Culp, Niagara Falls, N.Y.; B. P. Overhold, Guelph; E. Snider, South Cayuga.

Ottawa, Ont.—Peerless Motor Specialty Company, $40,000. B. H. Sills, J. Lumsden, J. I. MacCraken.

Belleville, Ont.—Ontario Limestone and Clay Company, $50,000. F. R. Lingham, L. E. Allen, S. Masson.

Niagara Falls, Ont.—Excelsior Cobalt Larder Lake Mining Company, $1,000,000. J. Culp, Niagara Falls, N.Y.; C. B. Hodges, N. McDonald, Depew, N.Y.

Toronto.—Coon's de Marvel Company, $40,000; W. R. Bird, R. Verity, A. F. White. Stitt & Company, $100,000; R. W. Eyre, H. C. Macdonald, R. J. G. Dow. Britnell and Company, $40,000. W. Britnell, A. E. Britnell, T. Reid. Oldsmobile Company of Canada, $40,000; F. Sager, Toronto; F. L. Smith, A. Smith, Lansing, Mich. Toronto Fireproofing and Concrete Company, $40,000; W. E. Denise, E. Lake, J. A. Jackson. E. R. Burns Saw Company, $50,000; A. W. Holmested, F. H. Potts, A. R. Bickerstaff.

Montreal.—Consolidated Realty Company, $90,000. H. G. Wallace, J. A. McQueston, E. M. Taylor.

Chicoutimi, Que.—La Caisse de Petite Economie de Chicoutimi. Rev. M. T. Labrecque, E. Lapointe, R. Hudon.

British Columbia.—Fosthall Lands, $25,000. Eastern British Columbia Lumber Company, $500,000. Canadian Pacific Trust and Investment Company, $200,000. New Fountain Hotel Company, $35,000.

Quebec Province.—Drummond Real Estate and Power Company, $20,000. N. Turner, C. Manseau, W. A. Moisan, Drummondville.

MARKET CONDITIONS.

Montreal, March 4th, 1908.

The situation in the United States has not materially changed. Some good sales have been reported for foundry grades during the past two or three days, especially for pipe works, and the general inquiry is assuming pretty large proportions. Prices, however, are not showing any change, but may be said to be rather firmer than they were in the early part of the year. No material change in the situation can be reported.

In the United Kingdom the position is materially stronger. The latest published reports show a much firmer tone, especially in Middlesboro' grades. Shipments during the month of February were even heavier than they were during the corresponding month of last year, which month, up to that time, held the record for Januaries. Stocks in store are steadily, though slightly decreasing, and this, coupled with good Continental demand, warrants makers in asking somewhat better prices. The market may safely be said to have advanced 3s. 6d. per ton from the low point. Steelmaking irons are, however, in poor demand, and prices continue low with an upward tendency. Good Scotch brands are assuming a better tone, and the feeling is that the bottom has been reached. It would not be surprising to hear of an advance in these grades, as indications are that the market will improve as spring months approach, there being at such times a better demand and heavier exports than usual.

In the local market, demand is quiet, but business is going forward steadily and prices show little change. A moderate tonnage is moving for prompt delivery. Good inquiries are being received for spring delivery, but purchasers are looking for low prices, and in most cases are holding off until satisfactory figures are quoted. It is thought, however, that a considerable buying movement will take place for May and June deliveries here.

Antimony.—The market is steady at 10½ to 11c. per pound.

Bar Iron and Steel.—The market on mild steel, sleigh shoe, tire and machine steel has declined 5c., that on toe calk having declined 10c. Bar iron, $2 per 100 lbs.; best refined horseshoe iron, $2.25, and forged iron, $2.15; mild steel, $2.05; sleigh shoe steel, $2.05 for 1 x ⅜-base; tire steel, $2.05 for 1 x ⅜-base; toe calk steel, $2.50; machine steel, iron finish, $2.15.

Boiler Tubes.—The market holds steady, demand being fair. Prices are as follows: Two-inch tubes, 8 to 8¼c., 2½-inch, 11c.; 3-inch, 12 to 12¼c.; 3½-inch, 15 to 15¼c.; 4-inch, 19¼ to 19½c.

Building Paper.—Tar paper, 7, 10, or 16 ounce, $2 per 100 pounds; felt paper, $2.75 per 100 pounds; tar sheathing, No. 1, 60c. per roll of 400 square feet No. 2, 40c.; dry sheathing, No. 1, 50c. per roll of 400 square feet, No. 2, 32c.

Cement—Canadian and American.—Canadian cement is generally quoted at $1.85 to $1.90 per barrel, in cotton bags, and $2.10 to $2.20 in wood, weights in both cases 350 pounds. There are four bags of 87½ pounds each, net, to a barrel, and 10 cents must be added to the above prices for each bag. Bags in good condition are purchased at 10 cents each. Where paper bags are wanted instead of cotton, the charge is 2½ cents for each, or 10 cents per barrel weight. American cement is steady at $1.10 per 350 pounds, basis Glens Falls or Lehigh mills, cotton or paper bags. When the cotton bags are returned in good condition, only 7½ cents is allowed for them. American cement sold at $2 on track.

Cement—English and European.—English cement is unchanged at $1.75 to $1.90 per barrel in jute sacks of 82½ pounds each (including price of sacks) and $2.25 to $2.35 in wood, per 350 pounds, gross. Belgian cement is quoted at $1.70 to $1.80 per barrel in bags, and $2.05 to $2.10 per barrel, in wood.

Copper.—The market for copper is unchanged. Prices are 15½ to 16c. per pound.

Iron.—Summerlee iron is $23 for No. 2 selected, and $24.50 for No. 1, and No. 3 Clarence or Cleveland, $20; Carron, special, $24, and soft $23.75. Quotations are for car lots, f.o.b., for immediate delivery. Lower prices may be had for future delivery.

Lead.—The market is steady and unchanged, this week, at $4 to $4.10 per 100 pounds.

Nails.—Demand for nails is steady, prices being $2.30 per keg for cut, and $2.25 for wire, base prices.

Pipe—Cast Iron.—The market is next thing to dead, as nothing is used during the winter. Prices are steady at $36 for 8-inch pipe and larger; $37 for 6-inch pipe, $38 for 5-inch, and $39 for 4-inch at the foundry. Gas pipe is quoted at about $1 more than the above.

Pipe, Wrought.—The market is firm but duller. Quotations and discounts for small lots, screwed and coupled, are as follows: ¼-inch to ⅜-inch, $5.50, with 54 per cent. off for black and 38 per cent. off for galvanized. The discount on the following is 66 per cent. off for black and 56 per cent. off for galvanized: ½-inch, $8.50; 1-inch, $16.50; 1¼-inch, $22.50; 1½-inch, $27; 2-inch, $36; and 3-inch, $75.50; 3½-inch, $95; 4-inch, $108.

Spikes.—Railway spikes are not in very good demand $2.60 per 100 pounds, base of 5½ x 9-16 Ship spikes are steady at $3.15 per 100 pounds, base of ⅝ x 10 inch and ⅝ x 12 inch.

Steel Shafting.—At the present time prices are steady at the list, less 25 per cent. Demand is very dull and lower figures would hardly be refused.

Steel Plates.—Demand is quite dull and a firm bid at lower figures than quotations would be considered. Quotations are: $2.75 for 3-16, and $2.50 for ¼ and thicker, in small lots.

Tar and Pitch.—Coal tar, $4 per barrel of 40 gallons, weighing 575 to 600 pounds; coal tar pitch, No. 1, 75c. per 100 pounds, No. 2, 65c. per 100 pounds; pine tar, $4.35 to $4.50 per barrel of about 280 pounds; pine pitch, $4.25 per barrel of 180 to 200 pounds.

Tin.—Tin is steady, at 32½ to 33c. per pound.

Tool Steel.—Demand is light, but the market is firm. Base prices are as follows: Jessop's best unannealed, 14½c. per pound, annealed being 15½c.; second grade, 8½c., and high-speed, "Ark," 60c., and "Novo," 65c.; "Conqueror," 55 to 60c.; Sanderson Bros. and Newbould's "Saben," high-speed, 60c.; extra cast tool steel, 14c., and "Colorado" cast tool steel, 8c., base prices. Sanderson's "Rex A" is quoted at 75c. and upward; Self-Hardening, 45c.; Extra, 15c.; Superior, 12c.; and Crucible, 8c.; "Edgar Allan's Air-Hardening," 55 to 65c. per pound.

Zinc.—Zinc is steady at $5.25 to $5.50 per 100 pounds.

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Toronto, March 5th, 1908.

The wintry aspect of the country checks any activity in demand for building materials, while the immediate construction jobs are neither so numerous nor so large as a year ago. But with April or May will begin a number of structures. Churches and schools in Toronto, new factories and extensions of existing ones outside, besides Government work at various points.

Bricks and cement maintain their price. Roofing and building paper, pitch and tar, while quiet, are firm. Among metals there are no startling changes, although tin and copper are subject to fluctuation from speculative causes as before. In New York there are increased deliveries of late into almost all consuming channels of iron, steel and other metals. Timber and lumber are firm, pine especially so, hemlock showing ease in some quarters. Spruce easier at the moment, with prospect of stiffening in spring.

Efforts were made a fortnight ago, and again a week ago, to create an impression that but little copper is available in America, whereas the reverse is the fact. A so-called independent copper interest has been thus trying to boom the price while secretly accepting low prices in Europe. At the end of February tin advanced £1 in Singapore, closing at £129 c.i.f., London. A sharp advance took place in London, too, and a small supply was temporarily cornered in New York. The following are wholesale prices for Toronto, where not otherwise explained. Higher prices are quoted for broken quantities:—

American Bessemer.—Fourteen-gauge, $2.45; 17, 18, and 20-gauge, $2.60; 22 and 24-gauge, $2.65; 26-gauge, $2.80; 28-gauge, $3.

Antimony.—Quiet, but inquiries are coming in more freely; we quote 11½ to 13c.

Bar Iron.—$2.10 base, from stock to the wholesale dealer.

Beams and channels, $2.75 to $3, according to size and quantity; angles, 1¼ by 3-16 and larger, $2.65; tees, $2.90 to $3 per 100 pounds. Extras for smaller sizes.

Boiler Heads.—25c. per 100 pounds advance on boiler plate.

Boiler Plates.—¼-inch and heavier, $2.50. Supply probably adequate and quotations still firm.